Vacuum leak detector

VLR ..

Documentation VLR

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Read instructions
prior to commencing
any work, please!

Overview of the Design Variations

Vacuum leak detectors VLR are available in different versions that are described more precisely by the letters attached to them. The levels of availability and the possible combinations depend on the device. Please contact our sales team. Phone +49 0271 48964-0, email sgb@sgb.de

VLR .. E FA P M MV S Si T

"**T**ightness alarm"

"**S**ervice **I**ndication": (LED) display with variably adjustable service periods

"**S**ervice display": Integrated service display with fixed 12-month interval

"Solenoid valve" (**MV**): An MV with monitored function can be connected for applications with high pressure in the inner pipe.

"**M**anometer": The leak detector is equipped with a digital pressure indicator in the housing cover.

"**P**rotected": Leak detector version in a weather-protected housing

"Filling level indicator" (**FA**): An electronic filling level indicator is integrated in the leak detector

"**E**nhanced functions": This version provides the option of connecting additional equipment, such as a solenoid valve and/or a probe in the leak detector.

"**..**" = numerical value stands for the alarm vacuum of the leak detector. The alarm pressures range from 34 mbar to 570 mbar.

"**V**acuum **L**eak detector for pipes" (**R**). The leak detector operates with negative pressure toward the atmosphere.

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1. Object

Vacuum leak detector of the type VLR .. (dots stand for alarm vacuum) as part of a leak detection system in the following versions:

a) VLR ..

b) VLR .. E (extended version, i.e., either a leak probe or solenoid valve or both can be connected in addition)

Leak probe: Either in place of the liquid stop valve if special installation conditions or resistance matters make it necessary or as a probe used separately (e.g., in the leakage containment).

Solenoid valves: **Must be used** whenever tanks are operated at **more than 5 bar** overlay pressure or if resistance requirements make them necessary (system is then executed resistant up to the solenoid valves).

2. Area of application

2.1. Interstitial space requirements

- Vacuum resistance to the operating vacuum of the leak detector, also taking fluctuations in temperature into account.
- Assurance of the suitability of the interstitial space as part of a leak detection system (e.g., DIN standards, proofs of usability issued by the building inspection authorities, determination of suitability etc.)
- The pipes listed under section 2.4 meet the above requirements acc. to App. E.
- The volume of the space monitored by the leak detector must not exceed 10 m^3 for pipes (manufacturer's recommendation: 4 m^3).

2.2. Material to be conveyed

Liquids hazardous to water with a flash point > 60°C (for Germany > 55°C acc. TRGS 509 and 751), where no potentially explosive vapor-air mixtures occur.

If different liquids are conveyed in individual pipes and monitored with one leak detector, these liquids may not have a negative influence on one another nor lead to chemical reactions.

2.3. Resistance / materials

For the leak detector VLR .. the material polyamide (PA) in connection with brass (MS-58) or (1.4301, 1.4306, 1.4541)[1] or 1.4571[2], as well as the material of the connecting tubes used has to be sufficiently resistant to the material to be stored/conveyed.

If the materials mentioned above are not sufficiently resistant, correspondingly resistant solenoid valves can be used in the tanks.

[1] cf. DIN 6601, centre column
[2] cf. DIN 6601, right-hand column

2.4. Double-walled pipes (up to 5 bar or up to 25 bar)

Group	Type of pipe	Installation example	Suitable leak detector type	Use limits
P	Double-walled pipes made in the factory or on site with up to 5 bar pressure in the primary pipe (conveying pressure)	P – 01 to P – 03	VLR 230 to VLR 570	Appendix E, No. E.1
Q	Double-walled pipes made in the factory or on site with up to 25 bar pressure in the primary pipe (conveying pressure)	Only **with** solenoid valve(s): Q– 01 to Q– 04	VLR 230 E to VLR 570 E	Appendix E, No. E.1

3. Functional description

3.1. Normal operation

The vacuum leak detector is connected to the interstitial space via the suction and measuring line, possibly also via the connection line(s). The vacuum generated by the pump is measured and controlled by a pressure sensor.

When the operating vacuum (pump OFF) has been reached, the pump is switched off. Due to slight, unavoidable leaks in the leak detection system, the vacuum begins to fall slowly. When the switching value for “pump ON” has been reached, the pump is switched on and the interstitial space evacuated until the operating vacuum (pump OFF) has been reached again.

During normal operation the vacuum moves between the switching value pump OFF and the switching value pump ON, with the pump running for a short time and then switching off for a longer time, depending on the tightness and temperature fluctuations in the complete system.

3.2. Air leak

If an air leak occurs (in the outer or inner wall, above the liquid level) the vacuum pump switches on in order to re-establish the operating pressure. If the air flow leaking into the pipe exceeds the limited feed flow of the pump, the pump remains on continuously.

Increasing leak rates lead to a further increase in pressure until the switching value for alarm ON has been reached. An optical and audible alarm signal is triggered. If solenoid valves are closed, the pump stops.

3.3. Liquid leak

In the case of a liquid leak, liquid enters the interstitial space and collects at the lowest point of the interstitial space.

The incoming liquid leads to the vacuum dropping, the pump is switched on and evacuates the interstitial space(s) until operating pressure has been reached. This process is repeated until the liquid stop valve in the suction line closes.

Due to the vacuum still present in the measuring line, further leak liquid is sucked into the interstitial space, the measuring pipe and into a pressure compensating vessel if appropriate. This leads to reduction of the vacuum until the pressure has reached the “alarm ON” level. The opti-

cal and audible alarm signal is triggered. If solenoid valves are connected, they close and the pump stops.

If in place of the liquid stop valve a leak probe is mounted in the suction line in connection with solenoid valves, the alarm signal is triggered when leak liquid reaches the leak probe. This closes the solenoid valves and the pump stops.

3.4. Switching values of the leak detector in mbar

NOTE: The leak detector with the lowest alarm pressure for the respective application should be used whenever possible (lower component wear)

Type	**alarm ON**	**Pump OFF**	Use on **Group:**
VLR 230	> 230	< 360	P/Q
VLR 330, VLR 330 E	> 330	< 450	P/Q
VLR 410, VLR 410 E	> 410	< 540	P/Q
VLR 500, VLR 500 E	> 500	< 630	P/Q
VLR 570, VLR 570 E	> 570	< 700	P/Q
VLR .. - .. (E)	Special switching values agreed between SGB and customer		

The measured switching value for "alarm OFF" has to be at least 5 mbar smaller than the measured switching value for "pump OFF".

The measured switching value for "pump ON" has to be at least 15 mbar bigger than the measured switching value for "alarm ON".

3.5. Description of the display and operating elements

3.5.1 States of the display elements (signal lamps)

Signal lamp	Operating state	Start-up	Start-up, alarm acknowledges	Alarm, vacuum below the "alarm ON" level	Alarm, as left-hand column, acknowledged	Alarm probe	Alarm probe, acknowledged	Alarm solenoid valve	Alarm solenoid valve, acknowledged	Device malfunction
OPERATION: green	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
ALARM: red	OFF	BLINKING	BLINKING	ON	BLINKING	OFF	OFF	ON	BLINKING	ON[3]
ALARM 2[4]: red	OFF	BLINKING	BLINKING	OFF	OFF	ON	BLINKING	ON	ON	OFF

Description:

Start-up: If the alarm is acknowledged as the pump is being put into operation, an optical distinction is not made, the audible signal is on or off depending on the button position. When the switching value "alarm OFF" has been exceeded, the audible signal is always off.

[3] The button "mute" is without function
[4] Only applies to VLR .. E

Alarm $p<p_{AE}$: Alarm signal when the vacuum in the monitored system is below the switching value "alarm ON".
NOTE: If an alarm probe should occur following this alarm signal, the alarm probe has priority! (i.e., the alarm probe is displayed. Once the cause for this has been eliminated, the Alarm $p<p_{AE}$ will be displayed again.) The audible alarm signal is not given, but the other LED blinks according to the table.

Alarm probe: See Alarm $p<p_{AE}$

Alarm solenoid valve: Is triggered when the solenoid valve has an electrical defect.

Device malfunction: Is displayed if a fault should occur on the PCB.

3.5.2 Operating functions via buttons

- Switch off audible alarm signal:
  Press the "mute" button briefly once, the audible signal is switched off, the red LED blinks.
  If the button is pressed again, the audible signal is switched back on.
  This function is not available during normal operation and in the event of a malfunction.

- Testing the optical and audible alarm signal
  Press the "mute" button and keep it pressed (approx. 10 seconds), the alarm signal is triggered until the button is released again.
  This scan is only possible if the pressure in the system has exceeded the "alarm OFF" pressure.

- Scanning the tightness of the system monitored
  Press the "mute" button and keep it pressed until the signal lamp "alarm" blinks quickly after approx. 5 seconds, then release the button. The "alarm" signal lamp displays a value for tightness on the basis of the number of blinks.
  10 seconds after this value has been displayed the signal lamp returns to normal operation.
  For the tightness inquiry function, the leak detector must have performed at least 1 automatic refilling interval in normal operating conditions (i. e., without external filling/evacuation, e. g., by an assembly pump) to achieve a valid statement.

- Zero-point adjustment
  Three-way valve 21 in position II.
  Press the "mute" button and keep it pressed until the "alarm" signal lamp blinks quickly after approx. 5 seconds, then release the button. Press the button again immediately and then release it again. Adjustment is confirmed by 3 optical and audible signals.
  Before repeating zero-point adjustment the "pump OFF" switching value must be reached.

VLR .. E ONLY

- Start-up (opening the solenoid valves)
  Press the "start-up" button and keep it pressed for approx. 5 seconds until both red signal lamps light up. The solenoid valves are opened, the pump starts to run.
  If this button is kept pressed longer than 10 seconds, the alarm signal is generated. Shortly after the button is released the alarm signal triggered is deleted again.
  For information about activating or deactivating the solenoid valves, refer also to chapter 4.5.1

4. Mounting instructions

4.1. General notes

(1) Heed manufacturers' approval for the pipes and the interstitial space.

(2) Installation and start-up must be carried out by a qualified company[5].

(3) Companies that put leak detectors into operation must be trained by SGB or an authorized representative.

(4) Heed relevant regulations concerning electrical installation[6].

(5) Heed and observe accident prevention regulations.

(6) Pneumatic connections, connection lines and fittings must be able to withstand the pressure (static pressure plus superimposed pressure) which could occur in the case of a leak, for the whole temperature range possible.

(7) Before anyone enters a dome or control shaft, the oxygen content must be checked and the shaft flushed out if necessary.

4.2. Mounting the leak detector

(1) Wall mounting, within a building

(2) To allow the ventilation slots to work properly, make sure there is a side clearance of at least 2 cm from other objects and walls.

(3) Wall mounting in the open, using a suitable protective box.
If the detector is to be mounted in a protective box, at least one of the following points must be observed:
- Signal lamps for operation must be visible from the outside (protective box with transparent lid or signal lamps mounted on the outside)
- Use of potential-free contacts to extend alarm - if these contacts are not used, additional external signal

(4) OUTSIDE potentially explosive areas.

(5) As near to the tank/pipe as possible (cf. section (6) of the following chapter).

4.3. Mounting the (pneumatic) connecting lines

(1) Plastic hoses (e.g., PVC) or tubes made of plastic or metal.
Pressure resistance, see requirements specified in chapter 4.1.

(2) Clearance at least 4 mm for underground pipe laying and/or inside buildings
at least 6 mm for all other applications.

(3) Resistant to the product to be stored.

(4) Color marking:
Measuring line: RED;
Suction line: WHITE or TRANSPARENT,
Exhaust line: GREEN.

[5] For Germany: Specialist firms according to the Federal Water Act, which have verified their qualification for the installation of leak detection systems. For Europe: Authorisation from the manufacturer.
[6] For Germany: e.g., VDE regulations, regulations issued by utilities companies.

(5) The full cross-section must be retained.

(6) The length of the lines between the interstitial space and the leak detector should not exceed 50 m. If the distance is bigger, a larger pipe cross-section must be used.

(7) Routing lines with lowest points: mounting of condensate traps at each lowest point (heed pressure resistance specified in 4.1).

(8) Mount the liquid stop valve in the suction line (heed pressure resistance specified in 4.1).

(9) Exhaust line must lead with slope to the tank ventilation outlet. In the case of laying with lowest points, use condensate traps.

Alternatively: The exhaust line can terminate out in the open, at a non-dangerous spot. In this case, provide for a condensate trap and liquid stop valve in the exhaust line[7].

(10) Conduits for connecting lines have to be sealed gas- and liquid tight at the inlet and outlet points.

(11) For applications using a pressure compensating vessel in the measuring line, if suction and measuring line are connected together in a node point, the following shall apply:
Per 0.1 litre volume[8] of the pressure compensating vessel, the length of the measuring line (L_{max}) may only be a maximum of

VLR 330	36 m
VLR 410	28 m
VLR 500	22 m
VLR 570	18 m

NOTE: The lower edge of the pressure compensating vessel must not be lower than the node point, the upper edge of the pressure compensating vessel must not be more than 30 cm above the node point.
Per 10 ml of the condensate trap(s) mounted in the measuring line between pressure compensating vessel and leak detector, **L_{max} is reduced by**:
0.5 m (6 mm clearance)
1 m (4 mm clearance).

ALTERNATIVELY: In place of the pressure compensating vessel, the measuring line can be laid from the node point over 50% of the measuring line length (=L_{min}) with approx. 1% slope to the node point.

4.3.1 In case several interstitial spaces for pipes are connected parallel to a leak detector.

(1) Route connecting lines with slope to the interstitial space or to the manifold. In the case of lowest points in the connecting lines with the lines routed in the open, mount condensate traps at all the lowest points.

(2) Route the suction and measuring line with slope to the manifold. If this is not possible, use condensate traps at all the lowest points.

(3) Connect a liquid stop valve in each of the connecting lines to the interstitial space, against the stop direction. These prevent leaked liquid entering the interstitial spaces of the other ducts of the double walled pipe.

[7] Condensate trap and liquid stop valve are not required if the exhaust pipe ends above a liquid-proof area (e.g., filling area, leak containment room).
[8] Multiplying this volume leads to a multiplication of L_{max}. Dividing this volume leads to a division of L_{max}.

4.4. Mounting the probe (VLR .. E ONLY)

4.4.1 Probe requirements

(1) Approval as overload protection or as leak probe is required.

(2) Voltage supply identical to voltage supply of the leak detector.

(3) Current consumption of the probe P < 200 W

(4) Dry relay contacts which open in the case of alarm.

(5) Other versions can be agreed with the manufactures, since adaptation could be necessary.

4.4.2 Probe in place of the liquid stop valve

(1) A probe can be integrated in the suction line as a component part of the installation kit in place of a liquid stop valve (agree version of installation kit (MBS) with the manufacturer). The probe can also be mounted as an additional fixture at the low point of the interstitial space.

(2) With this version the leak detector indicates that liquid (product or groundwater) is in the suction line (and thus usually in the interstitial space).

(3) This version can become necessary if
– the alarm signal is not possible due to the pneumatic principle
– the liquid to be monitored is extremely dangerous (e.g., potentially fatal).
– if escaping liquid (e.g., due to "just" sufficient resistance of the interstitial space) has to be established immediately.

4.4.3 Probe in addition to the leak detector for monitoring increase in liquid level

(1) Set up or mount the probe in the space to be monitored (dome or control shaft, leak tub, leakage containment) according to the manufacturer's instructions.

(2) Install the electrical supply line to the leak detector and connect it according to the instructions in chapter 4.7.

4.5. Mounting the solenoid valve(s) (VLR .. E ONLY)

(1) The solenoid valves must be mounted as near to the interstitial space as possible. Pressure resistance, resistance to substances (incl. sealing materials), temperature range and protective rating (in the case of mounting in the open air) must be guaranteed.

(2) For VLR .. E: ONLY one solenoid valve in the connection line to the interstitial space:
– Voltage supply: 230 V
– Current consumption: 5 to 10 W

4.5.1 Activation or deactivation of the solenoid valve monitoring

(1) If solenoid valves (or one solenoid valve) are used, solenoid valve monitoring must be **ACTIVATED**: The coding plug must be inserted according to the photo. The photo shows an active solenoid valve monitoring case. **NOTE:** If solenoid valve monitoring is not activated, the valve will not open; the start-up button will not work!

4.6. Selection of the electrical supply line (VLR .. E ONLY)

4.6.1 Probe

(1) Cable length should not be longer than 30 meters[9]

(2) Recommended cable type: NYM 5 x 1.5 mm^2, LiYY 5 x 0.75 mm^2 with wire-end ferrules

4.6.2 Solenoid valve(s)

(1) Cable length should not be longer than 30 meters[10]

(2) Recommended cable type: NYM 3 x 1.5 mm^2, LiYY 3 x 0.75 mm^2 with wire-end ferrules

4.7 Electric cables

Supply cable: minimum 1.0 mm^2, e.g. NYM 3 x 1.5 mm^2, and maximum 2.5 mm^2

Power connection:

- 2.5 mm^2 without ferrule
- 1.5 mm^2 with ferrule and plastic collar

Voltage-free contacts and external signal:

- 1.5 mm^2 without ferrule
- 0.75 mm^2 with ferrule and plastic collar

4.8 Electrical connection

(1) Voltage supply: see type plate.

(2) Recommended cable type: NYM 3 x 1.5 mm2, LiYY 3 x 0.75 mm^2 with wire-end ferrules

(3) Firmly laid, i.e., no plug or switch connectors.

(4) Devices with a plastic housing may only be connected with a fixed cable.

(5) Close unused cable glands properly and professionally.

(6) Terminal assignment (see also SL-853 600 (VLR .. and SL-854 800 (VLR .. E):

1	230 V
2	230 V
3/4	Occupied (leak detector pump)
5/6	External signal (voltage supply in case of alarm, is switched off using "mute" button.
7/8	VLR .. E ONLY connection of the solenoid valve(s)
9/10	230 V for supplying voltage to a probe, if necessary
11/12	Dry relay contacts, open in case of alarm and power failure
21/22	VLR .. E ONLY connection of the dry relay probe contacts (contacts have to be open in case of alarm and power failure) NOTE: When the device is delivered a bridge is used which must be removed when the probe is connected
X/X	Serial data transmission (no. 106 in the circuit diagrams)

[9] The length is limited for EMC-related reasons, longer lengths only after consultation and agreement with the manufacturer.

[10] The length is limited for EMC-related reasons, longer lengths only after consultation and agreement with the manufacturer.

4.9 Installation examples

Installation examples are given in the appendix.

The following notes must always be heeded:

Note: The connection of interstitial spaces is only permitted for battery tank plants and pipework UNDER the following conditions.

1. Installation example P – 01:
   The low point(s) must not exceed the dimension H_{max}. The pipe may also have further highest points and lowest points AS LONG AS the difference in height between high points and lowest points is not above H_{max}.
2. Installation example P – 02:
   The pipe here, as under No. 5, may also have highest and lowest points within the above-mentioned limits.
3. Installation example P – 03:
   The dimensions H_{max} is the limit between the "highest" highest point and the "lowest" lowest point. The volumes of the pipes connected have to keep the following conditions:
   $4 \bullet V_{ÜR\ 1} > V_{ÜR\ 1} + V_{ÜR\ 2} + V_{ÜR\ 3} + V_{ÜR\ 4}$ and
   $4 \bullet V_{ÜR\ 2} > V_{ÜR\ 2} + V_{ÜR\ 3} + V_{ÜR\ 4}$ etc.
   $V_{ÜR\ (number)}$ is the volume of the respective interstitial space.
4. Installation example Q – 01:
   The solenoid valve protects the leak detector from impermissibly high pressure. The solenoid valve is monitored electronically, which means failure of the solenoid valve leads to triggering of the alarm signal. The conditions listed under points 5 to 7 also apply here.

5 Start-up

(1) Heed and observe specifications in chapter 4.

(2) Carry out pneumatic connection.

(3) Set up electrical connection, do not apply voltage supply yet.

(4) Close the housing cover.

(5) Apply voltage supply.

(6) Establish lighting up of operating and alarm lamp as well as the audible alarm signal. Press the "mute" button, the signal lamp "alarm" will blink.

(7) Only VLR .. E with solenoid valve: carry out the start-up sequence (see chapter 3.5.2).

(8) Three-way valve 21 in position "III", connect measuring gauge. (cf. P-060 000)

(9) Apply vacuum to the system. To do this, the installation pump can be connected to the muff on three-way valve 20, position IV. Switch on the installation pump. The interstitial space will be evacuated. Monitor the vacuum build-up on the measuring gauge.
NOTE: If no pressure is built up with the installation pump connected, the leak must be located and eliminated (if necessary, check the feed capacity of the pump and/or the position of the three-way valve).

(10) Once the leak detector has reached operating vacuum (pump in the leak detector switches off), the three-way valve must be set to position I, the installation pump switched off and removed.

(11) Three-way valve 21 in position "I", remove the measuring gauge.

(12) Carry out the functional test according to section 6.4.

6 Operating instructions

6.1 General instructions

(1) If the leak detection system is installed tightly and correctly then it can be assumed that the leak detector is working in the range of control.

(2) Frequent switching on, or continuous running of the pump indicates leaks which must be eliminated within a reasonable period of time.

(3) In the case of an alarm there is always either a major leak or a fault. The cause must be established quickly and the problem eliminated.

(4) The leak detector must be disconnected from the mains for any repair work.

(5) Use a dry cloth to clean the leak detector with a plastic housing.

(6) Current interruptions are indicated by the "operation" signal lamp going out. The alarm signal is triggered via the dry relay contacts (if used to extend the alarm).
Following the current interruption, the green signal lamp lights up again, the alarm signal is switched off via the potential-free contacts (unless the pressure has fallen below the alarm pressure during power failure). Carry out the start-up sequence for leak detectors with connected solenoid valve(s).

(7) CAUTION: The protective function of the device may not be impaired if it is not used as specified by the manufacturer.

6.2 Intended use

- Double-walled tanks and pipes according to chapter 2, under the listed conditions
- Grounding according to valid regulations
- Leak detection system is tight according to the table in the documentation
- Leak detector is mounted outside the potentially explosive area
- Conduits into and out of dome or control shafts are closed airtight
- Electrical connection cannot be switched off

6.3 Maintenance

(1) Maintenance work and functional tests may only be carried out by trained staff[11].

(2) Work is carried out once a year to assure functional and operating safety.

(3) Extent of the tests is described in chapter 6.4.

(4) It must be checked whether the conditions described in chapters 4 to 6.3 are being observed.

(5) Disconnect from the mains before opening the leak detector housing.

6.4 Functional test

Tests of the functional and operating safety must be carried out

- after every start-up,
- acc. to chapter 6.3[12],
- after every case of troubleshooting.

[11] For Germany: qualified knowledge or under the responsibility of a qualified person.
For Europe: Authorisation from the manufacturer.
[12] For Germany: heed state-specific regulations accordingly (e.g., AwSV)

6.4.1 Extent of the test

(1) If necessary, discuss the tasks to be carried out with the person responsible on-site.

(2) Heed the safety instructions regarding contact with the stored products present.

(3) Monitoring and emptying the condensate traps if necessary (6.4.2).

(4) Testing the probe if appropriate (chapter 6.4.3)

(5) Check the free passage of air in the interstitial space (chapter 6.4.4).

(6) Test the switching values with the interstitial space (chapter 6.4.5).
alternatively: test the switching values using the test device (chapter 6.4.6).

(7) Test the lift of the vacuum pump (chapter 6.4.7).

(8) Check tightness of the leak detection system (chapter 6.4.8).

(9) Set up operating state (chapter 6.4.9).

(10) A qualified person must fill out a test report confirming function and operational safety.

6.4.2 Checking and emptying the condensate traps if necessary

(1) If there are shut-off valves on the interstitial space, close these.

(2) Three-way valve 20 and 21 to position IV to ensure aeration of the connecting lines.

(3) Open condensate traps and empty them.
NOTE: Condensate traps can contain storage/conveying product(s), make sure you take suitable precautions.

(4) Close condensate traps.

(5) Three-way valves 20 and 21 to position I.

(6) Open shut-off valves on the interstitial space.

6.4.3 Testing the probe

(1) If there are shut-off valves on the interstitial space, close these. (Not applicable when the probe is installed separately from the leak detector. Also applicable for section (2) and section (6))

(2) Three-way valve 20 in position IV, thus aeration of the connecting line.

(3) Remove probe and check reaction in storage products or water.

(4) Establish optical and audible alarm signal on the leak detector. Press the "mute" button if necessary.

(5) Clean / dry and insert the probe.

(6) Move three-way valve 20 to position I and open the shut-off valves.

6.4.4 Checking the free passage of air in the interstitial space

(1) Connect the measuring gauge to three-way valve 21, then position III.

(2) <u>For tanks and pipes according to Installation examples P-03, Q-03:</u> Three-way valve 20 to position IV,
<u>For pipes according to Installation examples P-01, P-02, Q-01, Q-02 and Q-04:</u> Open the test valve at the end of the interstitial space away from the leak detector. In the case of several ducts of a pipe the stop valves of the interstitial spaces not integrated in the test can be closed.

(3) Determine the drop in pressure on the measuring gauge. If there is no drop in pressure, establish the cause and eliminate it.

(4) Three-way valve 20 to position I, or close test valve(s).

(5) Three-way valve 21 to position I.

(6) Remove measuring gauge.

6.4.5 Testing the switching values using the interstitial space

(1) Connect the measuring gauge to three-way valve 21 and three-way valve 21 in position III.

(2) For tanks and pipes acc. to Installation examples P-03, Q-03: Aerate via three-way valve 20 (position III)
For tanks and pipes acc. to Installation examples P-01, P-02, Q-01, Q-02 and Q-04: Open the test valve at the end of the interstitial space away from the leak detector. In the case of several ducts the stop valves of the interstitial spaces not integrated in the test can be closed.

(3) Determine switching values "pump ON" and "alarm ON" (with optical and audible alarm signal). Note values.

(4) Press the "mute" button if necessary.

(5) Carry out the start-up sequence if necessary (see chapter 3.5.2).

(6) Three-way valve 20 to position I, or close test valve and determine switching values "alarm OFF" and "pump OFF". Note values.

(7) The test is considered passed if the switching values measured are within the specified values.

(8) Open the shut-off valves previously closed, if appropriate.

(9) Three-way valve 21 to position I. If necessary, press "mute" button again.

(10) Remove the measuring gauge.

6.4.6 Testing the switching values using the testing device (P-115 392)

(1) Connect the testing device with both hose ends on one of the free muffs of three-way valves 20 and 21 respectively.

(2) Connect the measuring gauge to the T-piece of the testing device.

(3) Close the needle valve of the testing device.

(4) Three-way valves 20 and 21 to position II. Operating pressure is built up in the test tank.

(5) Aerate using the needle valve, determine the "pump ON" and "alarm ON" (optical and audible) switching values. Note values.

(6) Press the "mute" button if necessary.

(7) Carry out the start-up sequence if necessary.

(8) Slowly close the needle valve and determine the switching values "alarm OFF" and "pump OFF".

(9) The test is considered passed if the switching values measured are within the specified values.

(10) Three-way valves 20 and 21 to position I. Press the "mute" button if appropriate.

(11) Remove the testing device.

6.4.7 Testing the lift of the vacuum pump

(1) Connect a measuring gauge to three-way valve 20. Three-way valve 20 to position II.

(2) Three-way valve 21 to position II, thus aeration of the pressure switch, the alarm is triggered, the pump runs (carry out the start-up sequence if necessary to make the pump run)

(3) Read off the lift of the pump on the measuring gauge.

(4) The test is considered passed when the pressure value reached is
> 150 mbar (Type 34 and 30-70),
> 430 mbar (Type 230, 255)
> 500 mbar (Type 330, 230-340),
> 600 mbar (Type 410)
> 680 mbar (Type 500) or
> 750 mbar (Type 570).

(5) Three-way valve 20 and 21 to position I.

(6) Remove the measuring gauge.

6.4.8 Tightness test on the leak detection system

(1) Check that all the shut-off valves between the leak detector and interstitial space are open.

(2) Connect the measuring gauge to three-way valve 21, position III.

(3) For the tightness test, the vacuum pump must have reached the "pump OFF" switching value. Wait for possible pressure compensation and then begin with the tightness test.

(4) It must be evaluated as positive if the values in the following table are observed. A higher drop in pressure means increased stress on the wear parts.

Volume of interstitial space in liters	**1 mbar drop in pressure in**	**Volume of interstitial space in liters**	**1 mbar drop in pressure in**
100	9 minutes	**2000**	3.00 hours
250	22 minutes	**2500**	3.75 hours
500	45 minutes	**3000**	4.50 hours
1000	1.50 hours	**3500**	5.25 hours
1500	2.25 hours	**4000**	6.00 hours

(5) Test valve to position I, remove measuring gauge.

6.4.9 Setting up the operating condition

(1) Seal the housing

(2) Seal the shut-off valves (between leak detector and interstitial space) in the open position for every interstitial space connected.

6.5 Alarm

When monitoring pressure lines, use the potential-free contacts of the leak detector to switch off the feed pumps.

(1) In case of alarm the "alarm" signal lamp lights up and the audible signal sounds.

(2) If available, close the shut-off valves in the connection line between interstitial space and leak detector.

(3) Switch off the audible signal by pressing the "mute" button. The button will light up.

(4) Determine the cause of the alarm signal according to the table in chapter 3.5.1.

(5) Inform the installation company (detailing the cause of the problem if possible).

(6) The installation company has to determine and eliminate the cause.

(7) Carry out the functional test according to chapter 6.4, observing the conditions specified in chapters 4 to 6.2.

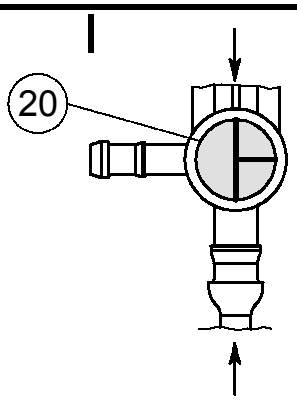
7 Marking

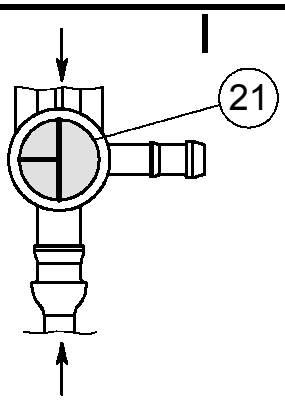
- Type
- Electrical data
- Manufacturer or manufacturer's mark
- Model year (month/year)
- Serial number
- Statutory marks

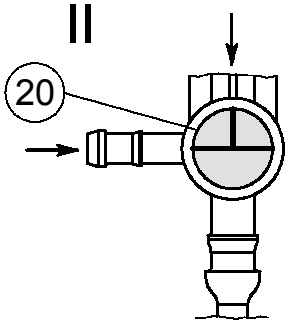
8 Index used

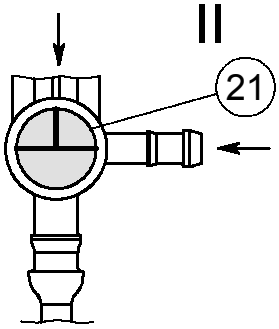
01 Signal lamp "alarm", red
01.2 Signal lamp "alarm 2", red (leak probe)
02 Shut-off valve
03 Exhaust line
09 Signal lamp "operation", green
20 Three-way valve in the suction line
21 Three-way valve in the measuring pipe
22 Needle valve
24.1 Fine-wire fuse T 1 A (230 VAC version)
24.2 Fine-wire fuse T 250 mA (230 VAC version)
24.3 Fine-wire fuse T 1 A (230 V version)
27 Liquid stop valve
27* Liquid stop valve, connection against the block direction
30 Device housing
33 Condensate trap
36 "Start-up" button
43 Measuring pipe
44 Solenoid valve
52 Measuring gauge
57 Test valve
59 Relay
60 Vacuum pump
61 Check valve with filter
68 Suction line
69 Buzzer
71 "Mute" button
73 Interstitial space
74 Connection line
76 Main PCB

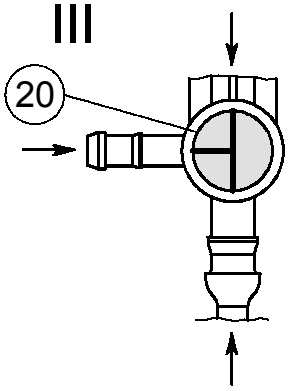
84 Test tank 1 litre
85 Test muff for measuring gauge
88 Double-walled pipe
89 Double-walled battery tank
93 Tank ventilation
95 Pressure compensating vessel
96 Node point
97 Leak probe (only VLR .. E)
101 Suction line leading to low point
102 Pressure sensor
105 Control unit
106 Contacts for serial data transmission

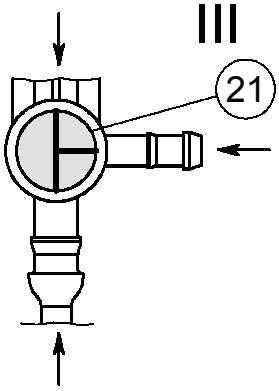


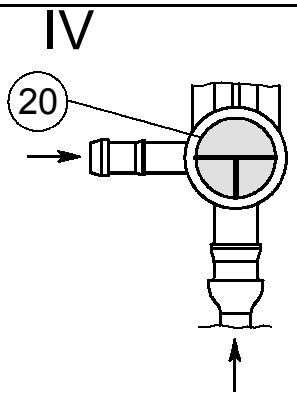


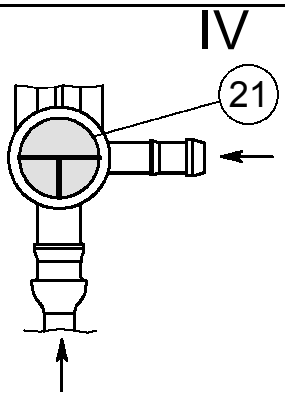












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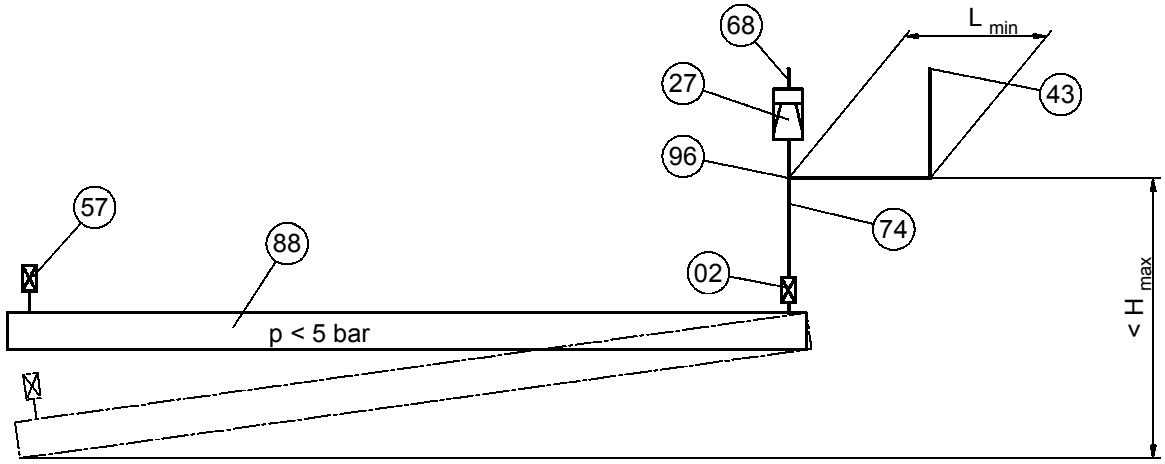

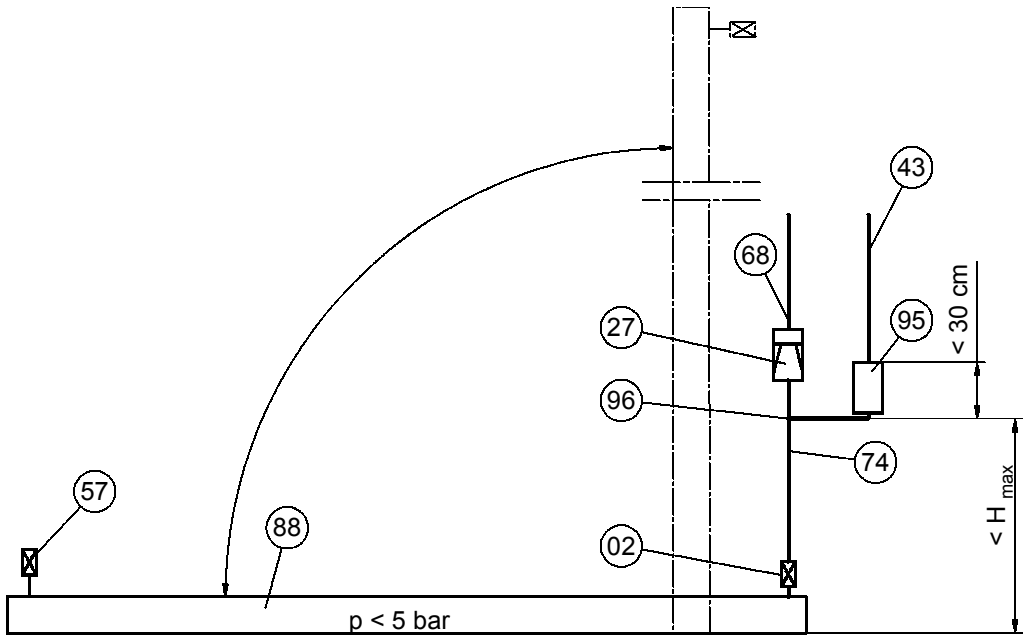

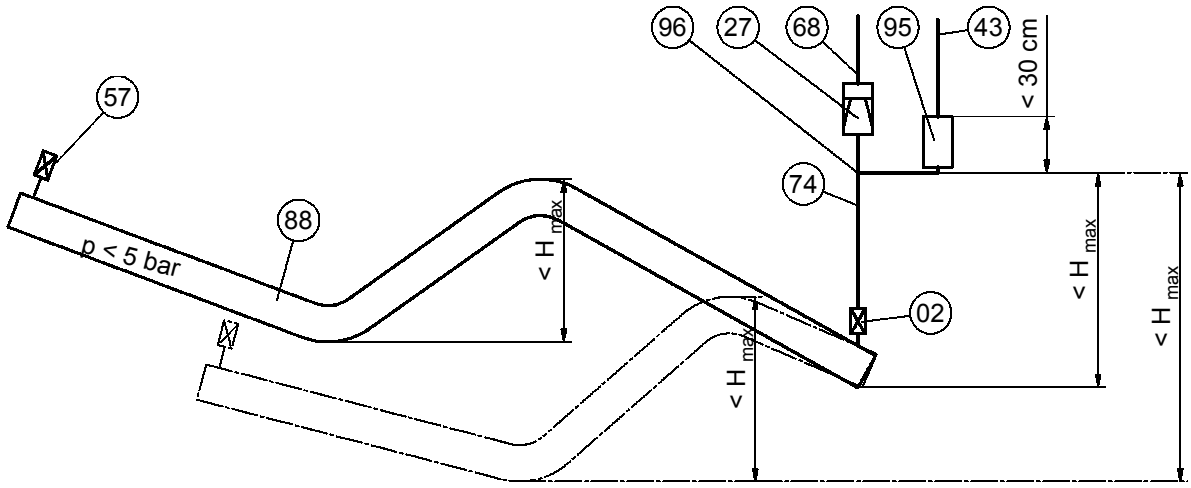

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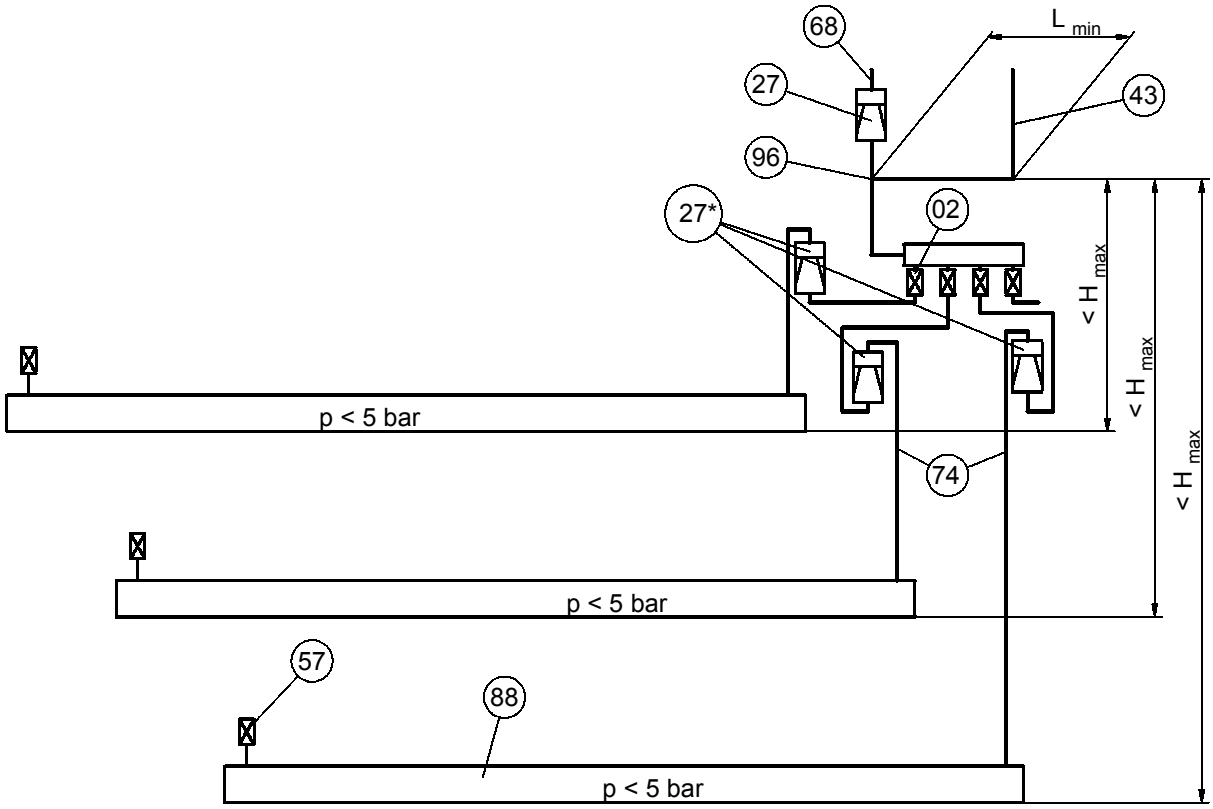

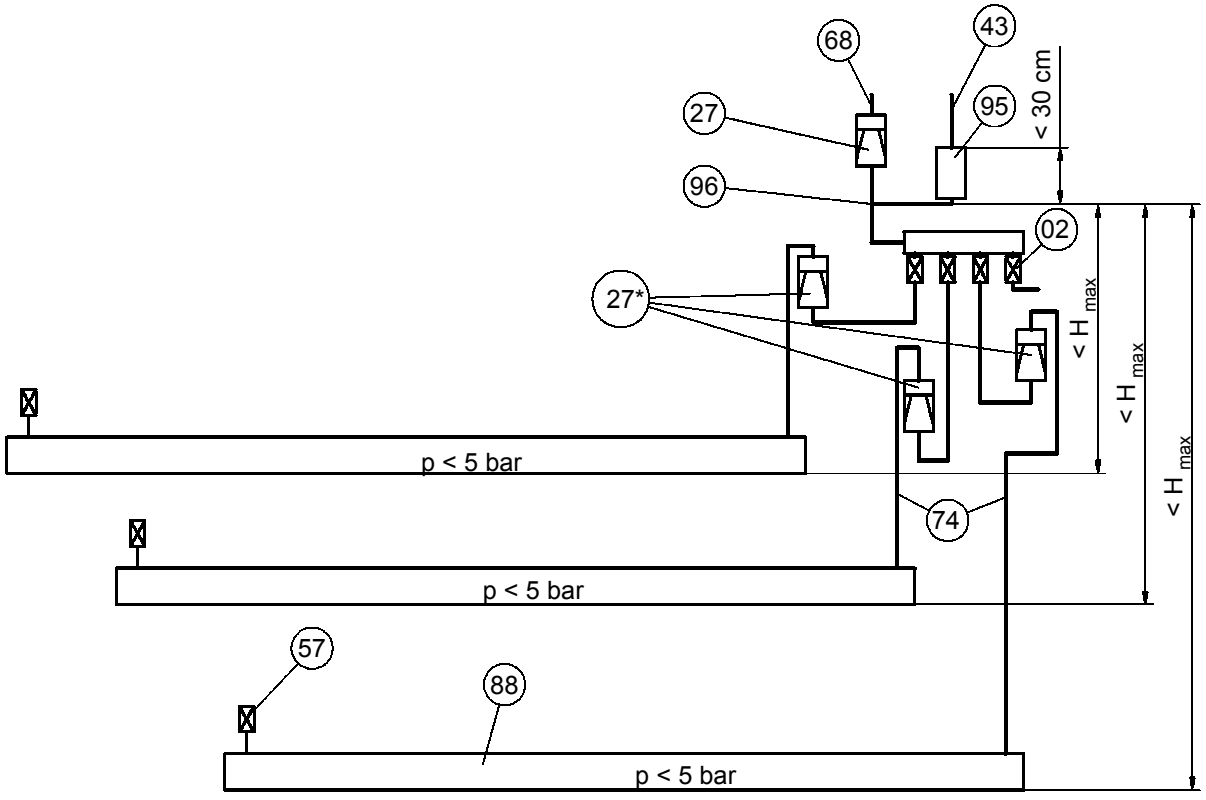

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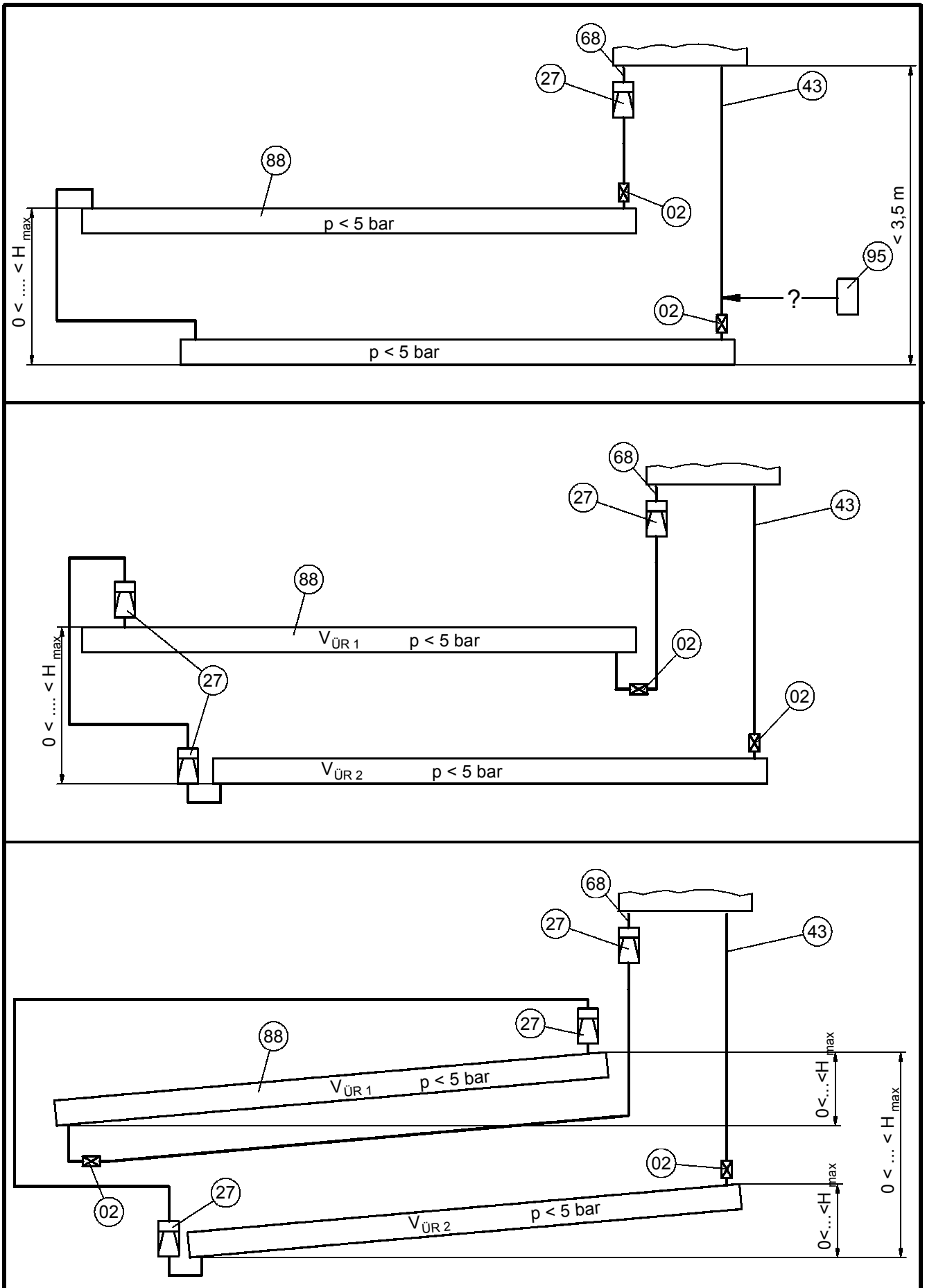

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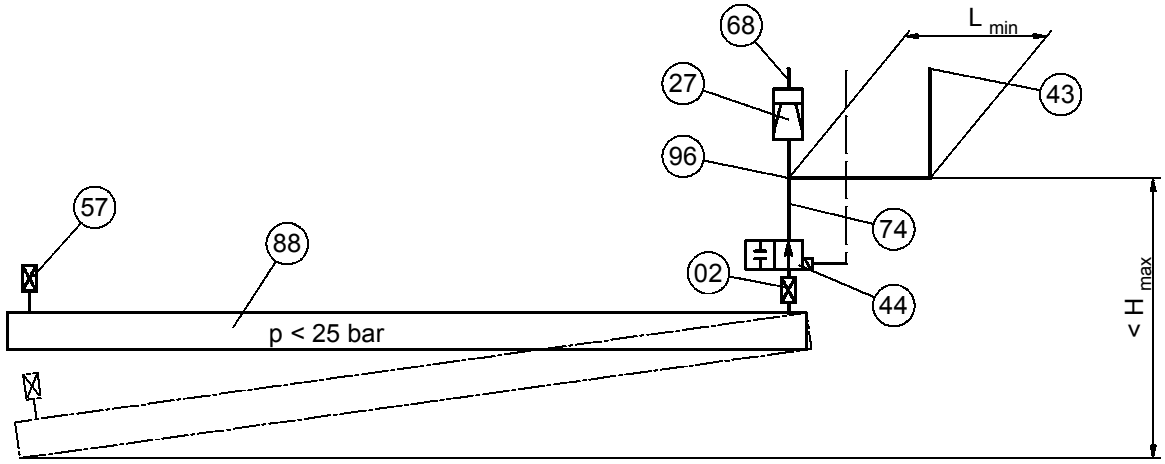

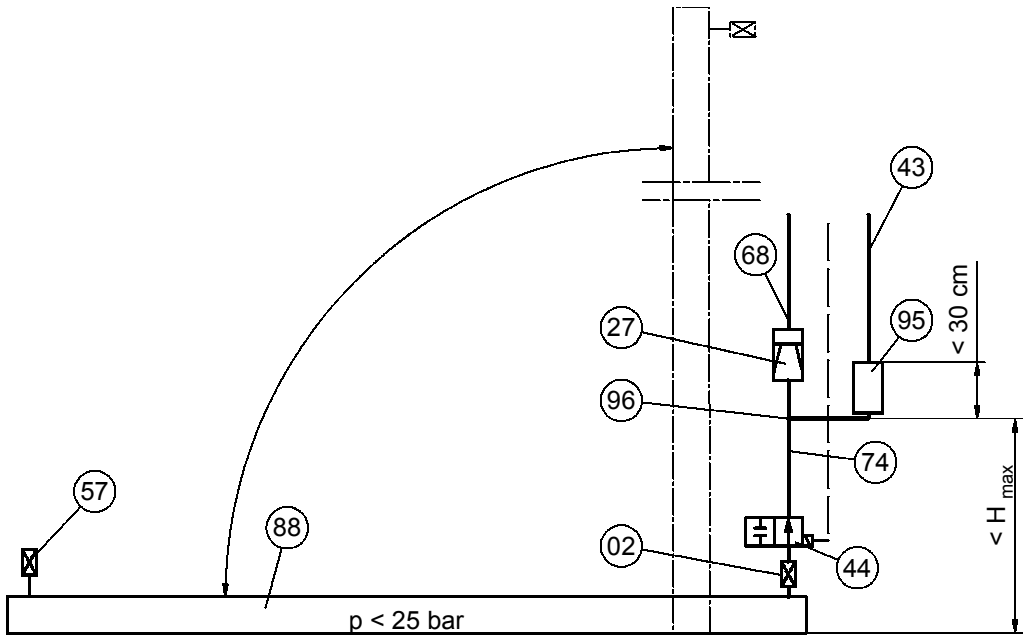

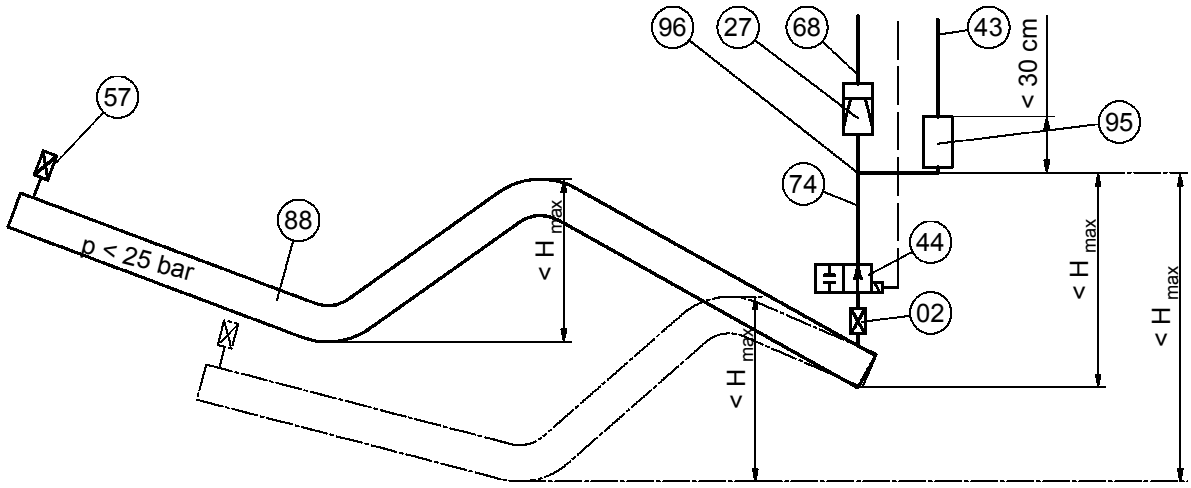

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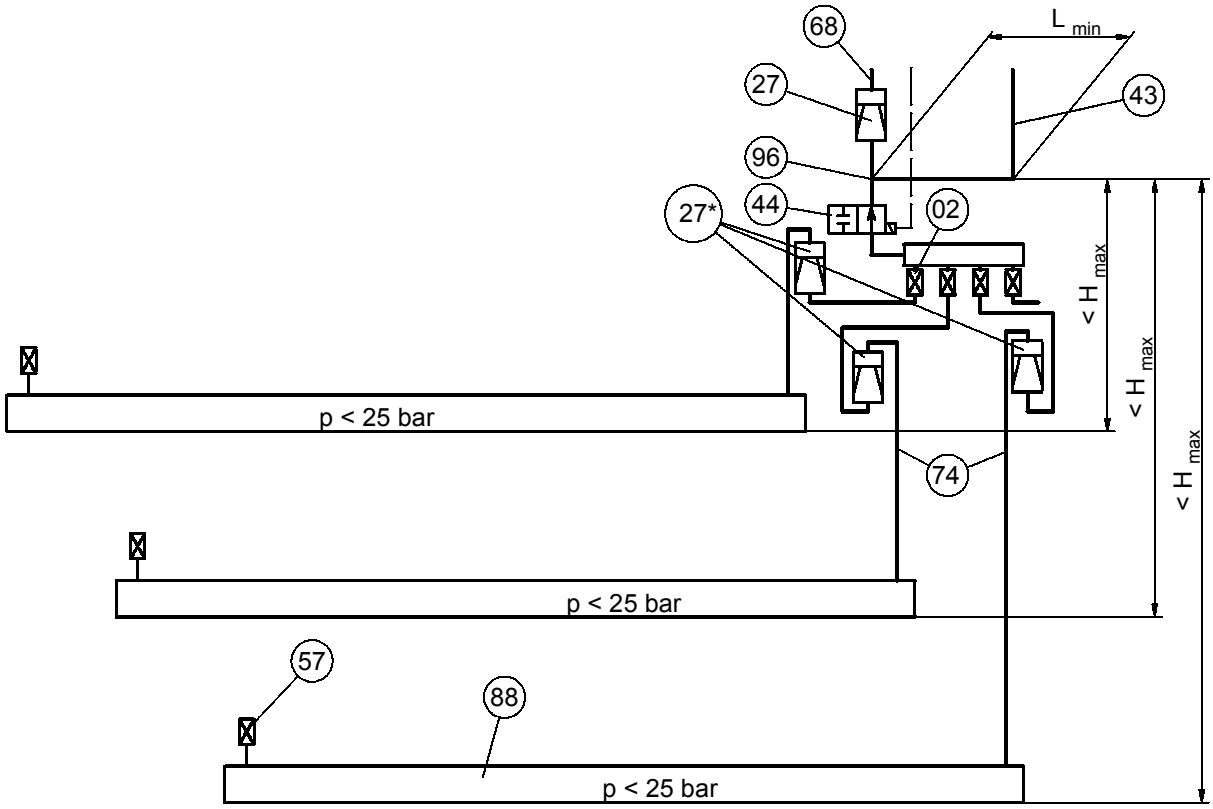

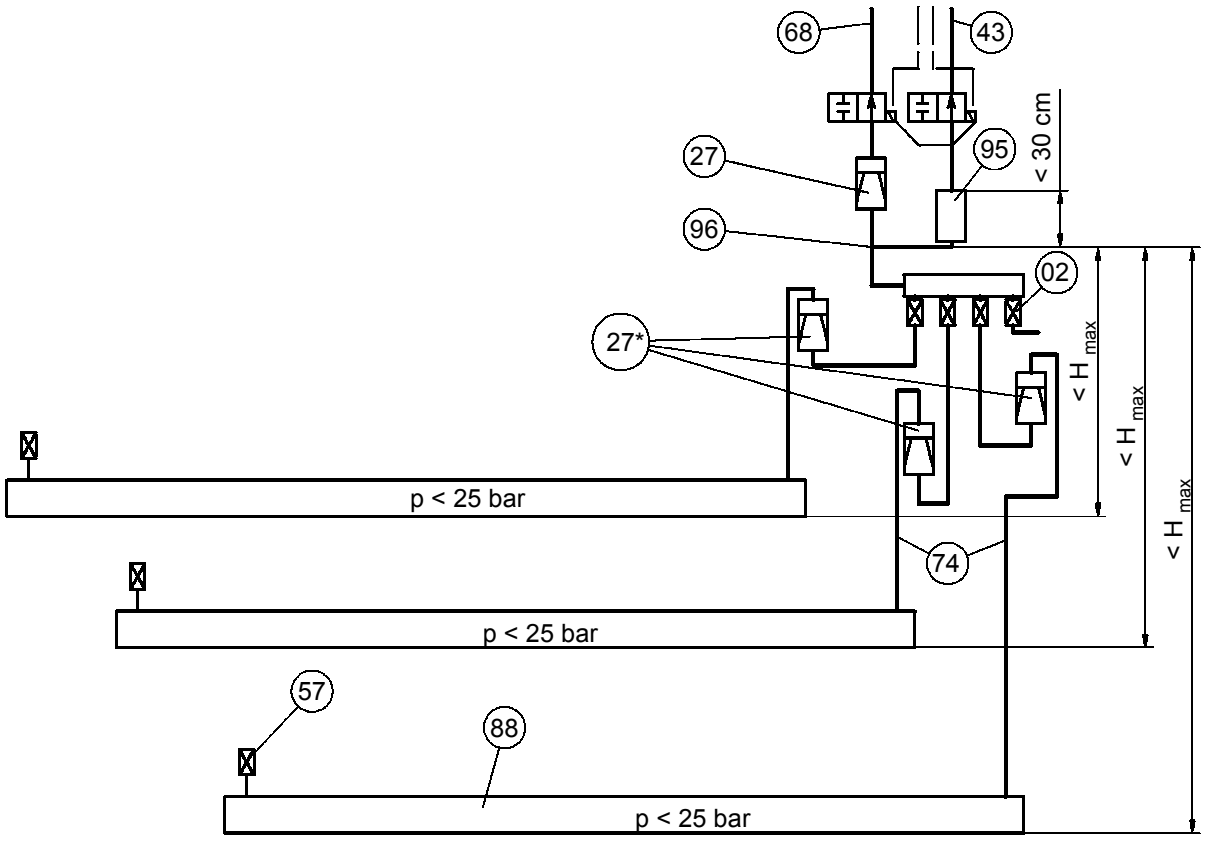

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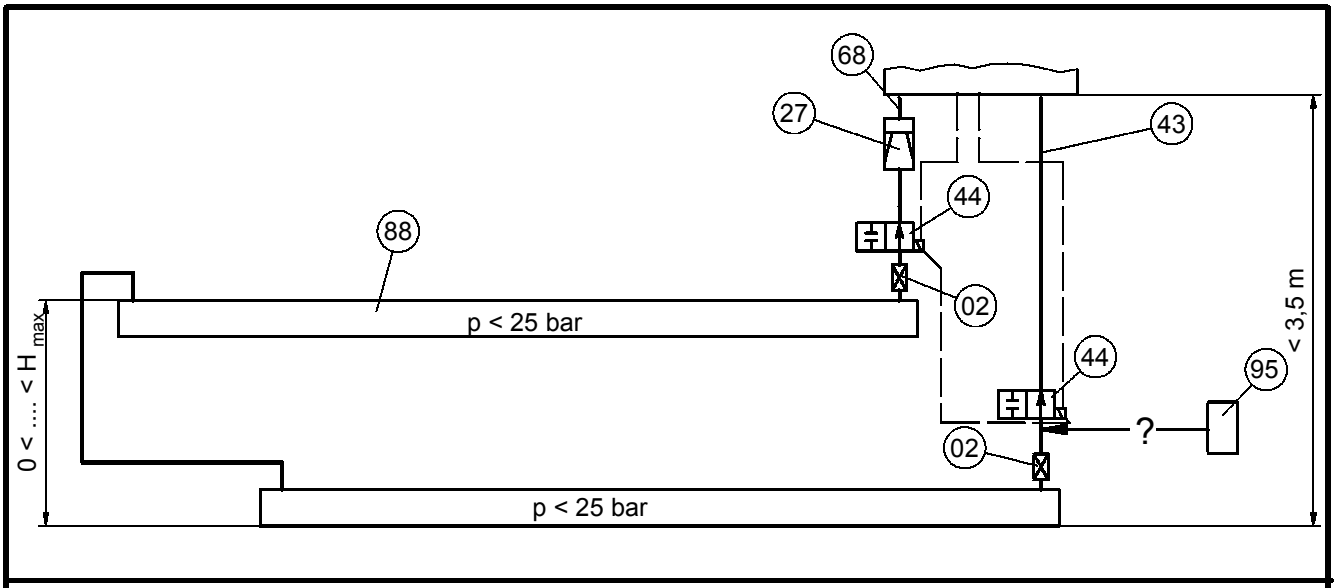

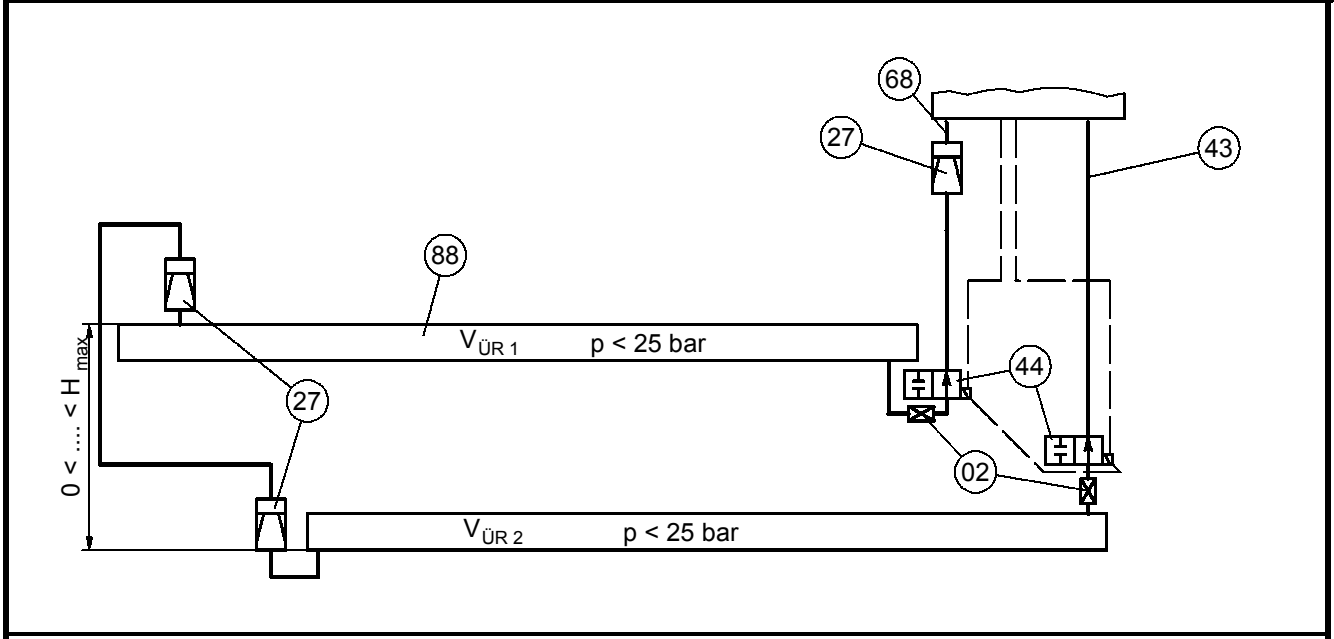

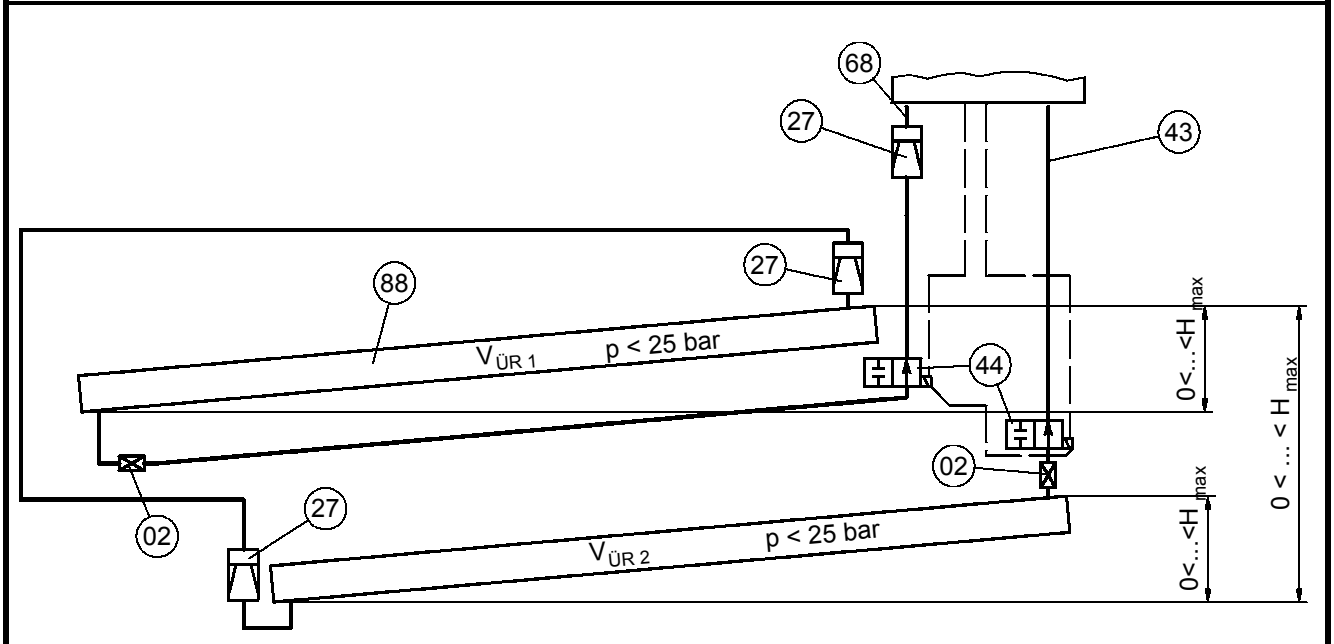

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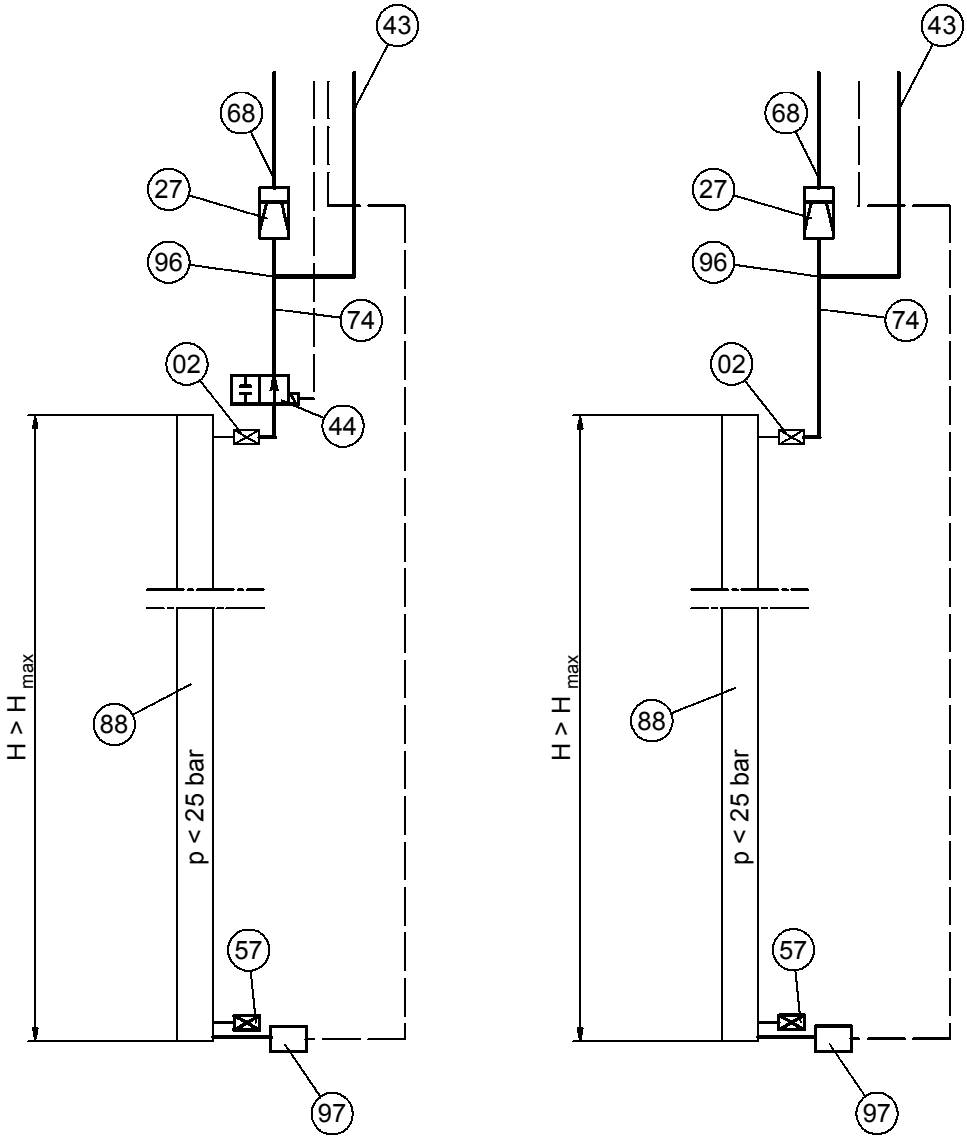

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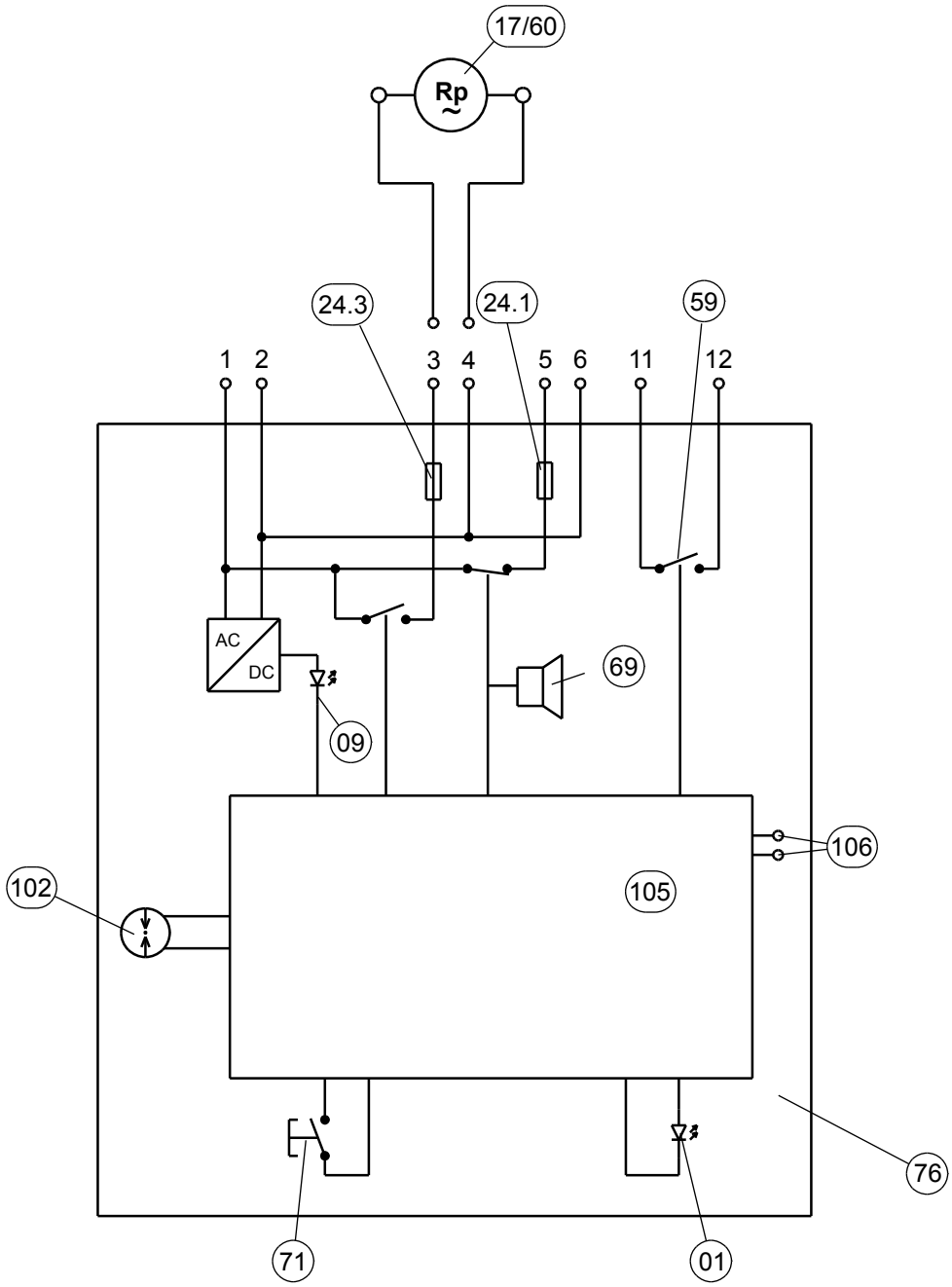

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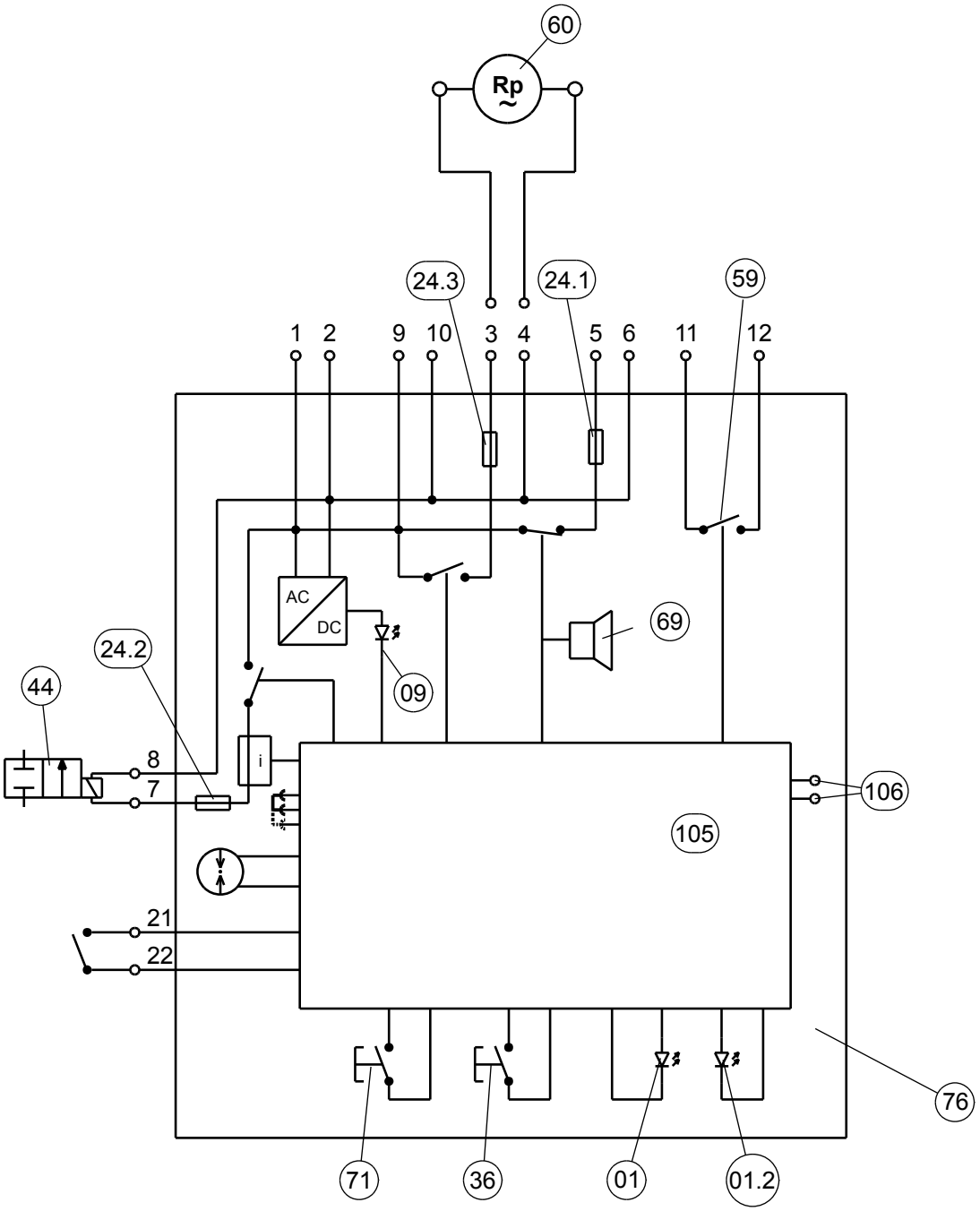

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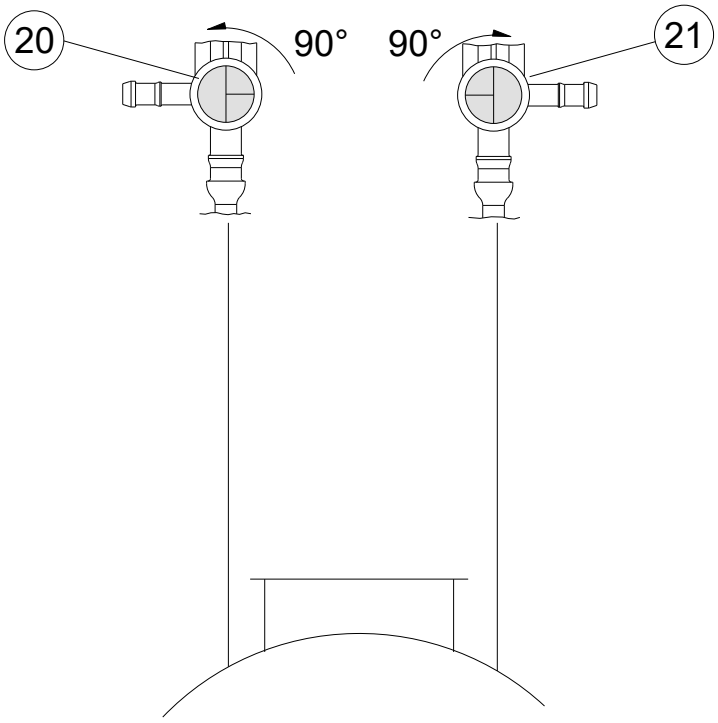

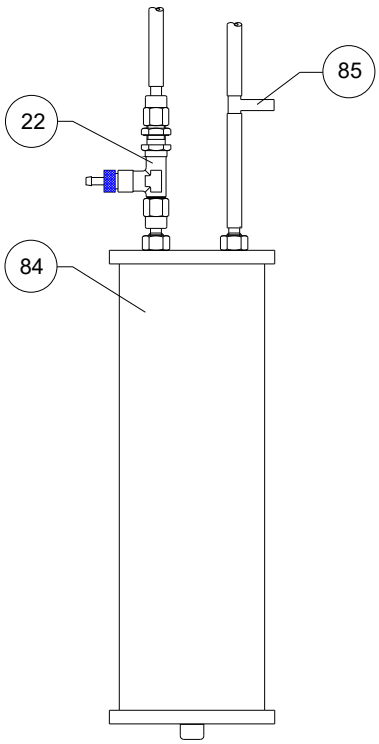

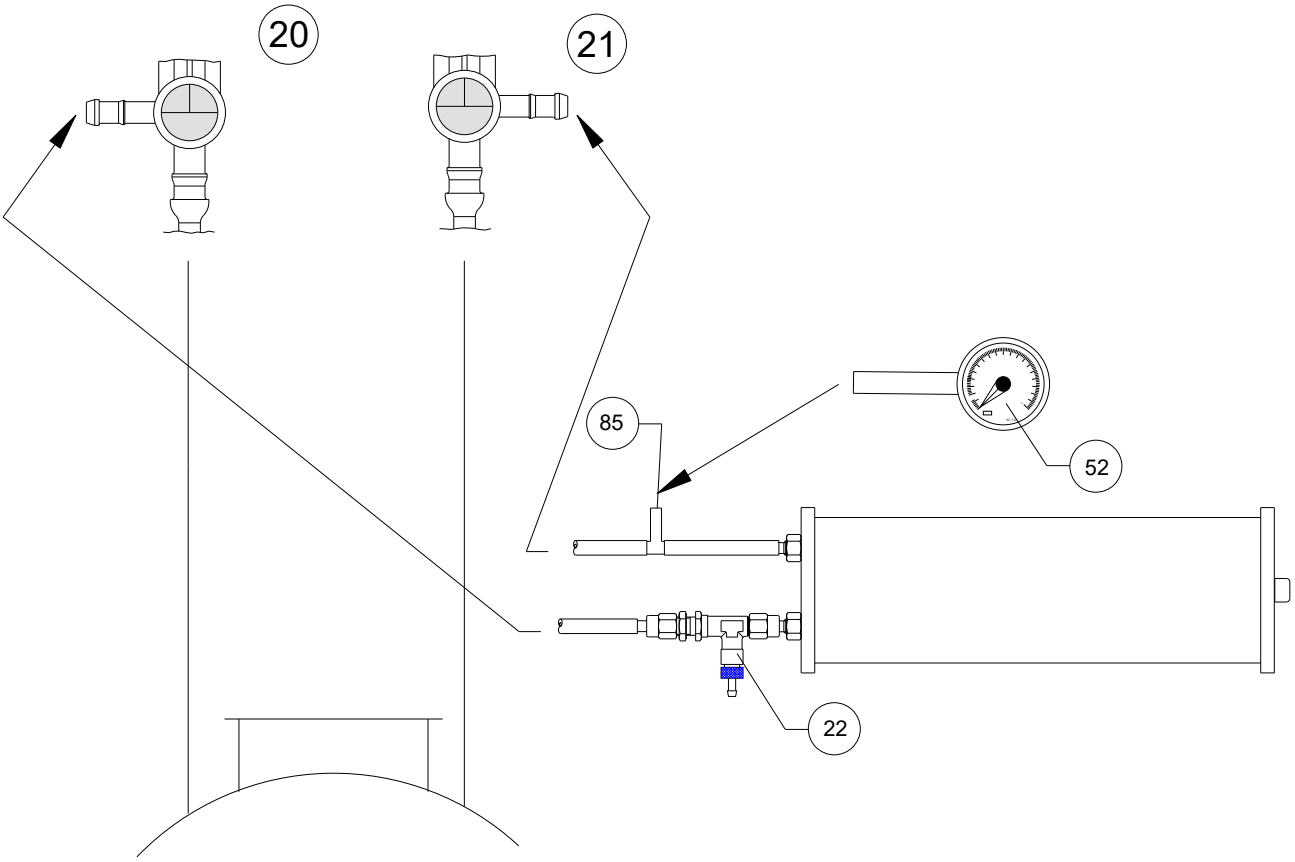

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APPENDIX DP: Evaluating the display for the function "Tightness test"

Chapter 3.5.2 described "Checking the tightness of the monitored system". This function can be used to obtain an indication of the tightness of the monitored system.

This is only possible if the switching value "Alarm OFF" has been exceeded. It can be repeated several times in succession.

This check is advisable **before** carrying out a recurrent function test on a leak detector, to see directly whether there is any need to look for leaks.

After pressing the button, this is confirmed by a brief audible signal which can be heard once, followed by a flashing signal, i.e., the Alarm LED flashes briefly to indicate the tightness as follows:

Number or flashes	Evaluation of the tightness
0	Very tight
1 to 3	Tight
4 to 6	Sufficient tight
7 to 8	Maintenance recommended
9 to 10	Maintenance highly recommended

The smaller the above value, the tighter is the system. The meaningfulness of this value naturally also depends on temperature fluctuations and should therefore be considered to be an indicative value.

APPENDIX E: E.1 H_{max} Depending on density

In this appendix, VL .. stands for all versions, i.e. also for VLR .. or VLR .. E

Density of the product stored [kg/dm³]	$H_{max.}$ [m]						
	VL 230	VL 255	VL 330	VL 410	VL 500	VL 570	
0.8	2.6	2.9	3.8	4.8	6.0	6.9	Aboveground tank(s) and pipe(s)
0.9	2.3	2.6	3.4	4.3	5.3	6.1	
1.0	2.0	2.3	3.1	3.9	4.8	5.5	Above- and underground tank(s) /pipe(s)
1.1	1.9	2.1	2.8	3.5	4.4	5.0	
1.2	1.7	1.9	2.6	3.2	4.0	4.6	
1.3	1.6	1.8	2.4	3.0	3.7	4.2	
1.4	1.5	1.6	2.2	2.8	3.4	3.9	
1.5	1.4	1.5	2.0	2.6	3.2	3.7	
1.6	1.3	1.4	1.9	2.4	3.0	3.4	
1.7	1.2	1.4	1.8	2.3	2.8	3.2	
1.8	1.1	1.3	1.7	2.2	2.7	3.1	
1.9	1.1	1.2	1.6	2.0	2.5	2.9	

Technical data

1. General data

Temperature range (operation and storage)	Plastic housing	0–40 °C
	Stainless steel housing	-20 °C–60 °C
Max. height for safe operation:		2000 m above sea level
Max. relative humidity for safe operation		95 %
Protection type of housing,	Plastic Version VL .. P	IP 30 IP 66

2. Electrical data

Electrical supply (without external signal)		230 V, 50 Hz, 50 W
Input capacity (with external signal)		230 V, 50 Hz, 280 W
Supply tolerance (network)		± 10 %
Switch contact load, terminal strips AS (5 and 6)	max: min:	230 V, 50 Hz, 200 VA 20 mA
Switch contact load, dry relay contacts (Terminals 11, 12 and 13)	max: min:	230 V, 50 Hz, 3 A 6 V/10 mA
External fuse for the leak detector Note: Acts as a separating point for the device and should be attached as close as possible.		max. 10 A
Overvoltage category		2
Degree of soiling		PD2

3. Pneumatic data (requirements concerning the test measuring gauge)

Nominal size	min. 100
Accuracy class	min. 1.6
Scale end value	-600 mbar / -1000 mbar

4. Data for applications that fall under the Pressure Equipment Directive (PED) in the event of an error

Note: The leak detector, installation kits, and manifolds are pressure accessories (in the event that the system being monitored leaks) without a safety function.

Volume	Leak detector	0,05 liter
	Kit (193…); with solenoid valve	0,05 liter
	Manifold 2 to 8 (with manometer + liquid stop valve)	0,07–0,27 liter
Max. operating pressure	Leak detector	5[1] bar
	Kit (193…); with solenoid valve	25 bar
	Manifold 2 to 8 (with manometer + liquid stop valve)	25 bar

[1] Suction line side up to liquid stop valve and measuring line side up to pressure capsule

1. Subject

ZD … "Additional pressure switch" for applications in which this equipment is required, e.g. when certain piping lengths are exceeded (see approval for double-walled pipes).

2. Field of application

(1) ZD … can be installed outdoors

(2) Components in contact with the conveyed product are made of V4A, PE and PP

(3) Pressure-resistant up to 25 bar

3. Electrical connections

Connect terminals 10 / 11 of the VL-HFw2 and terminals 21 / 22 of the VLR .. E to the terminals with the same names on the ZD ….

4. Start-up

After installation and electrical connections are complete:

4.1. In conjunction with the VL-HFw2 leak detector

Connect the ZD to terminals 10 and 11 of leak detector VL-HFw2.

(1) Press button on the ZD (so that it latches).

(2) Press start-up button on the VL-HFw2 and generate underpressure in the system.

(3) After the operating underpressure is reached, press the start-up button again (also see documentation for the above-mentioned leak detector).

4.2. In conjunction with the VLR .. E leak detector

Connect the ZD as a "sensor" to terminals 21 and 22 in leak detector VLR .. E.

4.2.1 VLR .. E WITHOUT connected solenoid valve

(1) Do not press button (not latched).

(2) Generate operating underpressure in the system.

(3) When the switching value "Alarm OFF" of the ZD … is reached, the "Sensor alarm" on the leak detector is cleared.

4.2.2 VLR .. E WITH connected solenoid valve

(1) Press button on the ZD (so that it latches). This causes the "Sensor alarm" on the leak detector to go out.

(2) Execute start-up sequence in accordance with the documentation for leak detector VLR .. E until the "Alarm OFF" pressure is reached.

(3) As soon as this underpressure is reached, the sensor alarm is triggered again, the solenoid valve closes, the pump of the leak detector stops.[1]

(4) Press button on the ZD (so that it unlatches). This causes the "Sensor alarm" on the leak detector to go out again, and an additional start-up operation (underpressure build-up) can be carried out until the operating underpressure is reached.

5. Normal operation

In normal operation the button on the ZD …
• must be pressed (latched) for the VL-HFw2, and
• not pressed (not latched) for the VLR …/E.

6. Functional tests

6.1. Testing the electrical connection

(1) Press the button on the ZD …, triggering the alarm on the leak detector.

(2) Press the button on the ZD … again; the alarm goes out

6.2. Testing the switching values

(1) Connect measuring instrument to the 3-way valve in the measuring line (below the leak detector).

(2) Turn the valve 90° anti-clockwise, thus "blinding" the pressure switch in the lead detector.

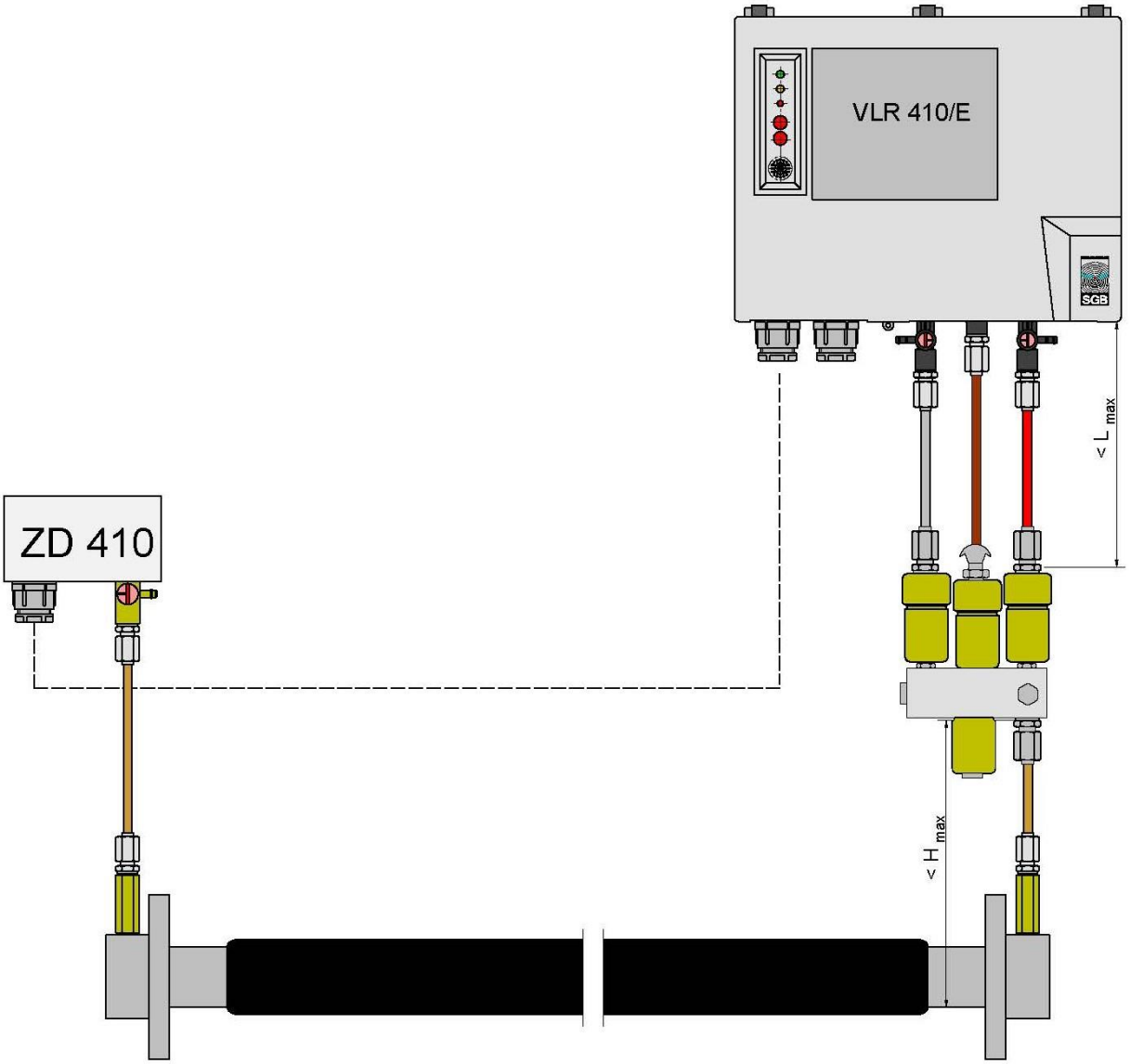
(3) Ventilate the system at the leak detector using the ventilation unit and the 3-way valve in the suction line until the alarm is activated.

(4) The switching value for "Alarm ON" must correspond to column 2, chapter 3.4.

(5) Build up underpressure in accordance with Chapter 4 of this appendix.

(6) The switching value for "Alarm OFF" must be lower than the "Pump OFF" switching value of the leak detector.

[1] The "Sensor alarm" is a priority circuit, i.e. this alarm has the topmost priority, because it originally comes from an application in which a sensor was used in connection with a solenoid valve to replace the hydraulic seal.



- NO need for a liquid stop valve underneath ZD …
- NO need for a solenoid valve underneath ZD … (ZD … is pressure-resistant up to 25 bar)

Statement

on the use of type VLR vacuum leak detectors

The VLR vacuum leak detector approved for connection to double walled pipes is now also to be used for the monitoring of double walled hoses by “System Klenk” designated “DWSL”. The suitability of the structural design of the interstitial space of the double walled pipe as part of a vacuum-operated leak detector was tested during approval procedure, Approval No. Z-65.25-220. The test evaluations involved defining the parameters for the leak detectors in use. The interstital space of the double walled hose may have vacuum leak detectors connected, which produce vacuums of up to 500 mbar and which trigger an alarm at or before a vacuum of 325 mbar. The conveying pressure in the double walled hose can be up to 16 bar, which means that the leak detectors in use must also be overpressure-proof up to 16 bar and/or protected against unacceptable overpressure.

The test on the manufacturer’s data for the VLR vacuum leak detector confirmed that this leak detector satisfies the requirements for monitoring type VLR.. /R double walled hoses by Klenk, where the designation E indicates use of the devices with interconnected solenoid valve. The alarm switching pressures are to be selected in accordance with the aforementioned vacuum pressure value of ≥ 325 mbar. The Test Inspectorate has no reservations regarding expanding the operative range of type VLR../E leak detector which has been approved by the building authorities to include the double walled hoses by Klenk. For installation, compliance is required with the manufacturer’s instructions, specifically relating to the distances between conduit and junction of the measuring and suction lines (node point) and observing the requirement to install a pressure equalizing vessel in the measuring line for creating an additional volume.

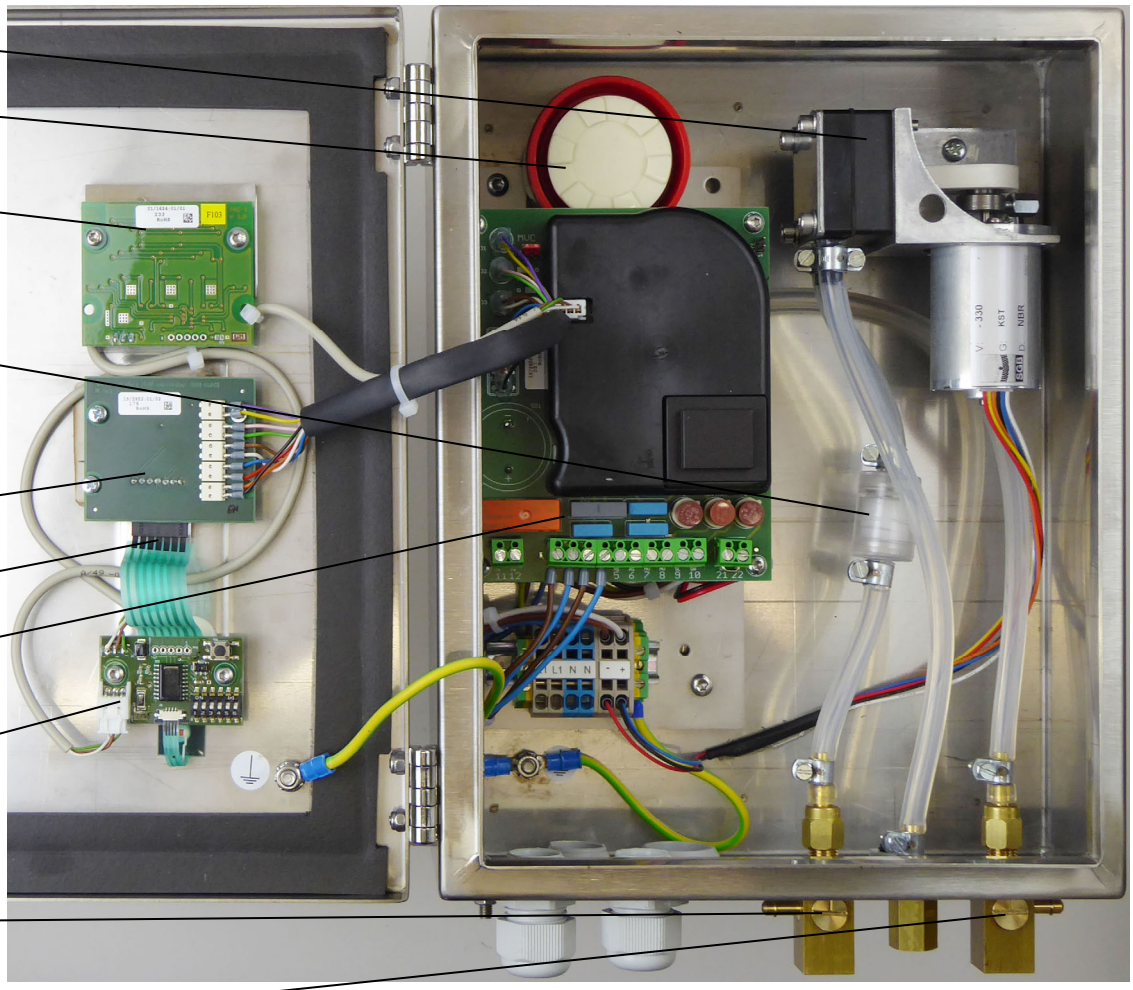
[Signed & Stamped]
Straube
Expert
TÜV Nord GmbH
Test Inspectorate for Leak Detection Devices

1. General

This appendix describes the deviations from the VLR documentation implemented in the PMSi version as of March 2022.

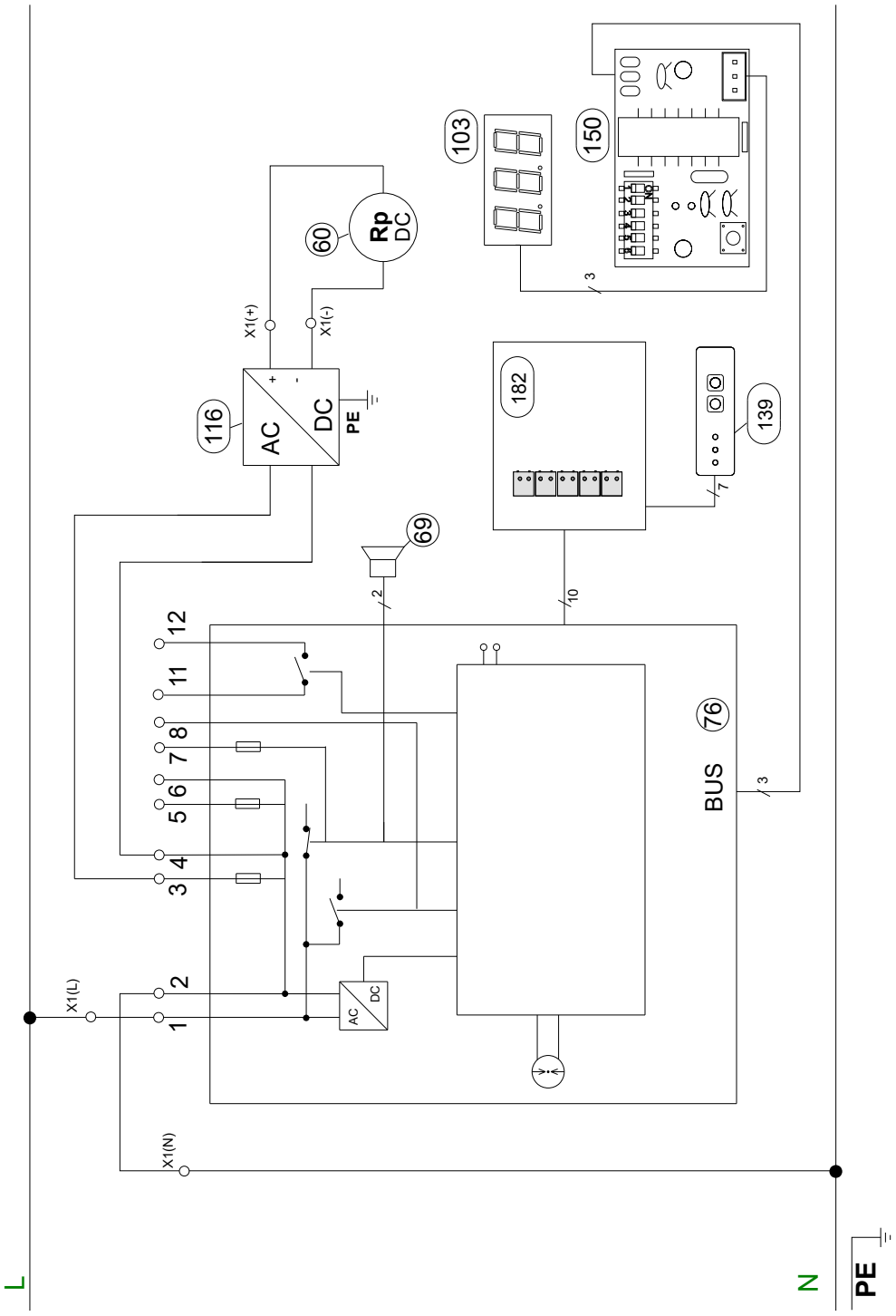
The explanations and provisions of the previous sections remain in effect.

2. Interior view and components



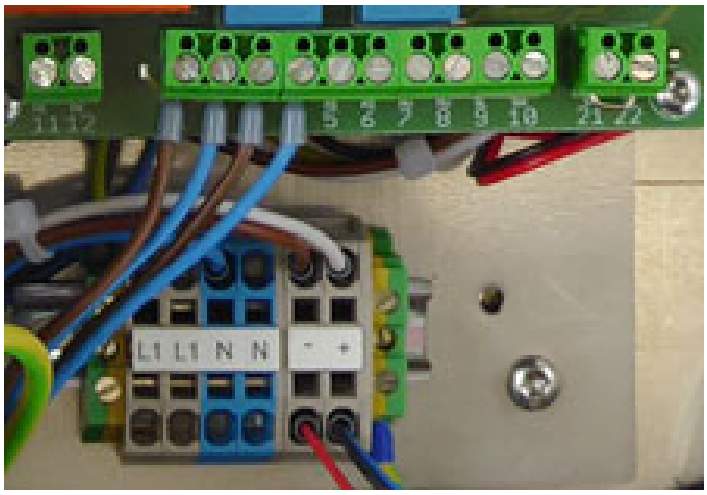
20	Three-way valve in the suction line
21	Three-way valve in the measuring line
60	Vacuum pump
61	Check valve with filter
69	Buzzer
75	Display board
76	Main board
139	Keypad
150	Maintenance display
182	Circuit board for keypad

3. Circuit diagram / Block diagram



60	Vacuum pump
61	Check valve with filter
69	Buzzer
76	Main board
103	Display
116	Power supply unit (24 V DC)
139	Keypad
150	Maintenance display
182	Circuit board for keypad

4. Terminal layout



L1 230 V (phase)

N 230 V (neutral)

3/4 Assigned (leak detector pump)

5/6 External signal, voltage present in the event of an alarm, is switched off via the “Sound off” button.

11/12 Potential-free contacts, opened in the event of an alarm or loss of power

Only in the version VLR **.. E** Available:

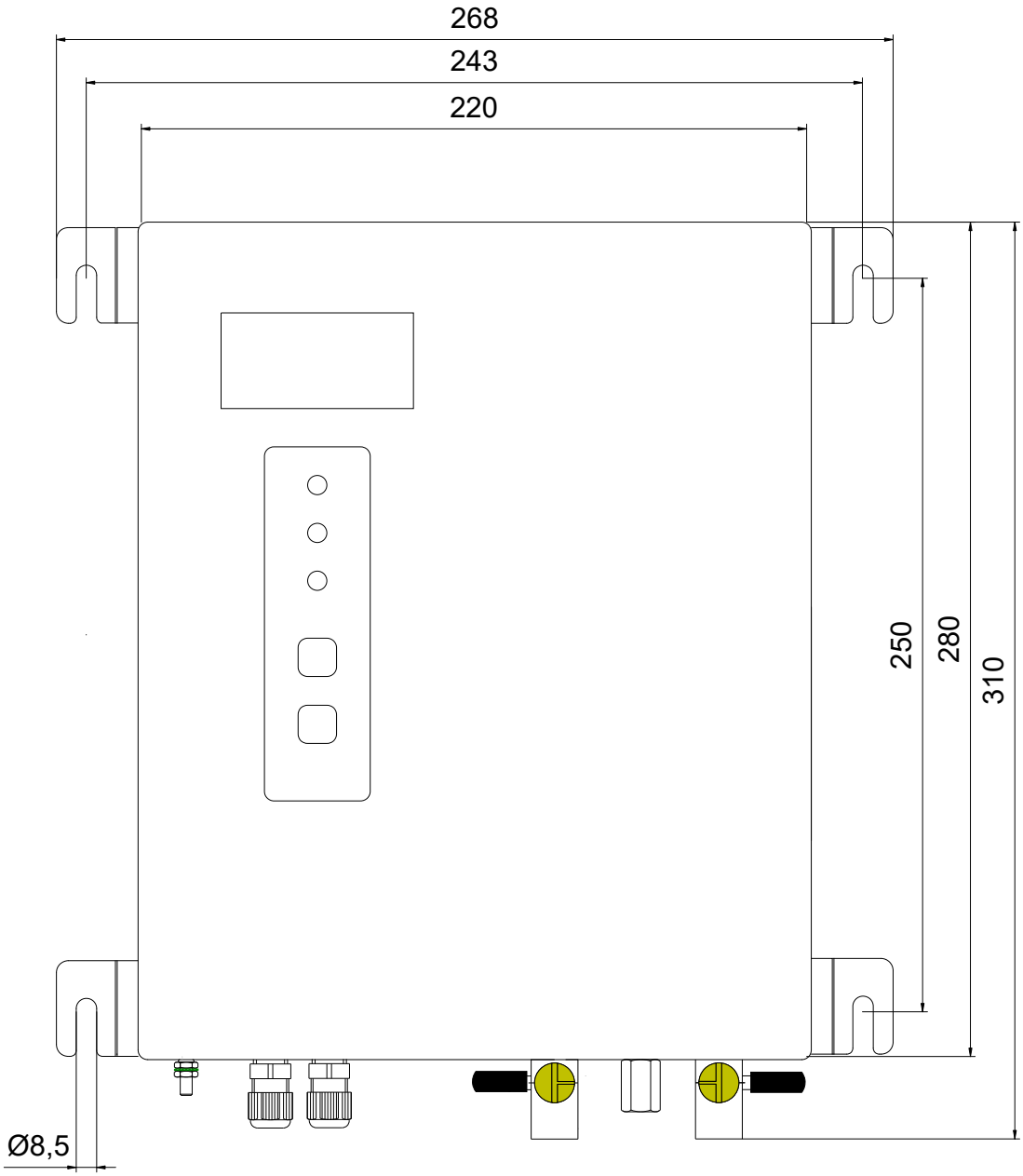
7/8 Connection of solenoid valve(s)

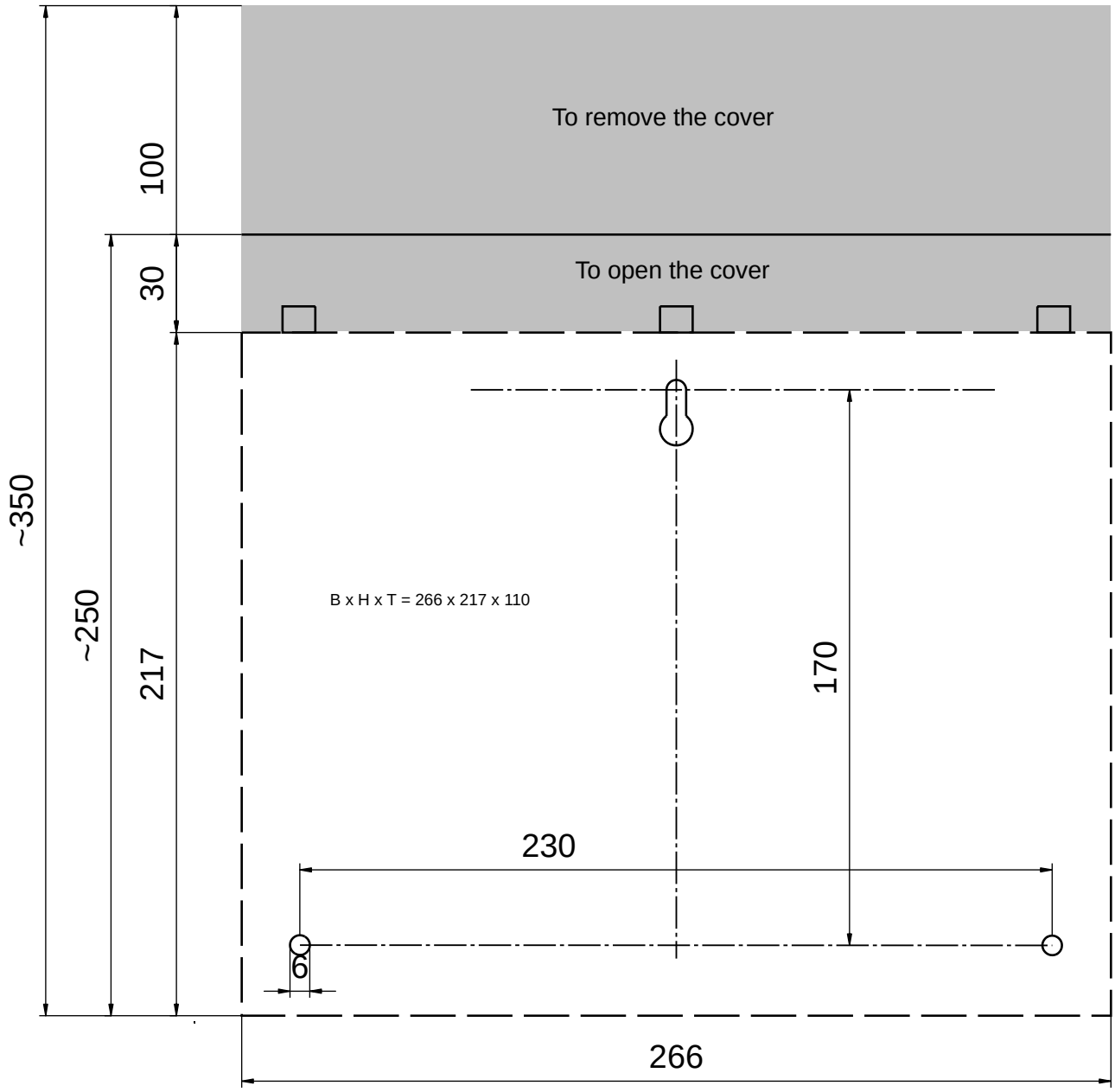
9/10 230 V voltage supply for a probe, if required

21/22 Connection of potential-free contacts for probe (contacts must open in the event of an alarm or loss of power) [1]
NOTE: On delivery, a jumper is inserted; it must be removed when connecting the probe!

[1] 9/10 Only for probe with its own voltage supply. NOT for contact switch, e.g., float switch.

5. Dimensions and Drilling Pattern

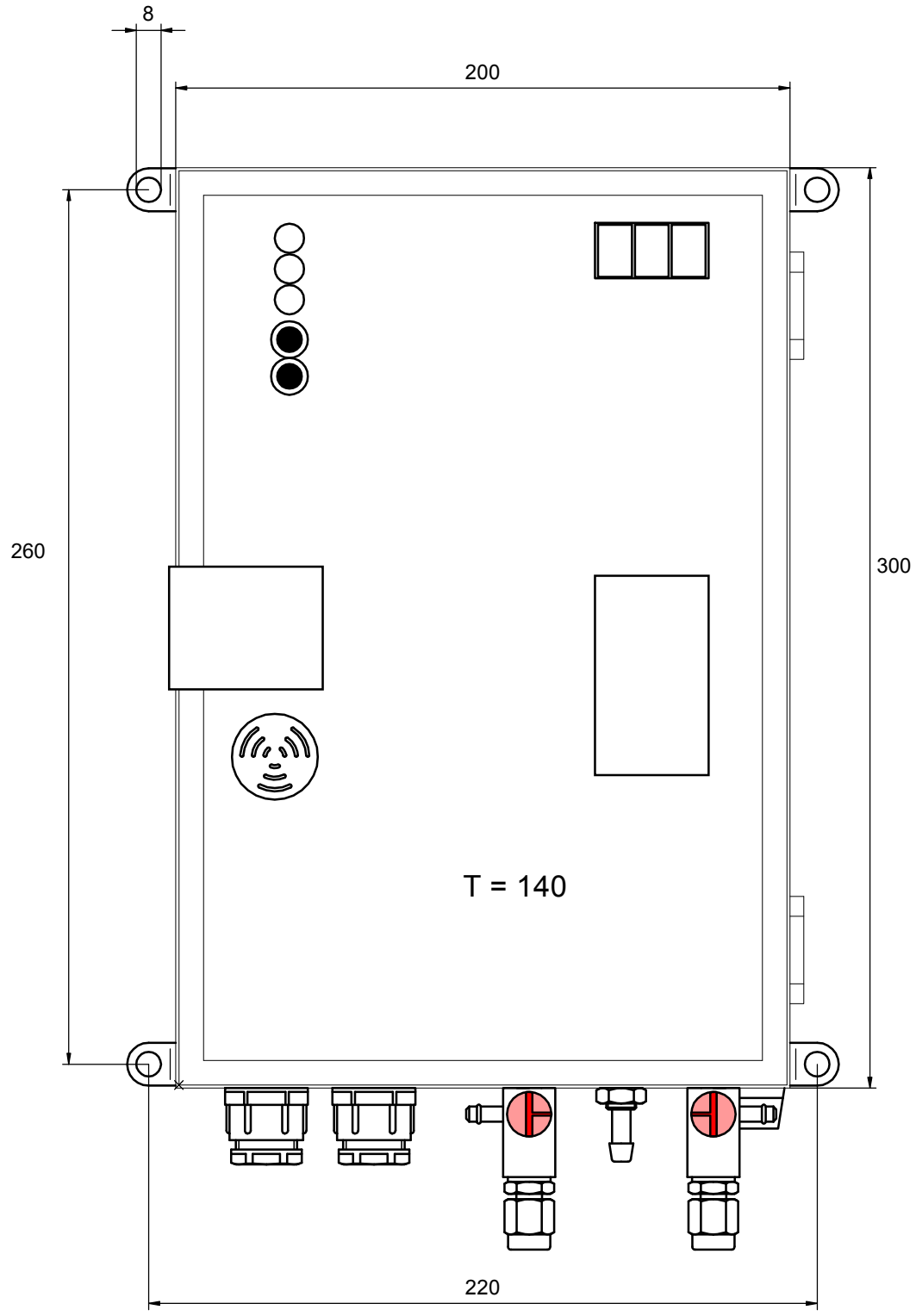




18-11-2003

SGB

Dimension / Drilling



28-06-2005

SGB

Dimension / Drilling

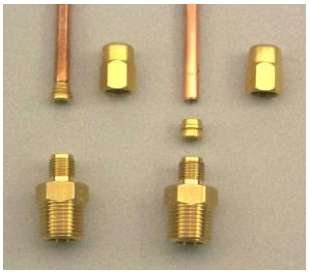
Work sheet: AB-820 500

Installation of screw connections

1 Flanged screw connection for flanged pipes

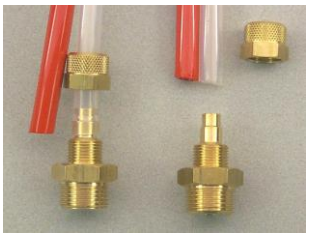
1. Oil o-rings
2. Place the intermediate ring loosely in the screw connection sleeve
3. Push the union nut and pressure ring over the pipe
4. Tighten the union nut by hand
5. Tighten the union nut until there is a noticeable increase in force
6. Final installation: Turn ¼ turn further

2 Clamping ring screw connection for plastic and metal pipes



1. Insert support sleeve (only plastic pipe) into the pipe end
2. Insert the pipe (with support sleeve) as far as it will go
3. Tighten nut of screw connection by hand to the resistance; then turn further 1¾ turns with the wrench
4. Release nut
5. Tighten nut by hand until stronger resistance
6. Final assembly of the screw connection by tightening ¼ turn

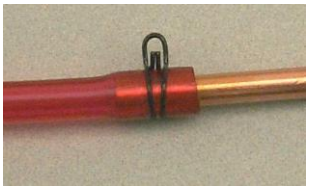
3 Quick-release screw connection for PA and PUR hose

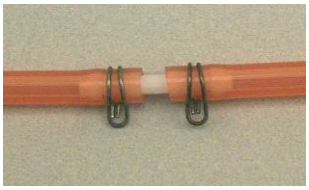


1. Cut the PA pipe to length at a right angle
2. Unfasten the union nut and push it over the end of the pipe
3. Push the pipe onto the nipple up to the start of the thread
4. Tighten the union nut by hand
5. Re-tighten the union nut with a screwdriver until there is a noticeable increase in force (approximately 1 to 2 turns)

NOT suitable for PE hose

4 Hose connections (4 and 6 mm nozzle for OVERPRESSURE)





1. Push the wire or screw clip over the hose
2. Push the hose onto the Cu pipe or hose nozzle (heat or moisten PVC hose as necessary). The hose must fit tightly all round
3. Wire clip: press together with pliers and push onto the connection point
   Screw clip: push onto the connection point and tighten with screw-driver
   Make sure that the clip is an even tight fit.

5 Hose connections (4 and 6 mm nozzle for NEGATIVE PRESSURE)

For negative pressure applications with which there is no overpressure on the connection lines even in case of a leak, as point 5 but without clips.

For negative pressure applications with which there may be overpressure, as point 5.

EU DECLARATION OF CONFORMITY

We,

SGB GmbH
Hofstr. 10
57076 Siegen, Germany,

hereby declare in sole responsibility that the leak detector

VL(R) ../..

comply with the essential requirements of the EU directives / regulations / UK statutory requirements listed below.

This declaration shall lose its validity if the device is modified without consulting us.

Number / short title	**Satisfied regulations**
2014/30/EU EMC Directive SI 2016 No. 1091	EN 61000-6-3:2007 / A1:2011 EN 61000-6-2:2006 EN 61000-3-2:2014 EN 61000-3-3:2013
2014/35/EU Low Voltage Directive SI 1989 No. 728	EN 60335-1:2012 / A11:2014 / A13:2017 / A1:2019 / A2:2019 / A14:2019 / A15:2020 EN 61010-1:2010 / A1:2019 EN 60730-1:2011
2014/68/EU Pressure Equipment Directive SI 2016 No. 1105	Pressure accessory without safety function in accordance with Art. 1 (2) letter f) iii)

Compliance is declared by

ppa. Martin Hücking
(Technical Director)

Declaration of Performance (DoP)

Number: **001 EU-BauPVO 2014**

1. Distinct identification code of the product type:

   Vacuum leak detector type VLR ..

2. Purpose of use:

   Class I vacuum leak detector for monitoring double-walled pipes

3. Manufacturer:

   SGB GmbH, Hofstr. 10, 57076 Siegen, Germany
   Tel.: +49 271 48964-0, E-Mail: sgb@sgb.de

4. Authorized representative:

   n/a

5. System for the evaluation and inspection of the reliability of performance:

   System 3

6. In the case of the declaration of performance, which applies to a building product, which is covered by a harmonized standard:

   Harmonized standard: EN 13160-1-2:2003
   Notified body: TÜV Nord Systems GmbH & Co.KG, CC Tankanlagen, Große Bahnstraße 31, 22525 Hamburg, Germany
   ID number of the notified test laboratory: 0045

7. Declared performance:

Essential features	Performance	Harmonized standard
Pressure switch point	Passed	EN 13160-2: 2003
Reliability	10,000 Cycles	
Pressure test	Passed	
Volume flow rate test in the alarm switch point	Passed	
Function and leak tightness of the leak detection system	Passed	
Temperature resistance	-20°C .. +60°C	

8. Signed for the manufacturer and in the name of the manufacturer by:

   Dipl.-Ing. M. Hücking, Director of Operations

   Siegen, 02/2023

Manufacturer's declaration of compliance

SGB
MVV TB
Anhang C 2.15.15
TÜV-NORD

Compliance with the "Muster-Verwaltungsvorschrift Technische Baubestimmungen" (sample administrative regulation technical building regulations) is hereby declared.

Dipl.-Ing. M. Hücking, Director of Operations

Siegen, 02/2023

Note:
By TÜV not certified translation of the German original version

TÜV NORD Systems GmbH & Co. KG
Manufacturer Certification Competence Center

Grosse Bahnstrasse 31, D-22525 Hamburg
Phone: 040 8557-0
Fax: 040 8557-2295
hamburg@tuev-nord.de
www.tuev-nord.de

Certificate no. 8117744963-2

Subject of the test:	**Underpressure leak detector type VL(R)..**
Client:	SGB GmbH Hofstrasse 10 57076 Siegen
Manufacturer:	SGB GmbH
Test type:	Type testing of an underpressure leak detector with alarm device, type VL(R) in accordance with EN 13160-2:2016. Classification of the leak detection system as per classifications in accordance with EN 13160-1:2016.
Test object	Leak detector with alarm device, type VLR 410, device no. 1912430780
Test period:	02/2020
Test location:	Accredited test laboratory at TÜV NORD Systems GmbH & Co. KG
Test results:	**In the type test, the underpressure leak detector of type VLR 410 met the essential characteristics of Table ZA.1 of EN 13160-2:2016 and corresponds to leak detection system class I in accordance with EN 13160-1:2016. The specifications in the technical description "Documentation 605 400" dated 02/2018 apply in relation to the field of application and installation.**

Note: The certificate is only valid in combination with the test report of TÜV NORD test laboratory PB 8117744963-2 dated February 19, 2020. Production inspection is not required in accordance with EN 13160-2:2016.

Hamburg, 2/21/2020

TÜV NORD Systems GmbH & Co. GK
Manufacturer Certification Competence Center

J. Straube

Warranty

Dear customer,

You have purchased a high-quality leak detector from our company.

All of our leak detectors undergo a 100% quality control examination. The type plate with the serial number is only affixed after all test criteria have been complied with.

We provide warranty for the leak detector for a period of **24 months** from the day of installation on site in accordance with our General Terms and Conditions. The maximum warranty period is 27 months from our date of sale.

Our warranty will be effective only if the customer submits to us the functional report or test report on initial putting into service, prepared by a recognised company specialised in water and water protection systems, including the serial number of the leak detector.

The warranty shall not apply in the event of faulty or improper installation or improper operation, or if modifications or repairs are carried out without the manufacturer's consent.

Our warranty does not include parts, which may be perished premature due to their consistence or category of usage (e.g., pumps, valves, gaskets, etc.). Furthermore, we are not liable for defects or corrosion damages caused by humid or inappropriate installation environments.

The warranty is also subject to our General Terms and Conditions of business (see these online at: https://sgb.de/en/contact/generaltermsandconditions).

In case of malfunction, please contact your local specialist company:

Stamp of the specialist company

Yours sincerely

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Hofstr. 10
57076 Siegen
Germany

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E sgb@sgb.de
I sgb.de | shop.sgb.de