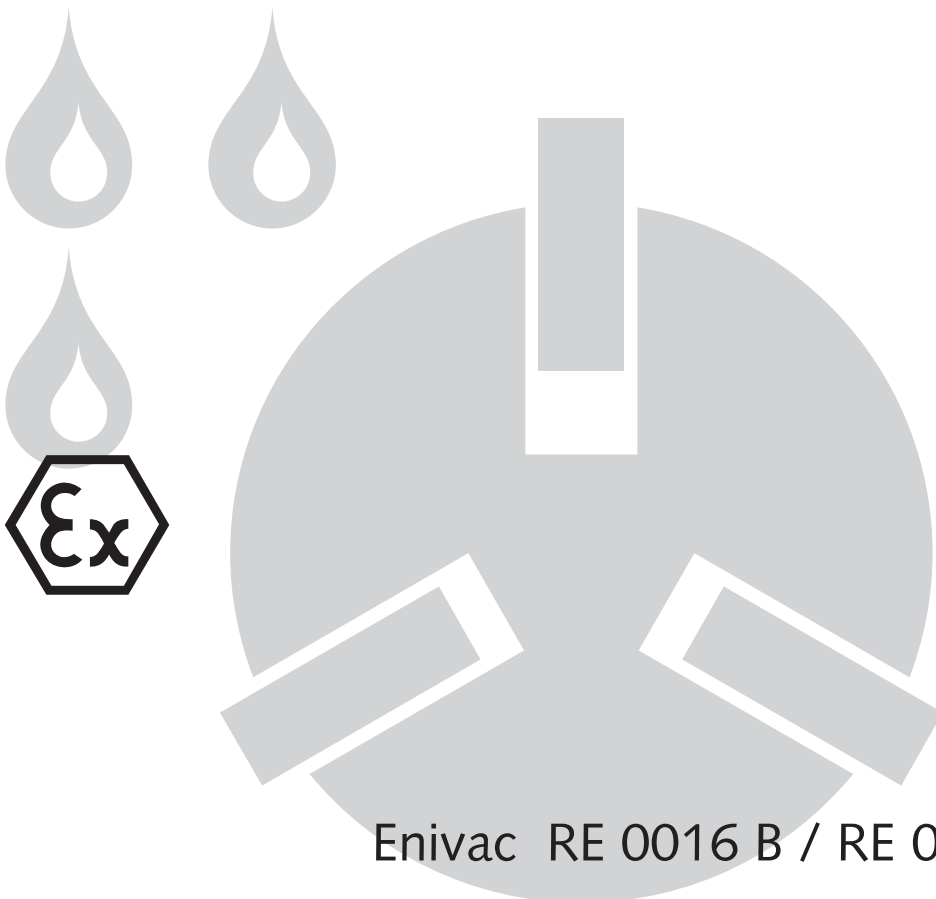




Installation and Operating Instructions



Vacuum Pumps

Enivac RE 0016 B / RE 0040 B / RE 0063 B



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Preface

Congratulations on your purchase of the Busch vacuum pump. With watchful observation of the field's requirements, innovation and steady development Busch delivers modern vacuum and pressure solutions worldwide.

These operating instructions contain information for

- product description,
- transport,
- storage,
- installation and commissioning,
- maintenance,
- overhaul,
- troubleshooting and
- spare parts

of the vacuum pump.

For the purpose of these instructions, "handling" the vacuum pump means the transport, storage, installation, commissioning, influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

Prior to handling the vacuum pump these operating instructions shall be read and understood. If anything remains to be clarified please contact your Busch representative!

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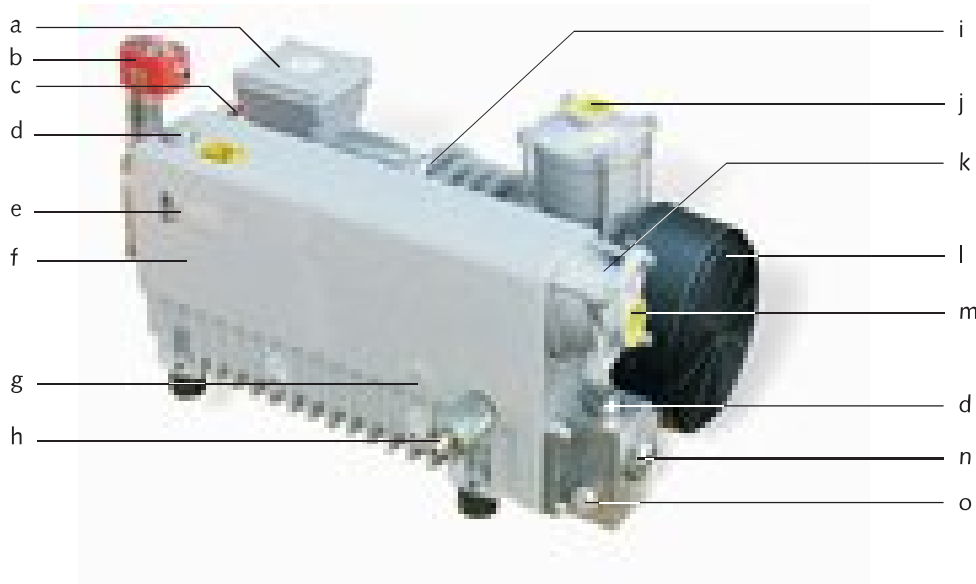
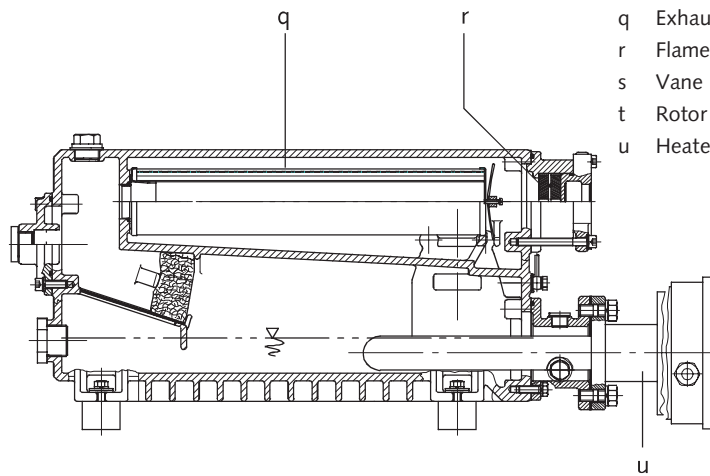
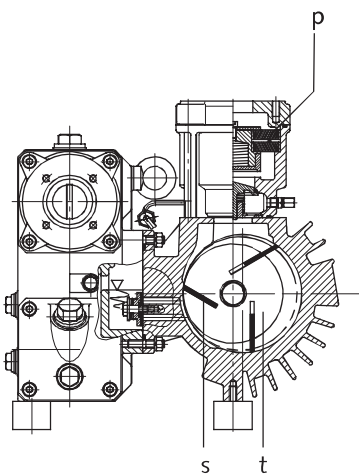


Illustration shows RE 0040 B, RE 0016 B / RE 0040 B / RE 0063 B are similar

- a Terminal box
- b Pressure switch/indicator
- c Directional arrow
- d Oil fill plugs
- e Nameplate
- f Oil separator
- g Earth connection
- h Temperature switch
- i Eye bolt
- j Suction connection
- k Exhaust cover plate
- l Axial flow fan
- m Gas discharge
- n Oil sight glass
- o Oil drain plug
- p Flame arrestor with slip stream interruption
- q Exhaust filter
- r Flame arrestor
- s Vane
- t Rotor
- u Heater (optional)



Product Description

Use

The vacuum pump is intended for

- the suction
- of
- explosive mixtures of gases according to the Type Examination Certificate

Conveying media with a higher density than air leads to an increased thermal and mechanical load and is permissible only after prior consultation with Busch.

For permissible temperatures of environment and inlet gas see "Technical Data".

According to the directive 94/9/EG ("ATEX 95") the vacuum pump is made for the intended use in explosive areas.

According to this directive the vacuum pump is inside a category 1 device (suitable for connection to tubings the inside of which is classified as zone 0). Outside the vacuum pump is approved as category 2 device (for use in zone 1).

According to the EC-Type Examination Certificate issued by the Physikalisch-Technische Bundesanstalt (PTB) the vacuum pump may be used for the conveying of explosive gas/air mixtures of flammable material, provided that the material belongs to the temperature classes T1 to T4 according to EN 13463-1 and to the explosion groups IIA to IIB3 according to E. Brandes, W. Möller "Sicherheitstechnische

Kenngößen, Band 1: Brennbare Flüssigkeiten und Gase", ISBN 3-89701-745-8 (or equivalent source).

The vacuum pump is suitable for placement in an environment where explosive gas/air mixtures of flammable material with temperature class T1 to T4 are likely to occur in normal operation occasionally (zone 1).

In case Busch delivered the vacuum pump without drive motor or a spare motor is to be mounted or for economic reasons the vacuum pump was equipped with a simpler motor, the following must be observed:

In case the classifications of the vacuum pump and of the drive motor are different the inferior classification is relevant. This means also that the vacuum pump is suitable for the placement in an explosive environment and for the conveying of explosive gases only when both the vacuum pump and the drive motor are approved for use in explosive areas.

The vacuum pump is thermally suitable for continuous operation.

The vacuum pump is ultimate pressure proof.

The approval for use in potentially explosive atmospheres is valid for the vacuum pump together with described measurement and safety equipment. The approval is void if the system is altered or if the scheduled maintenance is not performed. Maintenance must be performed by specifically instructed personnel only.

Safety Concept

The safety concept for the vacuum pumps Enovac RE 0016 B / RE 0040 B / RE 0063 B for use in potentially explosive atmosphere as a

category 1 device (inside) and category 2 device (outside) is based on two safety principles being independent from each other:

1. Avoidance of ignition caused by an electric or non-electric ignition source inside or outside the vacuum pump.

In order to avoid an ignition inside as well as outside the vacuum pump an oil sight glass (optionally a level switch) and two different electric switches are used, all of which must be checked for allowed operating parameters prior to start and continuously during operation. In case of an illegal operating parameter the vacuum pump must not start or must be shut down immediately respectively (see "Equipment Documentation Measurement and Safety Instrumentation, Flow Chart Safety Tests").

- The oil sight glass must be read every day prior to the start of the vacuum pump.
- Version with level switch (optional): The level switch must safely shut down the vacuum pump if the level is below minimum.
- The pressure switch/indicator gives an alarm at switching point S1 (550 hPa (=mbar) g) and must safely shut down the vacuum pump at switching point S2 (600 hPa (=mbar) g). The digital display gives an indication to the operator about the degree of soiling and therefore necessary maintenance of the exhaust filter or the discharge/pressure side flame arrestor.
- The temperature switch must safely shut down the vacuum pump if the temperature limit (120 °C) is exceeded.

2. Avoidance of hazards to persons and goods from the effects of an explosion that might happen inside the vacuum pump despite the mentioned safety precautions.

- Pressure proof design of the vacuum pump, capable of resisting a pressure up to 18 bar g without bursting.
- The suction connection and the gas discharge feature flame arrestors, preventing flashbacks into the suction side and discharge side of the system.
- Flame arrestor with slip-stream interruption on the suction side.

Operational Options / Use of Optionally Available Equipment

Operation with varying speed, i.e. with a frequency inverter is permitted. The minimum speed shall not drop below 700 rpm. The maximum speed is the one for which the drive motor is intended without frequency inverter operation (i.e. the frequency inverter must not be used to increase the speed), but no more than 1800 min⁻¹.

Operation with gas ballast, e.g. in order to avoid condensates, is permitted.

The return of separated oil from the oil separator into the suction connection (required for continuous operation at suction pressures higher than 300 hPa/mbar; standard for RE 0016 B, optional for RE 0040 B and RE 0063 B) is permitted.

Keeping the oil sump warm (heater, optional for RE 0040 B and RE 0063 B), required for low ambient temperatures (see "Oil"), is permitted.

Operation with a level switch (optional) in order to monitor the oil level is permitted.

Operation with a nickel-plated oil separator (optional) is permitted.

Principle of Operation

The vacuum pump works on the rotating vane principle.

A circular rotor (t) is positioned centrally on the shaft the vacuum pump. The shaft of the vacuum pump is driven by the drive motor shaft by means of a flexible coupling.

The rotor (t) rotates in an also circular, fixed cylinder, the centreline of which is offset from the centreline of the rotor such that the rotor and the inner wall of the cylinder almost touch along a line. Vanes, sliding in slots in the rotor, separate the space between the rotor and the cylinder into chambers. At any time gas is sucked in and at almost any time ejected. Therefore the vacuum pump works almost pulsation free.

In order to avoid reverse rotation after switching off, the vacuum pump is equipped with a check valve.

NOTE: This valve shall not be used as a check valve or shut-off valve to the vacuum system and is no reliable means to prevent suction of oil into the vacuum system while the vacuum pump is switched off.

In case the vacuum pump is equipped with a gas ballast (optional):

Through the gas ballast valve a small amount of ambient air is sucked in the pump chamber and compressed together with the process gas. This counteracts the accumulation of condensates from the process gas inside the vacuum pump (see also "Operation Notes").

The gas ballast line is equipped with a sinter metal filter.

In order to improve the operating characteristics the outlet of the pump chamber is equipped with a spring loaded valve.

Oil Circulation

The vacuum pump requires oil to seal the gaps, to lubricate the vanes and to carry away compression heat.

The oil reservoir is located on the pressure side of the vacuum pump (i.e. high pressure) at the bottom of the bottom chamber of the oil separator.

The feed openings are located on the suction side of the vacuum pump (i.e. low pressure).

Forced by the pressure difference between pressure side and suction side oil is being drawn from the oil separator (f) through the oil supply lines and injected on the suction side.

Together with the sucked gas the injected oil gets conveyed through the vacuum pump and ejected into the oil separator (f) as oil mist. Oil that separates before the exhaust filter (q) accumulates at the bottom of the bottom chamber of the oil separator (f).

Oil that is separated by the exhaust filter (q) accumulates at the bottom of the upper chamber of the oil separator (f).

The flow resistance of the exhaust filters (q) causes the inside of the exhaust filters (which are connected to be bottom chamber of the oil separator) to be on a higher pressure level than the outside of the exhaust filters (i.e. the upper chamber of the oil separator). Because of the higher pressure in the bottom chamber it is not possible to let oil that drips off the exhaust filters simply flow down to the bottom chamber.

Version with oil return line to the suction connection:

Therefore the oil that accumulates in the upper chamber is sucked through the oil return line right to the suction connection.

Version with oil return line to B-cover:

Therefore the oil that accumulates in the upper chamber is sucked through the oil return line right to the cylinder chamber.

Cooling

The vacuum pump is cooled by

- radiation of heat from the surface of the vacuum pump incl. oil separator (f)
- the air flow from the fan wheel of the drive motor
- the conveyed gas
- the air flow from the fan wheel (k) on the shaft of the vacuum pump

(fan wheel on the shaft of the vacuum pump only for RE 0040 B and RE 0063 B)

On/off Switch

The vacuum pump comes without on/off switch. The control of the vacuum pump is to be provided in the course of installation.

Safety

Intended Use

DEFINITION: For the purpose of these instructions, "handling" the vacuum pump means the transport, storage, installation, commissioning, influence on operating conditions, maintenance, troubleshooting and overhaul of the vacuum pump.

The vacuum pump is intended for industrial use. It shall be handled only by qualified personnel.

The allowed media and operational limits according to the "Product Description" and the "Installation Prerequisites" of the vacuum pump shall be observed both by the manufacturer of the machinery into which the vacuum pump is to be incorporated and by the operator.

In particular the intended use in explosive areas, i.e. either inside the vacuum pump or in its adjacency explosive atmosphere can appear, requires that the vacuum pump is equipped accordingly and carries the Ex-mark and that the associated documentation acc. to the directive 94/9/EC is available.

The maintenance instructions shall be observed.

Prior to handling the vacuum pump these operating instructions shall be read and understood. If anything remains to be clarified please contact your Busch representative!

Safety Notes

The vacuum pump has been designed and manufactured according to the state-of-the-art. Nevertheless, residual risks may remain. These operating instructions inform about potential hazards where appropriate. Safety notes are tagged with one of the keywords DANGER, WARNING and CAUTION as follows:



DANGER

Disregard of this safety note will always lead to accidents with fatal or serious injuries.



WARNING

Disregard of this safety note may lead to accidents with fatal or serious injuries.



CAUTION

Disregard of this safety note may lead to accidents with minor injuries or property damage.

Emission of Oil Mist

The oil in the conveyed gas is separated to the greatest possible extent, but not perfectly.



CAUTION

Aspiration of gas conveyed by the vacuum pump over extended periods can be harmful.

The room into which the gas conveyed by the vacuum pump is discharged must be sufficiently vented.

NOTE: The possibly sensible smell is not caused by droplets of oil, though, but either by gaseous process components or by readily volatile and thus gaseous components of the oil (particularly additives).

Noise Emission

For the sound pressure level in free field according to DIN 45635, part 13 see "Technical Data".

Transport

Transport in Packaging

Packed on a pallet the vacuum pump is to be transported with a forklift.

Transport without Packaging

In case the vacuum pump is packed in a cardboard box with inflated cushions:

- Remove the inflated cushions from the box

In case the vacuum pump is in a cardboard box cushioned with rolled corrugated cardboard:

- Remove the corrugated cardboard from the box

In case the vacuum pump is layed in foam:

- Remove the foam

In case the vacuum pump is bolted to a pallet or a base plate:

- Remove the bolting between the vacuum pump and the pallet/base plate

In case the vacuum pump is fastened to the pallet by means of tightening straps:

- Remove the tightening straps



CAUTION

Do not walk, work or stand under suspended loads.

- Attach lifting gear securely to the eyebolt on the oil separator
- Attach the lifting gear to a crane hook with safety latch
- Lift the vacuum pump with a crane

In case the vacuum pump was bolted to a pallet or a base plate:

- Remove the stud bolts from the rubber feet



CAUTION

Tilting a vacuum pump that is already filled with oil can cause large quantities of oil to ingress into the cylinder.

Starting the vacuum pump with excessive quantities of oil in the cylinder immediately breaks the vanes and ruins the pump.

Once the vacuum pump is filled with oil it shall not be lifted anymore.

- Prior to every transport make sure that the oil is drained

Storage

Short-term Storage

Version with gas ballast device without ball-cock, with sinter metal filter:

- Close the sinter metal filter of the gas ballast device with adhesive tape
- Make sure that the suction connection and the gas discharge are closed (leave the provided plugs in)
- Store the vacuum pump
 - if possible in original packaging,
 - indoors,
 - dry,
 - dust free and
 - vibration free

Conservation

In case of adverse ambient conditions (e.g. aggressive atmosphere, frequent temperature changes) conserve the vacuum pump immediately. In case of favourable ambient conditions conserve the vacuum pump if a storage of more than 3 months is scheduled.

- Make sure that the oil is drained (see "Maintenance, Oil Change, Draining Used Oil")
- Wrap PTFE-tape around the thread of a plug
- Firmly insert the plug into the suction connection (j)



CAUTION

Operation with a gas discharge (m) closed will damage the vacuum pump.

Make sure that the gas discharge is open.

- Fill in 1 litres (RE 0016 B) or 2 litres (RE 0040 / 0063 B) resp. conservation oil (see "Maintenance, Oil Change, Filling in Fresh Oil")



CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 70 °C.

Risk of burns!!

Do not touch the hot housing.

- Electrically connect the vacuum pump (see "Installation and Commissioning, Installation, Connect Electrically")
- Let the vacuum pump run for at least half an hour with suction connection (j) closed
- Switch the vacuum pump off
- Drain the conservation oil (see "Maintenance, Oil Change, Draining Used Oil")
- Wrap PTFE-tape around the thread of a plug
- Firmly insert the plug into the gas discharge (m)

Version with gas ballast device without ball-cock, with sinter metal filter:

- Close the sinter metal filter of the gas ballast device with adhesive tape
- Make sure that all ports are firmly closed; seal all ports that are not sealed with PTFE-tape, gaskets or o-rings with adhesive tape

NOTE: VCI stands for "volatile corrosion inhibitor". VCI-products (film, paper, cardboard, foam) evaporate a substance that condenses in molecular thickness on the packed good and by its electro-chemical properties effectively suppresses corrosion on metallic surfaces. However, VCI-products may attack the surfaces of plastics and elastomers. Seek advice from your local packaging dealer! Busch uses CORTEC VCI 126 R film for the overseas packaging of large equipment.

- Wrap the vacuum pump in VCI film
- Store the vacuum pump
 - if possible in original packing,
 - indoors,
 - dry,
 - dust free and
 - vibration free

For commissioning after conservation:

- Make sure that all remains of adhesive tape are removed from the ports
- Commission the vacuum pump as described in the chapter "Installation and Commissioning"

Installation and Commissioning

Installation Prerequisites



CAUTION

In case of non-compliance with the installation prerequisites, particularly in case of insufficient cooling:

Risk of damage or destruction of the vacuum pump and adjoining plant components!

Risk of injury!

The installation prerequisites must be complied with.

- Make sure that the integration of the vacuum pump is carried out such that the essential safety requirements of the Machine Directive 98/37/EC are complied with (in the responsibility of the designer of the machinery into which the vacuum pump is to be incorporated; see also the note in the EC-Declaration of Conformity)

Mounting Position and Space

- Make sure that the following ambient conditions will be complied with:
 - Ambient temperature: see "Technical Data"
 - Ambient pressure: atmospheric
- Make sure that the environmental conditions comply with the protection class of the drive motor (according to the nameplate)
- Make sure that the vacuum pump can neither inadvertently nor intentionally be stepped on and cannot be used as a support for heavy objects
- Make sure that the vacuum pump will be placed or mounted horizontally
- Make sure that the base for placement / mounting base is even
- Make sure that in order to warrant a sufficient cooling there will be a clearance of minimum 0.1 m between the vacuum pump and nearby walls
- Make sure that no temperature sensitive parts (plastics, wood, cardboard, paper, electronics) will touch the surface of the vacuum pump
- Make sure that the installation space or location is vented such that a sufficient cooling of the vacuum pump is warranted



CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 70 °C.

Risk of burns!

- Make sure that the vacuum pump will not be touched inadvertently during operation, provide a guard if appropriate
- Make sure that the oil sight glass (n) will remain easily accessible

If the oil change is meant to be performed on location:

- Make sure that the oil drain port (o) and the oil inlet port (d) will remain easily accessible
- Make sure that enough space will remain for the removal and the reinsertion the exhaust filter (q)

Suction Connection



CAUTION

Intruding foreign objects or liquids can destroy the vacuum pump.

In case the inlet gas can contain dust or other foreign solid particles:

- Make sure that a suitable filter (5 micron or less) is installed upstream the vacuum pump
- Make sure that the suction line fits to the suction connection (j) of the vacuum pump
- Make sure that the pipe will cause no stress on the vacuum pump's connection, if necessary use bellows
- Make sure that the line size of the suction line over the entire length is at least as large as the suction connection (j) of the vacuum pump

In case of very long suction lines it is prudent to use larger line sizes in order to avoid a loss of efficiency. Seek advice from your Busch representative!

If two or more vacuum pumps work on the same vacuum system, the volume of the vacuum system is large enough to suck back oil or if the vacuum shall be maintained after switching off the vacuum pump:

- Provide a manual or automatic operated valve (= check valve) in the suction line

(the check valve that is installed inside the suction connection is not meant to be used for this purpose!)

If the vacuum pump is planned to be used for the suction of gas that contains limited quantities of condensable vapour:

- Provide a shut-off valve, a drip-leg and a drain valve in the suction line, so that condensates can be drained from the suction line

Discharge Connection



WARNING

The vacuum pump is intended to convey explosive gases/gas mixtures.

Risk of explosion in the discharge area!

The conveyed gas/gas mixture must be disposed of such that no explosive gas mixtures can accumulate in the discharge area.



CAUTION

The discharged air contains small quantities of vacuum oil.

Staying in vacuum oil contaminated air bears a risk of damage to health.

If air is discharged into rooms where persons stay, sufficient ventilation must be provided for.

- Make sure that the discharge line fits to the gas discharge (m) of the vacuum pump
- Make sure that the pipe will cause no stress on the vacuum pump's connection, if necessary use bellows
- Make sure that the line size of the discharge line over the entire length is at least as large as the gas discharge (m) of the vacuum pump

In case of very long discharge lines it is prudent to use larger line sizes in order to avoid a loss of efficiency. Seek advice from your Busch representative!

- Make sure that the discharge line either slopes away from the vacuum pump or provide a liquid separator or a drip leg with a drain cock, so that no liquids can back up into the vacuum pump



WARNING

Discharge lines made from non-conducting material can build up static charge.

Static discharge can cause explosion of potentially existing oil mist.

The discharge line must be made of conducting material or provisions must be made against static discharge.

Electrical Connection

- Make sure that the stipulations acc. to the EMC-Directive 89/336/EEC and Low-Voltage-Directive 73/23/EEC as well as the EN-standards, electrical and occupational safety directives and the local or national regulations, respectively, are complied with (this is in the responsibility of the designer of the machinery into which the vacuum pump is to be incorporated; see also note in the EC-Declaration of Conformity).
- Make sure that the power supply is compatible with the data on the nameplate of the drive motor
- Make sure that an overload protection according to EN 60204-1 is provided for the drive motor
- Make sure that the drive of the vacuum pump will not be affected by electric or electromagnetic disturbance from the mains; if necessary seek advice from your Busch representative

In case of mobile installation:

- Provide the electrical connection with grommets that serve as strain-relief
- Execute the interfaces for the switches for
 - pressure inside the oil separator
 - temperature inside the oil separator
 - level monitoring (level switch; optional)in the system control according to the safety concept (see "Product Description, Safety Concept") and according to the "Equipment Documentation Measurement and Safety Instrumentation"

Electrical circuits in zone 1 (outside) shall be executed intrinsically safe in protection class *ib* acc. to EN 50020.

Mounting

- Make sure that the "Installation Prerequisites" are complied with
- Set down or mount the vacuum pump at its location

Connecting Electrically



WARNING

Risk of electrical shock, risk of damage to equipment.

Electrical installation work must only be executed by qualified personnel that knows and observes the following regulations:

- IEC 364 or CENELEC HD 384 or DIN VDE 0100, respectively,
- IEC-Report 664 or DIN VDE 0110,
- VBG 4 or corresponding national accident prevention regulation.



CAUTION

The connection schemes given below are typical. Depending on the specific order or for certain markets deviating connection schemes may apply.

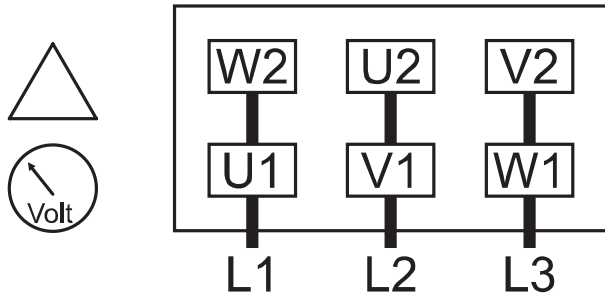
Risk of damage to the drive motor!

The inside of the terminal box shall be checked for drive motor connection instructions/schemes.

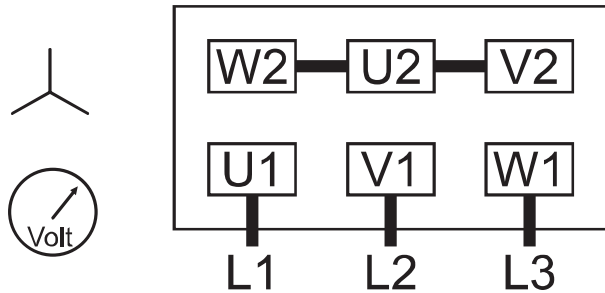
- Electrically connect the drive motor
- Connect the protective earth conductor

Connection Scheme Three-Phase Motor

Delta connection (low voltage):



Star connection (high voltage):



CAUTION

Operation in the wrong direction of rotation can destroy the vacuum pump in short time.

Prior to starting-up it must be made sure that the vacuum pump is operated in the proper direction.

Version with three-phase motor:

- ✦ Determine the intended direction of rotation with the arrow (stuck on or cast)
- ✦ "Bump" the drive motor
- ✦ Watch the fan wheel of the drive motor and determine the direction of rotation just before the fan wheel stops

If rotation must be changed:

- ✦ Switch any two of the drive motor wires (three-phase motor)



WARNING

The proper installation of measurement and safety equipment is decisive for the explosion safety of the vacuum pump.

Risk of explosion!

The vacuum pump may be operated in areas with potentially explosive atmosphere only with completely installed and checked measurement and safety equipment.

- ✦ Connect the switches for
 - temperature inside the oil separator
 - pressure inside the oil separator
 - level monitoring (optional)
 to the control system (see "Equipment Documentation Measurement and Safety Instrumentation")
- ✦ After connecting the cable to the temperature switch make sure that the gasket is inserted between the front and the rear part of the housing, the housing is firmly closed and the grommet is tightened

Connecting Lines/Pipes

In case the suction line is equipped with a shut-off valve:

- ✦ Connect the suction line

NOTE: During the functional check of the measurement and safety instrumentation in the course of the test run with inert gas it is necessary to throttle the gas outlet, which will require the discharge line to be disconnected from the vacuum pump.

- ✦ Connect the discharge line
- ✦ Make sure that all provided covers, guards, hoods etc. are mounted
- ✦ Make sure that cooling air inlets and outlets are not covered or obstructed and that the cooling air flow is not affected adversely in any other way

Filling Oil

In case the vacuum pump was treated with conservation oil:

- ✦ Drain the remainders of conservation oil (see "Maintenance/Oil Change/Draining Used Oil")



CAUTION

The vacuum pump is shipped without oil.

Operation without oil will ruin the vacuum pump in short time.

Prior to commissioning it must be made positively sure that oil is filled in.

The vacuum pump is delivered without oil (oil specification see "Oil").

- ✦ Keep approx. 1 litres (RE 0016 B) or 2 litres (RE 0040 / 0063 B) resp. oil acc. to the table "Oil" ready

NOTE: The amount given in these operating instructions is a guide. The oil sight glass (n) indicates the actual amount to be filled in.

Version with level switch:

- ✦ Make sure that the level switch reports "low level"



CAUTION

The vacuum pump has potentially been treated with conservation oil.

Synthetic oils (except for oils based on poly- α -olefin) are incompatible with mineral oils and conservation oils.

Risk of foaming leading to destruction of the vacuum pump.

Before changing the oil type compatibility shall be checked and, if necessary, the pump be flushed.



CAUTION

Filling oil through the suction connection (j) will break the vanes (s) and ruin the pump.

Oil may be filled through the oil inlet port (d) only.



CAUTION

During operation the oil separator is filled with hot, pressurised oil mist.

Risk of injury from hot oil mist with open oil inlet port.

Risk of injury if a loosely inserted oil inlet plug (d) is ejected.

Remove the oil inlet plug (d) only the vacuum pump is stopped.

The vacuum pump must only be operated with the oil inlet plug (d) firmly inserted.

- ✦ Remove the oil inlet plug (d)

- Fill in approx. 1 litres (RE 0016 B) or 2 litres (RE 0040 / 0063 B) resp. of oil
- Make sure that the level is between the MIN and the MAX-markings of the oil sight glass (n)

Version with level switch:

- Make sure the level switch reports correct level
- Make sure that the seal ring is inserted into the oil inlet plug (d) and undamaged, replace if necessary
- Firmly reinsert the oil inlet plug (d) together with the seal ring

NOTE: Starting the vacuum pump with cold oil is made easier when at this very moment the suction line is neither closed nor covered with a rubber mat.

- Switch on the vacuum pump

In case the suction line is equipped with a shut-off valve:

- Close the shut-off valve

In case the suction line is not equipped with a shut-off valve:

- Cover the suction connection (j) with a piece of rubber mat
- Let the vacuum pump run for a few minutes

Version with level switch:

- Check that the level switch reports correct level
- Switch off the vacuum pump and wait a few minutes
- Check that the level is between the MIN and the MAX-markings of the oil sight glass (n)

In case the level has fallen below the MIN-marking:

In case the level switch has reported low level:

- Top-up oil

In case the suction line is equipped with a shut-off valve:

- Open the shut-off valve

In case the suction line is not equipped with a shut-off valve:

- Remove the piece of rubber mat and connect the suction line

Checking the Function of the Measurement and Safety Instrumentation

- Disconnect the discharge line from the vacuum pump
- Connect a throttle valve to the gas discharge (m)
- Make sure that the vacuum pump sucks in inert gases
- Switch on the vacuum pump
- Interrupt the electrical circuit of the temperature switch by pulling a connector from the temperature switch
- Make sure that an alarm is released in the system control and the vacuum pump is shut down automatically
- Push the connector back on the temperature switch
- Make sure that the alarm is still on
- Make sure that the vacuum pump does not start self-acting
- Switch on the vacuum pump again
- Throttle the gas discharge until the display on the pressure switch/indicator shows 550 hPa (=mbar) g
- Make sure that a warning is released in the system control
- Relief the throttling of the gas discharge
- Make sure that the warning continues
- Throttle the gas discharge further until the display on the pressure switch/indicator shows 600 hPa (=mbar) g
- Make sure that an alarm is released in the system control, the vacuum pump is shut down automatically and remains shut down
- Remove the throttle valve and connect the discharge line

- Make sure that on the temperature switch the gasket is inserted between the housing cover and the housing bottom, firmly close the housing and tighten the cable gland

Recording of Operational Parameters

As soon as the vacuum pump is operated under normal operating conditions:

- Measure the drive motor current and record it as reference for future maintenance and troubleshooting work
- Read the display on the pressure switch/indicator and record it for future maintenance and troubleshooting work

Operation Notes

Application



CAUTION

The vacuum pump is designed for operation under the conditions described below.

In case of disregard risk of damage or destruction of the vacuum pump and adjoining plant components!

Risk of injury!

The vacuum pump must only be operated under the conditions described below.

The vacuum pump is intended for

- the suction of
- explosive mixtures of gases according to the Type Examination Certificate

Conveying media with a higher density than air leads to an increased thermal and mechanical load and mechanical on the vacuum pump and is permissible only after prior consultation with Busch.

For permissible temperatures of environment and inlet gas see "Technical Data".

According to the directive 94/9/EG ("ATEX 95") the vacuum pump is made for the intended use in explosive areas.

According to this directive the vacuum pump is inside a category 1 device (suitable for connection to tubings the inside of which is classified as zone 0). Outside the vacuum pump is approved as category 2 device (for use in zone 1).

According to the EC-Type Examination Certificate issued by the Physikalisch-Technische Bundesanstalt (PTB) the vacuum pump may be used for the conveying of explosive gas/air mixtures of flammable material, provided that the material belongs to the temperature classes T1 to T4 according to EN 13463-1 and to the explosion groups IIA to IIB3 according to E. Brandes, W. Möller "Sicherheitstechnische Kenngrößen, Band 1: Brennbare Flüssigkeiten und Gase", ISBN 3-89701-745-8 (or equivalent source).

The vacuum pump is suitable for placement in an environment where explosive gas/air mixtures of flammable material with temperature class T1 to T4 are likely to occur in normal operation occasionally (zone 1).

In case Buch delivered the vacuum pump without drive motor or a spare motor is to be mounted or for economic reasons the vacuum pump was equipped with a simpler motor, the following must be observed:

In case the classifications of the vacuum pump and of the drive motor are different the inferior classification is relevant. This means also that the vacuum pump is suitable for the placement in an explosive environment and for the conveying of explosive gases only when both the vacuum pump and the drive motor are approved for use in explosive areas.

The vacuum pump is thermally suitable for continuous operation.

The vacuum pump is ultimate pressure proof.

The approval for use in potentially explosive atmospheres is valid for the vacuum pump together with described measurement and safety equipment. The approval is void if the system is altered or if the scheduled maintenance is not performed. Maintenance must be performed by specifically instructed personnel only.



During operation the surface of the vacuum pump may reach temperatures of more than 70 °C.

Risk of burns!!

The vacuum pump shall be protected against contact during operation, it shall cool down prior to a required contact or heat protection gloves shall be worn.



The gas conveyed by the vacuum pump contains remainders of oil.

Aspiration of conveyed gas over extended periods can be harmful.

The room into which the gas conveyed by the vacuum pump is discharged must be sufficiently vented.

- Make sure that all provided covers, guards, hoods etc. remain mounted
- Make sure that protective devices will not be disabled
- Make sure that cooling air inlets and outlets will not be covered or obstructed and that the cooling air flow will not be affected adversely in any other way
- Make sure that the "Installation Prerequisites" are complied with and will remain complied with, particularly that a sufficient cooling will be ensured

Conveying Condensable Steams



Residual condensates dilute the oil, deteriorate its lubricating properties and can cause a seizure of the rotor.

Apply a suitable operating method to make sure that no condensates remain in the vacuum pump.

In order to use the vacuum pump for the conveyance of condensable vapours, the vacuum pump must be equipped with shut-off valve in the suction line and with a gas ballast valve.

- Close the shut-off valve in the suction line
- Operate the vacuum pump with the shut-off valve in the suction line in closed position for approx. half an hour, so that the operating temperature rises to approx. 75 °C

At process start:

- Open the shut-off valve in the suction line

At the process end:

- Close the shut-off valve in the suction line
- Operate the vacuum pump for another approx. half an hour

Maintenance



The vacuum pump must only be operated with the genuine components that were approved by the German Physikalisch-Technische Bundesanstalt (PTB) and released for service with this vacuum pump.

Use of other components voids the vacuum pump's approval for service.



During operation the surface of the vacuum pump may reach temperatures of more than 70 °C.

Risk of burns!!

- Prior to action that requires touching of the vacuum pump, let the vacuum pump cool down, however, if the oil is to be drained, for no more than 20 minutes
- Prior to disconnecting pipes/lines make sure that all pipes/lines are vented to atmospheric pressure

Maintenance Schedule

Daily:

Version without level switch:

- Prior to start-up check the level and the colour of the oil (see "Checking the Oil")

Weekly:

Version without level switch (optional):

- Check the level and the colour of the oil (see "Checking the Oil")
- Check that the oil inlet plug (d) and the oil drain plug (o) are firmly seated
- Check the vacuum pump for oil leaks – in case of leaks repair the vacuum pump (Busch service)

Monthly:

In case an inlet air filter is installed:

- Check the inlet air filter, if necessary replace

In case of operation in a dusty environment:

- Clean as described under "Every 6 Months:"

Every 6 Months:

- Make sure that the housing is free from dust and dirt, clean if necessary
- Make sure that the vacuum pump is switched off and locked against inadvertent start up

NOTE: any kind of deposit on the vacuum pump compromises the explosion safety of the vacuum pump.

- Clean the fan cowlings, fan wheels, ventilation grilles and cooling fins



The proper assembly of flame arrestors is essential for their safe function.

Risk of explosion in case of faulty assembly!

Flame arrestors must only be maintained by personnel that have received specific training for this purpose either by Busch or by the manufacturer of the flame arrestors.

- Service the flame arrestors (p) (r) – in case of discolouration or deformation consult Busch or the manufacturer of the flame arrestor in any case
- Check the electrical connection
- Check the function of the measurement and safety instrumentation (see “Functional Check of the Measurement and Safety Instrumentation”)

Every 500 – 2000 Operating Hours (see “Oil Life”):

- Change the oil (see “Oil Change”)

Every 2000 Operating Hours:

In case an inlet air filter is installed:

- Replace the inlet air filter

In case an inlet screen is installed:

- Check the inlet screen, clean if necessary

Version with gas ballast with sinter metal filter:

- Clean the sinter metal filter (pressurised air)

Every 16000 Operating Hours, at the Latest after 4 Years:

- Have a major overhaul on the vacuum pump (Busch service)

Checking the Oil

Checking the Level

- Make sure that the vacuum pump is switched off and the oil has collected at the bottom of the oil separator (f)
- Read the level on the sight glass (n)

In case the level has dropped underneath the MIN-marking:

- Top up oil (see “Topping up Oil”)

In case the level exceeds the MAX-marking:

- Excessive dilution with condensates – change the oil and check the process
- If appropriate retrofit a gas ballast (Busch Service) and observe the chapter “Operating Notes, Conveying Condensable Vapours”

Topping up Oil

NOTE: Under normal conditions there should be no need to top up oil during the recommended oil change intervals. A significant level drop indicates a malfunction (see “Troubleshooting”).

NOTE: During operation the exhaust filter gets saturated with oil. It is therefore normal that the oil level will drop slightly after replacement of the exhaust filter.



CAUTION

Filling oil through the suction connection (j) will break the vanes (s) and ruin the pump.

Oil may be filled through the oil inlet port (d) only.



CAUTION

During operation the oil separator is filled with hot, pressurised oil mist.

Risk of injury from hot oil mist with open oil inlet port.

Risk of injury if a loosely inserted oil inlet plug (d) is ejected.

Remove the oil inlet plug (d) only the vacuum pump is stopped.

The vacuum pump must only be operated with the oil inlet plug (d) firmly inserted.

- Make sure that the vacuum pump is switched off and locked against inadvertent start up
- Remove the oil inlet plug (d)
- Top up oil until the level reaches the middle of the oil sight glass (n)
- Make sure that the level is between the MIN and the MAX-markings of the oil sight glass (n)

Version with level switch:

- Make sure the level switch reports correct level
- Make sure that the seal ring is inserted into the oil inlet plug (d) and undamaged, replace if necessary
- Firmly reinsert the oil inlet plug (d) together with the seal ring

Checking the Colour of the Oil

NOTE: The oil should be light, either transparent, a little foamy or a little tarnished. A milky discolouration that does not vanish after sedimentation of the oil indicates contamination with foreign material. Oil that is either contaminated with foreign material or burned must be changed (see “Oil Change”)

Oil Life

The oil life depends very much on the operating conditions. A clean and dry air stream and operating temperatures below 100 °C are ideal. Under these conditions the oil shall be changed every 500 to 2000 operating hours or after half a year.

Under very unfavourable operating conditions the oil life can be less than 500 operating hours. Extremely short life times indicate malfunctions (see “Troubleshooting”) or unsuitable operating conditions, though.

If there is no experience available with regard to the oil life under the prevailing operation conditions, it is recommended to have an oil analysis carried out every 500 operating hours and establish the change interval accordingly

Oil Change



DANGER

In case the vacuum pump conveyed gas that was contaminated with harmful foreign material the oil will be contaminated with harmful material.

Danger to health during the changing of contaminated oil.

Danger to the environment.

Wear protective clothing during the changing of contaminated oil.

Contaminated oil is special waste and must be disposed of separately in compliance with applicable regulations.

Draining Used Oil

NOTE: After switching off the vacuum pump at normal operating temperature wait no more than 20 minutes before the oil is drained.

- Make sure that the vacuum pump is switched off and locked against inadvertent start up
- Make that the vacuum pump is vented to atmospheric pressure
- Put a drain tray underneath the oil drain port
- Remove the oil drain plug (o) and drain the oil

When the oil stream dwindles:

- Reinsert the drain plug (o)
- Switch the vacuum pump on for a few seconds
- Make sure that the vacuum pump is switched off and locked against inadvertent start up
- Remove the oil drain plug (o) again and drain the remaining oil

- Make sure that the seal ring is inserted into the oil drain plug (o) and undamaged, replace if necessary
- Firmly reinsert the oil drain plug (o) together with the seal ring
- Dispose of the used oil in compliance with applicable regulations

Flushing the Vacuum Pump



WARNING

Degraded oil can choke pipes and coolers.

Risk of damage to the vacuum pump due to insufficient lubrication.

Risk of explosion due to overheating.

If there is a suspicion that deposits have gathered inside the vacuum pump the vacuum pump shall be flushed.

- Make sure that all the used oil is drained
- Create 1 litre (RE 0016 B) or 2 litres (RE 0040 / 0063 B) resp. flushing agent from 50 percent oil and 50 percent paraffin or diesel fuel/fuel oil
- Make sure that the oil outlet plug (o) is firmly inserted
- Remove the oil inlet plug (d)
- Fill in the flushing agent
- Firmly reinsert the oil inlet plug (d)
- Close the suction line
- Run the vacuum pump for at least half an hour
- Drain the flushing agent and dispose of it in compliance with applicable regulations

NOTE: Due to the use of paraffin and even more in case of using Diesel fuel/fuel oil, unpleasant odour can occur after recommissioning. If this is a problem, Diesel fuel/fuel oil should be avoided and the vacuum pump be run at idle in a suitable place until the unpleasant odour vanishes.

Filling in Fresh Oil

- Keep 1 litre (RE 0016 B) or 2 litres (RE 0040 / 0063 B) resp. oil acc. to the table "Oil" ready

NOTE: The amount given in these operating instructions is a guide. The oil sight glass (n) indicates the actual amount to be filled in.

Version with level switch:

- Make sure that the level switch reports "low level"
- Make sure that the oil outlet plug (o) is firmly inserted



CAUTION

Filling oil through the suction connection (j) will break the vanes (s) and ruin the pump.

Oil may be filled through the oil inlet port (d) only.

- Remove the oil fill plug (d)
- Fill in approx. 1 litre (RE 0016 B) or 2 litres (RE 0040 / 0063 B) resp. of oil
- Make sure that the level is between the MIN and the MAX-markings of the oil sight glass (n)

Version with level switch:

- Make sure the level switch reports correct level
- Make sure that the seal ring is inserted into the oil inlet plug (d) and undamaged, replace if necessary
- Firmly reinsert the oil inlet plug (d) together with the seal ring

Exhaust Filter

Checks during Operation

- Make sure that the vacuum pump is running
- Check that the indication of the display of the pressure switch/indicator is in the usual range
- Check that the discharged gas is free from oil

Assessment

If

the pressure switch/indicator indicates a higher pressure than usual, then the exhaust filter (q) is clogged and must be replaced.

NOTE: Exhaust filters cannot be cleaned successfully. Clogged exhaust filters must be replaced with new ones.

If

the pressure switch/indicator indicates a lower pressure than usual, then the exhaust filter (q) is broken through and must be replaced.

If the discharged gas contains oil,

the exhaust filter (q) can either be clogged or broken through and, if applicable, must be replaced.



WARNING

The proper assembly of flame arrestors is essential for their safe function.

Risk of explosion in case of faulty assembly!

Flame arrestors must only be maintained by personnel that have received specific training for this purpose either by Busch or by the manufacturer of the flame arrestors.

If the pressure switch/indicator continues to indicate a higher pressure than usual after the replacement of the exhaust filter, the flame arrestor on the discharge/pressure side can be soiled:

- Service the flame arrestors (p) (r) – in case of discolouration or deformation consult Busch or the manufacturer of the flame arrestor in any case

Change of the Exhaust Filter



DANGER

In case the vacuum pump conveyed gas that was contaminated with harmful foreign material the exhaust filter will be contaminated with harmful material.

Danger to health during the changing of the contaminated exhaust filter.

Danger to the environment.

Wear protective clothing during the changing of the contaminated exhaust filter.

Used exhaust filters are special waste and must be disposed of separately in compliance with applicable regulations.



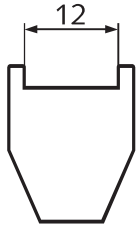
CAUTION

The filter spring can fly out of the exhaust port during removal or insertion.

Risk of eye injury.

Eye protection goggles must be worn while handling filter springs.

NOTE: In order to facilitate the removal and insertion of filter springs it is recommend to make a special tool:



- Make a fork acc. to the sketch from approx. 2 mm steel plate
- Weld the bottom end of the fork to the tip of a medium size slotted head screw driver

Removing the Exhaust Filter

- Make sure that the vacuum pump is switched off and locked against inadvertent start up
- Prior to disconnecting pipes/lines make sure that all pipes/lines are vented to atmospheric pressure
- Remove the discharge line, if necessary
- Remove the exhaust cover (k) from the oil separator (f)
- Loosen the screw in the centre of the exhaust filter retaining spring, but do not remove it at this time
- With the aid of the special tool press the exhaust filter retaining spring out of the indent and rotate it
- Remove the exhaust filter retaining spring from the oil separator
- Pull the exhaust filter (q) out of the oil separator (f)

Inserting the Exhaust Filter

- Make sure that the new exhaust filter (q) is equipped with a new o-ring
- Insert the exhaust filter (q) such that its port is properly seated in its receptacle in the oil separator (f)
- Make sure that the tip of the screw in the centre of the exhaust filter retaining spring protrudes the retaining spring by about 2 – 5 revolutions
- With the aid of the special tool insert the exhaust filter retaining spring such that its ends are secured in their receptacles in the oil separator (f) by the protrusions and that the tip of the screw snaps into the indent of the exhaust filter (q)
- Tighten the screw in the exhaust filter retaining spring such that the screw head touches the spring steel sheet
- Make sure that the seal under the exhaust cover (k) is clean and undamaged, if necessary replace with a new seal
- Mount the exhaust cover (k) together with the seal, hex head screws and spring washers on the oil separator (f)
- If necessary connect the discharge line

NOTE: During operation the exhaust filter gets saturated with oil. It is therefore normal that the oil level will drop slightly after replacement of the exhaust filter.

Functional Check of the Measurement and Safety Instrumentation

- Disconnect the discharge line from the vacuum pump
- Connect a throttle valve to the gas discharge (m)
- Make sure that the vacuum pump sucks in inert gases
- Switch on the vacuum pump
- Interrupt the cable to the temperature switch
- Make sure that an alarm is released in the system control and the vacuum pump is shut down automatically
- Reconnect the cable to the temperature switch
- Make sure that the alarm is still on
- Make sure that the vacuum pump does not start self-acting

- Switch on the vacuum pump again
- Throttle the gas discharge until the display on the pressure switch/indicator shows 550 hPa (=mbar) g
- Make sure that a warning is released in the system control
- Relief the throttling of the gas discharge
- Make sure that the warning continues
- Throttle the gas discharge further until the display on the pressure switch/indicator shows 600 hPa (=mbar) g
- Make sure that an alarm is released in the system control, the vacuum pump is shut down automatically and remains shut down
- Remove the throttle valve and connect the discharge line

Overhaul



Improper work on the vacuum pump put the operating safety at risk

Risk of explosion!

Approval for operation will be void!

Any dismantling of the vacuum pump that is beyond of what is described in this manual must be done by specially trained Busch service only.



In case the vacuum pump conveyed gas that was contaminated with harmful foreign material the oil and the exhaust filter(s) will be contaminated with harmful material.

Harmful material can reside in pores, gaps and internal spaces of the vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

Prior to shipping the vacuum pump shall be decontaminated as good as possible and the contamination status shall be stated in a "Declaration of Contamination" (form downloadable from www.busch-vacuum.com).

Busch service will only accept vacuum pumps that come with a completely filled in and legally binding signed "Declaration of Contamination" (form downloadable from www.busch-vacuum.com).

Removal from Service

Temporary Removal from Service

- Prior to disconnecting pipes/lines make sure that all pipes/lines are vented to atmospheric pressure

Recommissioning



Vanes can stick after a long period of standstill.

Risk of vane breakage if the vacuum pump is started with the drive motor.

After longer periods of standstill the vacuum pump shall be turned by hand.

After longer periods of standstill:

- ✦ Make sure that the vacuum pump is locked against inadvertent start up
- ✦ Remove the cover around the fan of the drive motor
- ✦ Slowly rotate the fan wheel by hand several revolutions in the intended direction of rotation (see stuck on or cast arrow)
- ✦ Mount the cover around the fan wheel of the drive motor

If deposits could have gathered in the vacuum pump:

- ✦ Flush the vacuum pump (see "Maintenance")
- ✦ Observe the chapter "Installation and Commissioning"

Dismantling and Disposal



In case the vacuum pump conveyed gas that was contaminated with harmful foreign material the oil and the exhaust filter(s) will be contaminated with harmful material.

Harmful material can reside in pores, gaps and internal spaces of the vacuum pump.

Danger to health during dismantling of the vacuum pump.

Danger to the environment.

During dismantling of the vacuum pump protective clothing must be worn.

The vacuum pump must be decontaminated prior to disposal.

Oil and exhaust filters must be disposed of separately in compliance with applicable regulations.



Used oil and used exhaust filters are special waste and must be disposed of in compliance with applicable regulations.



The filter spring can fly out of the exhaust port during removal.

Risk of eye injury.

Eye protection goggles must be worn while handling filter springs.

- ✦ Remove the exhaust filter (q) (see "Maintenance")
- ✦ Drain the oil
- ✦ Make sure that materials and components to be treated as special waste have been separated from the vacuum pump
- ✦ Make sure that the vacuum pump is not polluted with harmful foreign material

According to the best knowledge at the time of printing of this manual the materials used for the manufacture of the vacuum pump involve no risk.

- ✦ Dispose of the used oil in compliance with applicable regulations
- ✦ Dispose of special waste in compliance with applicable regulations
- ✦ Dispose of the vacuum pump as scrap metal

Troubleshooting



WARNING

Risk of electrical shock, risk of damage to equipment.

Electrical installation work must only be executed by qualified personnel that knows and observes the following regulations:

- IEC 364 or CENELEC HD 384 or DIN VDE 0100, respectively,
- IEC-Report 664 or DIN VDE 0110,
- VBG 4 or corresponding national accident prevention regulation.



CAUTION

During operation the surface of the vacuum pump may reach temperatures of more than 70 °C.

Risk of burns!!

Let the vacuum pump cool down prior to a required contact or wear heat protection gloves.

Problem	Possible Cause	Remedy
The vacuum pump does not reach the usual pressure The drive motor draws a too high current (compare with initial value after commissioning) Evacuation of the system takes too long	The vacuum system or suction line is not leak-tight	Check the hose or pipe connections for possible leak
	In case a vacuum relief valve/regulating system is installed: The vacuum relief valve/regulating system is misadjusted or defective	Adjust, repair or replace, respectively
	Contaminated oil (the most common cause)	Change the oil (see "Maintenance")
	No or not enough oil in the reservoir	Top up oil (see "Maintenance")
	The exhaust filter (q) is partly clogged	Replace the exhaust filter (q) (see "Maintenance")
	One or more flame arrestors (p) (r) are partly obstructed	WARNING: Risk of explosion in case of faulty assembly! Flame arrestors must only be maintained by personnel that have received specific training for this purpose either by Busch or by the manufacturer of the flame arrestors. Clean the flame arrestors (p) (r)
	In case a screen is installed in the suction connection (j): The screen in the suction connection (j) is partly clogged	Clean the screen If cleaning is required too frequently install a filter upstream
	In case a filter is installed on the suction connection (j): The filter on the suction connection (j) is partly clogged	Clean or replace the inlet air filter, respectively
	Partial clogging in the suction, discharge or pressure line	Remove the clogging
	Long suction, discharge or pressure line with too small diameter	Use larger diameter
The valve disk of the inlet check valve is closed or partly opened position	Disassemble the inlet and clean the screen and the valve as required	

	The oil tubing is defective or leaking The oil return line is broken	Tighten the connections Replace the connections or the tubing (replace with identically dimensioned parts only)
	A shaft seal is leaking	Replace the shaft seal ring (Busch service)
	The exhaust valve is not properly seated or partially stuck open	Disassemble and reassemble the exhaust valve(s) (Busch service)
	A vane (s) is blocked in the rotor or otherwise damaged	Free the vanes (s) or replace with new ones (Busch service)
	The radial clearance between the rotor (t) and the cylinder is no longer adequate	Readjust the vacuum pump (Busch service)
	Internal parts worn or damaged	Repair the vacuum pump (Busch service)
	<p>The oil return line starts in an area vented to atmospheric pressure. Particularly on small model pumps, a fairly large amount of air is sucked through the oil return line, which may prevent the ultimate pressure from reaching 20 bar.</p> <p>In order to exclude this possible cause: either temporarily disconnect the oil return line from its connection near the exhaust opening and close it or squirt oil through the outlet into the oil return line. While oil is being sucked back, the ultimate pressure is not affected by the air normally sucked back through the return line.</p>	
The gas conveyed by the vacuum pump smells displeasing	Process components evaporating under vacuum Readily volatile and thus gaseous components of the oil, e.g. additives, particularly right after an oil change. NOTE: This is no indication of a malfunction of the oil separator. The oil separator is able to retain droplets of oil, however no gaseous components of it.	Check the process, if applicable Use a different type of oil, if applicable
There is an indication on the control panel / in the control centre that the switching point S1 has been reached at the pressure switch/indicator	Excessive pressure in the oil separator, possible causes: the exhaust filter (q) is partly clogged throttling of the discharge line, the flame arrestor (r) on the pressure/discharge side is partly clogged	Replace the exhaust filter (q) (see "Maintenance") Check the discharge line for throttling WARNING: Risk of explosion in case of faulty assembly! Flame arrestors must only be maintained by personnel that have received specific training for this purpose either by Busch or by the manufacturer of the flame arrestors. Clean the flame arrestor (r) on the pressure/discharge side
There is an indication on the control panel / in the control centre that the switching point S2 has been reached at the pressure switch/indicator The vacuum pump is shut down	Excessive pressure in the oil separator, possible causes: the exhaust filter (q) is partly clogged throttling of the discharge line, the flame arrestor (r) on the pressure/discharge side is partly clogged	Replace the exhaust filter (q) (see "Maintenance") Check the discharge line for throttling WARNING: Risk of explosion in case of faulty assembly! Flame arrestors must only be maintained by personnel that have received specific training for this purpose either by Busch or by the manufacturer of the flame arrestors. Clean the flame arrestor (r) on the pressure/discharge side
There is an indication on the control panel / in the control centre that the oil level has dropped below the minimum level The vacuum pump is shut down	Oil level too low	Top up oil
The vacuum pump does not start	The drive motor is not supplied with the correct voltage or is overloaded	Supply the drive motor with the correct voltage

	The drive motor starter overload protection is too small or trip level is too low	Compare the trip level of the drive motor starter overload protection with the data on the nameplate, correct if necessary In case of high ambient temperature: set the trip level 5 percent above the nominal drive motor current
	One of the fuses has blown	Check the fuses
	Version with alternating current motor: The drive motor capacitor is defective	Repair the drive (Busch service)
	The connection cable is too small or too long causing a voltage drop at the vacuum pump	Use sufficiently dimensioned cable
	The vacuum pump or the drive motor is blocked	Make sure the drive motor is disconnected from the power supply Remove the fan cover Try to turn the drive motor with the vacuum pump by hand If the unit is still frozen: remove the drive motor and check the drive motor and the vacuum pump separately If the vacuum pump is blocked: Repair the vacuum pump (Busch service)
	The drive motor is defective	Replace the drive motor (Busch service)
The vacuum pump is blocked	Solid foreign matter has entered the vacuum pump	Repair the vacuum pump (Busch service) Make sure the suction line is equipped with a screen If necessary additionally provide a filter
	Version with three-phase motor: The vacuum pump was run in the wrong direction	Repair the vacuum pump (Busch service) When connecting the vacuum pump make sure the vacuum pump will run in the correct direction (see "Installation")
	After shutting down the vacuum pump the vacuum system exerted underpressure onto the pump chamber which sucked back excessive oil from the oil separator into the pump chamber When the vacuum pump was restarted too much oil was enclosed between the vanes Oil cannot be compressed and thus broke a vane	Repair the vacuum pump (Busch service) Make sure the vacuum system will not exert underpressure onto the shut-down vacuum pump, if necessary provide an additional shut-off valve or check valve
	After shutting down the condensate ran into the pump chamber When the vacuum pump was restarted too much condensate was enclosed between the vanes Condensate cannot be compressed and thus broke a vane	Repair the vacuum pump (Busch service) Make sure no condensate will enter the vacuum pump, if necessary provide a drip leg and a drain cock Drain condensate regularly
The drive motor is running, but the vacuum pump is stopped	The coupling between the drive motor and the vacuum pump is defective	Replace the coupling element
The vacuum pump starts, but labours or runs noisily or rattles The drive motor draws a too high current (compare with initial value after commissioning)	Loose connection(s) in the drive motor terminal box Version with three-phase-motor: Not all drive motor coils are properly connected The drive motor operates on two phases only	Check the proper connection of the wires against the connection diagram Tighten or replace loose connections
	Version with three-phase motor: The vacuum pump runs in the wrong direction	Verification and rectification see „Installation and Commissioning“

	Standstill over several weeks or months	Let the vacuum pump run warm with inlet closed
	Oil viscosity is too high for the ambient temperature	Use synthetic oil, if necessary use oil of the next lower viscosity class (CAUTION: operation with too low viscosity can cause chatter marks inside the cylinder) Warm up the oil with a heater prior to starting up the vacuum pump
	Improper oil quantity, unsuitable oil type	Use the proper quantity of one of the recommended oils (see "Oil", Oil change see "Maintenance")
	No oil change over extended period of time	Perform oil change incl. flushing and filter replacement (see "Maintenance")
	The exhaust filter (q) is clogged and appears black from burnt oil	Flush the vacuum pump Replace the exhaust filter (q) Fill in new oil (see "Maintenance") In case the oil life is too short: use oil with better heat resistance (see "Oil") or retrofit cooling
	Foreign objects in the vacuum pump Broken vanes (s) Stuck bearings	Repair the vacuum pump (Busch service)
The vacuum pump runs very noisily	Defective bearings	Repair the vacuum pump (Busch service)
	Worn coupling element	Replace the coupling element
	Stuck vanes (s)	Repair the vacuum pump (Busch service) Use only recommended oils and change more frequently
The vacuum pump runs very hot (the oil sump temperature shall not exceed 100 °C)	Insufficient air ventilation	Make sure that the cooling of the vacuum pump is not impeded by dust/dirt Clean the fan cowlings, fan wheels, ventilation grilles and cooling fins Install the vacuum pump in a narrow space only if sufficient ventilation is ensured On a vacuum pump with oil-cooler: clean the intermediate spaces of the finned tube
	Ambient temperature too high	Observe the permitted ambient temperatures
	Temperature of the inlet gas too high	Observe the permitted temperatures for the inlet gas
	Not enough oil in the reservoir	Top up oil
	Oil burnt from overheating	Flush the vacuum pump Replace the exhaust filter (q) Fill in new oil (see "Maintenance") In case the oil life is too short: use oil with better heat resistance (see "Oil") or retrofit cooling
	Mains frequency or voltage outside tolerance range	Provide a more stable power supply
	In case a vacuum relief valve/regulating system is installed: The vacuum relief valve/regulating system is misadjusted or defective	Adjust, repair or replace, respectively

	Partial clogging of filters or screens Partial clogging in the suction, discharge or pressure line	Remove the clogging
	Long suction, discharge or pressure line with too small diameter	Use larger diameter
The vacuum pump fumes at the exhaust side or expels oil droplets through the outlet The oil level drops	The exhaust filter (q) is not properly seated	Check the proper position of the exhaust filter (q), if necessary insert properly (see "Maintenance")
	The O-ring is missing or damaged	Add the O-ring (see "Maintenance")
	The exhaust filter (q) shows cracks	Replace the exhaust filter (q) (see "Maintenance")
	The exhaust filter (q) is clogged with foreign matter NOTE: The saturation of the exhaust filter with oil is no fault and does not impair the function of the exhaust filter! Oil dropping down from the exhaust filter is returned to the oil circulation.	Replace the exhaust filter (q) (see "Maintenance")
	The oil return line is clogged or broken	Clean a clogged oil return line Replace a broken oil return line with an identically dimensioned line, top up oil (if necessary by Busch service)
The oil is black	Oil change intervals are too long The oil was overheated	Flush the vacuum pump Replace the exhaust filter (q) Fill in new oil (see "Maintenance") In case the oil life is too short: use oil with better heat resistance (see "Oil") or retrofit cooling
The oil is watery and coloured white	The vacuum pump aspirated water or significant amounts of humidity	Flush the vacuum pump Replace the exhaust filter (q) Fill in new oil (see "Maintenance") Modify the operational mode (see "Installation and Commissioning, Operating Notes, Conveying Condensable Vapours")
The oil is resinous and/or sticky	Improper oil type, perhaps in confusion Topping up of incompatible oil	Flush the vacuum pump Replace the exhaust filter (q) Fill in new oil (see "Maintenance") Make sure the proper oil is used for changing and topping up
The oil foams	Mixing of incompatible oils	Flush the vacuum pump Replace the exhaust filter (q) Fill in new oil (see "Maintenance") Make sure the proper oil is used for topping up

Spare Parts

NOTE: When ordering spare parts or accessories please acc. to the table below always quote the type and the serial no. of the vacuum pump. This will allow Busch service to check if the vacuum pump is compatible with a modified or improved part.

Pos.	Part	Qty	Part no.
—	Oil fill plug (RE 0016 B)	1	by request
—	Upper oil fill plug (RE 0040/0063 B)	1	by request
—	Bottom oil fill plug (RE 0040/0063 B)	1	0415 000 065
—	Oil drain plug (RE 0016 B)	1	0415 000 055
—	Oil drain plug (RE 0040/0063 B)	1	0415 000 065
—	Flame arrestor (gas discharge, RE 0016 B)	1	0534 101 223
—	Flame arrestor (gas discharge, RE 0040/0063 B)	1	0534 119 651
—	Flame arrestor with slip stream interruption (suction connection, RE 0016 B)	1	0543 102 758
—	Flame arrestor with slip stream interruption (suction connection, RE 0040/0063 B)	1	0543 119 590
—	Coupling (for the connection of the pressure switch/indicator)	1	0680 135 293

Spare Parts Kits

Spare parts kit	Description	Part no.
Service kit RE 0016 B	Exhaust filter, o-ring for exhaust filter, o-ring for oil fill plug, seal ring for oil drain plug, o-ring for exhaust cover	by request
Service kit RE 0040/0063 B	Exhaust filter, o-ring for exhaust filter, o-ring for upper oil fill plug, seal ring for bottom fill plug, seal ring for oil drain plug, o-ring for exhaust cover	by request

Accessories

Accessories	Part no.
Heater (RE 0040/0063 B)	0651 121 688
Oil return line to inlet flange (RE 0040/0063 B)	0946 124 018
Gas ballast, complete (RE 0016 B)	0916 101 562
Gas ballast, complete (RE 0040/0063 B)	0916 128 516
Level switch	0652 125 885

Oil

Denomination	VM 100	VE 101	VSL 101
ISO-VG	100	100	100
Base	Mineral oil	Diester	PAO
Density [g/cm ³]	0.888	0.96	0.84
Ambient temperature range [°C]	12 ... 30	0 ... 40	0 ... 40
Kinematic viscosity at 40 °C [mm ² /s]	110	95	100
Kinematic viscosity at 100 °C [mm ² /s]	11.5	9.5	14
Flashpoint [°C]	260	255	275
Pourpoint [°C]	-15	-30	—
Part no. 1 l bottle	0831 000 060	0831 000 099	by request
Part no. 5 l canister	0831 000 059	0831 000 100	by request
Remark	Version with heater for ambient temperature range -10 ... 30 °C	Version with heater for ambient temperature range -20 ... 40 °C	Food applications; Version with heater for ambient temperature range -20 ... 40 °C
Filling quantity, approx. [l]	RE 0016 B: 1 RE 0040 / 0063 B: 2		

EC-Declaration of Conformity

NOTE: This Declaration of Conformity and the **CE**-mark affixed to the nameplate are valid for the vacuum pump within the Busch-scope of delivery. When this vacuum pump is integrated into a larger machinery the manufacturer of the larger machinery (this can be the operator, too) must conduct the conformity assessment process acc. to the Directive Machinery 98/37/EC for the larger machine, issue the Declaration of Conformity for it and affix the **CE**-mark.

We

Busch Produktions GmbH
 Schauinslandstr. 1
 79689 Maulburg
 Germany

declare that vacuum pumps RE 0016 B / RE 0040 B / RE 0063 B

in accordance with the European Directives

“ATEX” 94/9/EC for use in potentially explosive areas acc. to the type examination certificate PTB 03 ATEX 4043 X,

“Machinery” 98/37/EC,

“Electrical Equipment Designed for Use within Certain Voltage Limits” (so called “Low Voltage”) 73/23/EEC,

“Electromagnetic Compatibility” 89/336/EEC

have been designed and manufactured to the following specifications:

Standard	Title of the Standard
Harmonised Standards	
EN 292-1 EN 292-2	Safety of machinery – Basic concepts, general principles of design - Part 1 and 2
EN 294	Safety of machinery - Safety distance to prevent danger zones being reached by the upper limbs
EN 1012-1 EN 1012-2	Compressors and vacuum pumps - Safety requirements - Part 1 and 2
EN 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61000-6-1 EN 61000-6-2	Electromagnetic compatibility (EMC) - Generic immunity standards
EN 61000-6-3 EN 61000-6-4	Electromagnetic compatibility (EMC) - Generic emission standards
EN 60079-10 EN 60079-14	Electrical apparatus for explosive gas atmospheres - Part 10 and 14
EN 13463-1	Non-electrical equipment for potentially explosive atmospheres - Part 1: Basic methodology and requirements
EN 1127-1	Explosives atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology
EN 12874	Flame arresters - Performance requirements, test methods and limits for use
National Standard	
DIN 45635-13	Measurement of airborne noise emitted by machines - enveloping surface method - Compressors, vacuum pumps included (displacement-, turbo- and jet-compressors)

Manufacturer



Dr.-Ing. Karl Busch
 General director



(1) **EC-TYPE-EXAMINATION CERTIFICATE**
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**



(3) EC-type-examination Certificate Number:

PTB 03 ATEX 4043 X

(4) Equipment: Vacuum pump Typ Enivac RE 0016 B, RE 0040 B, RE 0063 B

(5) Manufacturer: Vakuumpumpen und Systeme Busch Produktions GmbH

(6) Address: Schauinslandstraße 1, D-79689 Maulburg

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-43068.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 13463-1
EN 50020

EN 12874

EN 50014

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

II 1/2 G IIB3 T4

Zertifizierungsstelle Explosionsschutz

Braunschweig, 2003-10-23

By order:

Dr. H. Förster
Regierungsdirektor



sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

(13) **SCHEDULE**
(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 4043 X**

(15) Description of equipment

Vacuum pumps type Enivac RE 0016 B, RE 0040 B and RE 0063 B work on the rotating vane principle. A circular rotor is positioned centrally on the shaft of the vacuum pump. The rotor rotates in an also circular, fixed cylinder, the centreline of which is offset from the centreline of the rotor such that the rotor and the inner wall of the cylinder almost touch along a line. Vanes, gliding in slots in the rotor, separate the space between the rotor and the cylinder into chambers. During the first half of a revolution the free volume increases and vanishes to almost zero during the second half of a revolution. This causes the conveyed gas to be sucked in, compressed and ejected. The pumps are lubricated with oil, which seals the gap between the sliding vanes and the cylinder while also providing a lubricating film between the vanes and the cylinder.

Vacuum pumps type Enivac RE 0016 B, RE 0040 B and RE 0063 B feature one flame arrester each on the suction side and on the pressure side. The crimped ribbon type flame arrester elements inside the flame arrester consist of one crimped and one flat ribbon each made of stainless steel. The ribbons, each 10 mm wide and 0.15 mm thick are spirally wound in tight layers. This forms passages of triangular shape, which pass vapour-air mixtures, but shall prevent the transmission of flames. Two flame arrester elements are used in each flame arrester. The triangle heights of the ribbons are 0.5 mm on the suction side and 0.3 mm on the pressure side.

The vacuum pumps can optionally be fitted with an explosion-proof oil sump heater.

Several monitoring devices shall make sure that

1. the oil level will not drop below the minimum level,
2. impermissibly high temperatures inside the pump as well as at gas outlet connection will not occur and
3. impermissibly high pressure inside the oil separator and inside the flame arrester on the pressure side will not occur.

The design, materials and dimensions are specified in drawings, part lists and data sheets as listed in the test report PTB EX 03-43068.

Requirements for explosion protection

Interior of inlet and outlet pipe: requirements according to category 1

Vacuum pump environment: requirements according to category 2

- (16) Test report PTB Ex Ex 03-43068 (consisting of 10 pages, 126 drawings, 21 parts lists, 17 drawings and parts lists of the flame arresters, installation and operating instructions, hazard analysis and risk assessment, list of variety of types, 5 test reports, data sheets and test protocols with calibration data)

sheet 2/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 4043 X

Result: the type complies with the requirements of directive 94/9/EC for equipment group II, (subdivision IIA and IIB according to EN 50014), temperature class T4 according to EN 50014 and – as specified under (15) in the requirements for explosion protection – category 1 in one part and category 2 in the other part.

(17) Special conditions for safe use

- The housing of the vacuum pumps type Enivac RE 0016 B, RE 0040 B and RE 0063 B shall be tested for leak tightness and strength with a static pressure of 15 bar.
- For the operation of the vacuum pumps type Enivac RE 0016 B, RE 0040 B and RE 0063 B all mounted devices, components and parts (coupling, drive motor etc.) shall be suitable for the respective zone. This includes that the requirements according to equipment group II (subdivision IIA, IIB), category 2G, temperature class T4 (according to EN 50014) are complied with.
- The drive motor must not exceed the allowed power and speed as specified in the operating instructions of the pump.
- Prior to commissioning of the pump a comprehensive equipotential bonding of the entire system shall be applied in accordance with EN 50014:2000, chapter 15 and other applicable EN-, IEC- and ISO-standards.
- The operator shall observe the temperature limits for the oil, the ambient temperature and the conveyed gas and the pressure values on the suction and the pressure side as stipulated in the operating instructions.
- The operator is allowed to commission the pump only when the monitoring devices (as mentioned in the operating instructions) have been properly installed and the prescribed switching conditions have been implemented into the controls.
- Only oils as mentioned in the operating instruction or equivalent oils are allowed to be used.
- The oil separator may alternatively be nickel-plated.
- The optionally available oil sump heater must comply with the requirements acc. to equipment group II (subdivision IIA, IIB), category 2G, temperature class T4 (according to EN 50014).
- The temperature switch may only be operated in an intrinsically safe electrical circuit according to EN 50020, annex A.
- The vacuum pumps may alternatively be fitted with a gas ballast.

The manufacturer of the rotating vane vacuum pump Enivac RE 0016 B, RE 0040 B and RE 0063 B is required to transmit the above conditions to the user in a suitable form, and the user is required to duly fulfill and observe them.

(18) Essential health and safety requirements

Zertifizierungsstelle Explosionsschutz

Braunschweig, 2003-10-23

By order:



Dr. H. Förster
Regierungsdirektor



sheet 3/3


EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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Equipment Documentation Measurement and Safety Instrumentation

Overview

Temperature Switch

Type	2010206-R28-120 05 J ö TR 105+-5 03EN15S040-M5X6	
Marking	03EN A 120°C* VDE T150 (* = code for date of manufacture)	
Arrangement of contacts	 <p>Opening at temperature rise (i.e. excessive temperature interrupts the electrical circuit)</p>	
Switching points:	Open: 120 °C ± 5 K Close: 105 °C ± 5 K	
Transition resistance	< 30 mΩ	
Nominal temperature range	-20 ... +150 °C	
Nominal current/ Nominal voltage (these data refer to the capabilities of the switch alone, they constitute no limit values for intrinsically safe circuits!)	Nominal voltage	250 V AC 125 V AC 30 V DC
	Nominal current at $\cos \varphi = 1.0$	250 V AC 10 A/16 A 125 V AC 15 A 30 V DC 5 A
	Nominal current at $\cos \varphi = 0.75$	250 V AC 10 A 125 V AC 13,5 A 30 V DC 4 A
<p>More installation notes:</p> <p>The temperature switch is intended for use in an intrinsically safe circuit acc. to EN 50020, annex A, i.e. for connection to an isolation switch amplifier, e.g. Pepperl+Fuchs KF__-SR2-Ex1.W; not in the Busch scope of delivery).</p> <p>The temperature switch is a simple apparatus in terms of EN 50020.</p> <p>The limit values for intrinsically safe circuits shall be established acc. to EN 50020, annex A for the explosion group IIB.</p> <p>Interruption of the electrical circuit must automatically shut down the vacuum pump. Closing of the electrical circuit after cooling down of the temperature switch must not autostart the vacuum pump. The restart of the vacuum pump is permitted only by action from the operating personnel after remedy of the cause of the excessive temperature.</p> <p>For the functional check in the course of the test run of the vacuum pump with inert gas interrupt the electrical circuit by pulling a connector from the temperature switch.</p> <p>After reconnection of the cable to the temperature switch make sure that the gasket is inserted between the housing cover and the housing bottom, the housing is firmly closed and the cable gland is tightened.</p>		

Pressure Switch/Indicator

Type/Marking	ExS10-0AVA0811R2SB
<p>Brief description:</p> <p>The device is fed with a voltage between 14.5 and 45 V DC (upper limit cannot be exploited in intrinsically safe circuits, though). The positive pole of the supply is connected to pin 1, the negative pole to pin 3.</p> <p>Depending on the pressure signal the current between pin 3 and the negative pole of the supply varies between 4 mA (corresponding to 0 hPa (=mbar) g) and 20 mA (corresponding to 1600 hPa (=mbar) g). 1600 hPa are not reached in practice, though, as the vacuum pump must be shut down at 600 hPa g (corresponding to 10 mA).</p> <p>Under normal operating conditions the voltage between the pins 4 and 3 is the supply voltage minus 2 V. The LED S1 is lit. When the switching point S1 is reached the voltage falls to zero and the LED S1 goes out.</p> <p>Under normal operating conditions the voltage between the pins 2 and 3 is the supply voltage minus 2 V. The LED S2 is lit. When the switching point S2 is reached the voltage falls to zero and the LED S2 goes out.</p>	
Technical data	see excerpt from Installation and Operating Instructions BA1003 (on the following pages)
Upon delivery the pressure switch/indicator is set as follows:	
Lower pressure signal with signal applied (liquid adjustment)	not to be set
Zero signal without applied signal (dry adjustment)	0000
Upper pressure signal with signal applied (liquid adjustment)	not to be set
Span signal without applied signal (dry adjustment)	1600
Display Adjustment	dp0 (corresponds to indication 8888., i.e. indication in hPa (mbar))
Damping	6 (corresponds to 2 seconds delay)
Limit value switch point 1	0550
Hysteresis switch point 1	0015
Operating mode switch point 1	n.c. (quiescent principle)
Function switch point 1	norF
Limit value switch point 2	0600
Hysteresis switch point 2	0015
Operating mode switch point 2	n.c. (quiescent principle)
Fast adjustment	oFF
Behaviour of signal output	oFF

More installation notes:

Observe the excerpt from Installation and Operating Instructions BA1003 (on the following pages); the complete documentation is available from www.acs-controlsystem.de.

A matching coupling for the connection of a cable to the pressure switch/indicator is included in the scope of delivery of the vacuum pump.

The direct connection of switching relays to the pins 2 and 4 can cause the current on pin 1 to exceed the limit for intrinsically safe circuits. In order not to exceed the allowed current either only the 4 ... 20 mA signal is to be evaluated with a suitable transmitter supply (e.g. Pepperl+Fuchs KF__-CRG-Ex1.D, set to the switching points 9.5 and 10 mA (corresponding to 550 and 600 hPa (=mbar); not in the Busch scope of delivery), or isolation switch amplifiers, e.g. Pepperl+Fuchs KF__-SR2-Ex1.W; not in the Busch scope of supply) are to be switched between the pins 1,2 and 4 of the pressure switch/indicator on the one side and the switching relays on the other. Alternatively the evaluation of the 4 ... 20 mA signal, after isolation by means of a suitable transmitter supply (e.g. ACS ExTVA500, Pepperl+Fuchs KFD2-STC4-Ex1) can be performed by the non-Ex-system control or SPS respectively. See also "Connection Examples Hydrocont S and Precont S in Ex-areas".

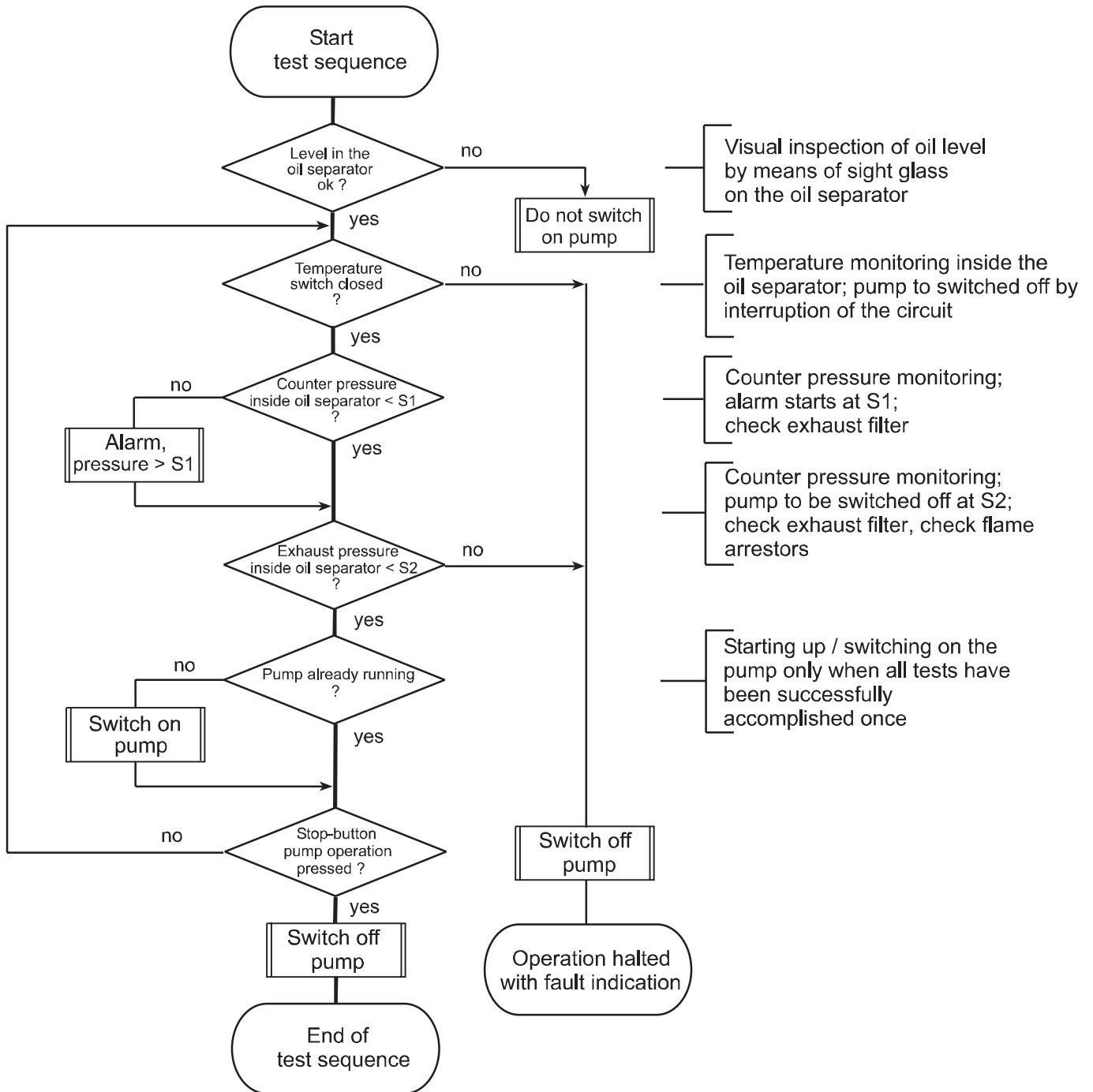
The pressure switch/indicator is to be integrated into the system control such that 550 hPa (=mbar) g will release a warning, which must be acknowledged by the operating personnel. 600 hPa (=mbar) g must automatically shut down the vacuum pump. The restart of the vacuum pump is permitted only by action from the operating personnel after remedy of the cause of the excessive pressure.

For the functional check in the course of the test run of the vacuum pump with inert gas throttle the gas discharge until the display on the pressure switch/indicator shows 550 hPa (=mbar) g. Make sure that a warning is released in the system control. Relief the throttling of the gas discharge, so that the indicated pressure drops below 550 hPa (=mbar) g. Make sure that the warning continues. Throttle the gas discharge further until the display on the pressure switch/indicator shows 600 hPa (=mbar) g. Make sure that an alarm is released in the system control, the vacuum pump is shut down automatically and remains shut down.

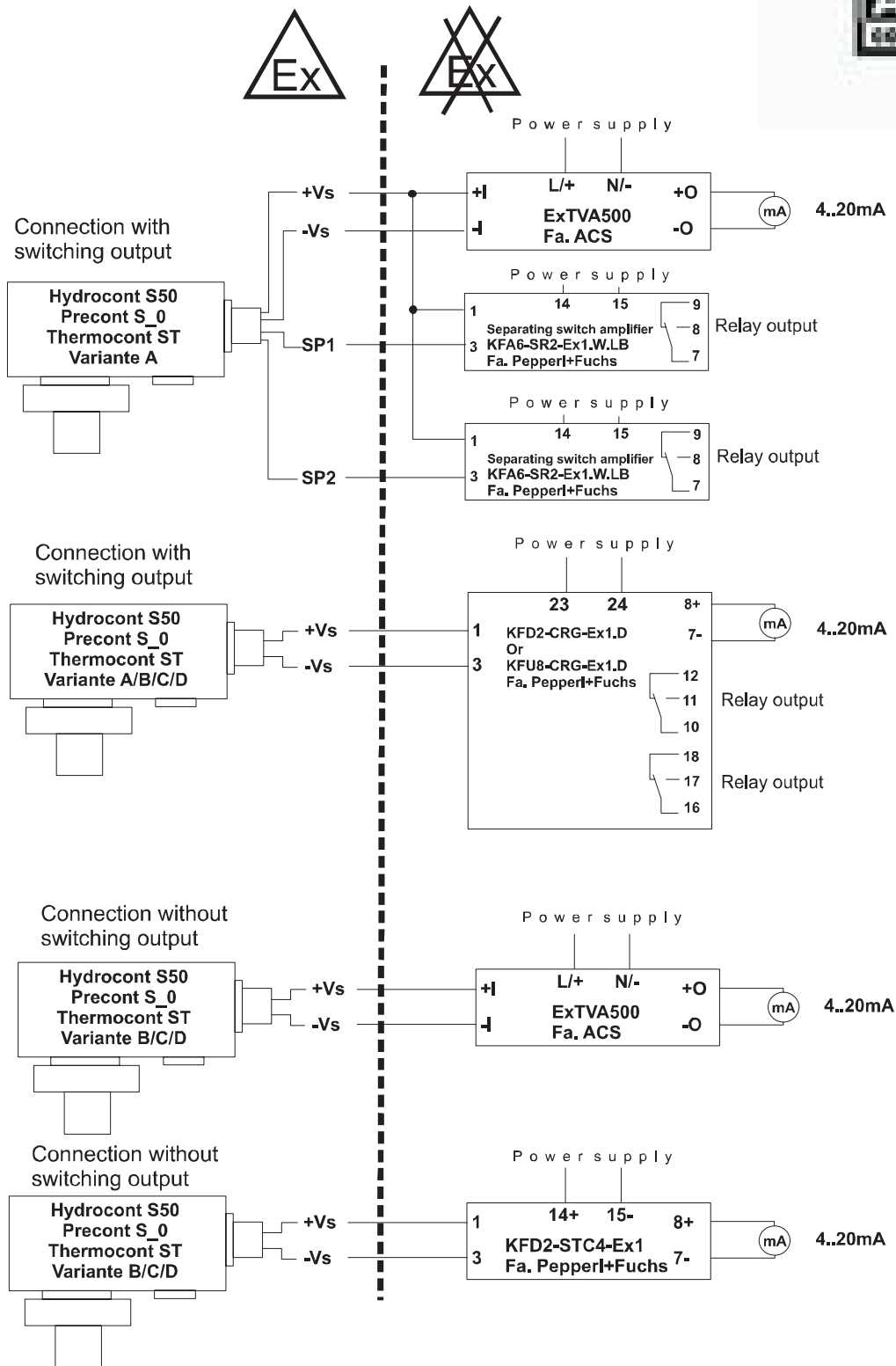
Level Switch (Optional)

Type/Marking	FTL50-GGR2AA6G4A
Interface	Elektronic insert FEL 56: for separate switching unit (isolation switch amplifier not in the Busch scope of delivery); Signal transmission L-H edge 0.6...1.0 / 2.1...2.8 mA to EN 50227 (NAMUR) along two-wire cabling.
Anzeige- und Bedienoberfläche	2 switches for fail-safe mode and density change, green LED flashes to indicate power on, red LED to indicate switching status, flashes on damage by corrosion on sensor or with defective electronics
More installation notes:	Installation and operation acc. to Operating Instructions XA 063F, excerpt from Technical Information TI 328F and excerpt from Operating Instructions KA 143F (on the following pages; the complete documentation is available from www.endress.com).

Flow Chart Safety Tests



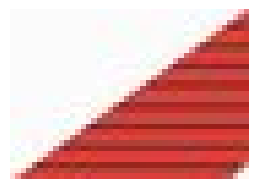
Connection Examples Hydrocont S and Precont S in Ex-areas




ACS-CONTROL-SYSTEM GmbH

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84307 Eggenfelden
 Email: info@acs-controlsystem.de
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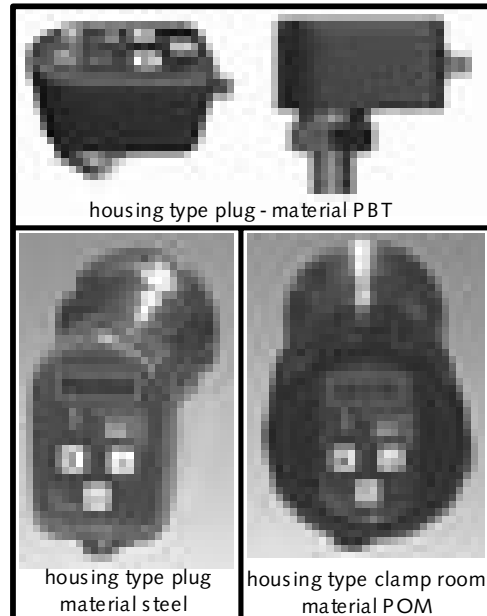
Compact pressure sensor Precont S 10/S 20/S 40/S 60/S 70 
 with dry capacitive measurement membrane, Precont D40
 polysilicon measurement membrane or with special pressure mediator

BA1003

Installation and operating instructions

Page 1 of 14

- + Accuracy relative / absolute pressure measurement
- + Up to 80 times overload resistance
- + Pressure measurement up to 400 bar
- + Medium temperatures from – 40°C up to +370°C
- + insensitive at high air humidity and condensed water formation
- + Connection housing in steel or plastic with clamp room, plug M12x1 or mounted cable
- + Electronic rotatable by 330 degree
- + Integrated digital 4...20mA 2-wire-electronic or 0...10V 3-wire-electronic
- + Four-digit, very high brightness LED display
- + Two free programmable PNP-switching outputs, e.g. for use as two-position-controller
- + Fast sensor adjustment by key combinations or menu controlled adjustment by LED display
- + Password protection
- + Adjustment by customer specification



Application:

The devices Precont S / D40 with integrated digital evaluation electronic are compact sensors for measuring and monitoring of pressures in liquids, gases and steams. The use of an optional capacitive ceramic or a polysilicon measurement sensor or the optional choice of different pressure mediators allow the use in all fields of the industrial environment.

Because of the special construction of the device Precont D40, this sensor is especially suitable for the use in areas with high air humidity and condensed water formation, where conventional devices can not be used or can only be used by applying an expensive leaded pressure compensation capillary.

Function:

The pressure measurement system Precont S / D40 is built in the wall of the medium container or in the pipe wall.

Measurement principle of the dry capacitive ceramic membrane – Precont S 10 / S 40 / D40

The system pressure is applied directly to the ceramic membrane of the sensor without using a pressure mediator liquid and causes there a deflection of the membrane. At the maximum deflection the membrane contacts a robust ceramic carrier and because of this, the membrane come through over pressure of up to 40-times of nominal load without damage.

The capacitive ceramic measurement system offers excellent characteristics like highest strength against pressure and pressure blows, high resistance against chemicals and corrosion, very good insensitiveness against temperature shocks and EM interference, highest accuracy and long term stability and also low influence of temperature.

Measurement principle of the polysilicon membrane – Precont S 20

The system pressure is applied to the metal membrane of the sensor and is transferred to the polysilicon sensor behind by using silicon oil as pressure mediator.

The polysilicon measurement system offers highest pressure ranges, good reproducibility and hysteresis, an over load resistance of up to 4-times of the nominal pressure, an adjustable mechanical damping and a good long term stability.

Measurement principle of the special pressure mediator – Precont S 60 and Precont S 70

The system pressure is applied to the metal membrane of the pressure mediator and is transferred to the ceramic or metal membrane of the respective measurement sensor behind by using vegetable, silicon or high temperature oil. This leads to an fundamentally expansion of the permitted medium temperature range up to – 40...+370°C.

The pressure proportional signal of the respective measurement membrane is recorded from a processor with high resolution adjusted according to the settings and converted in high resolution output signal of 4...20mA or 0...10V. By using 3 keys and a LED display the sensor measurement range, the display, the PNP-switching outputs and the damping can be adjusted or the behaviour in the case of failure and the release of the fast adjustment can be set. The switching state of the two PNP-switching output is signalled by one LED for every output.

ACS-CONTROL-SYSTEM GmbH – Lauterbachstraße 57 – 84307 Eggenfelden – Tel. (08721)9668-0
 Fax. (08721)966830 – Email: info@acs-controlsystem.de
 Internet: www.acs-controlsystem.de



Compact pressure sensor Precont S 10/S 20/S 40/S 60/S 70 with dry capacitive measurement membrane, Precont D40 polysilicon measurement membrane or with special pressure mediator

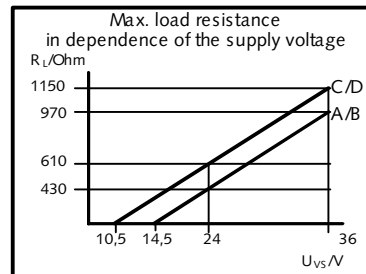
BA 1003

Installation and operating instructions

Page 2 of 14

Electrical data:

Output variants A/B/C/D:	4...20mA \rightarrow linear from 3,9...21 mA or in case of transgression step to 3,8 mA or 22 mA permitted load $R_{Lmax} = (V_{S actual} - V_{S min}) / 22mA \rightarrow$ see scheme
Output variants E/F/G/H:	0...10 V \rightarrow linear from 0 V...10,5 V or in case of transgression step to 0 V or 11,25 V permitted load $\approx 2000 \Omega$ at 10 V, equals 5 mA, current limited
Permitted supply voltage:	variants C/D: 10,5 V (12,5V for Precont D40) to 45 V DC variants A/B/E/F/G/H: 14,5 V (16,5V for Precont D40) to 45 V DC
Ripple voltage:	$\approx 2 V_{SS}$ (condition: within the permitted supply voltage range)
Temperature deviation:	$\approx 0,1$ /10 K of nominal measurement range \rightarrow ceramic membrane $\approx 0,2$ /10 K of nominal measurement range \rightarrow Precont D40 If the adapter housing is kept at constant environmental air temperature, the max. temperature deviation is reduced to: $\approx 0,1$ /10 K of nominal measurement range
Characteristic deviation:	$\approx 0,5$ /10 K of nominal measurement range \rightarrow polysilicon membrane $\approx 0,1$ /0,2 of nominal measurement range \rightarrow ceramic membrane (see order code) $\approx 0,5$ of nominal measurement range \rightarrow polysilicon membrane
Calibration deviation:	$\approx 0,05$ of nominal measurement range or $\approx +0,5$ of nominal measurement range zero deviation at output 0...10 V
Long term deviation:	$\approx 0,1$ /year of nominal measurement range
Influence of supply voltage:	$\approx 0,02$ /10V of nominal measurement range
Resolution:	better than 1 A or 0,5 mV (16 bit = 65536 steps)
Adjustment measurement range:	free adjustable within the nominal range
Delay time analogue output:	at damping 1 T90 typ. 260 ms, max. 310ms
Adjustment range damping:	0,3...30 seconds /100 steps
EMC specifications:	EN 61326 industrial environment, class A

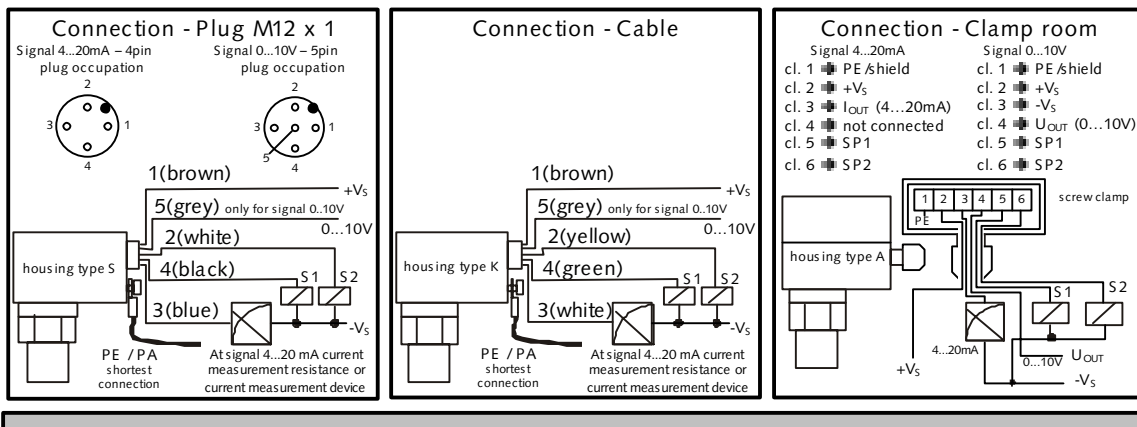


Switching outputs (S1/S2):

Output current:	PNP-switching to +V _S , V _{OUT} \approx +V _S - 2 V
Rising time:	≈ 200 mA, current limited, short circuit protected
Delay time:	< 700 μ s with R _L < 3 k Ω or I _L 4,5 mA
	at damping 1 typ. 280 ms, max. 330ms

Mechanical data:


Protection:	IP67
Material S10/S40/D40:	membrane \rightarrow AL ₂ O ₃ 96 or 99,9 process connection \rightarrow steel 1.4404
Material S20:	membrane \rightarrow steel 1.4435 screw thread \rightarrow steel 1.4301
Material S60/S70:	membrane \rightarrow steel 1.4404 process connection \rightarrow steel 1.4301
Material adapter housing:	polybutylenterephthalat PBT / polypropylene PP / polyacetal POM (delrin) / steel 1.4301 / steel 1.4404
Seals S10/S40/D40:	viton / EPDM / neoprene / perfluorelastomere
Permitted filling temperature:	standard (excepted S20) \rightarrow -20°C...+90°C S20 \rightarrow -25°C...+70°C S10/S40/D40 with partition piece \rightarrow -40°C...+125°C S60 with decoupling \rightarrow 0°C...+140°C S70 with decoupling B \rightarrow -40°C...+140°C S70 with decoupling C \rightarrow -20°C...+250°C S70 with capillary tube \rightarrow -40°C...+370°C
mediator filling medium:	S20 silicon oil S60 vegetable oil S70 silicon oil or high temperature oil
Operation / storage temperature:	-20°C...+85°C



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Compact pressure sensor with dry capacitive measurement membrane, polysilicon measurement membrane or with special pressure mediator

Precont S 10/S 20/S 40/S 60/S 70 

Precont D40

BA1003

Installation and operating instructions

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Assembly, electrical installation and inauguration, maintenance:

Assembly, electrical installation, inauguration, operation and maintenance of the device must be carried out by a qualified employee. The electrical installation of the device must be carried out according to the respective country specific standards. An incorrect assembly or adjustment could cause applicationally conditioned risks. The device is maintenance free. Unscrew the housing cover for connecting the cable at the housing variant with clamp room. After that, the electronic module can be removed. After connecting the cable the electronic module must be correctly inserted, pressed in and after that the housing cover has to be screwed on. The cable screwing must be strongly fixed after bringing in the cable for achieving the required tightness of the housing.

The voltage applied to the plug contacts or to the clamps may not exceed 50 V to avoid damage of the electronic. All connections are polarity protected.

Use only shielded signal and measurement wires and install these wires separated from power leading wires.

Connect the shield only at one side to earth, ideally at the installation place of the device


The earth connection of the cable shield is carried out by the socket of the plug or by the clamp PE.


The metallic parts of the device with plug or with cable are electrically connected with the earth connection clamping screw.

This includes also the socket of the plug M12x1. The earth connection clamping screw has to be earthen by regulation.

The materials for housing, process connection, seals and cables must be selected corresponding to the respective operating conditions (medium, temperature). An unsuitable material can cause damage, abnormal behaviour or destruction of the device and from that it can lead to resulting danger.

If inductive loads, e.g. relays or contractors are connected to the PNP output, an RC protection circuit must be used to avoid high voltage peaks, because they could influence the properly function of the device.

The device meets the legal requirements of the EC-guideline  0032

 Safety notes:

If a device is installed and operated in a hazardous area, the general Ex construction standards (EN60079-14, VDE0165), this safety notes and the enclosed EC conformity certificate must be observed.

The assembly of an Ex system must be carried out principally by specialist staff.

The devices meets II 1/2 G EEx ia IIC T4 or II 2 G EEx ib IIC T4 with Ta \leq +85°C

The devices are conceived for measurement of filling levels in hazardous areas.

The measured medium may also be combustible liquids, gases, fogs or steams.

The permitted operating temperatures and pressures are type and variant dependent and can be found in this technical documentation.

The permitted highest values for U_i , I_i and P_i are equal for all variants. It must be paid especially attention on it in the case of combination of more intrinsically safe circuits at variants with voltage output 0...10V (variants E/F/G/H) and at variants with PNP-switching outputs (variants A/E).

The rules for combination of intrinsically safe circuits are valid.

At versions of the devices with chargeable plastic parts (e.g. adapter housing, cable), a warning marking points out to the safety measures, that must be applied because of the electrostatic charging in operation mode and especially in the case of maintenance activities.

avoid friction

no dry cleaning

no assembling in pneumatic conveying stream

Fast adjustment by key combination

Zero adjustment with existing pressure signal:

Press the keys **OK** and **■** in succession and keep it for 3 sec. \blacksquare 4mA / 0V are supplied. This value can be adjusted by using the keys **±** or **■** and **±**.

Pressing the key **OK** will take over the existing pressure signal as lower pressure value, assign it with the before adjusted output signal and store it protected against loss (duration approx. 3 s). After that the device will automatically return to measurement mode.

Span adjustment with existing pressure signal:

Press the keys **OK** and **▲** in succession and keep it for 3 sec. \blacksquare 20mA / 10V are supplied. This value can be adjusted by using the keys **±** or **■** and **±**.

Pressing the key **OK** will take over the existing pressure signal as upper pressure value, assign it with the before adjusted output signal and store it protected against loss (duration approx. 3 s). After that the device will automatically return to measurement mode.

Adjustment damping:

Press the keys **■** and **±** in succession and keep it for 3 sec. \blacksquare damping value can now be adjusted. The actual value can be adjusted by using the keys **±** or **■** and **±** arbitrary in the range of 0,3 to 30 seconds in 3 seconds steps. Pressing the key **OK** will take over the value and store it protected against loss (duration approx. 3 s). After that the device will automatically return to measurement mode.

Reset to factory values:

In a device of the variant C / G a reset to the factory values will be carried out by pressing the key **OK** for 5 seconds while the device is forced to a restart after removing the supply voltage. All customer specific adjustment values will be lost.

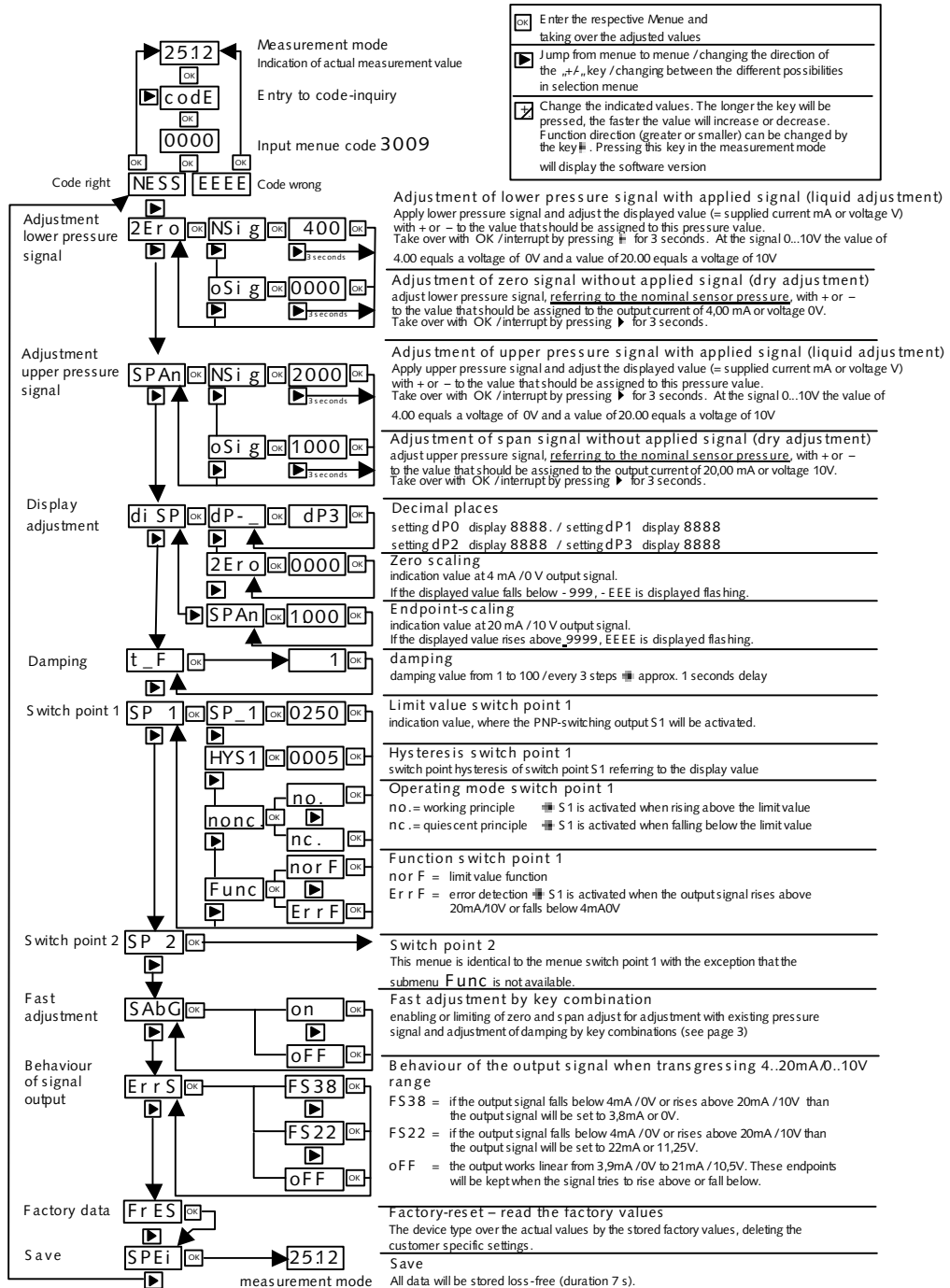
Attention: If the lower pressure value (Zero) is adjusted higher than the upper pressure value (span), the signal output falls below 3,8 mA or 0V and at the display the value **EEEE** appears until the key **OK** is pressed \blacksquare A new correct adjustment (zero < span) must be carried out again.


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Internet: www.acs-controlsystem.de





Compact pressure sensor Precont S 10/S 20/S 40/S 60/S 70 
 with dry capacitive measurement membrane, Precont D40
 polysilicon measurement membrane or with special pressure mediator

BA1003

Installation and operating instructions

Page 5 of 14

Precont S 10 Pressure sensor with inside lying, dry capacitive ceramic measurement membrane up to 60 bar
 four digit LED display, 2 switching outputs, analogue output

certificate:

S10 without certificate
 Ex S10 II 1/2 G EEx ia IIC T4 for Ex-Zone 0 appropriate ATEX100a

process connection:

0 G "A DIN 16288 form B
 6 G "A with inside drilling 11,4mm
 1 G "A


transmitter electronic:

A 4...20 mA 2-wire-electronic with display, 2 PNP switching outputs
 B 4...20 mA 2-wire-electronic with display
 C 4...20 mA 2-wire-electronic without display, adjustment by keys
 D 4...20 mA 2-wire-electronic fix adjusted, without display
 E 0...10 V 3-wire-electronic with display, 2 PNP switching outputs
 F 0...10 V 3-wire-electronic with display
 G 0...10 V 3-wire-electronic without display, adjustment by keys
 H 0...10 V 3-wire-electronic fix adjusted, without display

material process connection:

V steel 1.4404

material adapter housing:

A PBT (polybutylenterephthalat) - only for housing with plug M12x1 or cable 2m
 C steel 1.4301 - for housing with clamp room  steel 1.4404
 E PP (polypropylene) - only for housing with clamp room
 D POM (polyacetal - delrin) - only for housing with clamp room

pressure measurement range:

01 0...100 mbar (max. -0,3/4 bar)	10 0...10 bar (max. 40 bar)
02 0...200 mbar (max. 5 bar)	11 0...16 bar (max. 40 bar)
03 0...400 mbar (max. 5 bar)	12 0...20 bar (max. 40 bar)
04 0...600 mbar (max. 10 bar)	13 0...40 bar (max. 60 bar)
05 0...1 bar (max. 10 bar)	14 0...60 bar (max. 90 bar)
06 0...1,6 bar (max. 15 bar)	15 -100 ... 0 mbar (max. 4 bar)
07 0...2,5 bar (max. 25 bar)	16 -1...0 bar (max. 10 bar)
08 0...4 bar (max. 25 bar)	17 -1...1 bar (max. 15 bar)
09 0...6 bar (max. 40 bar)	18 -100...+100 mbar (max. 5 bar)
	YY special measurement range

seals:

1 viton
 2 neoprene
 3 EPDM (for food)
 4 perfluorelastomere (kalrez)

process temperature:

0 standard -20°C to +90°C
 1 with temperature partition piece -40°C to +125°C

pressure type:

R relative pressure
 A absolute pressure

type measurement membrane:

2 ceramic AL₂O₃ 96 , accuracy 0,2
 1 ceramic AL₂O₃ 99,9 high clean, accuracy 0,2
 0 ceramic AL₂O₃ 96 , accuracy 0,1 with linearization certificate
 3 ceramic AL₂O₃ 99,9 high clean, accuracy 0,1 with linearization certificate

sensor connection:


S plug M12x1
 K cable 2 m
 A clamp room

Precont - - - V - - - - -

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Compact pressure sensor
with dry capacitive measurement membrane,
polysilicon measurement membrane or with special pressure mediator

Precont S 10/S 20/S 40/S 60/S 70 

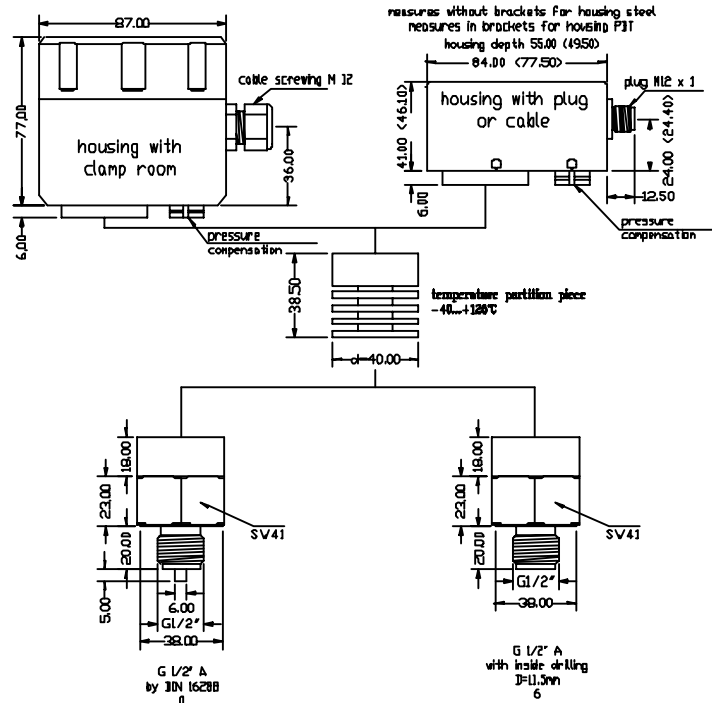
Precont D40

BA1003

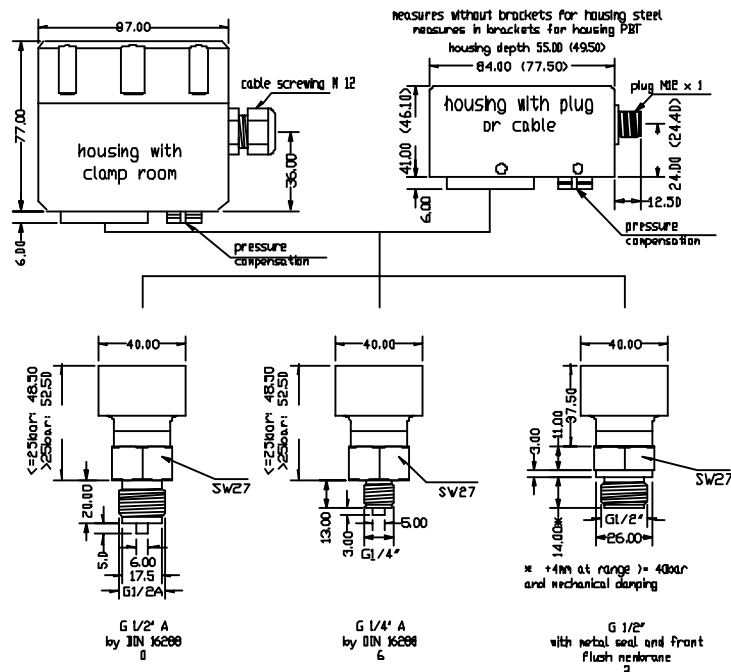
Installation and operating instructions

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Precont S 10



Precont S 20



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Internet: www.acs-controlsystem.de





(1) EG-Baumusterprüfbescheinigung

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - Richtlinie 94/9/EG

(3) EG Baumusterprüfbescheinigungsnummer



TÜV 02 ATEX 1950 X

(4) Gerät: Hydrostatisches Füllstandmessgerät Typ Precont Ex S_0...

(5) Hersteller: ACS CONTROL SYSTEM GmbH

(6) Anschrift: Lauterbachstraße 57
D-84307 Eggenfelden

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die TÜV NORD CERT GmbH & Co. KG, TÜV CERT-Zertifizierungsstelle, bescheinigt als benannte Stelle Nr. 0032 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie.

Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht Nr. 02YEX181587 festgelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 50014:1997

EN 50020:1994

EN 50284:1999

(10) Falls das Zeichen "X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf Konzeption und Prüfung des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Weitere Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen dieses Gerätes. Diese Anforderungen werden nicht durch diese Bescheinigung abgedeckt.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:



II 1/2 G EEx ia IIC T4 oder II 2 G EEx ib IIC T4

TÜV NORD CERT GmbH & Co. KG
TÜV CERT-Zertifizierungsstelle
Am TÜV 1
D-30519 Hannover
Tel.: 0511 986-1470
Fax: 0511 986-2555


Der Leiter



Hannover, 31.10.2002

TÜV CERT A4 0701 10.000 G3

Diese EG-Baumusterprüfbescheinigung darf nur unverändert weiterverbreitet werden.
Auszüge oder Änderungen bedürfen der Genehmigung der TÜV NORD CERT GmbH & Co. KG

Seite 1/3

(13)

ANLAGE

(14) **EG-Baumusterprüfbescheinigung Nr. TÜV 02 ATEX 1950 X**

(15) Beschreibung des Gerätes

Das hydrostatische Füllstandmessgerät Typ Precont Ex S_0... dient zur Druckmessung von Gasen, Dämpfen und Flüssigkeiten in Behältern und Rohrleitungen. Das Gehäuse darf in explosionsgefährdeten Bereichen, in denen Betriebsmittel der Kategorie 2 erforderlich sind, errichtet werden. Der Sensor darf in explosionsgefährdeten Bereichen, in denen Betriebsmittel der Kategorie 1 erforderlich sind, errichtet werden.

Die höchstzulässige Umgebungstemperatur im Bereich des Sensors beträgt 60°C.
Die höchstzulässige Umgebungstemperatur im Bereich des Gehäuses beträgt 85°C.
Erweiterung des Temperaturbereiches: siehe (17) "Besondere Bedingungen"

Elektrische Daten

Versorgungs- und Signalstromkreise in Zündschutzart Eigensicherheit EEx ia IIC
(Kabelanschluss, nur zum Anschluss an bescheinigte eigensichere
Steckeranschluss oder Stromkreise
Anschlussklemmen) Summe der Höchstwerte der eigensicheren Stromkreise:
 $U_i = 27,3 \text{ V}$
 $I_i = 140 \text{ mA}$
 $P_i = 0,9 \text{ W}$

In Abhängigkeit von den Varianten für die Transmitterelektronik ergeben sich folgende wirksame inneren Kapazitäten und Induktivitäten:

Variante	C_i [nF]	L_i [µH]
A	22	230
B/C/D	19	110
E	28	400
F/G/H	25	170

Zusätzlich zu den o. g. Werten sind bei Geräten mit fest montierter Anschlussleitung die Kapazitäten und Induktivitäten der Anschlussleitung (Länge L) zu berücksichtigen:

$$L_i = L \times 0,65 \mu\text{H/m}$$

$$C_i = L \times 120 \text{ pF/m (Ader/Ader)}$$

$$C_i = L \times 160 \text{ pF/m (Ader/Schirm)}$$

Die Versorgungs- und Signalstromkreise sind galvanisch miteinander verbunden. Die Kapazitäten und Induktivitäten jedes Stromkreises sind bei einer Zusammenschaltung zu berücksichtigen.

(17) Besondere Bedingung

Der Sensor des hydrostatischen Füllstandmessgerätes Typ Precont Ex S_0... darf in explosionsgefährdeten Bereichen, in denen Betriebsmittel der Kategorie 1 erforderlich sind, nur dann betrieben werden, wenn atmosphärische Bedingungen vorliegen (Temperatur von -20°C bis 60°C, Druck von 0,8 bar bis 1,1 bar).

In explosionsgefährdeten Bereichen, in denen Betriebsmittel der Kategorie 2 erforderlich sind, beträgt die höchstzulässige Umgebungstemperatur im Bereich des Sensors 85°C.

Die Versorgungs- und Signalstromkreise dürfen dann an eigensichere Stromkreise der Kategorie Ib angeschlossen werden. Die Kennzeichnung des Gerätes lautet dann II 2 G EEx Ib IIC T4.

Die zulässigen Betriebsdrücke und -temperaturen bei nicht explosionsfähigen Gasgemischen sind den entsprechenden Herstellerangaben (Betriebsanleitung) zu entnehmen.

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen

keine zusätzlichen

Operating Instructions
 XA 063F-C
 52009798
 KEMA 99 ATEX 0523

liquiphant M/S

FTL 50 (H)/51 (H), FTL 51 C, FTL 70/71

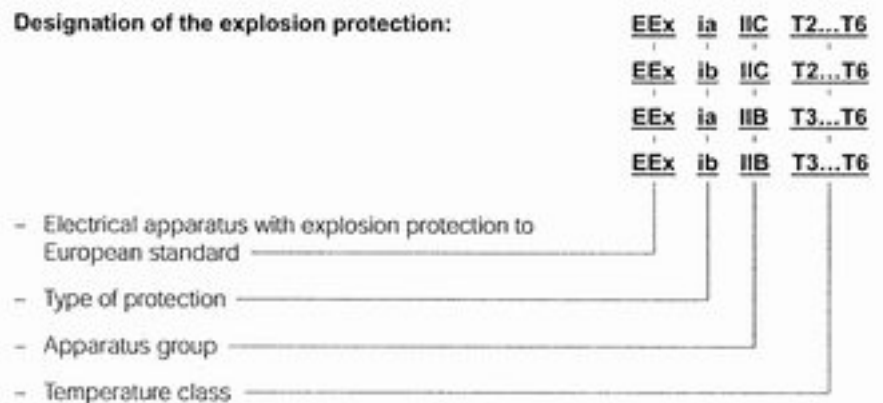
Associated Documentation
 Operating Instructions:
 KA 143F / KA 144F /
 KA 163F / KA 164F /
 KA 162F / KA 165F /
 KA 172F / KA 173F

Safety instructions for electrical apparatus for explosion-hazardous areas



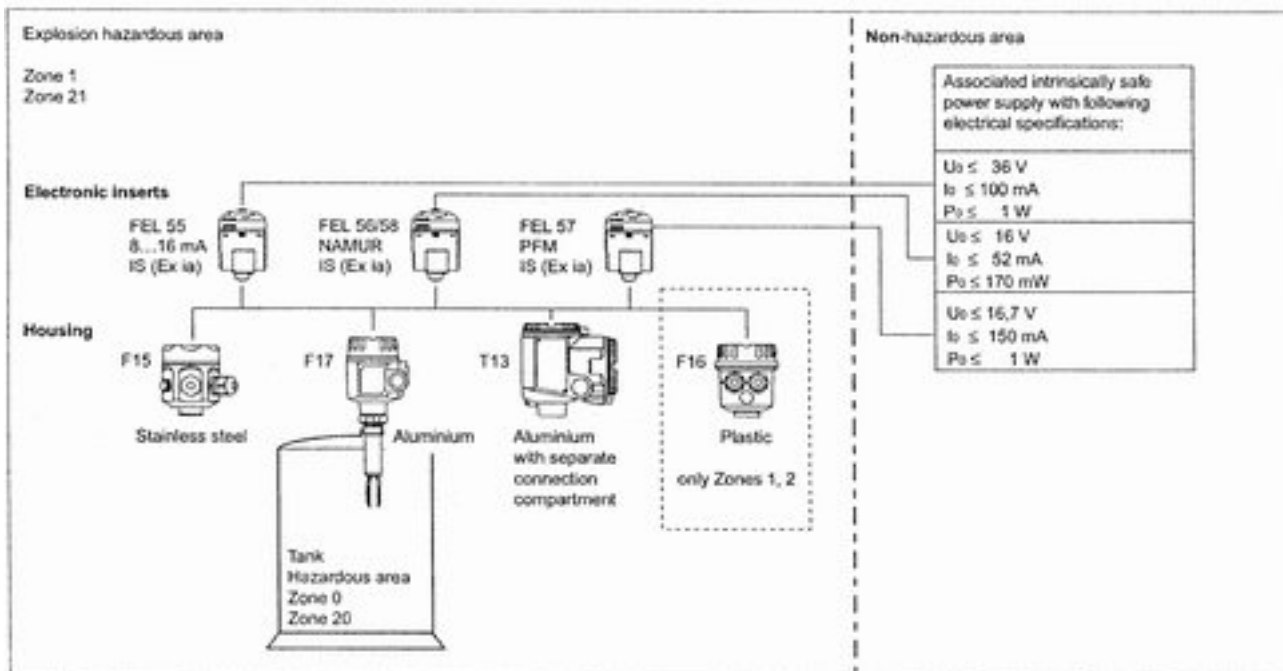
Areas of application:

Equipment Category	Explosive gas-air mixtures (G)	Explosive dust-air mixtures (D)
Category 1	Zone 0, 1 or 2	Zone 20, 21 or 22
Category 2	Zone 1 or 2	Zone 21 or 22
Category 3	Zone 2	Zone 22



Endress + Hauser
 The Power of Know How





Liquiphant M/S	Ambient temperature electronics	Electrical data
FTL 50 (H)/51 (H), FTL 51 C, FTL 70/71	$-40^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$	See Fig.; $L_I = 0$, $C_I = 0$

Type of protection	Category	for Liquiphant M/S, Type:
EEx ia IIC T3...T6 EEx ib IIC T3...T6*	II 1/2 G, II 1/2 D	FTL 50 (H)/51 (H), FTL 51 C with coating of enamel or conductive PFA
EEx ia IIB T3...T6 EEx ib IIB T3...T6*	II 1/2 G	FTL 51 C with coating of ECTFE or non-conductive PFA
EEx ia IIC T2...T6 EEx ib IIC T2...T6*	II 1/2 G, II 1/2 D	FTL 70/71

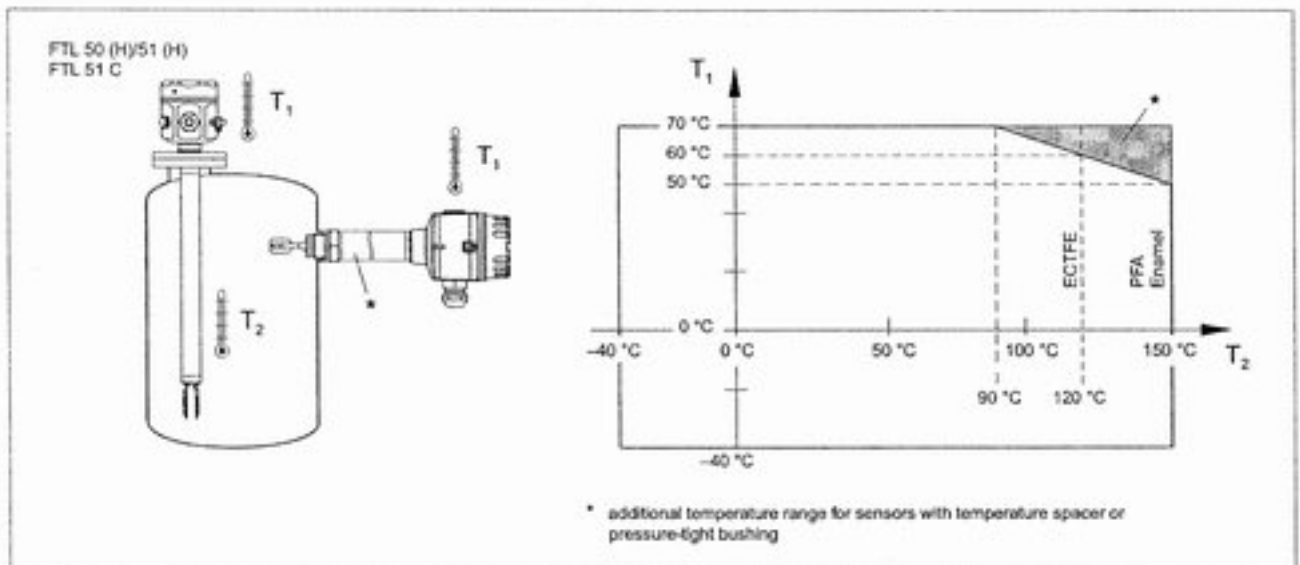
* not for highly polished version (surface $R_a \leq 0.5$)

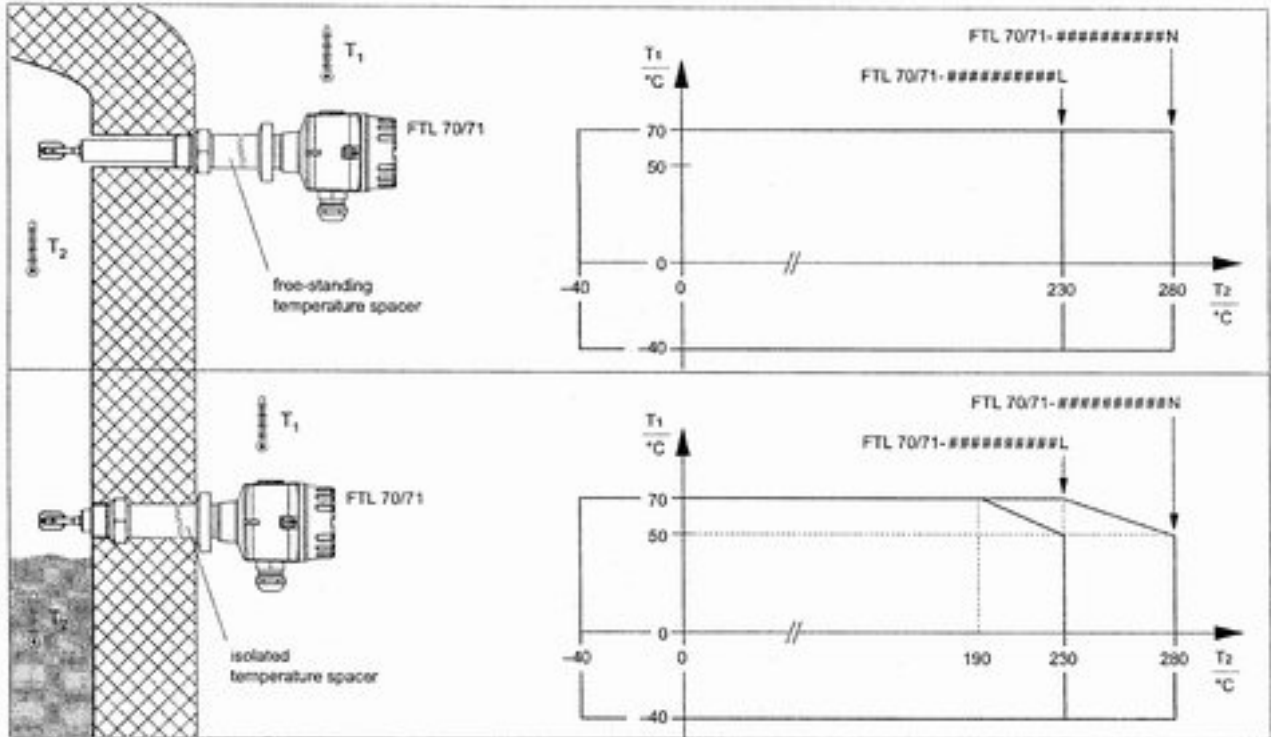
Please note the following installation instructions:

- Comply with the installation and safety instructions in the Operating Instructions.
- Install the device according to the manufacturer's instructions and any other valid standards and regulations.
- Pay attention to the maximum process conditions according to the manufacturer's Operating Instructions. At high medium temperatures: note flange pressure load capacity as a factor of temperature.
- Connect the instrument using suitable cable and line entries or via pipeline systems of protection type "intrinsic safety (Ex i)".
- The pertinent guidelines must be observed when intrinsically safe circuits are connected together acc. EN 60079-14 (Proof of Intrinsic Safety).
- To maintain the ingress protection IP66/67 of the housing, install the housing cover and cable glands correctly. Close off any unused entries with suitable plugs.
- Support extension tube of Liquiphant M FTL 51, FTL 51 H, FTL 51 C or Liquiphant S FTL 71 if a dynamic load is expected.
- The dependency of the ambient and process temperatures upon the temperature class is given in the following table:

Temperature class:

Type	Temperature class	Fluid temperature (sensor)	Ambient temperature (electronics)
FTL 50 (H) / FTL 51 (H); FTL 51 C (ECTFE, PFA or enamel coating) FTL 70/71	T6	≤ 85°C	-40°C...+70°C
FTL 50 (H) / FTL 51 (H); FTL 51 C (ECTFE, PFA or enamel coating) FTL 70/71	T5	≤ 100°C	FTL 50/51: -40°C...+70°C with temperature spacer; without temperature spacer see graph below
FTL 51 C (ECTFE coating)	T4	≤ 120°C	
FTL 50 (H) / FTL 51 (H); FTL 51 C (PFA or enamel coating) FTL 70/71	T4	≤ 135°C	
FTL 50 (H) / FTL 51 (H); FTL 51 C (PFA or enamel coating) FTL 70/71	T3	≤ 150°C	FTL 70/71: -40°C...+70°C
FTL 70/71	T3	≤ 200°C	-40°C...+70°C
FTL 70/71-.....L	T2	≤ 230°C	For restrictions, see the temperature diagram on the next page
FTL 70/71-.....N	T2	≤ 280°C	





Safety notes for Zone 0:

- The sensor part of Liquiphant M and Liquiphant S approved for Zone 0 does not cause any ignition hazards if it is operated under non-atmospheric pressures and temperatures.
Permissible medium temperatures for operation in accordance with manufacturer's specifications: dependent on ambient temperature; see Table on page 3 and temperature graphics.
Permissible pressures for operation in accordance with manufacturer's specifications: pe = -1 bar ... +64 bar, dependent on process connection; see manufacturer's Operating Instructions.
- Only install the instruments in media for which the wetted materials have sufficient durability (e.g. process connection seal).

Danger of electrostatic ignition:

- Avoid electrostatic charging of the F16 plastic housing (among other things, friction, cleaning, maintenance etc.).



es Declaración de conformidad

Por la presente declaración y la inclusión de la marca CE, el fabricante Endress+Hauser, Maulburg, Alemania, garantiza que el producto cumple lo estipulado por la Directiva CEM 89/336/CEE y la Directiva 94/9/CE. La prueba de conformidad se presenta según las normas expuestas.

it Dichiarazione di conformità

Con questa dichiarazione e con l'applicazione del marchio CE, il costruttore Endress+Hauser, Maulburg, Germania, assicura che il prodotto è conforme ai regolamenti della direttiva CEM 89/336/CEE e della direttiva 94/9/CE. Prova della conformità è fornita dall'osservanza degli standard elencati.

nl Conformiteitsverklaring

De leverancier Endress+Hauser, Maulburg, Duitsland, waarborgt met deze verklaring en het aanbrengen van de CE-markering dat het product overeenstemt met de voorschriften van de EMC-richtlijn 89/336/EEG en de richtlijn 94/9/EG. De overeenstemming wordt door de genoemde normen bewezen.

fi Varmennustodistus

Tällä varmennustodistuksella sekä CE-merkillä, valmistaja Endress+Hauser, Maulburg, Saksa, vakuuttaa, että tuote on direktiivien EMC 89/336/ETY ja 94/9/EU mukainen. Näyttö vastaavuudesta on annettu asiakirjoissa, jotka on listattu varmennustodistukseen.

sv Försäkran om överensstämmelse

Endress+Hauser, Maulburg, Tyskland försäkras med denna försäkran om överensstämmelse och med CE-märkningen att produkten uppfyller bestämmelserna i EMC-direktivet 89/336/EEG och direktiv 94/9/EG. Överensstämmelsen påvisas genom givna standarder.

da Overensstemmelseserklæring

Med denne overensstemmelseserklæring og tilføjjelsen af CE-mærket, sikrer producenten Endress+Hauser, Maulburg, Tyskland, at produktet er i overensstemmelse med bestemmelserne i det EMC-regulativ 89/336/EEC og Direktiv 94/9/EC. Dokumentation for overensstemmelsen gives i de anførte standarder.

pt Declaração de Conformidade

Com esta Declaração de Conformidade e o anexo do CE-Mark, o fabricante Endress+Hauser, Maulburg, Alemanha, garante que o produto obedece aos regulamentos da Directiva EMC 89/336/EEC e Directiva 94/9/EC. A prova da conformidade é apresentada segundo os padrões indicadas.

el Μ' αυτήν την Δήλωση

Συμμόρφωσης και τη συντημένη σήμανση CE, ο βεβαιώνει η Endress+Hauser, Maulburg, Γερμανία ότι το προϊόν συμμορφώνεται σύμφωνα με τους κανονισμούς της Ευρωπαϊκής Οδηγίας 89/336/ΕΟΚ περί Ηλεκτρομαγνητικής Συμβατότητας και την Οδηγία Προστασίας από Εκρήξεις 94/9/ΕΕ. Το Αποδεικτικό της Συμμόρφωσης δίνεται μέσω των προτύπων που αναφέρονται στη Δήλωση Συμμόρφωσης.

EG 99 021-6

EG-Konformitätserklärung

EC declaration of conformity
Déclaration CE de conformité

Endress+Hauser GmbH+Co., Hauptstraße 1, 79689 Maulburg

erklärt in alleiniger Verantwortung, dass das Produkt
declares in sole responsibility, that the product
déclare sous sa seule responsabilité que le produit

LIQUIPHANT M/S Füllstandgrenzscharfer
FTL 50(H)-, FTL 51(H)-, FTL 51 C-, FTL 70, FTL 71

mit den Vorschriften folgender Europäischer Richtlinien übereinstimmt:
conforms with the regulations of the following European Directives:
est conforme aux prescriptions et directives Européennes suivantes:

EMV-Richtlinie 89/336/EEG
Ex-Richtlinie 94/9/EG

Angewandte harmonisierte Normen oder normative Dokumente:

Applied harmonized standards or normative documents:
Normes harmonisées ou documents normatifs appliqués:

EN 61326	(1998)	EN 50014	(1992+prA1)
EN 61010-1	(1995)	EN 50020	(1994)
		EN 50284	(1999)

EG-Baumusterprüfbescheinigung Nr: KEMA 99 ATEX 0523

EC-Type Examination Certificate No.:
Numéro de l'attestation d'examen CE de type:

Benannte Stelle für die QS-Überwachung TÜV Hannover/Nr. 0032

Notified body performing the QA-surveillance:
Organisme notifié de contrôle du système de qualité:

Erstmalige Anbringung des CE-Zeichens: 99

CE-mark first affixed:
Année de mise en conformité CE:

Maulburg, 11.04.01

i.v. J. W. K. K.
Weiter Zertifizierung
Certification Manager
Responsable de Certification

Endress+Hauser
The Power of Know How

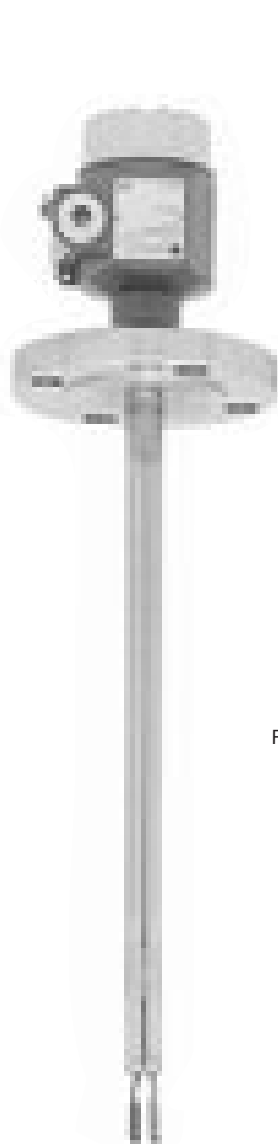


08070134132 / 031211

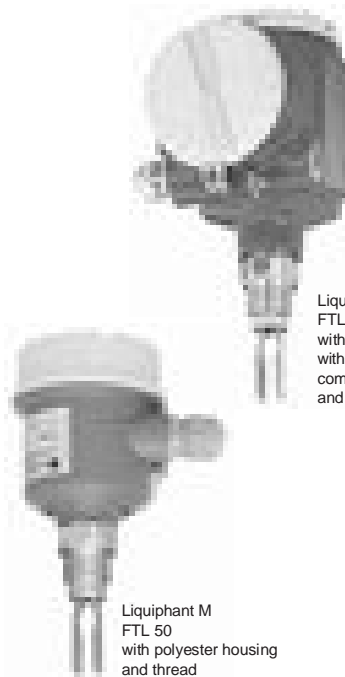
Vibration Limit Switch

Liquiphant M FTL 50, 51, 50 H, 51 H

Level limit switch for all liquids.
Suitable for use in explosion hazardous areas,
food and pharmaceuticals

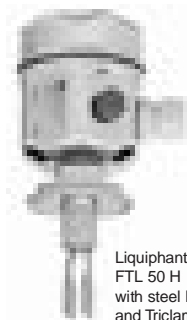


Liquiphant M FTL 51
with aluminium housing
(EEx d) and flange



Liquiphant M
FTL 50
with aluminium housing
with separate connection
compartment (EEx de)
and thread

Liquiphant M
FTL 50
with polyester housing
and thread



Liquiphant M
FTL 50 H
with steel housing
and Triclamp

Features and Benefits

- Large selection of process connections: universal use
- Process connections from and compact fork: also for difficult to access areas
- Wide variety of electronics, e.g. NAMUR, relay, thyristor, PFM signal output: the right connection for every process control system
- No calibration: quick, low-cost start-up
- No mechanically moving parts: no maintenance, no wear, long operating life
- Monitoring of fork for damage: guaranteed function
- PROFIBUS-PA protocol: commissioning and maintenance quick and easy

Applications

The Liquiphant M is a level limit switch for use in all liquids

- with a temperature between $-40\text{ }^{\circ}\text{C}$ and $+150\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$... $+300\text{ }^{\circ}\text{F}$)
- with a pressure up to 64 bar (930 psi)
- with a viscosity up to $10000\text{ mm}^2/\text{s}$
- with a density from $0.5\text{ g}/\text{cm}^3$

The function is not affected by flow, turbulence, bubbles, foam, vibration, bulk solids content or build-up. The Liquiphant is thus the ideal replacement for float switches.

FTL 50: Compact design, ideal for mounting in pipes

FTL 51: With extension tube to max. 3 m

FTL 50 H, FTL 51 H: With polished fork and easy-to-clean process connections and housings for food and pharmaceutical applications.

High corrosion-resistant Alloy C4 (2.4610) is available for the fork and process connections for applications in very aggressive liquids.

EEx ia (IS), EEx de and EEx d (XP) protection enable it to be used in explosion hazardous areas.

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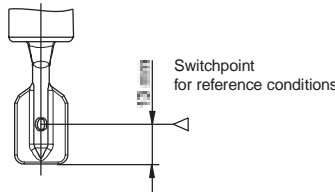
Output
FEL 56

<p>Electrical connection</p>	<p>Two-wire connection for separate switching unit</p> <p>For connecting to isolating amplifiers acc. to NAMUR (EN 50227), e.g. FXN 421, FXN 422, FTL 325 N, FTL 375 N or Commutec SIN 100, SIN 110 from Endress+Hauser. Output signal jump from low to <i>high current on limit</i>. (L-H edge)</p> <p>Connecting to multiplexer: Adjust clock time to min. 2 s.</p>																										
<p>Output signal</p>	<p> </p>	<table border="1"> <thead> <tr> <th rowspan="2">Fail-safe circuit</th> <th rowspan="2">Level</th> <th rowspan="2">Output signal</th> <th colspan="2">LEDs</th> </tr> <tr> <th>green</th> <th>red</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Max.</td> <td></td> <td>+ 0,65 2 1,0 mA</td> <td></td> <td></td> </tr> <tr> <td></td> <td>+ 2,15 2 2,8 mA</td> <td></td> <td></td> </tr> <tr> <td rowspan="2">Min.</td> <td></td> <td>+ 0,65 2 1,0 mA</td> <td></td> <td></td> </tr> <tr> <td></td> <td>+ 2,15 2 2,8 mA</td> <td></td> <td></td> </tr> </tbody> </table>	Fail-safe circuit	Level	Output signal	LEDs		green	red	Max.		+ 0,65 2 1,0 mA				+ 2,15 2 2,8 mA			Min.		+ 0,65 2 1,0 mA				+ 2,15 2 2,8 mA		
Fail-safe circuit	Level	Output signal				LEDs																					
			green	red																							
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Min.		+ 0,65 2 1,0 mA																									
		+ 2,15 2 2,8 mA																									
<p>Signal on alarm</p>	<p>Output signal with damaged sensor: 2.1 mA</p>																										
<p>Load (connectable load)</p>	<p>See Technical Data of isolating amplifier connected according to EN 50227 (NAMUR)</p>																										

Output
General
Information

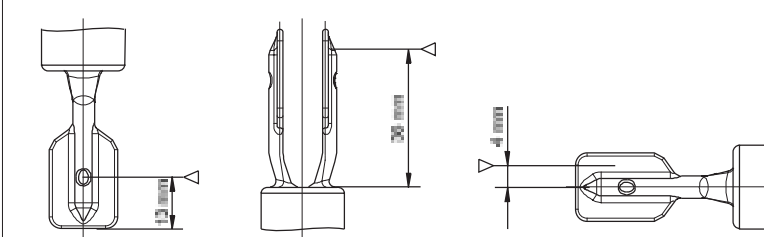
Connecting cables	Electronic inserts: cable section max. 2.5 mm ² ; strand in cable sleeve acc. to DIN 46228 Protective earth in housing: cable section max. 2.5 mm ² ; External terminal for plant grounding system: cable section max. 4 mm ²
Fail-safe mode	Switch-over for minimum/maximum residual current safety on electronic insert (with FEL 57 on Nivotester only) Max. = Maximum fail-safe: The output switches to the power fail response when the fork is covered For use with e.g. overspill protection Min. = Minimum fail-safe: The output switches to the power fail response when the fork is free For use with e.g. dry pump running
Switching time	When fork is covered approx. 0.5 s When fork is free approx. 1.0 s Additionally settable for PROFIBUS-PA: 0.5...60 s
Power up response	When switching on the power supply the output assumes the alarm signal. After max. 2 s it assumes the correct switching mode (Exception: FEL 57)

Performance
Characteristics

Reference conditions	Ambient temperature: 23 °C Product temperature: 23 °C Product density: 1 g/cm ³ (water) Viscosity: 1 mm ² /s Pressure p _e : 0 bar Sensor mounting: vertically from above Density switch: to 0.7	
Measured error	Specified by mounting position: max. +/- 1mm	
Repeatability	0,1 mm	
Hysteresis	approx. 2 mm	
Effects of product temperature	Max. +1.4 mm ... -2.8 mm (-40 °C ... +150 °C)	
Effects of density	Max. +4.8 mm ... -3.5 mm (0.5 g/cm ³ ... 1.5 g/cm ³)	
Effects of pressure	Max. 0 mm ... -2.5 mm (0 bar ... 64 bar)	

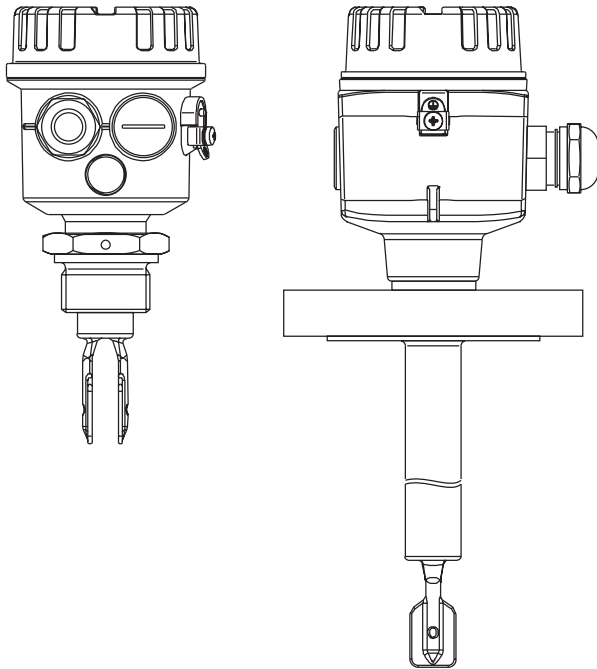
Operating
Conditions

Installation

Mounting	Switchpoints ▷ on the sensor depend on the mounting position, with reference to water, density 1 g/cm ³ , 23 °C, p _e 0 bar.
	
<p>Note: The switchpoints of the Liquiphant M are at other positions to those of the previous version Liquiphant II.</p>	

liquiphant M

FTL 50, FTL 51



- d** Füllstandgrenzschalter
- e** Level Limit Switch
- f** Détecteur de niveau
- es** Detector de nivel
- i** Interruttore di livello
- nl** Niveauschakelaar

Endress + Hauser

The Power of Know How



d Inhalt	e Contents	f Sommaire
Sicherheitshinweise	Notes on Safety	Conseils de sécurité
Behandlung	Handling	Manipulation
Geräte-Identifikation	Device Identification	Dénomination
Verwendung	Application	Utilisation
Meßeinrichtung	Measuring system	Ensemble de détection de niveau
Einbau	Installation	Montage
Einstellungen	Setting-up	Réglage
Anschluß	Connections	Raccordement
Funktionsprüfung	Function	Fonction
Wartung	Maintenance	Entretien
Technische Daten	Technical Data	Caractéristiques techniques
Zubehör	Accessories	Accessoires
Fehlersuche	Trouble-shooting	Recherche de défauts
Ersatzteile	Spare parts	Pièces de rechange
Reparatur	Repair	Réparations
Ergänzende Dokumentation	Supplementary Documentation	Documentation complémentaire

d Sicherheitshinweise

Der Liquiphant M FTL 50/51 darf nur als Füllstandgrenzschalter für Flüssigkeiten verwendet werden.

Bei unsachgemäßem Einsatz können Gefahren von ihm ausgehen.

Das Gerät darf **nur von qualifiziertem und autorisiertem Fachpersonal** unter strenger Beachtung dieser Betriebsanleitung, der einschlägigen Normen, der gesetzlichen Vorschriften und der Zertifikate (je nach Anwendung) eingebaut, angeschlossen, in Betrieb genommen u. gewartet werden. In der Gebäudeinstallation ist ein Netzschalter für das Gerät leicht erreichbar in dessen Nähe zu installieren. Er ist als Trennvorrichtung für das Gerät zu kennzeichnen.



Achtung!

= verboten; führt zu fehlerhaftem Betrieb oder Zerstörung.

4

e Notes on Safety

The Liquiphant M FTL 50/51 is designed for level limit detection in liquids.

If used incorrectly it is possible that application-related dangers may arise.

The level limit switch Liquiphant M FTL 50, 51 may be installed, connected, commissioned, operated and maintained **by qualified and authorised personnel only**, under strict observance of these operating instructions, any relevant standards, legal requirements, and, where appropriate, the certificate. Install an easily accessible power switch in the proximity of the device.

Mark the power switch as a disconnect for the device.



Caution!

= forbidden; leads to incorrect operation or destruction.

f Conseils de sécurité

Le Liquiphant M FTL 50/51 doit être exclusivement utilisé comme détecteur de niveau pour liquides.

Il peut être source de danger en cas d'utilisation non conforme aux prescriptions.

L'appareil ne doit être installé, raccordé, mis en service et entretenu **que par un personnel qualifié et autorisé**, qui tiendra compte des indications contenues dans la présente mise en service, des normes en vigueur et des certificats disponibles (selon l'application). Installer un commutateur réseau proximité immédiate de l'appareil, en veillant ce qu'il soit facilement accessible. Marquer ce commutateur comme prise de coupure de l'appareil.



Attention !

= interdit; peut provoquer des dysfonctionnements ou la destruction.

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d Behandlung

Am Gehäuse, Flansch oder Verlängerungsrohr anfassen.

e Handling

Hold by housing, flange or extension tube.

f Manipulation

Tenir par le boîtier, la bride ou le tube prolongateur.

es Modo de empleo

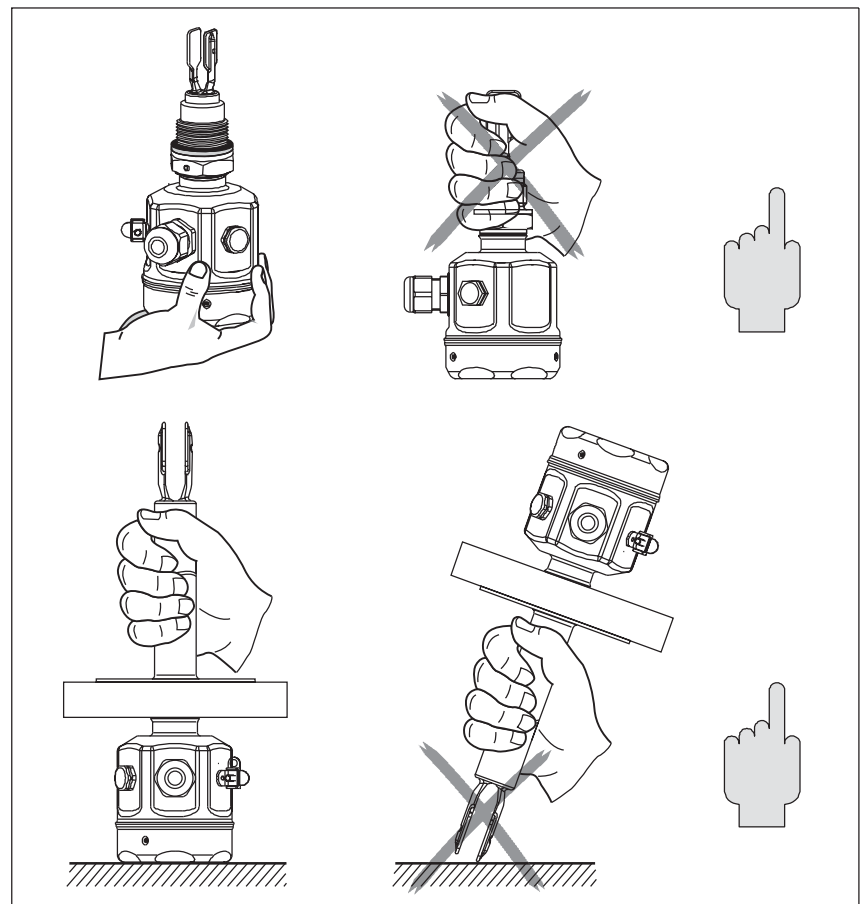
Coger por el cabezal, brida o tubo de extensión.

i Accorgimenti

Afferrare la custodia, per la flangia o per il tubo di estensione.

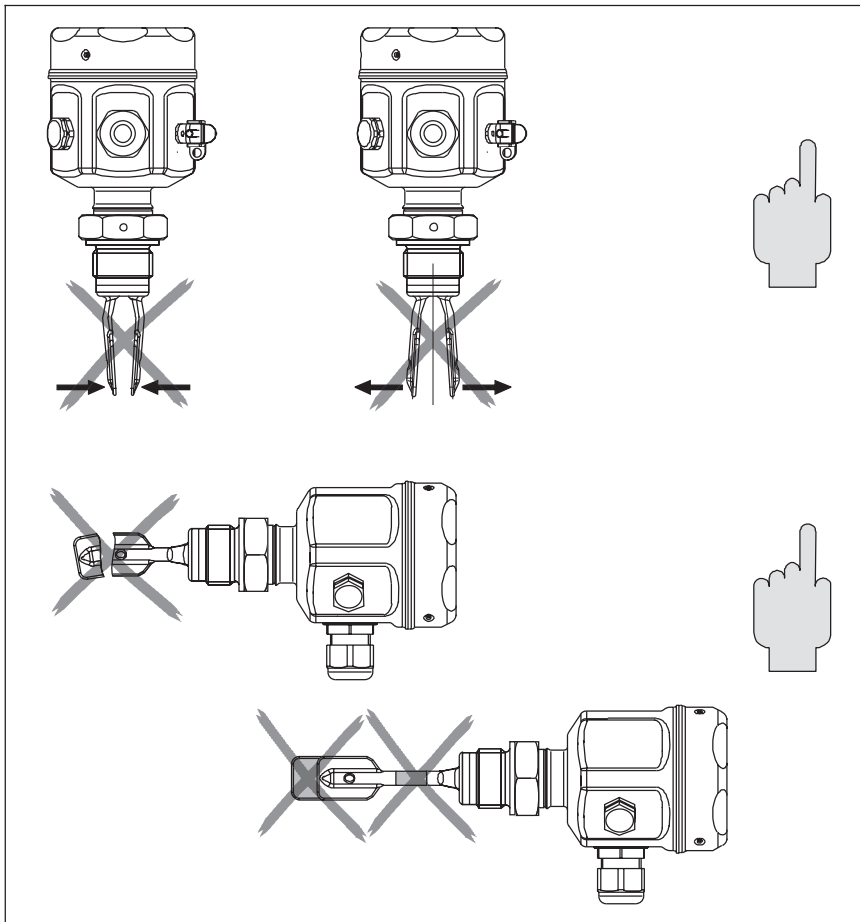
nl Behandeling

Vastpakken via behuizing, flens of verlengbuis.



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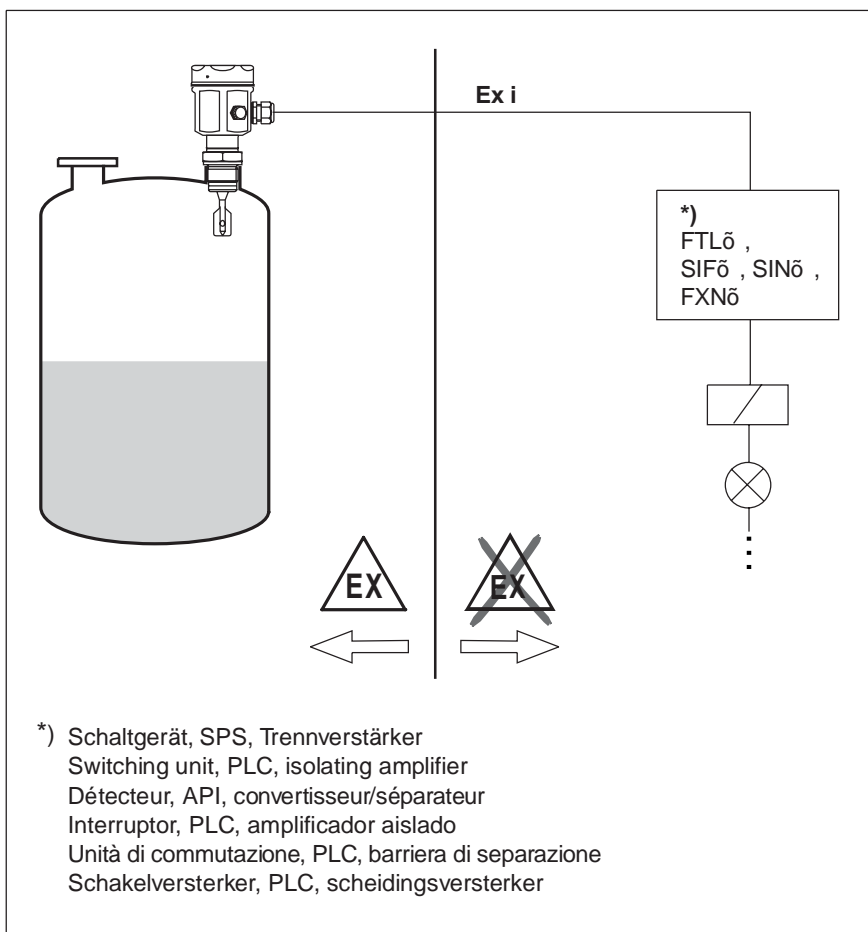
6



- d** **Nicht** verbiegen
Nicht kürzen
Nicht verlängern
- e** Do **not** bend
Do **not** shorten
Do **not** lengthen
- f** **Ne pas** déformer
Ne pas raccourcir
Ne pas rallonger
- es** **No** torcer
No acortar
No alargar
- i** **Non** stringere o allargare
Non accorciare o allungare
Non piegare
- nl** **Niet** verbuigen
Niet inkorten
Niet verlengen

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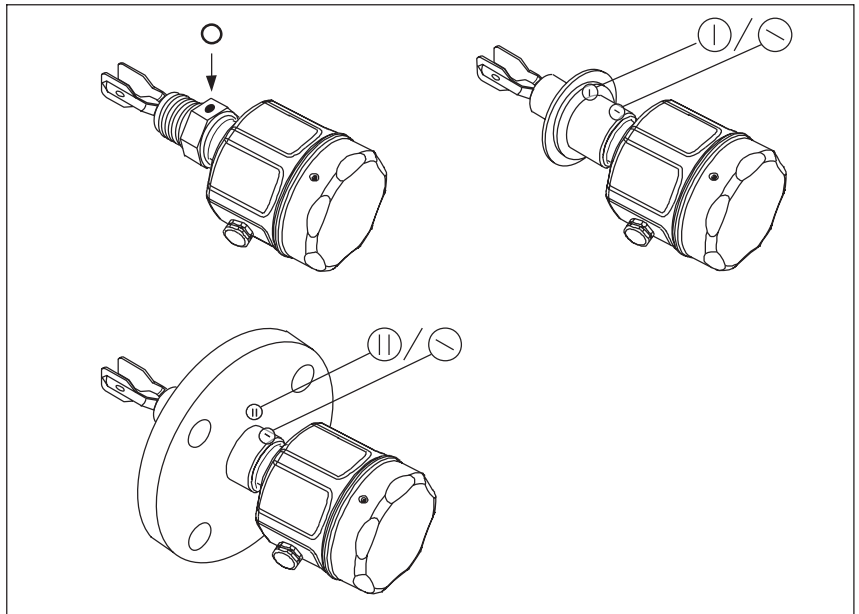
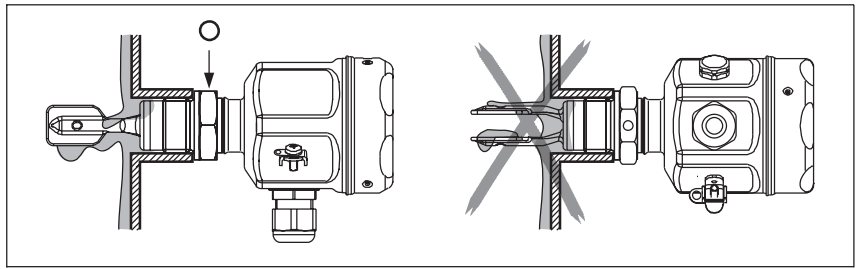
7



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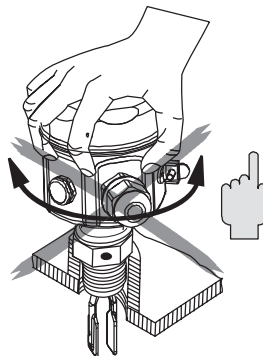
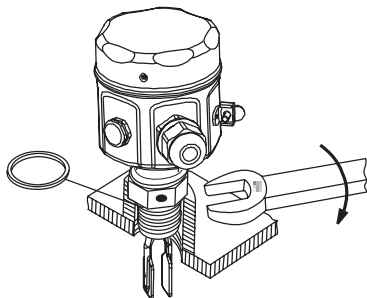
- d Schwinggabel ausrichten:
Markierung oben oder unten
- e Orientation of fork tines:
Marking above or below
- f Orientation des lames
vibrantes:
Repères en haut ou en bas
- es Orientación de la horquilla:
Marca arriba o abajo
- i Allineamento della forcella:
Marcatura in alto o in basso
- nl Vork uitrichten:
Markering boven of onder



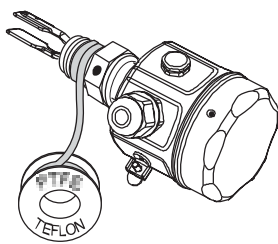
24

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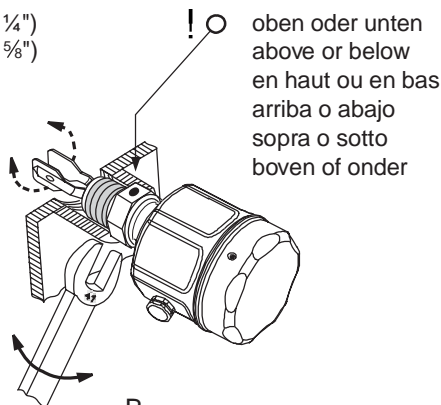
G ¾ A, SW 32 mm (1¼")
G 1 A, SW 41 mm (1½")



¾ NPT, R ¾, G ¾ A, SW 32 mm (1¼")
1 NPT, R 1, G 1 A, SW 41 mm (1½")



A

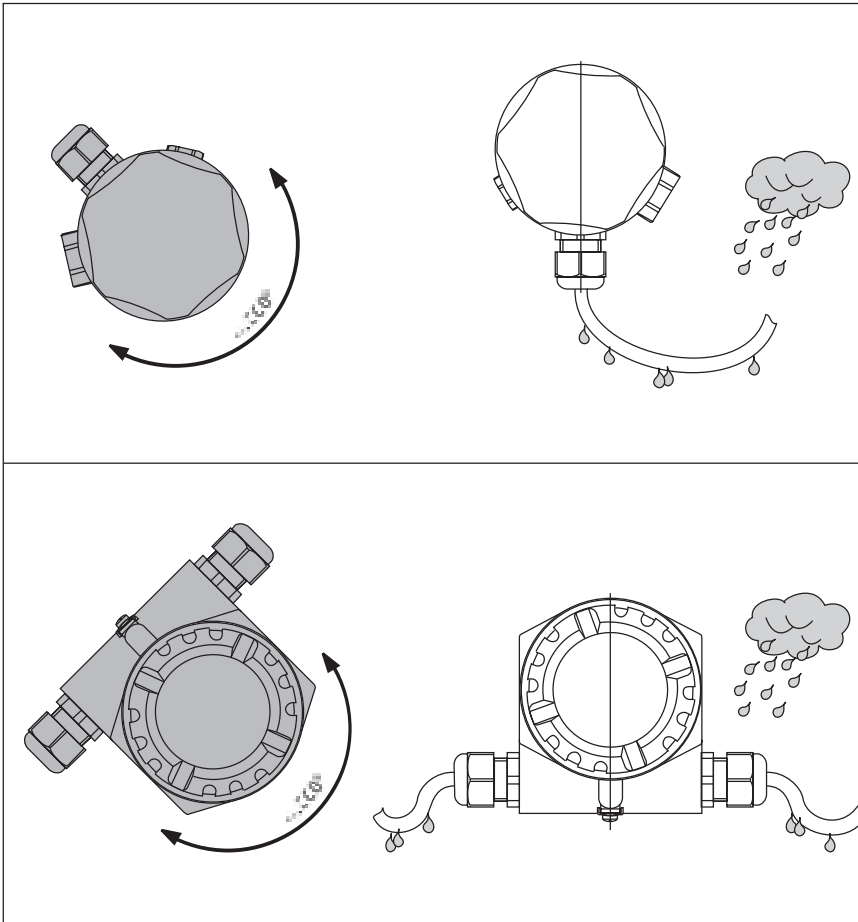


B

- d Liquiphant einschrauben.
Nicht am Gehäuse drehen.
- e Screw Liquiphant into
process connection.
Don't use housing to turn.
- f Visser le Liquiphant.
Ne pas se servir du boîtier.
- es Roscar el Liquiphant a la
conexión a proceso.
No girar el cabezal.
- i Avvitare il Liquiphant
all'attacco di processo.
Allo scopo **non** utilizzare
la custodia.
- nl Schroef de Liquiphant in de
proces aansluiting.
Draai hierbij **niet** aan de
behuizing.

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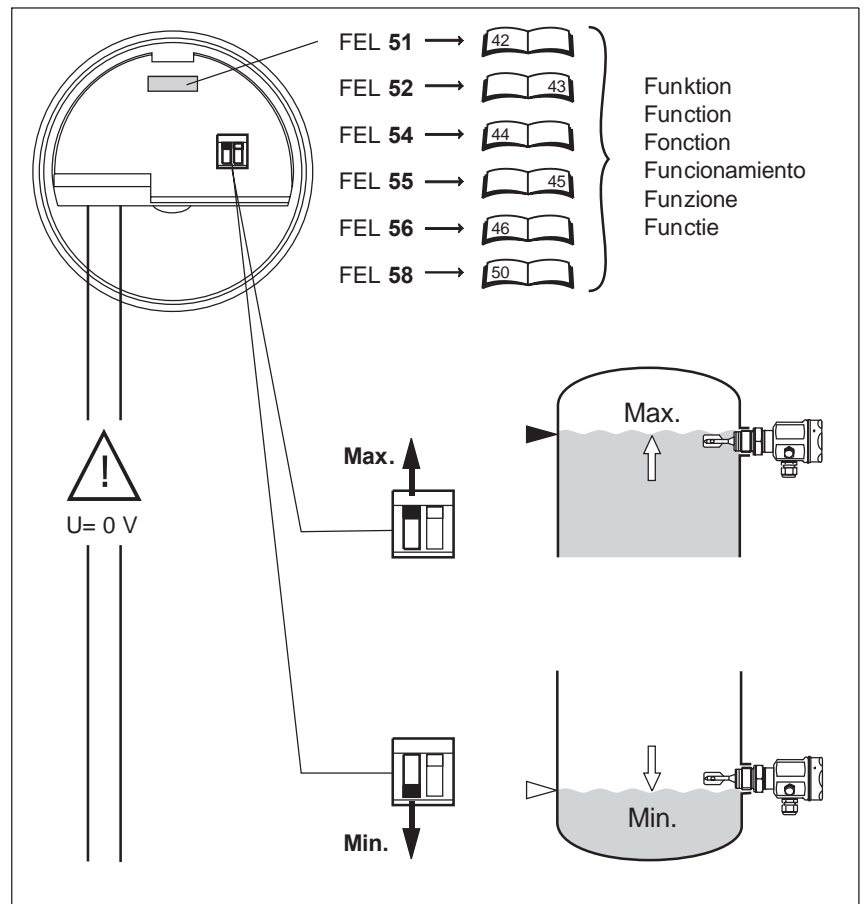
- d** Kabeleinführung ausrichten
- e** Cable gland orientation
- f** Positionnement de l'entrée de câble
- es** Ajuste del prensaestopa
- i** Posizionamento del passacavo
- nl** Kabelinvoer uitrichten

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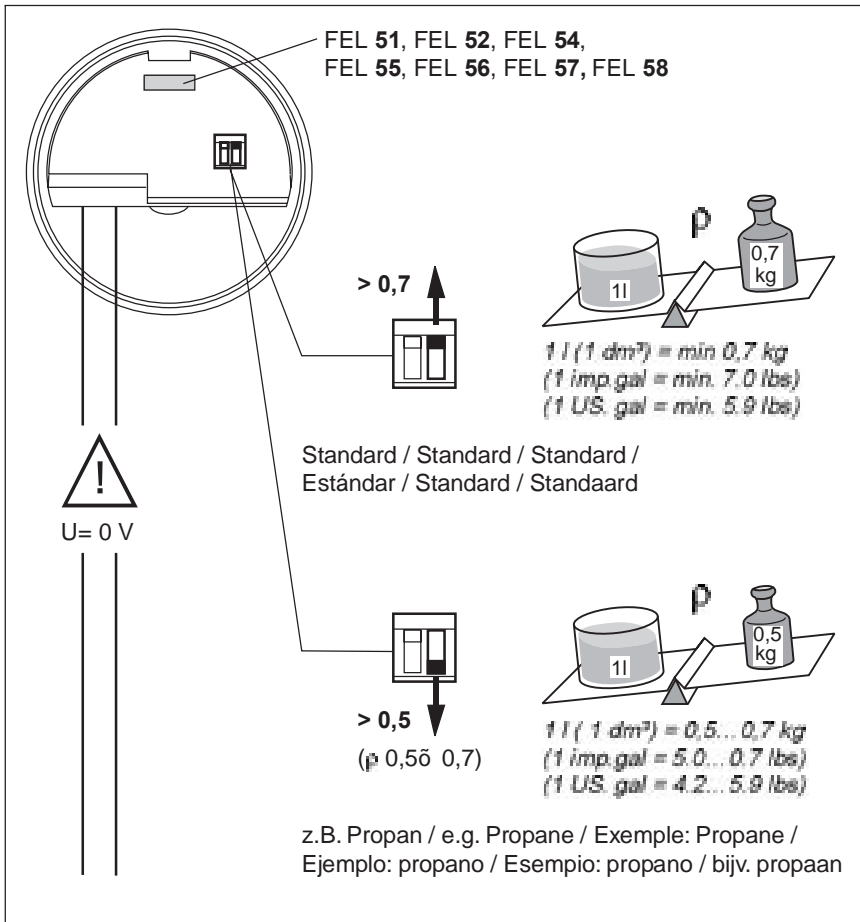
- d** Einstellungen
- e** Setting-up
- f** Réglage
- es** Ajuste
- i** Messa in servizio
- nl** Instellingen

- d** Minimum-/Maximum-Sicherheitschaltung
- e** Minimum/maximum fail-safe mode
- f** Sécurité minimum/maximum
- es** Conmutador de seguridad m.n./máx.
- i** Selezione della modalità di sicurezza min./max.
- nl** Minimum/maximum veiligheidsschakeling



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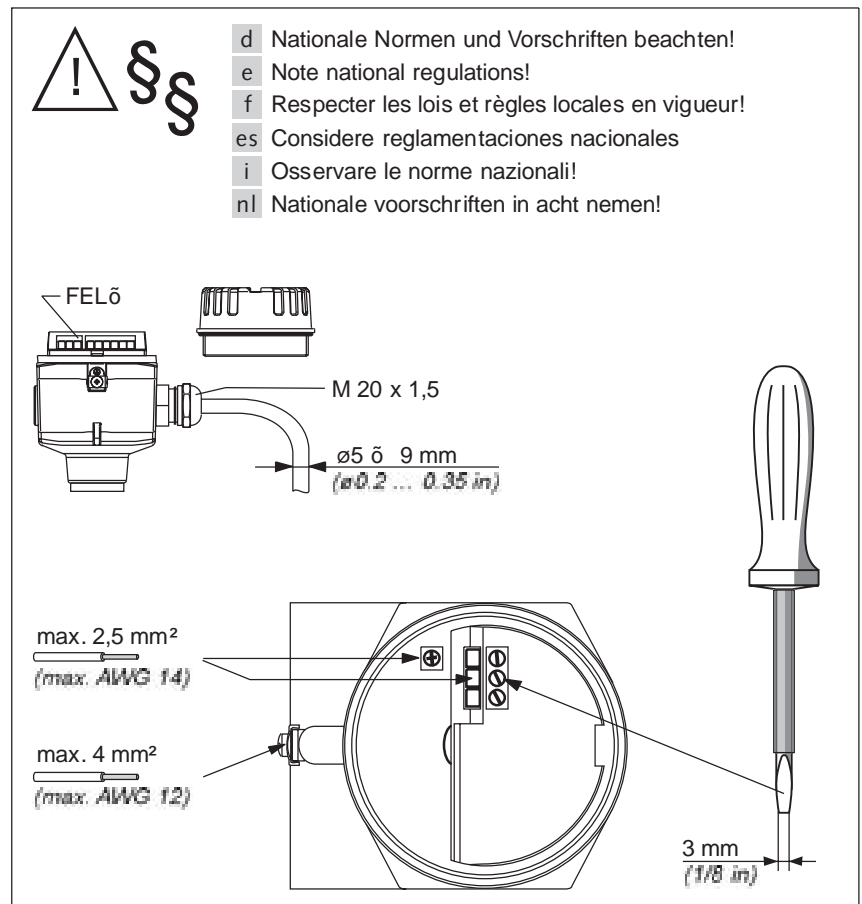
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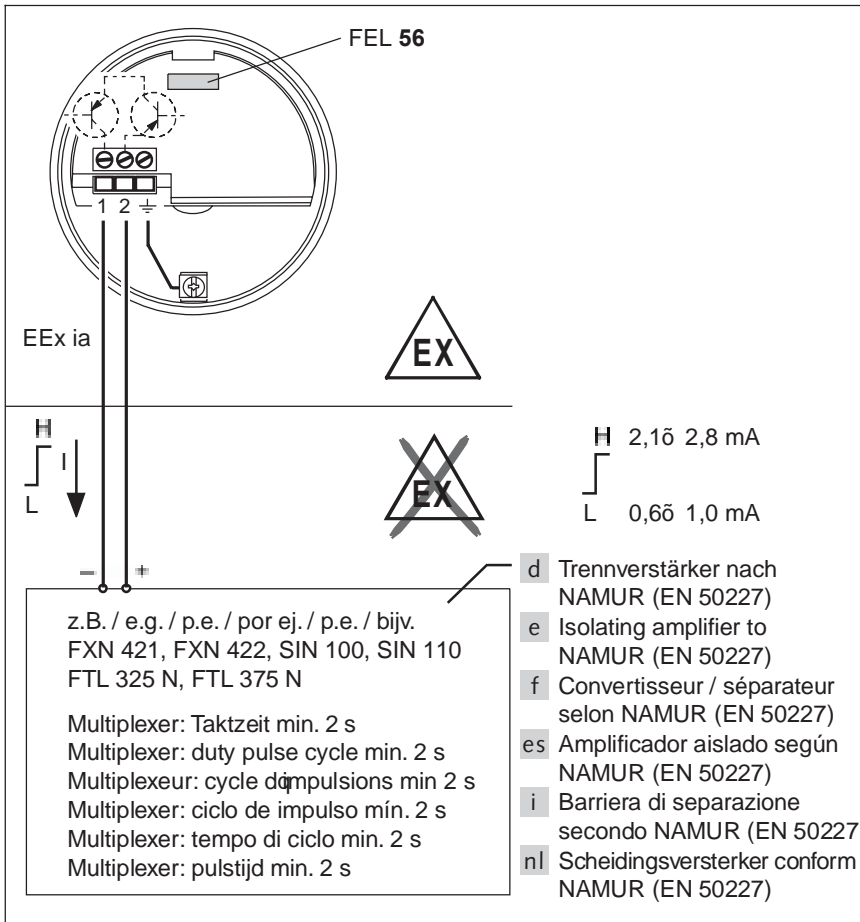
29

- d Anschluß
- e Connections
- f Raccordement
- es Conexiones
- i Collegamenti elettrici
- nl Aansluiting



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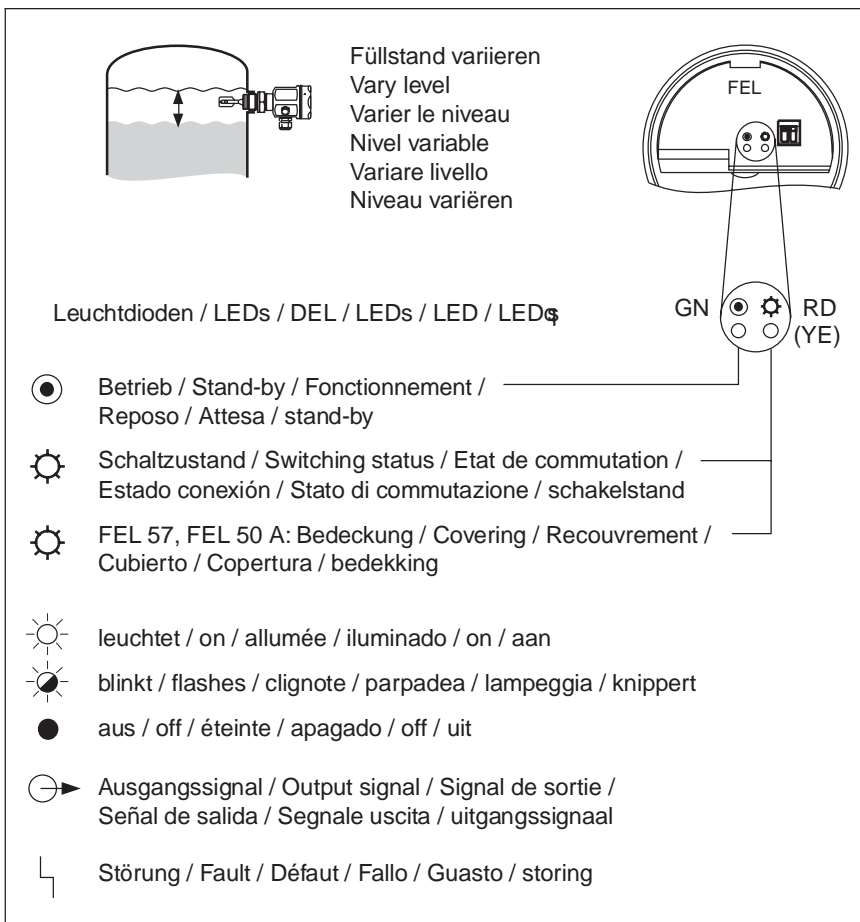
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- d Anschluß FEL 56
NAMUR-Ausgang L-H
<1,0 mA / 2,1 mA
- e Connections FEL 56
NAMUR output L-H
<1,0 mA / 2,1 mA
- f Raccordement FEL 56
Sortie NAMUR L-H
<1,0 mA / 2,1 mA
- es Conexiones FEL 56
Salida NAMUR L-H
<1,0 mA / 2,1 mA
- i Collegamenti elettrici FEL 56
NAMUR uscita L-H
<1,0 mA / 2,1 mA
- nl Aansluiting FEL 56
NAMUR uitgang L-H
<1,0 mA / 2,1 mA

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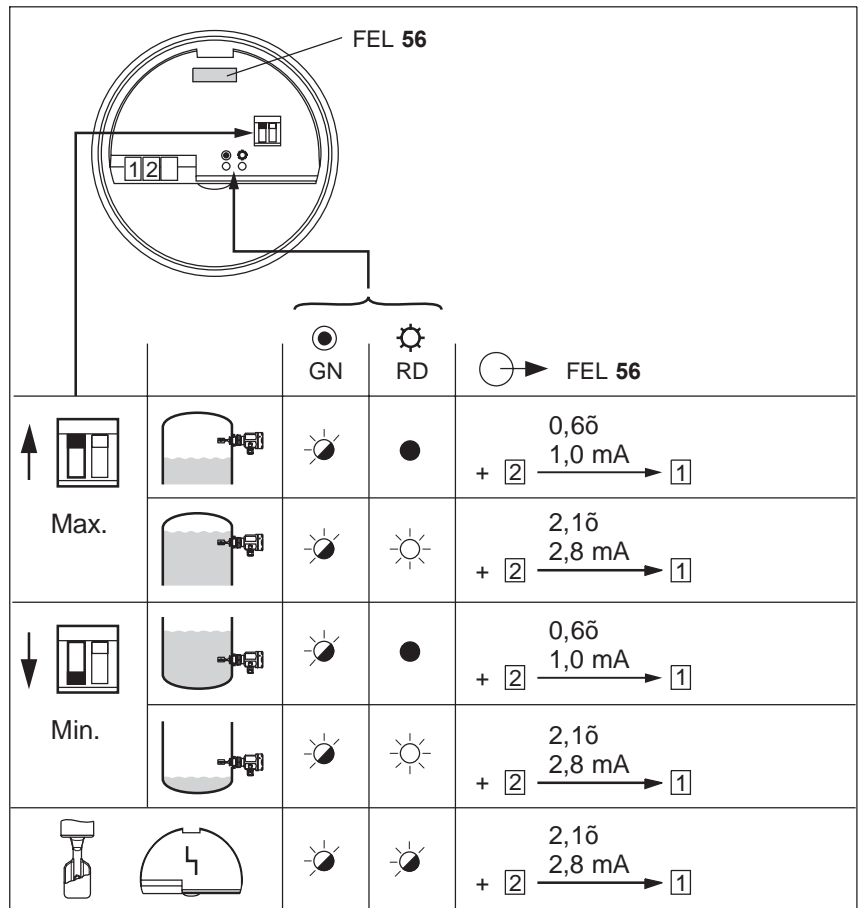


- d Funktionsprüfung
- e Function
- f Fonction
- es Funcionamiento
- i Funzione
- nl Functie

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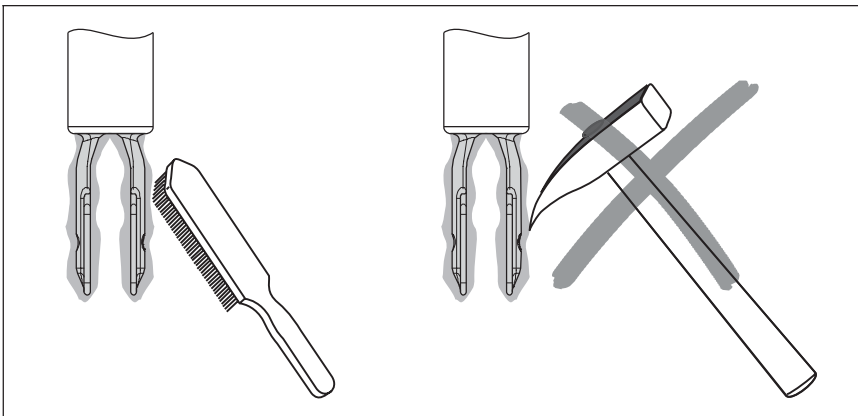
41

- d Funktion FEL 56
- e Function FEL 56
- f Fonction FEL 56
- es Funcionamiento FEL 56
- i Funzione FEL 56
- nl Functie FEL 56

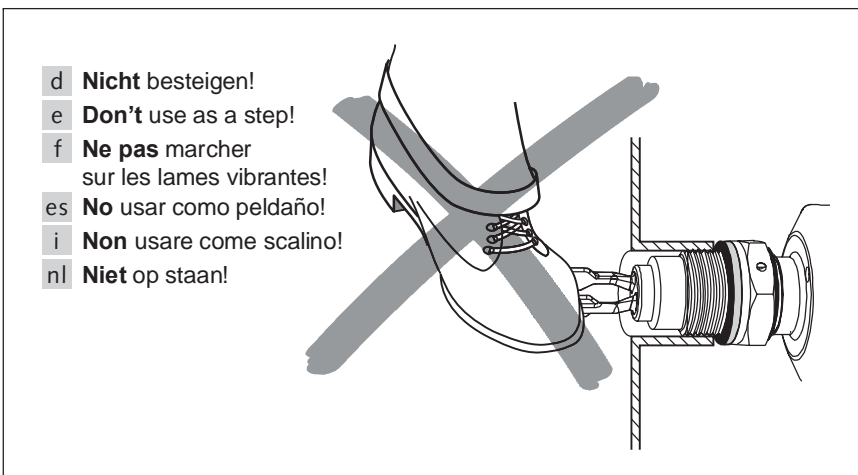


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- d Wartung
Dicke Krusten entfernen
- e Maintenance
Removal of thick encrustation
- f Entretien
Enlever les dép ts et incrustations
- es Mantenimiento
Eliminaci n de adherencias
- i Manutenzione
Rimozione di depositi consistenti
- nl Onderhoud
Aangroei verwijderen



- d **Nicht** besteigen!
- e **Don't** use as a step!
- f **Ne pas** marcher sur les lames vibrantes!
- es **No** usar como peldaño!
- i **Non** usare come scalino!
- nl **Niet** op staan!

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- d Technische Daten
Umgebungstemperatur T1
Betriebs­temperatur T2
- e Technical Data
Ambient temperature T1
Process temperature T2
- f Caractéristiques techniques
Température ambiante T1
Température de service T2
- es Datos técnicos
Temperatura ambiente T1
Temperatura de servicio T2
- i Dati tecnici
Temperatura ambiente T1
Temperatura di servizio T2
- nl Technische gegevens
Omgevings­temperatuur T1
Proces­temperatuur T2

+ "T" / "p" → 10 11

$x \text{ °C} = (1.8 x + 32) \text{ °F}$

* P_e } Prozeßanschluß / Zubehör
 * T_2 } Process connection / accessories
 Raccord process / accessoires
 Conexión a proceso / accesorios
 Connessione al processo / accessori
 Procesaanluiting / accessoires

$p_e = \text{max. } 64 \text{ bar (930 psi) }^*$

Dichte ρ
 Density ρ
 Densité ρ
 Densidad ρ
 Densità ρ
 Dichtheid ρ

$\rho > 0,5$
 (1 Imp. gal = min. 5.0 lbs)
 (1 US. gal = min. 4.2 lbs)

Viskosität ν
 Viscosity ν
 Viscosité ν
 Viscosidad ν
 Viscosità ν
 Viskositeit ν

$\nu \text{ max. } 10000 \text{ mm}^2/\text{s}$
 (max. 10000 cSt)

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e Trouble-shooting

Fault	Reason	Remedy	
Does not switch	No power	Check power	
	Faulty signal line	Check signal line	
	Faulty electronic insert – FEL 51 connected directly to L1 and N	Exchange – always connect FEL 51 via external load	
	Density of liquid too low	Set density to 0.5 at electronic insert	
	Fork encrusted	Clean fork	
	Fork corroded (Indication on FEL: red/yellow flashes, FEL 58: green flashes 0.3 Hz)	Exchange fork and process connection	
	FEL 51: Internal resistance of connected relay too large	Connect suitable relay	
	FEL 51: Holding current of connected relay too low	Connected resistor in parallel with relay	
Switches incorrectly	FEL 54: Contacts welded together (after short-circuit)	Exchange FEL 54; put fuse in contact circuit	
	Min- / Max- fail-safe mode set wrongly	Set correct mode at electronic insert	
	Sporadic faulty switching	Thick heavy foam, very turbulent conditions, foaming liquid	Mount Liquiphant in bypass
		Extreme RFI	Use screened cable
		Extreme vibration	Decouple, damp, turn fork 90°
Water in housing		Screw cover and cable gland tight	
Switches incorrectly after power failure	FEL 52: Output overloaded	Reduce load, (cable) capacitance	
	FEL 57, Behaviour during switch-on test (functional test)	Observe switching behaviour of FEL 57; After power failure block plant control for up to 45 s	

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d Ergänzung Fehlersuche

Ist das Schaltverhalten der Gabel ungewöhnlich, kann an PIN 4 der Diagnosebuchse die Gabelfrequenz gemessen werden. Bei den Elektronikeinsätzen FEL 51, 52, 54, 55, 56, 57, 58 ist dies eine sinusförmige Schwingung deren Amplitude einen Rückschluß auf den Gabelzustand zulässt. Bei FEL 50 A ist aufgrund eines Rechtecksignals nur noch die Gabelfrequenzmessung möglich.

e Trouble-Shooting Supplement


If the switching behaviour of the fork is abnormal, the fork frequency can be measured at PIN 4 of the diagnosis socket. With electronic inserts FEL 51, 52, 54, 55, 56, 57, 58, this is a sinusoidal vibration whose amplitude makes it possible to determine the condition of the fork. With FEL 50 A, only the fork frequency measurement is possible due to a rectangular pulse signal.

f Additif recherche de défauts

Si la commutation de la fourche est inhabituelle, il est possible de mesurer la fréquence de cette dernière au PIN 4 de la prise diagnostic. Pour les électroniques FEL 51, 52, 54, 55, 56, 57 et 58, il s'agit d'une oscillation sinusoïdale dont l'amplitude permet d'évaluer l'état de la fourche. Pour FEL 50 A, le signal rectangulaire ne permet qu'une mesure de la fréquence de fourche.

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	FEL 51	E+H 52002304
	FEL 52	E+H 52002305
	FEL 54	E+H 52002306
	FEL 55	E+H 52002307
	FEL 56	E+H 52002308
	FEL 57	E+H 52002309
	FEL 58	E+H 52006454
	FEL 50 A	E+H 52010527

d Installationsregel: Bei der Installation ist zu beachten, dass elektrische Betriebsmittel (Elektronikeinsätze) die mit nichteigensicheren Stromkreisen gespeist wurden, grundsätzlich **nicht** mehr mit eigensicheren Stromkreisen zusammenschaltet werden dürfen.

e Installation specification: During installation, please keep in mind that electrical resources (electronic inserts) which are powered by non-intrinsically-safe circuits may **no** longer be interconnected with intrinsically-safe circuits.

f Directive d'installation : Lors de l'installation, tenir compte du fait que les matériels électriques (électroniques) alimentés par des circuits sans sécurité intrinsèque **ne** doivent plus être connectés à des circuits à sécurité intrinsèque.

es Normas de instalación: Durante la instalación, tenga en cuenta que los elementos eléctricos (electrónicas) alimentadas por circuitos no intrínsecamente seguros, **no** podrán estar interconectadas con circuitos intrínsecamente seguros.

i Specifiche di installazione: Durante l'installazione è necessario tenere presente che gli impianti elettrici (inserti elettronici) alimentati da circuiti elettrici non a sicurezza intrinseca **non** possono più essere collegati con circuiti elettrici a sicurezza intrinseca.

nl Installatievoorschrift: Bij de installatie moet erop worden gelet, dat elektrisch materieel (elektronica-units) die via niet-intrinsiekveilige circuits worden gevoed, in principe **niet** meer met intrinsiekveilige circuits mogen worden samengeschaakeld.

Endress+Hauser

d Ersatzteile

Elektronikeinsätze

e Spare parts

Electronic inserts

f Pièces de rechange

Electroniques

es Repuestos

Electrónicas

i Ricambi

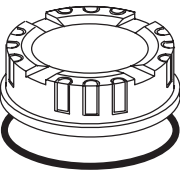
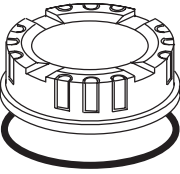
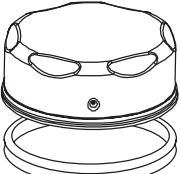
Inserti elettronici

nl Reserve-onderdelen

Elektronica inserts

67

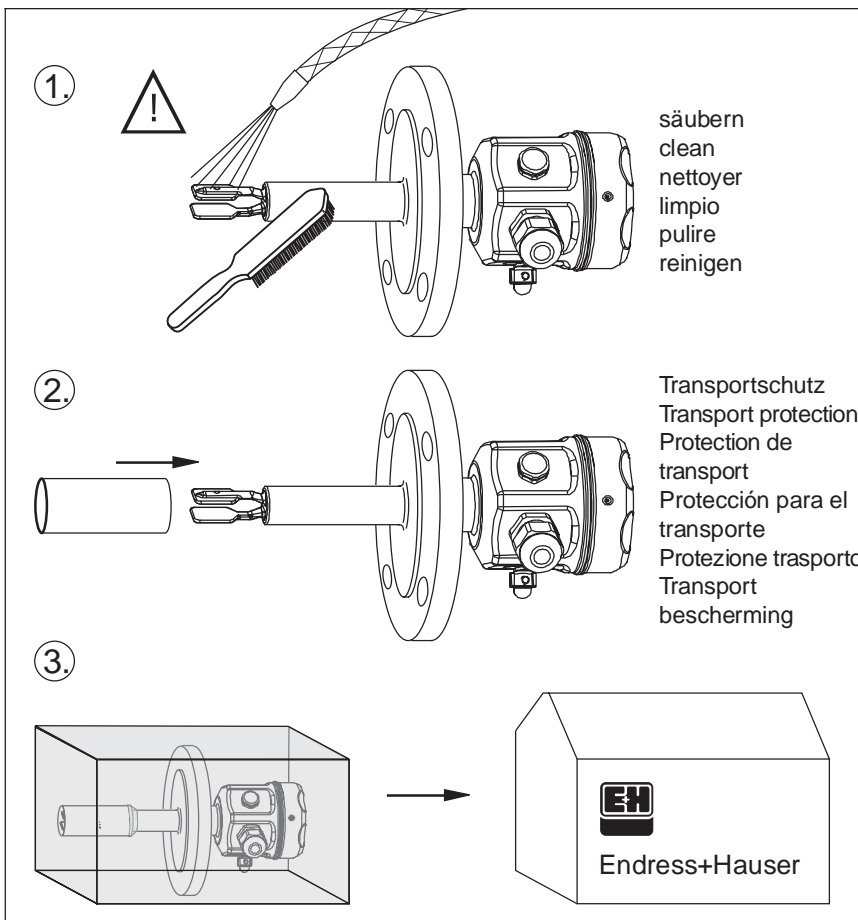
- d** Gehäusedeckel, Dichtungen
- e** Housing covers, seals
- f** Couvercles de bo tier, joints
- es** Cubiertas del cabezal, juntas
- i** Coperture custodia, guarnizioni
- nl** Behuizing deksels, dichtingen

*		Alu	}	Alu	E+H 52002699
		EPDM		Alu (Ex d)	E+H 52002698
*		PBT-FR			E+H 943461-0000
		EPDM			E+H 017717-0003
*		1.4301 / 1.4435 (AISI 304 / 316 L)			E+H 943301-0000
		MVQ			E+H 943304-0000

* **d** Mit Silikonfett oder Graphit schmieren
e Lubricate with silicone grease or graphite
f Lubrifier avec de la graisse silicone ou du graphite
es Lubricar con grasa de silicona o grafito
i Lubrificare con olio di silicone o grafite
nl Met siliconenvet of grafietvet insmeren

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Endress+Hauser



- d** Reparatur bei Endress+Hauser
- e** Repair at Endress+Hauser
- f** Réparations chez Endress+Hauser
- es** Reparaciones en Endress+Hauser
- i** Riparare presso la Endress+Hauser
- nl** Reparatie bij Endress+Hauser

Endress+Hauser

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Technical Data

For motor connection parameters see nameplate

General technical data			RE 0016 B	RE 0040 B	RE 0063 B
Nominal suction capacity	m ³ /h	50 Hz	16	40	63
		60 Hz	19	48	75
Ultimate pressure	hPa abs. (mbar abs)	with oil return line to B-cover	—	5	
		with oil return line to suction connection	20		
Nominal motor rating	kW	50 Hz	0,37	1,5	2,1
		60 Hz	0,55	2,1	2,6
max. allowed nominal motor rating	kW	50 Hz	0,37	1,5	2,2
		60 Hz	0,55	2,2	3,0
Nominal speed	min ⁻¹	50 Hz	1500		
		60 Hz	1800		
Sound pressure level (DIN 45635)	db(A)	50 Hz	60	63	64
		60 Hz	63	66	68
Ambient temperature/ temperature of inlet gas	° C	with oil Busch VE 101, with heater	—	-20 ... 40	
		with oil Busch VE 101, w/o heater	0 ... 40		
		with oil Busch VSL 101, with heater	—	-20 ... 40	
		with oil Busch VSL 101, w/o heater	0 ... 40		
		with oil Busch VM 100, with heater	—	-10 ... 30	
		with oil Busch VM 100, w/o heater	12 ... 30		
Oil quantity	l		1	2	
Weight	kg		~39	~87	~91
Explosion protection data			RE 0016 B	RE 0040 B	RE 0063 B
Category w.r.t. conveyed gas (i)			1		
Category w.r.t. environment (o)			2		
Explosion group			IIB3		
Temperature class			T4*		
Temperature switch switching point		° C	120		
Pressure switch switching point S1		hPa Ü (mbar Ü)	550		
Pressure switch switching point S2		hPa Ü (mbar Ü)	600		

* only if also the drive motor is approved for temperature class T4, else downgrading of the entire vacuum pump to the temperature class of the drive motor

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MANUEL D'EMPLOI
INSTALLATIE- EN BEDRIJFSINSTRUCTIE
INSTALLATION AND OPERATING INSTRUCTIONS

UNITÉ À VIDE ENIVAC RE 0016 B ATEX II 1 / 2 G b/c IIB T3
VACUÜMUNIT ENIVAC RE 0016 B ATEX II 1 / 2 G b/c IIB T3
VACUUMUNIT ENIVAC RE 0016 B ATEX II 1 / 2 G b/c IIB T3

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Intermédiaire SDT
Mons. Verstappen

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Intermédiaire BUSCH NV.
Mons. K. Pensaert

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Maintenance et service

Mons. K. Smet,
Manager Maintenance Busch NV

1. Contact klant

Klant

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Dhr. Verstappen

Contact klant

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Onderhoud en service

Dhr. K. Smet,
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1. Contact customer

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Contactpersoon SDT
Mr. Verstappen

Contact customer

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Contactpersoon BUSCH NV
Mr. K. Pensaert

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Maintenance en service

Mr. K. Smet,
Manager Service Busch NV

Opgesteld door/functie H. Ottenhoff Project Engineer	Gecontroleerd door/functie H. Ottenhoff Projectleider	Goedgekeurd door/functie Verkoop / Adviseur

2 Description du syst me

- Pompe à vide, type Enivac RE0016 B
- Moteur Eexd IIB T4 0,55 kW IP55 230 VAC 50 Hz avec PTC interne, monophasé EExd
- Manomètre
- Robinet clapet
- Châssis
- Garnitures

2.1 Un coffret électrique

- Explosion sûr Eex d [ia] II 2 (1) G IIB T5
- Thermistorrelais 230 VAC
- Interrupteur d'arrêt d'urgence Eex d, stay-put, 1 NC
- Interrupteur de travail, 0-1 Eex d, 2p.
- 5x presse étoupe Eexd

2.2 Différentes

Un câble réglementaire, branché sur le moteur. Un câble renforcé et souple, LIYYCY, avec une fiche réglementaire (bleu).

2. Beschrijving van het systeem

- Vacuümpomp type Enivac RE 0016 B
- Elektromotor Eex d IIB T4, 0,55 kW IP55 230 VAC 50 Hz, 1 fase met PTC
- Manometer
- Afsluitkraan
- Frame
- Fitwerk

2.1 Schakelkast

- Explosie veilig Eex d [ia] II 2 (1) G IIB T5
- Thermistorrelais 230 VAC
- Noodstop Eex d, stay-put, 1 NC
- Werkschakelaar, 0-1 Eex d, 2 polig
- 5x kabelwartel Eexd

2.2 Diverse

25 meter kabel (LIYYCY) met stekker (blauw).

2. vacuum unit arrangement

- Vacuum pump, type Enivac RE 0016 B
- Electric motor Eex d IIB T4, 0,55 kW IP55 230 VAC 50 Hz, included PTC, monophase EExD
- Pressure indicator
- Valve
- Frame
- Fitting

2.1 Switchboard

- Explosion proof Eex d [ia] II 2 (1) G IIB T5
- Thermistorrelais 230 VAC
- Emergencybrake Eex d, stay-put, 1 NC
- Circuit breaker, 0-1 Eex d, 2-pole
- 5x cable gland Eexd

2.2 Divers

A cable with a pliable length of 25 meter. A strengthened cable LIYYCY equipped with a regulatory plug (blue).

. Le choix du système

Les points de départ sur lesquels le système c'est basé sont décrit dans le fax avec :

- Une pompe avec un câble réglementaire, branché sur le moteur. Un câble renforcé et souple, LIYYCY, avec une fiche réglementaire (bleu).
- Le moteur est muni d'une sécurité thermique, qui doit faire arrêter la pompe dans trente secondes après le dépassement de la température réglementaire.

Le total deviendra fourni par BUSCH avec une Déclaration-CE.

. itgangspunten

Het systeem is in hoofdzaak gebaseerd op de volgende punten:

- Een pomp met een aan de motor aangesloten, reglementaire kabel met een lengte van 25 meter, een versterkte soepele kabel LIYYCY voorzien van een reglementaire stekker (blauw).
- De motor is voorzien van een thermische beveiliging die de pomp binnen de 30 seconde na het overschrijden van de reglementeerde temperatuur moet stilleggen.

Het geheel wordt door Busch afgeleverd met een CE-verklaring.

. Starting points

The following main points on which the system is based are:

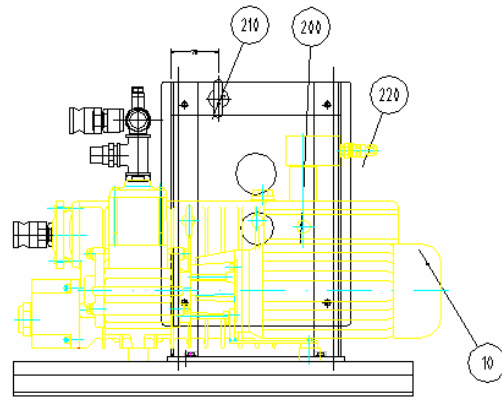
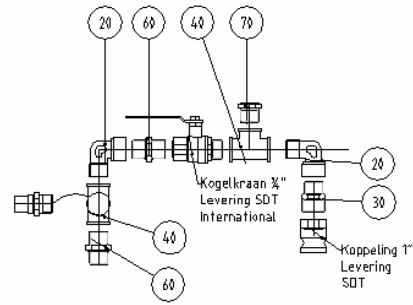
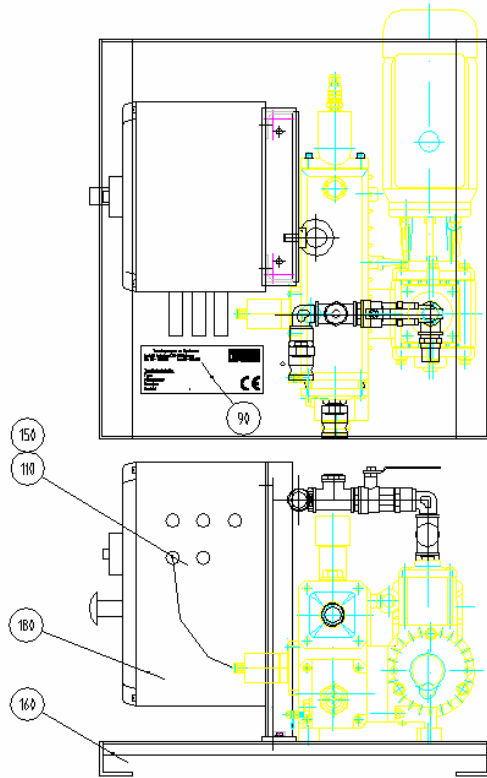
- Busch will deliver the pump with a regulatory cable connected to the motor, a motor and cable with a pliable length of 25 meter. A strengthened cable LIYYCY equipped with a regulatory plug (blue).
- The motor is provided with a thermal safety, which has to shut down the pump within 30 seconds after exceeding the regulated temperature.

The unit is delivered by Busch with CE-declaration.

4. In de l' ensemble

4. e eningen

4. Dra ing



os.	Description	mschrijving	Description
10	Enivac RE 0016 A	Enivac RE 0016 A	Enivac RE 0016 A
10-1	Moteur Eexd IIC T4 0,55 kW	Electromotor Eexd IIC T4 0,55 kW	Electromotor Eexd IIC T4 0,55 kW
180	un coffret électrique	Schakelkast	Switch board
160	Châssis	Frame	Frame
210	L'anneau de leverage	Hijsoog	Lifting lug
60	Mamelon M 3/4"-3/4"	Nippel 3/4" bu/bu	Nipple M 3/4"
40	Té F 3/4"	T-stuk 3/4"	Tee F 3/4"
20	Coude F 3/4" – M 3/4"	Knie 3/4" bi/bu	Elbow F 3/4" – M 3/4"
SDT	Vanne à boule F 3/4" – M 3/4"	Afsluitkraan 3/4" bi/bu	Ball valve F 3/4" – M 3/4"
70	Manchon M 1/2" – F 1/4"	Verloopring 1/2"- 1/4"	Reduce ring M 1/2"- M 3/4"
30	Mamelon M 1" – M 3/4"	Verloopnippel 3/4" – 1"	Reduce nipple M1" – M 3/4"
SDT	Kamlock M1" – F1"	Aansluitnippel 1"	Connection nipple M 1" – F 1"
SDT	Soupape de sécurité 3/4"	Vacuümbegrenzingsventiel 3/4"	Vacuumrelieve 3/4"
170	Vacuum-mètre M 1/4"	Manometer 1/4"	Pressure indicator 1/4"
110	Fiche 3P 220V nr.271	Stekker 3P 220V nr.271	Plug 3P 220V nr. 271
150	Câble SO 3x2,5 mm2 25 mtr.	25 meter kabel SO 3x2,5 mm2	Cable SO 3x2,5 mm2 25 mtr

5. Installation mécanique et électrique

5.1 Installation mécanique

- Le réservoir d'huile doit être rempli jusqu'à l'indication MAX sur le voyant. Pour les différentes sortes d'huile à utiliser, voir la table de choix dans l'instruction de la pompe à vide, le chapitre 7.
- Installer l'unité sur un fondement horizontal.
- Joindre la pompe à vide au processus, joint du processus 1".
- Mettre la pompe en marche, uniquement raccordée à la soupape d'admission.
- Les capots de protection sont obligatoirement montés quand la pompe est en marche.

Attention:
Les éteigneurs de flammes intégrés ne doivent pas être démontés.

5.2 L'installation électrique

- L'unité est prévue d'un câble LIYYCY de 25 mètres de longueur et équipé d'une prise mâle bleu CEE.
- L'unité est prévue d'un interrupteur de travail et d'arrêt d'urgence.
- Les réparations d'électricité ne peuvent être effectuées que par les personnes qualifiées.

5. Mechanische en elektrische installatie

5.1 Mechanische installatie

- Het oliereservoir van de pomp moet gevuld worden tot het niveau de MAX-aanduiding van het oliepeilglas bereikt. Voor de te gebruiken oliesoorten zie de keuzetabel in de bedrijfsinstructie van de vacuümpomp, zie hoofdstuk 7.
- De unit moet horizontaal geplaatst worden op een vlakke ondergrond.
- Aansluiten van de vacuüminunit op het proces, procesaansluiting 1".
- Pomp alleen laten draaien met aangesloten inlaat.
- Afschermkappen dienen bij gebruik altijd gemonteerd te zijn.

Waarschuwing:
De ingebouwde vlammeblussers mogen NIET verwijderd worden.

5.2 Elektrische installatie

- De unit is voorzien van 25 meter kabel LIYYCY met een blauwe CEE stekker.
- De unit is voorzien van een aan/uit schakelaar en een noodstop.
- Reparaties aan elektrisch gedeelte alleen door ter zake kundig personeel.

5. Mechanical and electrical installation

5.1 Mechanical installation

- The oil tank of the vacuum pump must be filled to the MAX level marked on the oil level gauge. For the oils to be used, see chapter 7 Installation and operating instructions for the vacuum pump.
- The unit must be set up horizontally on a flat surface.
- Connection of the vacuum unit to the process; process suction nozzle size 1".
- During operation the pump inlet must be mounted
- Fan covers must always be mounted during operation.

Warning:
The mounted flame extinguishers may not be removed

5.2 Electrical installation

- The unit is provided with a cable of 25 meter with a blue CEE plug.
- The unit is provided with an on/off switch and an emergency stop button.
- Repairs of the electrical part may only be performed by skilful personnel

6. Mode d'emploi

6.1 Le transport de l'unité à vide

- La masse totale de l'installation est de 85 kg.
- Le transport de l'installation se fait après le vidage de l'huile et le montage des chapeaux.
- Utiliser les possibilités de levage pour lever l'installation.
- Il ne faut lever l'installation qu'à l'aide des possibilités de levage.

6.2 Instructions de démarrage

- Avant le démarrage, lire les instructions des composants différents.
- Les tuyauteries doivent être nettoyées avant l'installation.
- Démarrer la pompe; Contrôler le sens de la pompe, par la mise en marche brève.
- faire tourner la pompe à vide, aspiration fermée pendant 10 minutes

6.3 Premier démarrage

L'unité vide ne peut être opérée que par des personnes qui sont au courant du fonctionnement de l'unité, l'application permise et le contenu du manuel d'opération!!

L'armoire électrique livré avec l'unité contient les instruments de commande suivants:

- Interrupteur d'arrêt urgence Eex d, stay-put, 1 NC
- Pousser l'interrupteur, 0-1 Eex d, 2p

6. Bedieningsinstructies

6.1 Transporteren van vacuüminstallatie

- De totale massa van de installatie bedraagt 85 kg.
- Het transporteren van de installatie alleen zonder olie in de pomp en met gemonteerde afvuldoppen.
- De installatie mag alleen aan het hijsorgaan worden gehesen.
- De installatie mag alleen verplaatst worden door te hijsen m.b.v. het hijsorgaan.

6.2 Opstart vacuüminstallatie

- Lees voor het opstarten de bedrijfsinstructies van de afzonderlijke componenten.
- Leidingwerk voor de installatie moet schoon zijn.
- Pomp inschakelen; controleer draairichting, door de pomp kort in te schakelen.
- Laat de pomp na het inschakelen 10 minuten warmdraaien met een gesloten inlaat

6.3 Eerste opstart

De vacuüminstallatie mag alleen worden bediend door personen die op de hoogte zijn van de toepassing van de unit, de toepassing waarvoor deze gebruikt mag worden en de inhoud van de bedringsinstructie!

Op de met de unit meegeleverde schakelkast zijn de volgende bedieningsorganen aangebracht:

- Noodstop Eex d, stay-put, 1 NC
- Werkschakelaar, 0-1 Eex d, 2 p.

6. Operating instructions

6.1 Transport of the vacuum unit

- The total mass of the unit is 85 kg.
- It is only allowed to transport the vacuum unit without oil in the pump and with mounted plugs.
- The unit may only be lifted by the liftinglug.
- Before lifting always check the mounting of the liftinglug and the mounting of the liftinglug on the frame.

6.2 Start-up

- Before start-up read the operating instructions of the separate components.
- Piping before the pump must be clean.
- Check the direction of rotation of the pump by flicking the ON/OFF switch.
- Operate the pump against a closed inlet valve for 10 minutes.

6.3 First start-up

The vacuum unit may only be operated by persons who are familiar with the operation of the unit, the application for which it is used and the contents of the manual!

The following controls are provided with the delivered switch box:

- Emergency stop Eex d, stay-put, 1 NC
- Main switch, 0-1 Eex d, 2 p.

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • Avant le démarrage, lire les instructions des composants individuels (chapitre 10). • Les pompes ne peuvent pas être mis en marche sans huile!! • Premier démarrage: contrôler le sens des pompes. • <i>Contrôler le sens de la pompe par la mise en marche par l'interrupteur principal très brève (1 seconde environ). Si le sens est incorrect, changer les deux phases.</i> • Vu du moteur, le sens de rotation doit être contraire des aiguilles d'une montre. • L'unité est mise en marche en choisissant "I" de l'interrupteur principal et en choisissant "1" de l'interrupteur à sélection. | <ul style="list-style-type: none"> • Lees voor het opstarten de bedrijfsinstructies van de afzonderlijke componenten (hoofdstuk 10). • De pomp mag niet zonder olie ingeschakeld worden!! • Bij de eerste keer inschakelen: controleer de draairichting van de pomp. • <i>Om de draairichting van de pomp te controleren de aan/uit-schakelaar kortstondig (ca. 1 sec.) aan te zetten. Indien de draairichting foutief is, dienen twee fasen omgedraaid te worden.</i> • <i>Van de motorzijde bekeken, is de draairichting tegen de klok in.</i> • De unit kan worden ingeschakeld door de werkschakelaar (pos.1) in de stand "I" te zetten. | <ul style="list-style-type: none"> • Read the operating instructions of the components and carry out the applicable instructions before the first start up. (chapter 10). • The pump may not be switched on without oil! • At first start up of the pump check its rotation direction. • <i>To check this shortly switch the pump on and off. When the rotation direction is false two phases have to be reversed.</i> • <i>From motor-side the rotation is counter clockwise.</i> • The unit can be turned on by switching the main switch (pos.1) in position "I". |
|---|--|--|

6.4 Démarrage et arrêt de l'installation à vide

L'unité est démarrée en effectuant les actions suivantes:

- Mettre l'interrupteur principal à "I"

L'unité s'arrête après les actions suivantes:

- Mettre l'interrupteur principal à "0".
- En cas de doute du fonctionnement correct de l'unité, contacter BUSCH N.V.

6.4 Starten en stoppen van de vacuüminstallatie

De unit kan gestart worden door de volgende handelingen uit te voeren:

- Werkschakelaar (pos.2) op "I"

De unit wordt gestopt door:

- De werkschakelaar (pos.2) op "0".
- Bij twijfel over het juist in bedrijf zijn van de unit contact opnemen met BUSCH vertegenwoordiger.

6.4 Starting and stopping the vacuum unit

The unit can be started by executing the following actions:

- Main switch (pos.2) on "I"

The unit can be stopped by:

- Main switch (pos.2) on "0".
- In case of doubt on the correct operation of the unit, contact your BUSCH representative.

6.5 Procédure arrêt d'urgence

- En cas d'urgence, l'unité peut être arrêtée en choisissant "0" de l'interrupteur principal (d'urgence).
- Afin de redémarrer l'unité, mettre l'interrupteur principal à "1". Redémarrer l'unité avec le bouton "redémarrage".

6.6 Dangers éventuels pendant l'emploi

La pompe et le boîtier de filtre d'embrume d'huile peuvent obtenir des températures très élevées pendant l'emploi. Les sécurités suivantes sont intégrées dans l'installation:

- Les moteurs électriques des pompes sont protégés contre l'absorption de courant excessive.
- Tous les pièces en mouvement sont pourvues d'un capot de protection afin d'éviter le contact

6.5 Noodstop procedure

- In geval van nood kan de unit volledig worden uitgeschakeld door de noodstop te in te schakelen (pos.2).
- Om de unit weer opnieuw op te starten dient de noodstop weer in de neutrale stand gezet te worden. Vervolgens kan de unit gestart worden met de werkschakelaar (pos.1).

6.6 Mogelijke gevaren tijdens gebruik

De pomp en het olienevelfilterhuis kunnen tijdens gebruik heet worden. De volgende beveiligingen zijn in de installatie ingebouwd:

- De elektromotor van de pomp is beveiligd tegen te hoge stroomopname.
- Alle bewegende delen zijn voorzien van een afscherming om aanraking te vermijden.

6.5 Emergency stop procedure

- In case of an emergency, the unit can be stopped by switching the emergency stop (pos.2).
- In order to restart the unit first switch the emergency stop in neutral position. Next the unit can be started using the main switch (pos.1).

6.6 Possible hazards during operation

During operation pumps can become hot. Do not touch the pump. The following safeties are built in the unit::

- The elektromotor of the pump is protected against a too high powersupply.
- All moving parts are covered with a shield in order to prevent touching.

6.7 Dispositions pour la sécurité personnelle

Le niveau sonore produit par la pompe ne dépasse pas les 77 dB (A). La détérioration de l'ouïe peut se manifester après une longue exposition aux 80 dB (A) ou plus.

- Pendant les travaux aux pompes, toujours porter les gants résistants à l'huile.
- Pendant le vidange, il faut éviter le contact de l'huile aux yeux et à la peau.

Les pompes à vide, le séparateur d'embrume d'huile et l'huile peuvent obtenir des températures très élevées, il faut éviter le contact.

Nous vous recommandons de faire effectuer l'entretien de l'installation à vide par BUSCH N.V.

Attention !
Avant de commencer l'entretien du système, l'alimentation doit être coupée et l'interrupteur principal doit être débranché.

6.7 Persoonlijke beschermingsmiddelen

- Het geluid dat de pomp produceert ligt onder de 77 dB (A). Gehoorbeschadiging kan optreden bij langdurige blootstelling aan 80 dB (A) of meer.
- Draag bij werkzaamheden aan de pomp altijd oliebestendige handschoenen.
- Bij het aftappen van de olie, mag de olie niet in contact komen met ogen of huid.

De vacuümpomp, de olienevelafscheider en de olie kunnen heet zijn, vermijd contact met deze delen.

Wij adviseren u het onderhoud aan de vacuüminstallatie uit te laten voeren door Busch N.V.

Waarschuwing !
Bij onderhoud aan de werkzaamheden aan het systeem moet de voeding worden afgeoppeld en de hoofdschakelaar uitstaan.

6.7 Personal protection

- The noise level of the pump is below 77 dB (A). Hearing damage can occur by long-term exposure to 80 dB (A) or more.
- During oil exchange oil resistant gloves must be worn.
- As well as safety glasses in order to protect the eyes against oil splashes.

During operation the pump and oilmistfilter can become hot. Do not touch the pump.

We advise the maintenance of the unit to be carried out by Busch N.V.

Warning !
During maintenance on the system the power supply must be disconnected and the main switch must be on FF mode!!

7. Situations d'urgence

7.1 Arrêt d'urgence

Le paragraphe 6.7 contient la procédure de l'arrêt d'urgence.

7.2 Précautions incendie

En cas d'incendie, il faut utiliser les moyens corrects pour éteindre les feux d'huile.

7. Noodsituaties

7.1 Noodstop

In paragraaf 6.7 staat de procedure voor een noodstop beschreven.

7.2 randbestrijding

In geval van brand dienen de juiste blusmiddelen gebruikt te worden, geschikt voor het blussen van olie.

7. Emergency situations

7.1 Emergency stop

The emergency stop procedure is written in par. 6.7

7.2 Fire fighting

In case of fire the correct extinguishing agents must be used, suitable for extinguishing oil.

8. Certificats	8. Certificaten	8.Certificates
8.1 Certificats de test	8.1 Testcertificaten	8.1 Test report
8.2 Certificats matériaux Pas en application	8.2 Materiaal certificaten N.V.T.	8.2 Material certificates N.A.
8.3 Déclaration du manufacturier	8.3 Verklaring fabrikant	8. Declaration of conformity

CESI

CESI
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Giacinto Motta SpA

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Registro Imprese di Milano
Sezione Ordinaria
N. R.E.A. 429222
P.I. IT00793580150

Schema di certificazione

ATEX CESI

Il CESI è stato autorizzato dal governo italiano ad operare quale organismo di certificazione di apparecchi e sistemi destinati a essere utilizzati in atmosfera potenzialmente esplosiva con D.M. 1/3/1983, D.M. 19/6/1990, D.M. 20/7/1998 e D.M. 27/9/2000

CERTIFICATE



[1] EC-TYPE EXAMINATION CERTIFICATE

[2] Equipment or Protective System intended for use
in potentially explosive atmospheres
Directive 94/9/EC

[3] EC-Type Examination Certificate number:

CESI 03 ATEX 266

[4] Equipment: Command and control units and interface units series CCF and EJB .

[5] Manufacturer: **BARTEC NEDERLAND b. v.**

[6] Address: Keurmeesterstraat 17b, Ridderkerk (Netherlands)

[7] This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] CESI, notified body n. 0722 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report n. EX-A3/030458.

[9] Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014: 1997 + A1..A2 EN 50018: 2000+A1 EN 50020:2002 EN 50281-1-1:1998+A1

[10] If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

[11] This EC-TYPE EXAMINATION CERTIFICATE relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

[12] The marking of the equipment or protective system shall include the following:

II 2(1) G EEx d [ia] IIB T6 o T5

II 2(1) GD EEx d [ia] IIB T6 o T5 IP 65 o IP 66/67 T85°C o T100°C

This certificate may only be reproduced in its entirety and without any change, schedule included.

Date September 10th, 2003 translation issued on September 10th, 2003

Prepared
Mirko Balaz

Approved
Ulisse Colombo

CESI
CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO
Business Unit Certificazione

Il Responsabile

[13]

Schedule

[14] EC-TYPE EXAMINATION CERTIFICATE n. CESI 03 ATEX 266

[15] Description of equipment

Command and control units and interface units series CCF and EJB.

In the interface units only associated apparatus are installed for the connection to intrinsic safety circuits.

In the command and control units both electrical and electronic components with command and control functions and associated apparatus for interface with intrinsic safety circuits are installed.

The associated apparatus are subject of separate certification with type of protection [EEx ia] IIB or IIC.

As regards the protection against combustible gases the type of protection is:

- EEx d [ia] IIB T6 for the interface units
- EEx d [ia] IIB T6 or T5 for the command and control units

As regards the protection against combustible dusts, the CCF and EJB enclosures are made in two versions with different degree of protection IP:

- enclosures with silicone grease placed between body and cover: IP 65
- enclosures with sealing gasket placed between body and cover: IP 66/67

The enclosures of these units are made in aluminium or stainless steel.

The characteristics of the electrical and electronic components which can be installed inside the enclosures are reported in the technical note A4-4249 annexed to this certificate.

The empty enclosures series CCF and EJB are subject of the component certificate CESI 01 ATEX 004 U. All the constructional details of the enclosures are reported in the documents annexed to the above mentioned component certificate.

Command and signalling operators type M. and P., subject of the component certificate CESI 02 ATEX 002 U, can be mounted on the units subject of this certificate. In this case the degree of protection of the enclosures is IP 66.

Electrical characteristics

Rated voltage	24 ÷ 1000 V a.c.	12 ÷ 250 V d.c.
Rated frequency	50 ÷ 60 Hz	----
Max. current in fuses and contacts	400 A	400 A

Ambient temperature	- 20 ÷ + 40 °C
	- 20 ÷ + 55 °C

Temperature class of the units of category II 2(1) G and II 2(1) GD: T6 or T5

Maximum surface temperature of the units of category II 2(1) GD: T85°C or T100°C

Maximum dissipated power: the maximum power which can be dissipated inside each enclosure is reported in the technical note A4-4249 annexed to this certificate, as a function of the enclosure dimensions, of the temperature class and of the ambient temperature.

Intrinsic safety circuits

The electrical characteristics of the intrinsic safety circuits are reported on the label of the associated apparatus used.

This certificate may only be reproduced in its entirety and without any change, schedule included.

[13] **Schedule**

[14] **EC-TYPE EXAMINATION CERTIFICATE n. CESI 03 ATEX 266**

[15] **Description of equipment (follows)**

The accessories used for cable entries and for closing unused apertures in the units of category II 2(1) G shall be certified according to the standards EN 50014 and EN 50018.

The accessories used for cable entries and for closing unused apertures in the units of category II 2(1) GD shall be certified according to the standards EN 50014, EN 50018 and EN 50281-1-1 and shall guarantee a degree of protection IP at least equal to that of the enclosure.

The service temperature of the command and signalling operators shall not be higher than 100 °C.

Warning label

"Use screws of quality A2-70 according UNI 7323 with ultimate tensile strength of at least 700 N/mm²".

Additional warnings

In case of enclosures including capacitors:

"After de-energizing, wait 10 minutes before opening"

In case of enclosures of temperature class T5:

"Use cables suitable for a temperature of 100 °C:

[16] **Report n. EX-A3/030458**

Routine tests

The manufacturer shall carry out the routine tests prescribed at clause 24 of the EN 50014 standard.

The routine overpressure test shall be carried out with the static method (clause 15.1.3.1 of EN 50018 standard) at the pressure of:

- 11.9 bar for enclosure size from 1 to 5
- 11.5 bar for enclosure size 6

Descriptive documents (prot. EX-A3/030461)

- | | |
|--|------------------|
| - n. A4-4249 Rev. 0 (10 p.) | dated 16.05.2003 |
| - n. A1-4239 Rev. 0 (2 p.) | dated 15.05.2003 |
| - Safety instructions SAFETY EJB-i Rev. 0 (7 p.) | dated 15.05.2003 |
| - EC declaration of conformity EJB-i | dated 15.05.2003 |

One copy of all documents is kept in CESI files.

[17] **Special conditions for safe use**

None.

[18] **Essential Health and Safety Requirements**

Covered by standards.



Wir/We/Nous

BARTEC NEDERLAND b.v.

Erklären in alleiniger Verantwortung/declare under our sole responsibility/

attestons sous notre seule responsabilité

daß das Produkt/that the product/que le produit

Command, control and interface units with associated apparatus,
series EJB... and CCF...

Execution: II 2(1)G EEx d [ia] IIB T5/T6

or II 2(1)GD EEx d [ia] IIB T5/T6 IP 65/IP66/67 T100/T85°C

auf das sich diese Erklärung bezieht/to which this declaration relates/se

référant à cette attestation

den Bestimmungen der folgenden Richtlinien entspricht/is in accordance

with the provision of the following directives/correspond aux dispositions

des directives suivantes

ATEX Directive

94/9/EC – 1994

und mit folgenden Normen oder normativen Dokumenten übereinstimmt/

and is in conformity with the following standards or other normative

documents/ et est conforme aux normes ou documents normatifs

cidessous

EN 50 014 : 1997 EN 50 018 : 2000 EN 50 020 : 1994

EN 50281-1-1 : 1999

Weitere angewendete Normen/ further used standards/ norme plus utiliser

EN 60 439-1

Ridderkerk, May 15th 2003

BARTEC
NEDERLAND b.v.



Postbus 4173 Keurmeesterstraat 17b
2980 GD Ridderkerk 2984 BA Ridderkerk
Telefoon 0180 - 410588 Telefax 0180 - 414134

ing. K. Neleman
Productmanager

BARTEC

UNITA' DI CONTROLLO E COMANDO O
UNITA' DI INTERFACCIA (APPARECCHIATURE ASSOCIATE)
SERIE CCF... EJB...

GRUPPO II CATEGORIA 2(1)G o 2(1)GD
MODO DI PROTEZIONE EEx d [ia] IIB T6 o T5
IP66 o IP66/67 T85°C o T100°C
ISTRUZIONI DI SICUREZZA

Control and Command units or
Interface units (associated apparatus) series CCF... EJB...
Group II category 2(1)G or 2(1)GD
Protection mode EEx d [ia] IIB T6 or T5
IP66 or IP66/67 T85°C or T100°C
Safety instruction

IN ACCORDO ALLA DIRETTIVA 94/9/CE
According to directive 94/9/EC

PRODUCTION LOCATION: KEURMEESTERSTRAAT 17 - NL 2984 BA RIDDERKERK - NETHERLANDS
TEL. (+31) 180 410588 - FAX. (+31) 180 414134
<http://www.bartec.nl> - e-mail: info@bartec.nl

BARTEC

UNITA' COMANDO E CONTROLLO E INTERFACCIA
(APPARECCHIATURE ASSOCIATE) SERIE CCF.. EJB..
ISTRUZIONI DI SICUREZZA
Command and control units or interface units (associated apparatus)
Safety, maintenance and mounting instruction

CONFORMITA' ALLE NORMATIVE STANDARD

CONFORMITY WITH STANDARDS

CUSTODIE CCF... EJB...

COSTRUITE IN ACCORDO ALLE NORMATIVE EN50014, EN50018, EN50020, EN50281-1-1 ACCORDO ALLA DIRETTIVA 94/9/EC DEL 23 MARZO 1994.

ENCLOSURES CCF... EJB...

Manufactured according to European standards EN50014, EN50018, EN50020, EN50281-1-1 according to the European Directive 94/9/EC of March 23, 1994.



ISTRUZIONI DI SICUREZZA

SAFETY INSTRUCTION

RIVOLTE A PERSONALE QUALIFICATO IN ACCORDO CON LE LEGGI NAZIONALI, INCLUSE LE RELATIVE NORME E, DOVE APPLICABILE, IN ACCORDO CON IEC 79.17 RIGUARDANTE LE APPARECCHIATURE ELETTRICHE PER ATMOSFERE POTENZIALMENTE ESPLOSIVE.

For skilled electricians and instructed personnel in accordance with national legislation, including the relevant standards and, where applicable, in accordance with IEC 79.17 on electrical apparatus for explosive atmosphere.

LE CUSTODIE NON DEVONO ESSERE INSTALLATE IN AREA PERICOLOSA ZONA 0.

The boxes must not be operated in zone 0 hazardous areas.

DEVONO ESSERE RISPETTATI I DATI TECNICI INDICATI SULLE CUSTODIE.

The technical data indicated on boxes are to be observed.

NON SONO AMMESSE MODIFICHE AL PRODOTTO.

Changes of the design and modifications to the equipments are not permitted.

LE CUSTODIE POSSONO ESSERE INSTALLATE SOLO SE COMPLETAMENTE INTEGRE.

The boxes shall be operated as intended and only in undamaged and perfect condition.

DEVONO ESSERE UTILIZZATE ESCLUSIVAMENTE PARTI DI RICAMBIO FONDISONZO.

Only genuine FONDISONZO spare parts may be used for replacement.

LE OPERAZIONI DI MANUTENZIONE ORDINARIE E STRAORDINARIE DEVONO ESSERE EFFETTUATE SOLO DA ELETTRICISTI QUALIFICATI CON L'APPROVAZIONE DI PERSONALE "ESPERTO".

Repairs may only be carried out by qualified electrician and will subsequently have to be checked by an "expert".

DEVONO ESSERE STRETTAMENTE OSSERVATE LE NORME NAZIONALI DI SICUREZZA E PREVENZIONE INFORTUNI, E LE PRESCRIZIONI INDICATE CON "△" NEL PRESENTE FASCICOLO TECNICO.

The national safety rules and regulations for prevention of accidents and the following safety instructions which are marked with an "△" in these operating instructions, will have to be observed.

EXECUTION: EEx d [ia] IIB T6 FOR INTERFACE UNITS

EEx d [ia] IIB T6 OR T5 FOR CONTROL AND COMMAND UNITS

PROTECTION DEGREE: IP-65 FOR SILICON GREASE BETWEEN COVER AND BODY

IP-65 FOR GASKET BETWEEN COVER AND BODY

GROUP : II CATEGORY: 2(1)G OR 2(1)GD

INSTALLATION : ZONE 1, ZONE 2, ZONE 21, ZONE 22

AMBIENT TEMPERATURE: -20°C +40°C o -20°C +55°C

TEMPERATURE CLASS: T6 for amb. temp. -20°C +40°C or T5 for amb. temp. -20°C +55°C

MAX. SUPERFICIAL TEMPERATURE FOR DUST PROTECTION "D" o "GD" :

T85°C for temp. class T6 T100°C for temp. class T5

GENERAL ELECTRICAL CHARACTERISTICS:

NOM. VOLTAGE: 24 ÷ 1000 V ac 12 ÷ 250V dc

NOM. FREQUENCY: 50/60 Hz

MAX. CURRENT FOR FUSIBLES AND CONTACTS : 400 A

MAX. POWER FOR LAMPS: 5W per Tamb. -20°C +40°C 3W per Tamb. -20°C +55°C

ELECTRICAL CHARACTERISTICS FOR ASSOCIATED APPARATUS: Um ÷ 250 V

MAX OUTPUT DISSIPATED

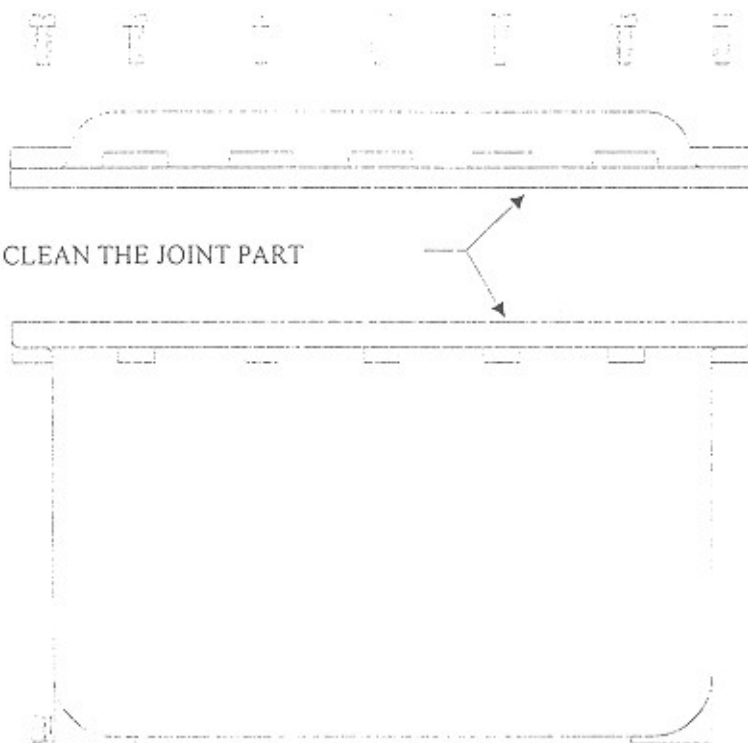
The maximum power which can be dissipated inside the enclosure and the maximum current on contact and fuses are a function on enclosure size, of the temperature class (or of the maximum surface temperature for category GD units) and of the ambient temperature as specified in details in the following tables:

INTERNAL FLANGE	EXTERNAL FLANGE	MAXIMUM OUTPUT DISSIPATED IN WATT WITH AMBIENT TEMPERATURE OF 40° C		MAXIMUM OUTPUT DISSIPATED IN WATT WITH AMBIENT TEMPERATURE OF 55° C	
		CLASS T6 WITHOUT SIGNALLING LAMPS, ONLY SIGNALLING LED ARE ALLOWED	CLASS T5 WITH SIGNALLING LAMPS AND/OR SIGNALLING LED	CLASS T6 WITHOUT SIGNALLING LAMPS, ONLY SIGNALLING LED ARE ALLOWED	CLASS T5 WITH SIGNALLING LAMPS AND/OR SIGNALLING LED
CCF - 1	EJB - 1	45	45	34	34
CCF - 2	EJB - 2	60	60	45	45
CCF - 3	EJB - 3	75	75	56	56
CCF - 3B	EJB - 3B	55	55	40	40
CCF - 4	EJB - 4	100	100	75	75
CCF - 4B	EJB - 4B	75	75	56	56
	EJB - 4S	140	140	105	105
	EJB - 4SB	120	120	90	90
CCF - 5	EJB - 5	210	210	160	160
CCF - 5B	EJB - 5B	170	170	130	130
	EJB - 6	600	600	460	460
	EJB - 6B	490	490	370	370

The max permitted heat dissipation and characteristics for the EJB and CCF series enclosure depending must not exceed the above mentioned values when intrinsically safe devices having a maximum heat dissipation of 1.1Watts and non-intrinsically safe devices are mounted together. The maximum value of heat dissipation into the box includes also the maximum power dissipated of cables, terminals, and contacts. The values of the density current permitted into the boxes are foreseen by the Standard EN 60439-1. The prescriptions of this Standard must be respected during Design and Manufacturing of EJB... and CCFE... boxes.

USE AND MAINTENANCE

BEFORE CLOSED THE BOX CLEAN THE JOINT PART



ALL OPERATIONS OF INSTALLATION, REPLACEMENT OR CONTROL MUST NOT BE PERFORMED WHEN CIRCUIT IS ALIVE.

MUST BE RESPECTED THE TECHNICAL DATA INDICATED ON TAG.

CLEAN AND LUBRICATE THE PART TO CONNECT:

WHEN GASKETS ARE USED TO MANTAIN RAINTINGHTNESS, BE SURE THE SAME ARE MOUNTED IN THEIR ADEGUATE LOCATIONS.

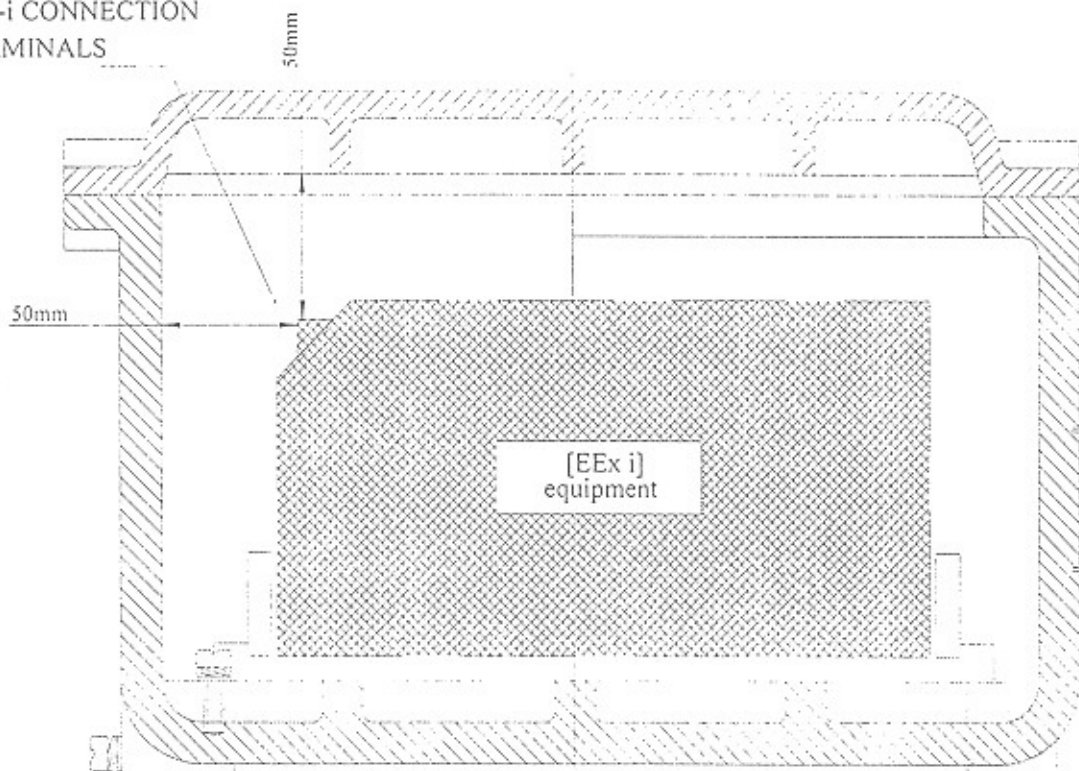
HANDLE CAREFULLY ALL JOINT PARTS SO TO AVOID DAMANGING COUPLING SURFACE.

ALL THE SPARE HOLES ON WALLS MUST BE CLOSED WITH CERTIFIED EEx d PLUGS.

THE SCREWS ON COVER ARE MADE IN STAINLESS STEEL QUALITY A2-70 ACCORDING TO UNI 7323 WITH A MAX. TENSILE STRESS OF 700 N/mm².

1) EXAMPLE FOR INTERFACE UNIT

EEx-i CONNECTION
TERMINALS



Types Of ACTIVE & PASSIVE Barriers Permissible for Installation inside the Enclosure

The active and passive (Zener) barriers utilised for installation inside the EJB and CCF series enclosures must possess their own individual ATEX generation certificate ("E" generation up to June 2003) according to Cenelec Norms EN50014 & EN50020 for Ex type of protection [Ex-ia] suitable for gas groups IIB & IIC and thus be marked as follows [EEx ia] IIB or IIC.

The characteristics and data of EEx-i circuits (U_0 , I_0 , P_0 , C_0 and L_0) are described on the device (certificate label), associated drawings for certification and the overall certificate for the EEx-i device. The maximum input voltage (U_m) of the barrier on the non Ex-i circuit must be < 250 volts.

Mounting details of Barriers inside EEx-d enclosures

The "OMEGA" guide as stated in EN50022 makes reference to the fixing of the active and passive (Zener) barriers inside an EEx-d enclosure.

The barriers are mounted as per the barrier manufactures standard din rail having a maximum distance of 7.5mm between the device and depth of enclosure.

The barrier must be locked on the DIN rail via two earth terminals having a nominal cross section of 6 -10sqmm or two end stops providing a mechanical protection as stated in the OMEGA guide EN50022.

The function and type of barrier determines the number of barriers installed inside the enclosure.

The maximum number must not exceed the value determined for each type of enclosure as detailed in drawing A1-4239 sheet 1 and 2.

Cable Terminations

The internal cable connections of the barrier refer to EN50022, which enables the barrier to possess a side of the device having an intrinsically safe circuit and the opposite side to have a non-intrinsically safe circuit as detailed below.

The internal cable connections to the intrinsically safe side of the device must be solely made with insulated conductors. The conductors must be fixed in such a way that they cannot be grouped, waved or placed directly next to conductors of non-intrinsically safe circuits

I.e Cables of non-IS circuits and IS circuits must be segregated.

The minimum distance between intrinsically safe and non-intrinsically safe conductors must be 8mm. The minimum grade of insulation for non-intrinsically safe conductors is >1.5KV and >0.5KV for intrinsically safe conductors.

Input & Output cables of the EEx-d Enclosure.

The input and output threaded cable entries of the EEx-d enclosure must be as per drawing

EE.222.1 (A1-4095) attached to certificate CESI 01 ATEX 004U.

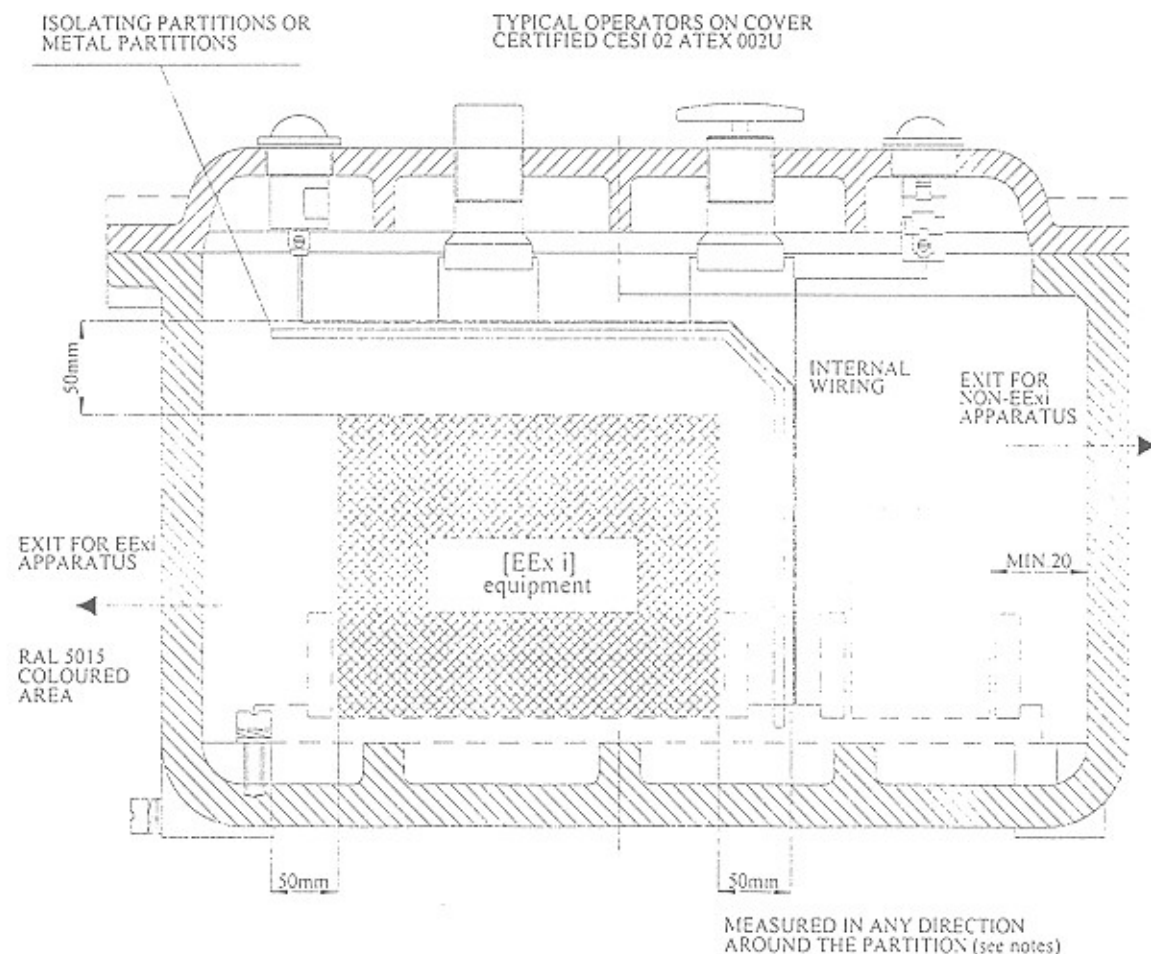
The accessories (cable glands) used to terminate the cables to and from the enclosure shall be certified according to Norms EN 50014 and EN 50018.

Accessories tested in accordance with ATEX certificate may also be utilised.

To assure the Protection Degree the possible cable entries mounted on boxes must have, at least, the same protection degree of boxes.

The intrinsically safe cable(s) entering and exiting the enclosure must be clearly identified with a label, which is affixed to the enclosure wall with threaded rivets.

2) EXAMPLE FOR COMAND AND CONTROL UNITS (ASSOCIATED APPARATUS)



Installation of IS Devices and Non IS Devices inside and EEx-d enclosure

The Command, Control Units complete with accessories execution EEx d IIB can containing also Associated Apparatus [EEx ia] IIB/IIC In this case the execution shall be EEx d [ia] IIB.

The following rules for installation of IS equipment inside the EJB and CCF type enclosures must be adhered to.

When intrinsically safe devices are installed inside an enclosure together with non-intrinsically safe devices and components, a minimum of 50mm segregation must be maintained as detailed in drawing A1-4239

The intrinsically safe earth must be always be a clean earth and be totally insulated from the supply ground.

Mounting

All the Associated Apparatus are mounted on DIN rail. They can be mounted also on internal frame respecting the min. distances foreseen. The Apparatus mounted on DIN rail or mounted on internal frame must respect the same prescriptions.

Partitions used to separation

When separation is accomplished by partitions, they are accurately dimensioned, thickness of partition and fixing into box must be estimated, the partitions must be guaranteed the air circulation into boxes.

Incoming Cables

The incoming cables for EEx-i connections are marked with a label, or the area is painted with blue colour RAL 5015. To assure the execution and the protection degree of construction, the cable entries mounted on boxes must have, at least, the same protection degree of boxes.

Internal wiring

The cable passages of EExi cables are manufactured and identified with one of the following methods:

- Cables with isolating colour light blue (if into housing are not other cables with this colour).
- Separation of cables EExi and cables non-EExi with cable tray painting in light blue
- Grouping the EExi cables with electric tape (or similar) and identify the area of a label (colour light blue) with the writing "Warning EExi circuits".

The section of cables for power circuits is min. 1.5 Sq.mm.

The distance between EExi circuits and non-EExi circuits is 50mm in all the directions.

The earth connection must be in accordance with EN 60079-14.

typical Disposition of internal Equipment

The number of equipment mounted inside the box are variable but according to some notes:

- The free area measured in any transversal section of box is min. 30%.
- The distance between equipment is adequate for the cable wiring

command control and signalling equipment

All the accessories series M... P... mounting on boxes are certified CESI 02 ATEX 002U. in this case the degree of protection is IP-66 with gasket between cover and body of box or IP-65 with silicon grease.

Any other type of accessories used, need to be ATEX certified, suitable for this application.

9. L'entretien préventif

Pour l'entretien des pompes, voir le chapitre 10, les instructions d'opération des pompes.

Attention !
Pendant les travaux d'entretien du système, l'alimentation doit être débranchée et l'interrupteur principal doit indiquer 0.

9.1 L'exécution de l'entretien

Pour le contrôle et le réglage de jeux etc., il faut offrir la pompe à BUSCH N.V. Pour assurer la garantie, il faut offrir le carter de pompe monté à BUSCH N.V.

Voir paragraphe 9.3 pour les inspections et/ou l'entretien que vous pouvez effectuer.

9.2 Nature et fréquence des inspections

- L'entretien ne peut être effectué que par les personnes qualifiées.
- Lire et respecter les instructions d'entretien des composants individuels. Voir chapitre 10

9. Onderhoud

Zie voor het onderhoud van de pomp de bedrijfsinstructie van de pomp. (hoofdstuk 10).

Waarschuwing:
Bij onderhoudswerkzaamheden aan het systeem moet de voeding worden afgekoppeld en de werkschakelaar uitstaan.

9.1 Uitvoeren onderhoudswerkzaamheden

Voor het controleren en afstellen van spelingen e.d. dient de pomp aangeboden te worden aan BUSCH NV. In verband met garantiebepalingen dient het pomphuis volledig gemonteerd aan BUSCH NV aangeboden te worden.

Zelf uit te voeren inspecties en/of onderhoudswerkzaamheden staan vermeld in paragraaf 9.3.

9.2 Aard en frequentie van de inspecties

- Onderhoudswerkzaamheden mogen alleen worden uitgevoerd door gekwalificeerd personeel.
- Lees en volg de onderhoudsinstructies van de afzonderlijke componenten. Zie hoofdstuk 10.

9. Maintenance

For maintenance of the pumps we refer to the manual of the pumps. See chapter 10.

Warning!
During maintenance on the system the power supply must be disconnected and the main switch must be on FF mode!!

9.1 Maintenance to be performed

For checking and adjusting of tolerance etc. pumps must be handed to BUSCH N.V. In connection with the guarantee stipulations the pump casing must be handed to BUSCH N.V completely mounted.

To be executed inspections and/or maintenance work which can be done by yourselves are mentioned in paragraph 9.3.

9.2 Frequency of the inspections

- Maintenance work may only be executed by qualified personnel.
- Read the instructions of the separate components, see chapter 10.

9.3 *Tableau de service*
Service tabel
Service table

oints de contr le Chec punten Chec points	Fréquence des contr les Chec interval Chec ing interval	emplacement ervangen, verversen Changing, replacement
Les contacts de la boîte des interrupteurs Kontakten schakelkast Contacts switch board	après 3 mois na 3 maanden after 3 months	Contrôler Natrekken Check
Réglage Soupape de sécurité Afstelling vacuumbegrenzingsventiel Adjustment vacuumrelieve valve	1x par an 1x per jaar 1x a year	Corriger réglage si nécessaire indien nodig instelling corrigeren Adjust if necessary
Pollution Vervuiling Dirt	1x par mois 1x per jaar 1x a year	En cas de filtres polluées Schoonmaken indien nodig Clean if necessary



**10. Instructions des
composants**

**10. Bedieningsinstructies
onderdelen**

10. Manuals components