WÖHLER

Operating Manual
Pressure Meter
Part 1

Wöhler M 603

Order No. 24811– 2023-01-18

The Measure of Technology

Contents

1 General information

1.1 Initial start-up

Fig. 1: Connector panel on the bottom of the unit

- If the unit cannot be switched on, activate the battery before using it for the first time by pushing the lock switch to the right with a pointed object.

1.2 Information about this operating manual

This operating manual enables you to work safely with the Wöhler M 603. Keep this manual in a safe place so you can refer to it when needed.

The Wöhler M 603 Pressure Meter is intended to be used solely by trained professionals and must only be used for its intended purpose.

Liability is excluded for any damages caused by failure to comply with this manual.

1.3 Notes

WARNING!
Failure to follow this warning can result in injury or death.

ATTENTION!
Failure to follow this information can result in permanent damage to the unit.

NOTE!
Important information

1.4 Intended use

This meter can be used to measure differential pressure, absolute pressure, flow speed, temperature, and humidity. It is designed for the following purposes in particular:

Stress testing and leak testing in accordance with the German Gas Installations Directive (TRGI 2018 - G 600)

Measurement of leakage rate in accordance with

the German Gas Installations Directive (TRGI 2018 - G 600)

Measurement of flow pressure, installation pressure, standing pressure, jet pressure

1.5 Components

Product	Items supplied
Wöhler M 603	Pressure meter
	Control report
	Measuring hose (1.7 m) with quick-release connector
	USB A / USB C cable
	USB power supply unit

1.6 Transportation

ATTENTION!
The unit can be damaged if it is not transported correctly.

To prevent damage to the unit, always transport it in the carrying case provided. The pressure connectors must be protected using the protective cap.

The case is included with the product and can also be bought separately.

1.7 Disposal

Electronic equipment does not belong in normal domestic waste and must be disposed of in accordance with the applicable regulations.

Defective batteries removed from the unit can be returned to our company or to public battery disposal and recycling points, or to places where new batteries are sold.

1.8 Manufacturer

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Wöhler-Platz 1
D-33181 Bad Wünnenberg
Tel.: +49 2953 73-100
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E-mail: info@woehler-international.com

2 Important information

WARNING!
Due to the compressibility of gases, for technical safety reasons the relevant accident prevention regulations (Germany: "*Arbeiten an Gasanlagen*" / Work on Gas Systems and Equipment) and the set of rules "*Technische Regeln für Gasinstallationen DVGW-TRGI*" (Technical Rules for Gas Installations issued by the German Association for Gas and Water) must be complied with during all pressure tests with air or inert gas.

3 Specification

3.1 Measured values

Differential pressure measurement (temperature-compensated piezo bridge)

Description	Reading
Measuring range	± 3,000 hPa
Permissible overload	± 3,200 hPa
Accuracy	< 3% of the measured value; in the range < ± 2 hPa better than ± 0.06 hPa
Resolution	0.01 Pa in the range from –210 hPa to +210 hPa, otherwise 0.1 hPa

Leakage amount (usability measurement)

Description	Reading
Measuring range	0.0 l/h to 10.0 l/h, tested up to 8 l/h
Accuracy	± 0.2 l/h in the range from 0 to 4 l/h, otherwise 5% of the measured value
Resolution	0.1 l/h

Internal temperature measurement

Description	Reading
Measuring range	-20°C to 60°C
Accuracy	< ± 1°C
Resolution	0.1°C

External temperature measurement

(optional, e.g. with a temperature clamp probe or surface temperature sensor)

Description	Reading
Measuring range	2 channels, -20.0°C to +800.0°C
Accuracy	< ± 1°C in the range from -20°C to 67°C, otherwise 1.5% of the measured value, in acc. with EN 50379-1
Resolution	0.1°C

Humidity measurement

Description	Reading
Measuring range	0% to 100% RH (relative humidity), non-condensing
Accuracy	± 5% RH
Resolution	0.1% RH
Response time	Up to 180 min.

Absolute pressure

Description	Reading
Measuring range	300 hPa to 1100 hPa
Accuracy	± 2 hPa
Resolution	0.1 hPa

3.2 Calculated values

Calculated parameter	Calculation
Pressure units	Conversion to hPa, Pa, mmH_2O, PSI, in_{wc}, bar, mbar in accordance with the generally accepted conversion guidelines.
Temperature units	Conversion from °C to °F in accordance with the generally accepted conversion guidelines.
Pipe volumes	Automatic from 0.0 to 1000.0 l

Calculated parameter	Calculation
Leakage rate	Fully-automatic (class V): 0.0 l/h to 10.0 l/h Gas leakage amount based on the measured pressure difference under simultaneous supply of a defined volume to maintain constant pressure in accordance with DVGW-TRGI worksheet G 600 in l/h.

3.3 Logger function

Description	Reading
Scope	9999 measurements, each with measured values for pressure and humidity, as well as three measured values for temperature (with external sensors connected) with freely selectable scanning intervals ranging from 1 second to 24 h can be saved in the internal memory.
USB data transmission	Online data, permanent, already during registration
Bluetooth data transmission	
Selectable scanning intervals	Intervals can be freely chosen in the range from 1 second to 24 h

☞ *IMPORTANT!*
For recordings that take a long time we recommend connecting the unit to the mains.

3.4 Technical data

Description	Reading
Display	5”
Power supply	Lithium-ion rechargeable battery 3.7 V, 6700 mAh, charged via USB Battery life: approx. 17 h (depending on the operating status and brightness of the display) Charging time: approx. 7 h
Battery charging cycles	After 500 charging cycles at least 70% of the battery's capacity should still be available.
Storage temperature	-20°C to + 50°C
Operating temperature	+5°C to 40°C to ensure accuracy is within the specified limits
Weight	700 g (fully equipped)
Dimensions	160 x 110 x 45 mm
Data exchange	USB C to the PC Bluetooth to Smart Connect sensors and to the PC Infrared to the printer

4 Layout and functions

4.1 Basic device

Fig. 2: Wöhler M 603 Pressure Meter

4.2 Connector panel

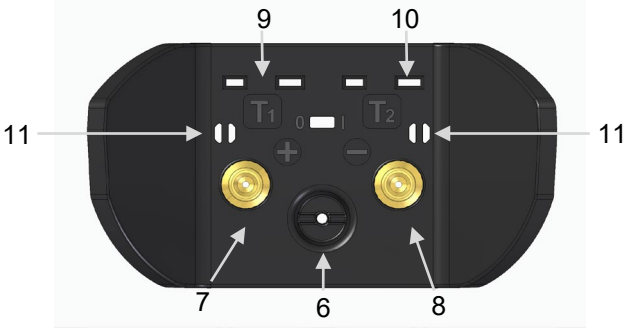


Fig. 3: Wöhler M 603 Pressure Meter: connector panel

Number	Function
1	ON/OFF button
2	USB C port / charging connection
3	Color display
4	Fastening lugs for carrying strap
5	Connector panel
6	Gas bellows connection (for usability testing with gas)
7 Pressure connection (+)	Main connection for measurement of gas leakage amount
8 Pressure connection (--)	Reference connection for differential pressure measurement
9, 10	Standard plug connection for temperature sensors NiCr-Ni (type “K”)
11	Diffusion openings for internal registration of humidity and temperature in the room. The integrated temperature measurement also serves for temperature compensation of the pressure sensor.

4.3 Protective covers

Fig. 4: Protective cover for pressure connections; the protective plugs are marked with an arrow

The display is protected with a removable perspex cover.

The pressure and temperature connections are protected with a removable protective cover. This contains two protective plugs (one of which is a replacement plug) for the USB C port.

- Insert a protective plug in the USB C port if no USB cable is connected.

4.4 Sensors and connection components

Fig. 5: Connection of the Wöhler M 603 for automatic usability measurement with filled gas bellows

Gas bellows connection for usability measurement with gas.

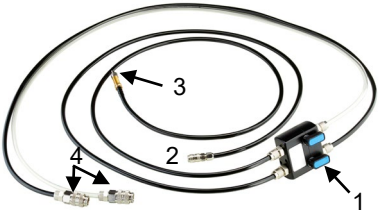
NOTE!
Refer to and comply with accident prevention regulation BGR 500, section 2.31 “Work on gas pipes.”

Fig. 6: Gas bellows connection

- Connect the gas bellows at the opening between the two pressure connections.

Fig. 7: Connection fittings for manual inflation

Connection fittings for performance of a stress test (manually)



Connections of the Wöhler leak tightness testing set for gas pipes:

1 Valve block

2 Connecting hose to the pressure meter

3 Connecting hose to the air pump

4 Connecting hose to the gas pipe

Fig. 8: Connections for differential pressure measurement on the gas fan burner

Connections for differential pressure measurement on the gas fan burner:

NOTE!
The following are required: a measuring hose with a
dia. of 3.5 mm / length of 1.5 m and 2x T-connectors with a dia. of 4 mm

- Split the measuring hose, and cut a 10 cm length of hose from each of the two halves.
- Push the longer hose sections onto the middle piece of the T-connector and each of the shorter hose sections onto the side of the relevant T-connector that is facing outwards.

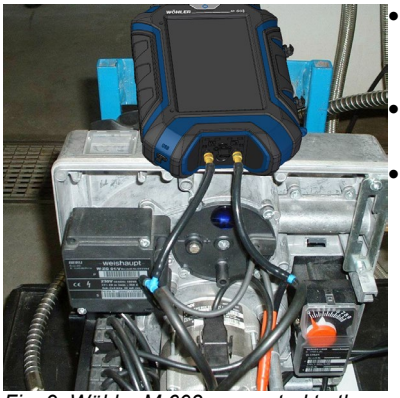


Fig. 9: Wöhler M 603 connected to the gas fan burner (for differential pressure measurement)

- Remove the connecting hoses from the burner and connect the free connection of the T-piece in each case.
- Then connect the 10 cm hose sections to the burner connection.
- Now switch on the Wöhler M 603 and read off the differential pressure in the live measurement (see part 2 of the operating manual).

Fig. 10: Connection of a temperature clamp probe

Connection of temperature sensors or temperature clamp probes:

Two temperature sensors or temperature clamp probes of type “K” can be connected at the same time.

Fig. 11: Connector panel with sockets for temperature connectors

Insert the connectors of the temperature clamp probes into the temperature sockets of the Wöhler M 603.

On the display, the temperature value measured via the left-hand socket is displayed as T1 and the temperature value measured via the right-hand socket as T2.

NOTE!
Any thermocouple of type “K” can be connected via the plug connections.

4.5 Touch display

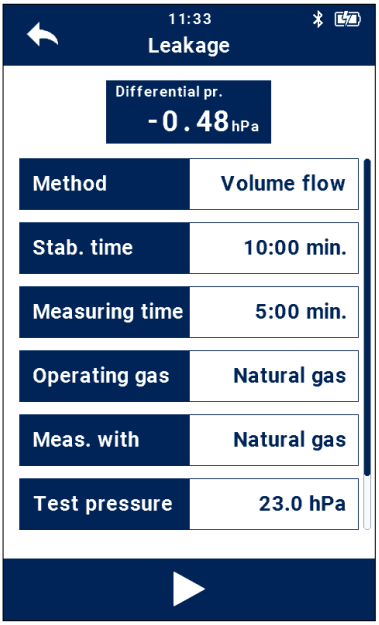


Fig. 12: Touch display of the Wöhler M 603 – example of active/inactive buttons and measurement displays

Active buttons have a blue or white background. Inactive buttons have a gray background.

If a bar can be seen on the right-hand edge of the display, this means that you can also scroll the display by dragging it up or down with your finger.

Header: Bluetooth status, time, battery status, measurement

Blue field "Differential pr.": Tap the field to zero the pressure sensor.

Blue buttons in the left-hand column: Tap the field to see information about the measuring requirements of DVGW TRGI.

White buttons in the right-hand column: Tap the button to select and/or make individual adjustments.

Play button, footer: Tap the play button to go to the next measuring step (in this example: "Start measurement").

Skip button, footer: If a skip button is displayed in the footer of a measurement screen, the user can tap the skip button to skip the current measuring step before it is finished, e.g. before the end of the stabilization phase.

NOTE!
In this case the measurement will not meet the requirements of the applicable standards.

Exit button, footer: Tap the exit button to end a measurement before the specified measuring time has elapsed.

Bluetooth symbols in the header

NOTE!
The Bluetooth function can be enabled and disabled in the settings menu – refer to part 2 of the operating manual.

Bluetooth disabled

Searching for Smart Connect sensor

Bluetooth connection established

Battery charge indicator in the header

Battery is fully charged

Battery is completely empty

Battery is being charged

5 Prior to use

5.1 Charging the battery

NOTE!
The battery is permanently installed in the device and cannot be removed by the operator.

When the unit is switched on, the battery charge status is indicated at the top right of the display. When the battery is fully charged, the battery icon is completely filled. The less the battery icon is filled, the lower the battery voltage. If the battery is nearly empty then the background lighting will be dimmed. In this case you should finish the measurement as quickly as possible.

- To charge the battery, connect the unit to the power supply using the USB C charging device supplied with it.
- The ON/OFF button flashes red during the charging process.

NOTE!
If the battery is completely empty it will take around 7 hours to charge. Measurements can be performed while charging is in progress. In this case the charging time will be extended.

Once the charging process has been completed the ON/OFF button lights up red continuously.

WARNING!
Risk of death due to electric shock!

Never touch the mains plug with wet hands.

Keep the power supply away from moisture.

Never pull out the power supply from the mains socket by the cable, as it could break.

Only operate the power supply if the voltage indicated on the type plate matches the voltage supplied from the mains socket.

Proceed as follows to charge the battery:

- Connect the corresponding power supply to

the unit via the USB C charging port (see Fig. 1) and then connect the power supply to the mains.

5.2 Leak tightness test

- Perform a leak tightness test in accordance with **part 2** of the operating manual, section 4.2.

6 Starting the unit

⚠ WARNING!
When performing measurements with the Wöhler Pressure Meter, always refer to the relevant accident prevention regulations (Germany: “Arbeiten an Gasanlagen” / Work on Gas Systems and Equipment) and the set of rules “Technische Regeln für Gasinstallationen DVGW-TRGI” (Technical Rules for Gas Installations issued by the German Association for Gas and Water).

! CAUTION!
Never leave the unit lying around unprotected.

To avoid damage, when performing measurements always

- hold the unit in your hands,

or

- use the magnets on the rear of the unit to attach it to the installation.

Switching on

Fig. 13: Switching ON/OFF

! CAUTION!
Whenever you use the unit, always start by visually inspecting it to make sure that everything is in proper working order.

- Switching the unit ON: Press and hold the ON/OFF button for 2 seconds.

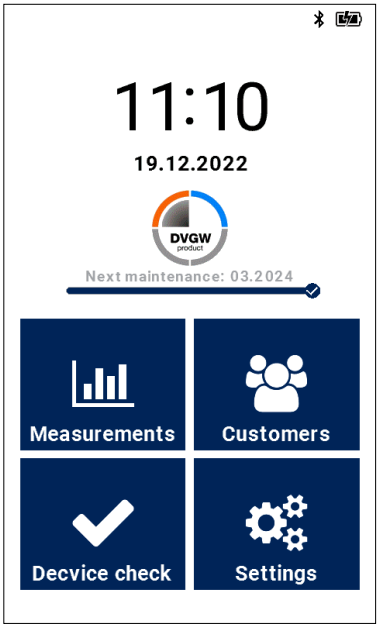


Fig. 14: Main menu, pressure sensor zeroing process complete

Once the unit has been switched on, the ON button lights up green.

The unit then performs a pressure zeroing process, which takes 10 seconds.

CAUTION!
During the zeroing process, it is important that no hose is connected and no differential pressure is applied, as the unit is stabilizing itself to determine its zero point.

After pressure zeroing, a maintenance notice appears above the menu tiles. If you do not want to see this message, you can disable it in the settings menu – see part 2 of the operating manual.

If the Bluetooth function is enabled and a switched-on Wöhler SC unit is within range, the Wöhler M 606 will automatically connect to the unit after being switched on.

4 main menus are available, which can be called up by tapping them with your finger.

7 Connecting the Wöhler M 603 to one or more Wöhler SC 660 units

So that the Wöhler M 603 unit can connect with the Wöhler SC 660, the Bluetooth function must be enabled in the Wöhler M 603 – refer to the device settings in part 2 of the operating manual. Once this function is enabled, after it is switched on the Wöhler M 603 will automatically search for “known” SC 660 units and will connect with them if available.

There are 3 ways to establish a new connection between a Wöhler SC 660 unit and the Wöhler M 603:

7.1 Connection via the settings menu

- In the settings menu select “Smart Connects.”
- Tap the + icon.

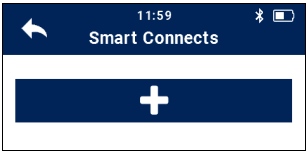


Fig. 15: Connection via Smart Connects

Fig. 16: Wöhler SC 660 connected

After searching briefly for available units, the Wöhler M 603 connects to the Wöhler SC 660 that is in range.

The connected device is displayed under Settings > Smart Connects.

- Tap “Disconnect” if you wish to break the connection.

7.2 Connection during live measurement

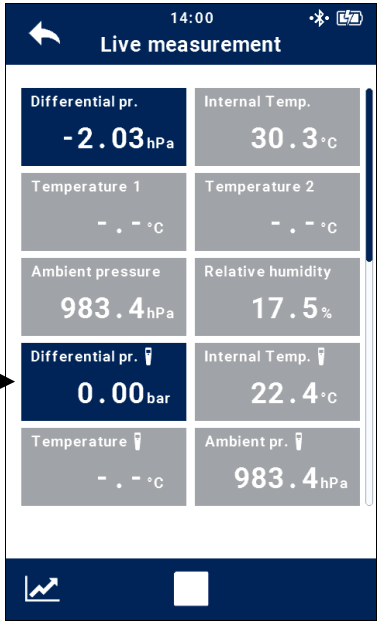


Fig. 17: Live measurement – the arrow indicates the field used to establish a connection to the Wöhler SC 660

- Check whether the Bluetooth icon is enabled in the header of the display on the Wöhler M 603.
- In the measurement menu, call up the menu item “Live measurement.”
- Tap the “Differential pr.” field (blue background) with the Smart Connect icon.

After searching briefly for available units, the Wöhler M 603 connects to the Wöhler SC 660 that is in range.

7.3 Connection prior to pressure testing with water

- Check whether the Bluetooth icon is enabled in the header of the display on the Wöhler M 603.
- In the measurement menu select Water > Pressure test (water).

After searching briefly for available units, the Wöhler M 603 connects to the Wöhler SC 660 that is in range.

8 Measurements on gas pipes

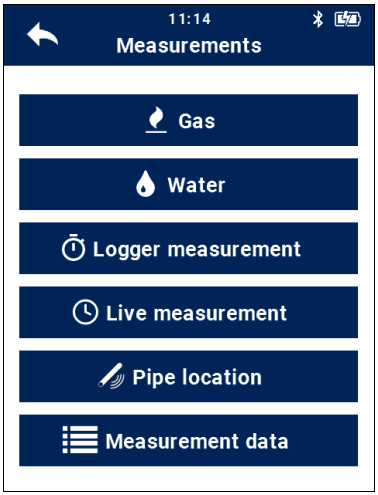


Fig. 18: Measurement menu

- In the measurement menu tap on “Gas”.

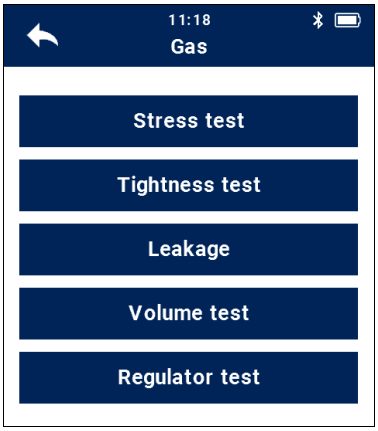


Fig. 19: Measurements on gas pipes

The Wöhler M 603 Pressure Meter can be used to carry out all tests on gas pipes in accordance with DVGW-TRGI 2018 and ÖVGW, as well as a measurement of the pipe volume and a test of the regulator.

NOTE!
If the subpoint “Evaluation in acc. with ÖVGW” is selected in the settings menu, then the menu item “Strength test” will be displayed on the Wöhler Pressure Meter instead of “Stress test” – see part 2 of the operating manual. To perform a strength test, proceed as described here under the point “Stress test.”

8.1 Stress test on gas pipes

Fig. 20: Leak tightness testing distributer, sealing plug, pump, individual shut-off

A stress test in accordance with DVGW-TRGI 2018 is used to test the strength of the connection after a new installation on pipes with an operating pressure of up to 100 hPa. Since the test pressure is considerably higher than the operating pressure, air must be fed to the gas pipe via an external compressed air connection (manual air pump or electric compressor). The test is performed without gas devices and without fittings/valves.

NOTE!
A compressed air pump (possibly an electric compressor), a distribution block, and connecting hoses are required for the stress test. We recommend using the Wöhler leak tightness testing set.

Fig. 21: Connection with the Wöhler leak tightness testing set for gas pipes for the stress test

- Seal the pipe and insert a suitable test plug.

WARNING!
Refer to and comply with accident prevention regulation BGR 500, section 2.31 “Work on gas pipes.”

- Connect the (+) pressure connection via a hose to the test plug.
- Connect a compressed air pump via the Wöhler leak tightness testing set.
- In the measurement menu select Gas > Stress test.

NOTE!
If you are using the Wöhler leak tightness testing set for gas pipes to make the necessary connections, refer to the operating manual for the Wöhler leak tightness testing set for gas pipes.

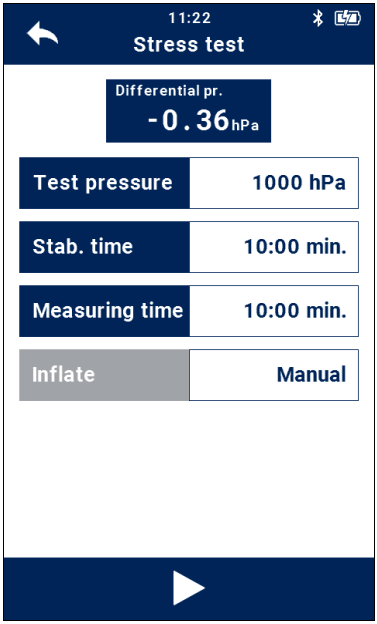


Fig. 22: Presets for the stress test

The currently measured differential pressure is now shown on the display.

- Tap the field “Differential pr.” if you wish to zero the pressure sensor.

The preset test pressure, stabilization time, and measuring time are now displayed.

The user can individually adjust the presets by tapping the blue or white fields. If the test pressure is below 300 hPa then the gas pipe can be inflated automatically via the pumps integrated in the unit.

NOTE!
We strongly recommend performing measurements using the default presets, as these comply with the requirements of the current TRGI technical rules.

- Tap the play button to start the measurement.

A prompt appears asking you to “Inflate to 1000 hPa.”

- Use the air pump to keep pumping air into the pipe until the Wöhler Pressure Meter indicates a pressure of at least 1000 hPa.

Once the preset test pressure of 1000 hPa is attained the stabilization time starts (stabilization time = 10 minutes in accordance with TRGI requirements).

NOTE!
The stabilization phase starts as soon as the test pressure reaches 1000 hPa. It ends automatically when the test pressure drops below 90% of the target value, i.e. 900 hPa. In this case the measurement cannot be performed and the connections will need to be checked as the first step.

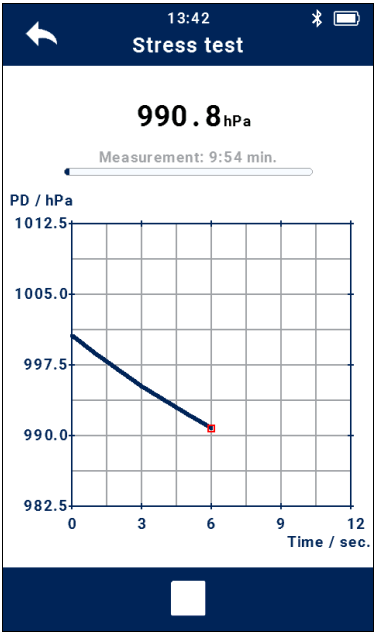


Fig. 23: Display of the currently measured pressure during the stress test

Afterwards the Wöhler Pressure Meter starts the measurement automatically. During the measurement (duration: 10 minutes) the pressure curve is displayed as a graphic on the display.

- Tap the exit button in the footer if you would like to stop the measurement early. The measurement will then no longer be compliant with the applicable standards.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

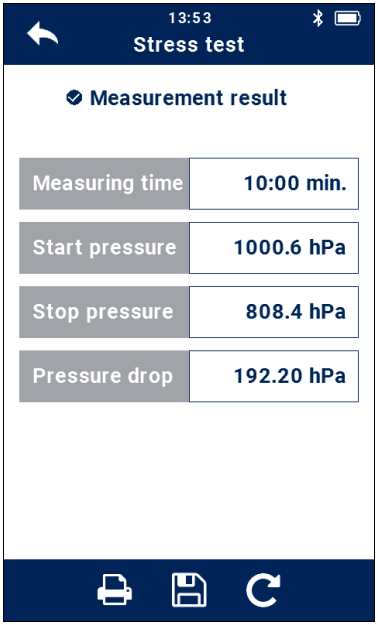


Fig. 24: Results display screen for the stress test

The test result is OK if the following conditions are satisfied:

- The start pressure is greater than or equal to the set test pressure.
- The measuring time was observed.
- The pressure drop during the measurement is less than 100 hPa (minimum resolution according to TRGI).

If the above requirements have not been met during the measurement, the message “Result: OK” is not displayed. The selection “OK” or “Not OK” appears in the report printout; it is up to the user to make the assessment.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to create the customer first – see part 2 of the operating manual.

In the measurement data menu of the customer (see part 2 of the operating manual) a padlock symbol now appears after the subpoint “Usability measurement / leak volume” to show that this measurement has already been performed.

8.2 Leak tightness test on gas pipes

Leak tightness testing in accordance with DVGW-TRGI 2018 is carried out after the stress test or any time changes are made to the gas pipe. The test is performed without gas devices and with the fittings/valves closed.

NOTE!
The regulator unit does not need to be included in the leak tightness test of the overall system (if required: insert a blank disk).

Fig. 25: Connections for leak tightness testing

- Seal the pipe and insert a suitable test plug. (E.g. single pipe meter cap).
- Switch on the Wöhler Pressure Meter.
- Wait for the unit to complete the zeroing phase.
- After the zeroing phase, connect the (+) pressure connection to the test connection using a hose and adapter.

WARNING!
Refer to and comply with accident prevention regulation BGR 500, section 2.31 “Work on gas pipes.”

- In the measurement menu select > Gas > Leak tightness test.

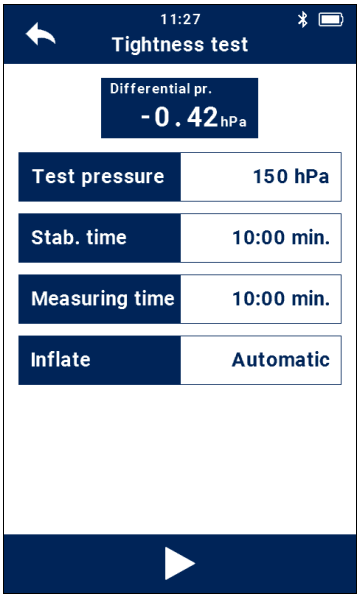


Fig. 26: Presets for a leak tightness test compliant with TRGI

The preset test pressure, stabilization time, and measuring time are now displayed.

- Tap the field “Differential pr.” if you wish to zero the pressure sensor.

The user can individually adjust all presets by tapping the white fields.

- Tap the blue fields Stab. time / Measuring time to view the default measuring requirements defined in DVGW TRGI G 600.
- Choose the defaults that correspond to the pipe volume under measurement.

NOTE!
We strongly recommend performing measurements using the default presets, as these comply with the requirements of the current TRGI technical rules.

Up to a test pressure of 300 hPa the Wöhler Pressure Meter can automatically inflate the gas pipe via the integrated pumps. If this is not required, the user can also pump in air manually.

NOTE!
If the leak tightness test is performed manually then connections should be made in the same way as for the stress test using the leak tightness testing set for gas pipes.

- Tap the play button in the footer to start the leak tightness test.
- Setting: “Inflate – Automatic.” The unit inflates up to the preset test pressure and the stabilization time starts. Afterwards the Wöhler Pressure Meter starts the measurement automatically.
- Setting: “Inflate – Manual.” The user uses an air pump to inflate up to the preset test pressure. This is followed by the stabilization time.

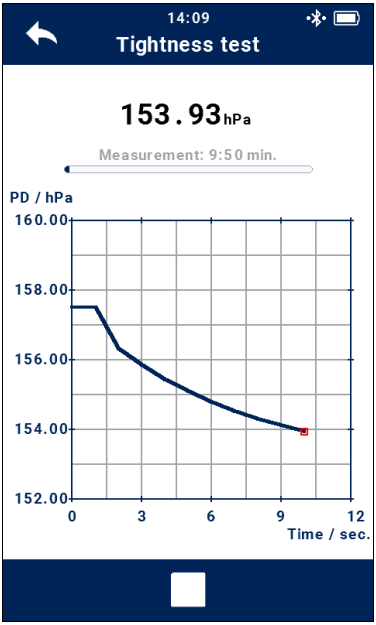


Fig. 27: Display of current measured values during the leak tightness test

After the end of the stabilization time the measurement starts automatically.

The current pressure values can be seen in a graphic. The remaining measuring time is displayed above the graphic.

- Only tap the exit button in the footer if you want to stop the measurement early. The measurement will then no longer meet the requirements of the applicable standards.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

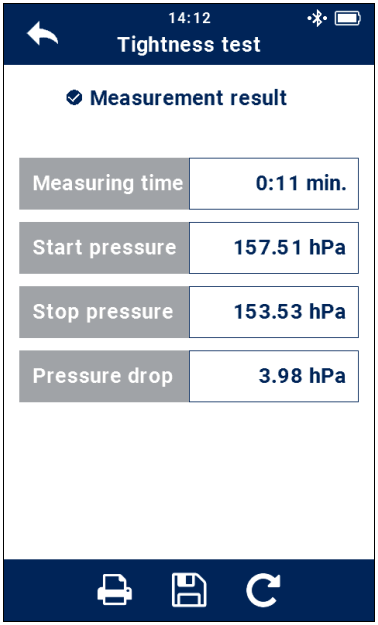


Fig. 28: Results of the leak tightness test

The measurement results are then displayed. The test result is OK if the following conditions are satisfied:

1. The start pressure is greater than or equal to the set test pressure.
2. The measuring time was observed.
3. The pressure drop during the measurement is less than 0.1 hPa (minimum resolution according to TRGI).

If the above requirements have not been met, the message “Result: OK” is not displayed. The selection “OK” or “Not OK” appears in the report printout; it is up to the user to make the assessment.

- Tap the print icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to create the customer first – see 2 of the operating manual.

In the measurement data menu of the customer (see part 2 of the operating manual) a padlock symbol now appears after the subpoint “Leak tightness test” to show that this measurement has already been performed.

8.3 Usability measurement on gas pipes

The usability measurement is used to check the usability of gas pipes that are already in operation.

With the pressure meter, it is possible to test the usability via fully automated determination of the leakage volume flow or by means of a manual measurement using the pressure drop method. Both measurements are compliant with the requirements of DVGW – G 5952.

☞ *NOTE!*
The Wöhler M 603 unit can be used to perform usability assessments that are compliant with both the German guidelines DVGW-TRGI G 600 and also the Austrian guidelines ÖVGW G K63. The user can select DVGW or ÖVGW under Settings > Device > Evaluation – the unit then automatically applies the measuring requirements of the chosen guideline and evaluates the results accordingly. The default setting is to perform the measurements in accordance with the DVGW requirements.

8.3.1 Usability testing, volume flow measurement

Usability testing, volume flow measurement, with gas bellows

Measuring principle

The Wöhler M 603 Pressure Meter determines the gas leakage amount by re-supplying a defined volume into the gas pipe to maintain constant pressure. (Class V, DVGW G 5952)

Constant pressure is maintained at operating pressure. The measuring device divides the total added volume by the measuring time to calculate the corresponding leakage rate. Here, the volume flow is re-supplied in intermittent steps by emptying a small pressure reservoir, which in turn is filled by two pumps. The volume flow is then released into the gas installation under testing in the form of a burst delivered via an electric valve.

If a filled gas bellows is connected to the inlet of the pump, the test can be performed with the operating gas.

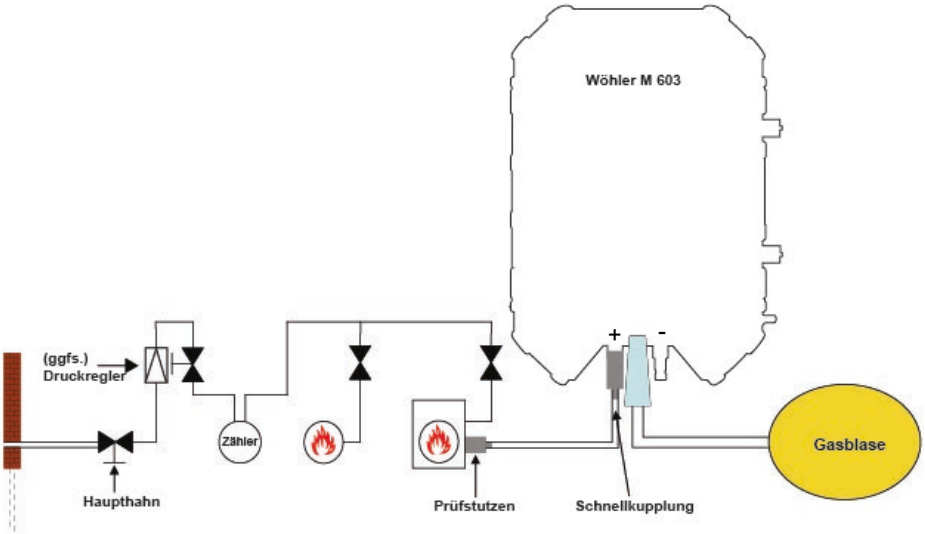


Fig. 29: Schematic representation of the connections for the usability testing (automatic testing with gas bellows)

Presets

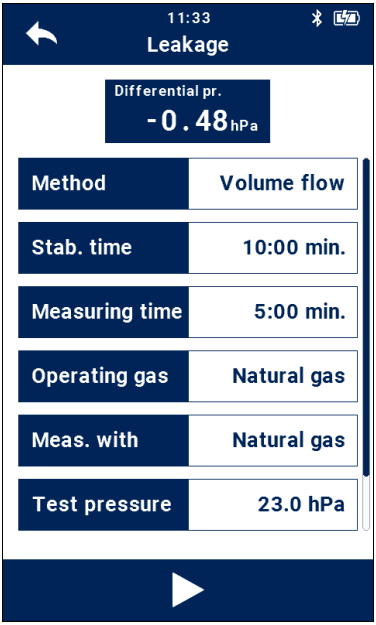


Fig. 30: Presets for usability measurement (automatic)

- Select **Measurements > Gas > Usability**.
- In the presets for the usability measurement select the following: **Method: Volume flow**

In addition, the stabilization time, measuring time, gas type, measuring medium, test pressure, and operating pressure are displayed. The user can change any of the presets by tapping the relevant fields.

- Select “Active.” In this case, after the start of the measurement the pressure meter will check whether the requirements are met. If they are, then the stabilization phase is shortened automatically.

Stabilization time / measuring time: The corresponding times from the selected standard (TRGI or ÖVGW) are set as defaults here.

NOTE!
*According to the TRGI guidelines, the measuring and stabilization times depend on the pipe volume. Information about the measuring and stabilization times in accordance with the requirements of DVGW G 5952 can be called up by tapping the blue fields **Stab. time** or **Measuring time**. These times must be taken into account during the measurement.*

- Tap “Stab. time.” An information table opens up based on DVGW G 5952.
- Select the pipe volume that corresponds to the measuring conditions and tap the corresponding stabilization time.

Shortened stabilization time: According to DVGW guideline G 5952, the stabilization time can be shortened if, during the adaptation time, the following stability criteria are met for a period of 2 minutes: Pressure fluctuations < 0.5 mbar; leakage amount fluctuations < 0.2 l/h. After the start of the measurement the Wöhler M 603 checks whether the requirements are met. If they are, then it shortens the stabilization time automatically.

- To disable automatic shortening of the stabilization time, tap Stab. time > Shortened.

- Proceed in the same way for the measuring time.

Operating gas: Natural gas, Air, Town gas, Propane, Butane, LPG, and Hydrogen.

- Here you can select the gas used to operate the system under testing.

NOTE!
If the pipe is filled with gas, then the measurement must be performed with the setting “Natural gas.”

Measurement with: Natural gas, Air, Town gas, Propane, Butane, LPG, and Hydrogen.

- Here you can select whether the test pressure is to be built up with air or with the operating gas.

The measurement can be performed either via the gas bellows directly with the operating gas or with air **after purging the pipe first**.

WARNING!
Before carrying out the measurement with air you must always purge the pipe with an inert gas first.

Test pressure / operating pressure: Default 23.0 hPa

Measurement

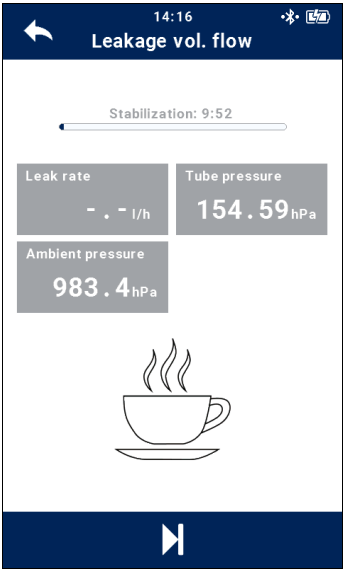


Fig. 31: Display during the stabilization phase

- Tap the play button in the footer to start the measurement.
- The unit pumps up to the preset test pressure and the stabilization time starts. After the end of the stabilization time the Wöhler M 603 automatically starts the usability measurement.

NOTE!
By tapping the skip button in the footer, the user can move to the next measuring step before the defined time has elapsed. In this case the requirements set out in TRGI-DVGW will not have been complied with.

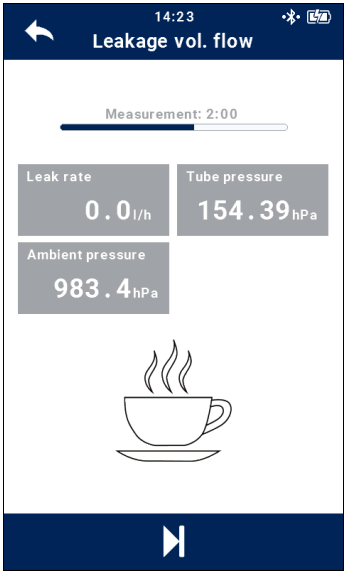


Fig. 32: Display during the measurement

- During the measurement, the current measurement results and the remaining measuring time are displayed.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

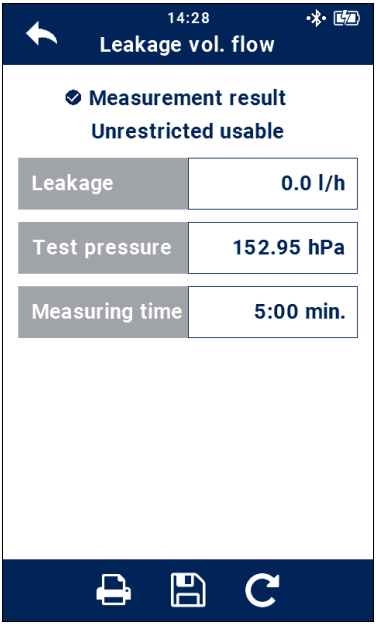


Fig. 33: Result: Leakage / volume flow

After the end of the measuring time the measurement results and an evaluation are displayed.

NOTE!

The displayed results have the following significance based on the requirements set out in the TRGI guidelines:

Unrestricted usability: Leakage rate 0 - 0.9 l/h

Reduced usability: Leakage rate 1.0 - 4.9 l/h

Not usable: Leakage rate ≥ 5.0 l/h

The displayed results have the following significance based on the requirements set out in the ÖVGW guidelines:

Unrestricted usability: Leakage rate ≤ 0.2 l/h

Time-limited usability: Leakage rate > 0.2 to ≤ 1 l/h

Reduced usability: Leakage rate > 1 to ≤ 5 l/h

Not usable: Leakage rate > 5 l/h

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to create the customer first – see part 2 of the operating manual.

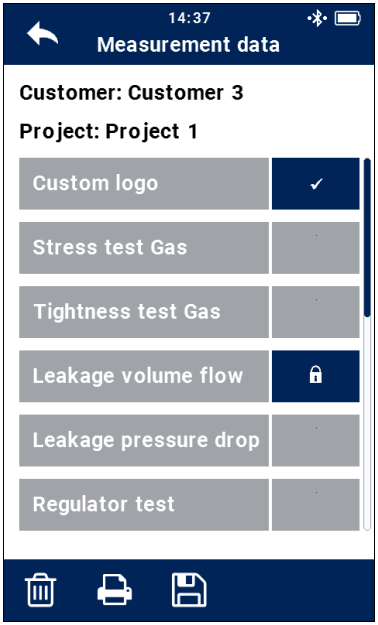


Fig. 34: Measurement data menu

In the measurement data menu of the customer (see part 2 of the operating manual) a tick symbol now appears after the subpoint “Usability measurement / volume flow” to show that this measurement has already been performed.

Usability testing, volume flow measurement, with direct gas infeed

On gas pipes with an operating pressure of up to 100 hPa, the Wöhler M 603 Pressure Meter can be used to measure the leakage rate with direct gas infeed, i.e. without connecting gas bellows. To ensure that the pressure meter can still pump gas instead of air into the gas pipe even with this type of testing, it is filled with gas via the in-house connection instead of via the gas bellows. The “measuring hose M 603 for flow measurement” is required for the connection.

NOTE!
The automatic leakage rate measurement with gas bellows is easier to use, as it is possible to perform measurements in both directions of the gas pipe from the measuring location. During measurements with the flow-through principle, only the pipe section from the gas meter to the consumer can be checked.

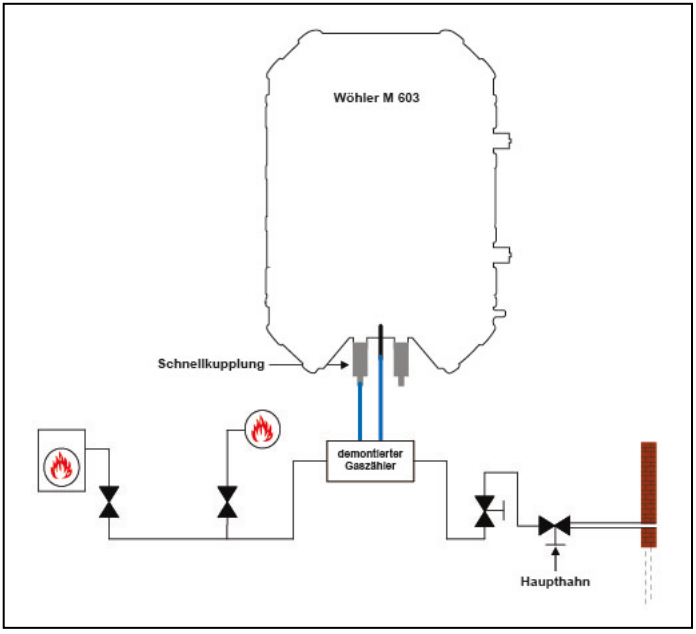


Fig. 35: Schematic representation of connections for usability testing (automatic, with direct gas infeed, without gas bellows)

Connection

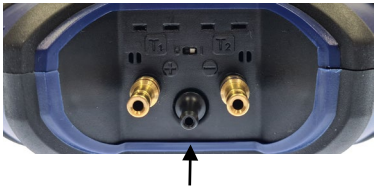


Fig. 36: Intake connector in the gas bellows connection

- Dismantle the gas meter and connect a single pipe meter cap or two plugs in its place (depending on the system).
- Switch on the Wöhler Pressure Meter.
- Wait for the unit to complete the zeroing phase.
- After the zeroing phase, connect the (+) pressure connection via a hose to the test plug.
- Connect the positive pressure connection of the Wöhler Pressure Meter (see Fig. 1) via the quick-release coupling and the measuring hose to the gas pipe.
- Connect the second measuring hose via the black intake connector (included in the scope of delivery of the “measuring hose for flow measurement”) to the gas bellows connection of the Wöhler Pressure Meter (see Fig. 1).
- In the measurement menu select **Gas > Usability > Volume flow mode**

The pressure meter now sucks gas from the gas pipe into the internal pump in the unit, and during the usability measurement it pumps this gas into the pipe section that is to be tested.

Measurement

- Next perform the measurement as described at the start of this section.

8.3.2 Usability testing, pressure drop method

Using the Wöhler M 603, it is also possible to perform the usability measurement manually using the pressure drop method.

Measuring principle of the pressure drop method

The calculation of the leakage rate in a manual process using the pressure drop method is performed automatically using the two equations below. As a result, it complies with the approach outlined in DVGW-TRGI worksheet G 600:

$$\dot{V}_B \doteq \dot{V}_L \cdot \frac{p_{B\max}}{p_{Start}} \cdot f$$

$$\dot{V}_L = \frac{V_{Rohr}}{t_{mess}} \cdot \left(\frac{p_{akt} + p_{start}}{p_{akt} + p_{stopp}} - 1 \right)$$

$\dot{V}_B$	Gas leakage amount (flow) in the operating state in l/h
$\dot{V}_L$	Air leakage amount (flow) at test pressure
$p_{B\max}$	Max. operating pressure of the gas locally
p_{Start}	Test pressure at the start of the measurement
p_{Stopp}	Test pressure at the end of the measurement
p_{akt}	Absolute air pressure, as measured by the integrated absolute pressure sensor
f	Absolute viscosity of air / absolute viscosity of the gas; this is automatically selected after selection of the gas
t_{mess}	Measuring time in hours (basic value 1 min)
V_{Rohr}	Volume of the test section in liters; this is to be determined via the “Volume” menu item

Performance of the measurement

Fig. 37: Connections for manual usability testing

NOTE!
If the user wishes to perform inflation manually, he/she will require a compressed air pump (possibly an electric compressor), the Wöhler valve block from the leak tightness testing set, and connecting hoses.

- Seal the pipe and insert a suitable test plug.

WARNING!
Refer to and comply with accident prevention regulation UVV BGF D2.

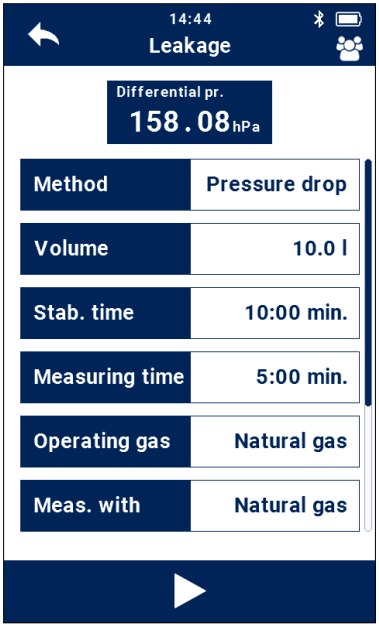


Fig. 38: Presets, manual usability testing, pressure drop method

- In the measurement menu select **Gas > Usability testing**.
- Select “Method: Pressure drop”

Volume: Here you need to enter the volume of the pipe section being measured.

- If you know the pipe volume, tap the white field and enter the volume.

Alternatively:

- Tap the blue field “Volume.” A measurement menu for determining the volume opens up.
- Perform the measurement and confirm with the tick.

The determined pipe volume is now automatically applied.

Stabilization time / measuring time: The corresponding times from the selected standard (TRGI or ÖVGW) are set as defaults here.

NOTE!
According to the TRGI guidelines, the measuring and stabilization times depend on the pipe volume. Information about the measuring and stabilization times based on the requirements of DVGW G 5952 can be called up by tapping the blue fields

***Stab. time** or **Measuring time**. These times must be taken into account during the measurement.*

- Tap Stab. time. An information table opens up based on DVGW G 5952.

Shortened: According to DVGW guideline G 5952, the stabilization time can be shortened if, during the adaptation time, the following stability criteria are met for a period of 2 minutes: Pressure fluctuations < 0.5 mbar; leakage amount fluctuations < 0.2 l/h.

- Select “Active.” In this case, after the start of the measurement the pressure meter will check whether the requirements are met. If they are, then it shortens the stabilization time automatically.
- Select the pipe volume that corresponds to the measuring conditions and tap the corresponding stabilization time.
- Proceed in the same way for the measuring time.

Type of gas: Natural gas, Air, Town gas, Propane, Butane, LPG, and Hydrogen.

- Select the gas used to operate the system.

The user can also individually adjust all presets by tapping the white fields.

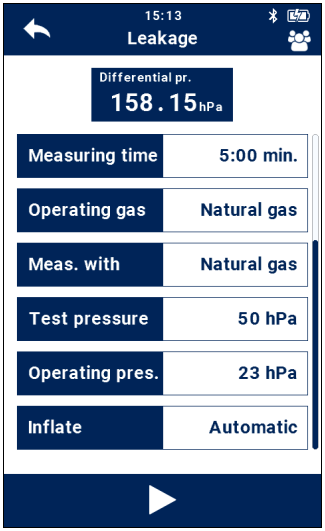


Fig. 39: Presets for usability measurement

> *NOTE!*
> In accordance with the TRGI guidelines, the test pressure depends on the operating pressure.

- Tap the test pressure or operating pressure.

An information table opens up containing the TRGI requirements.

- Select the correct test pressure for your measurement.
- Proceed in the same way for the stabilization time and for the measuring time.
- If required, tap the differential pressure to zero the pressure sensor.
-

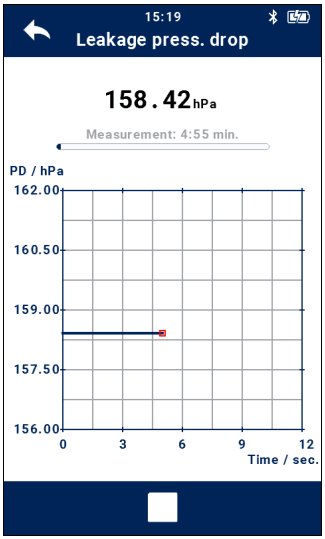


Fig. 40: Display of the pressure drop during the measurement

- Tap the play button to start the measurement.

During the measurement, the display shows a graphic with the current measurement results and the remaining measuring time.

- Only tap the exit button in the footer if you want to stop the measurement before the end of the measuring time. The measurement will then no longer be compliant with the applicable standards.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

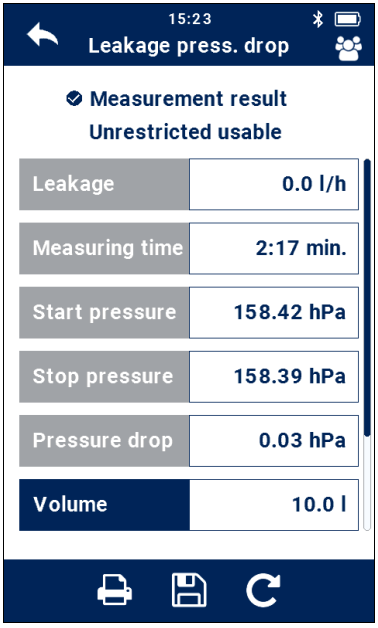


Fig. 41: Results display for usability testing (manual)

After the end of the measuring time the measurement results and an evaluation are displayed.

NOTE!
The displayed results have the following significance based on the requirements set out in the TRGI guidelines:

Unrestricted usability: Leakage rate 0 - 0.9 l/h

Reduced usability: Leakage rate 1.0 - 4.9 l/h

Not usable: Leakage rate ≥ 5.0 l/h

The displayed results have the following significance based on the requirements set out in the ÖVGW guidelines:

Usable: Leakage rate ≤ 0.2 l/h

Time-limited usability: Leakage rate > 0.2 to ≤ 1 l/h

Reduced usability: Leakage rate > 1 to ≤ 5 l/h

Not usable: Leakage rate > 5 l/h

If necessary, the tester can still change the pipe volume, the operating gas, and the test medium in the results display. The measuring device then recalculates the leakage rate.

- To make a change, tap the field with a blue background.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

- Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to have created the customer first – see part 2 of the operating manual.

8.4 Pipe volume measurement

8.4.1 Pipe volume measurement, automatic

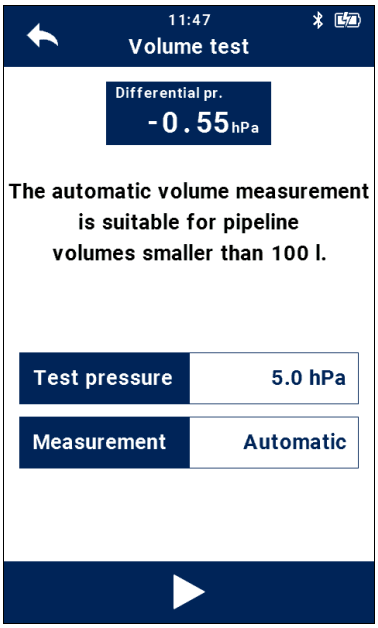


Fig. 42: Presets for determination of the pipe volume

- In the measurement menu select **Gas > Volume test**
- Select “Measurement: Automatic.”

The automatic volume measurement function can be used to determine the volume of pipes up to 100 l.

NOTE!
With larger pipe volumes from 100 l to 1000 l a manual volume flow measurement needs to be performed.

NOTE!
The test pressure can be individually adjusted. A test pressure of 5 hPa is recommended.

- Tap the play button in the footer to start the measurement.
- The unit will then inflate up to the preset test pressure.

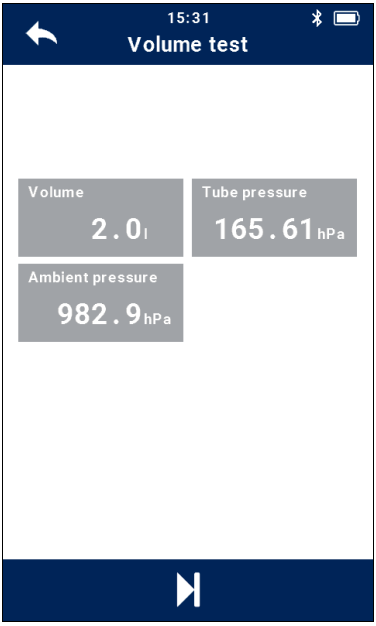


Fig. 43: Volume test

Once the test pressure has been reached, the volume, absolute pressure, and pipe pressure are displayed as results.

- When the values have stabilized, tap the play button in the footer to go to the final results.

8.4.2 Pipe volume measurement, manual

At pipe volumes from 100 l to a maximum of 1000 l a manual volume measurement needs to be performed.

Measuring principle of the manual pipe volume measurement

If a known sample volume V_{Sample} is taken from a pipe system using a suction pump (plunger or soot test pump), the resulting pressure change Δp can be used to determine the total volume V_{Pipe}.

The volume V_{Pipe} being searched for is determined based on the Boyle-Mariotte law using the following equation:

$$V_{Rohr} = V_{Probe} \cdot \left(\frac{p_{akt}}{\Delta p} - 1 \right) \Big|_{\text{Temp. = const.}}$$

V_{Pipe}	Pipe volume to be determined
V_{Sample}	Sample volume
Δp	Max. pressure difference resulting from extraction of the sample
p_{Curr}	Absolute air pressure, as measured by

	the internal air pressure sensor

The pressure difference Δp is measured. In order to obtain a sufficiently accurate measuring result, the measured pressure difference Δp should be at least 200 Pa. It follows from this that the sample volume V_{Sample} extracted with the soot test pump should be at least 1/500 of the pipe volume.

☞ *NOTE!*
A higher pressure will lead to longer stabilization times during temperature equalization and will increase the influence of any leaks that are present.

Guide values for selection of the volume to be extracted with the suction pump

Pump volume	Max. pipe volume
150 ml (1 stroke with plunger)	80 l
489 ml (3 strokes with soot test pump)	240 l

Performance of the manual pipe volume measurement

Fig. 44: Manual volume measurement with a Wöhler M 603 and a soot test pump

NOTE!
A Wöhler soot test pump or a plunger-type pump is required for the manual volume measurement. The soot test pump has a volume of 163 ml/stroke.

- Seal the pipe and insert a suitable test plug.

WARNING!
Refer to and comply with accident prevention regulation UVV BGF D2.

- Switch on the Wöhler Pressure Meter and then connect the (+) pressure connection via a hose to the test plug.
- Connect a soot test pump via a second hose and a single pipe meter cap.

NOTE!
If you are using the Wöhler leak tightness testing set for gas pipes, when making the connections please refer to the operating manual for the Wöhler leak tightness testing set for gas pipes

- Select “Volume” in the gas menu and tap “OK” to confirm.

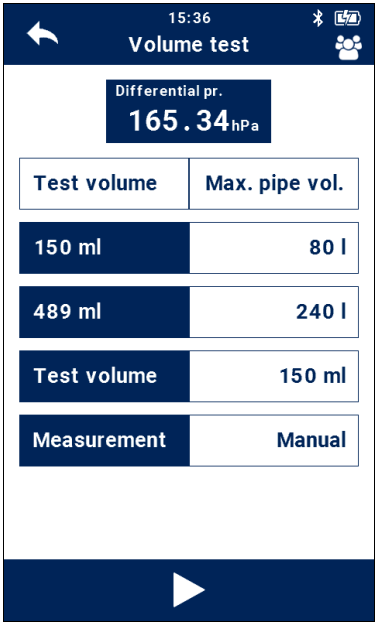


Fig. 45: Determination of the pipe volume, manual

- Select **Measurement: Manual.**
- Estimate the pipe volume and enter a suitable sample volume.
- Tap the play button in the footer to start the measurement.

Fig. 46: Determination of the pipe volume, manual

You will then be prompted to extract the preset sample volume.

- Remove the sample volume using the soot test pump.

The measurement will now start automatically.

- As soon as the value V has stabilized, tap the play button to go to the results display.

8.5 Regulator test

Fig. 47: Flexible adapter screwed onto the gas regulator

8.6 Regulator test

Under the menu item “Regulator test” you can check the functions of a gas pressure regulator (safety shut-off valve).

The rest pressure is measured with the gas consumer switched off and should be constant. If it rises or falls during the measurement then the regulator is defective.

The flow pressure is measured with the consumer running. It should only be marginally lower than the rest pressure. If the flow pressure drops significantly, the regulator is either defective or underdimensioned.

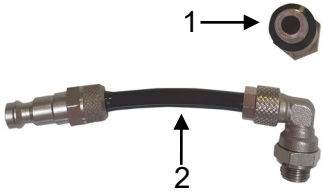


Fig. 48: Regulator test adapter with thread extension (1) and flexible adapter (2)

- Switch off the gas consumers.
- Close the inlet valve (main shut-off valve).
- Close the outlet valve at the gas meter.
- Connect the Wöhler M 603 via the flexible adapter with the gas regulator . (Depending on the mounting conditions, screw the threaded extension onto the gas regulator or onto the flexible adapter.)
- Slowly open the inlet and outlet valves so that the gas flows into the regulator.

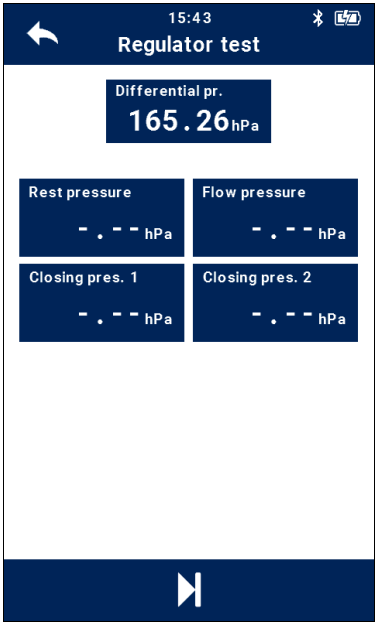


Fig. 49: Regulator test with measured rest pressure

- Tap the buttons for rest pressure and flow pressure to apply the relevant measured value in each case.

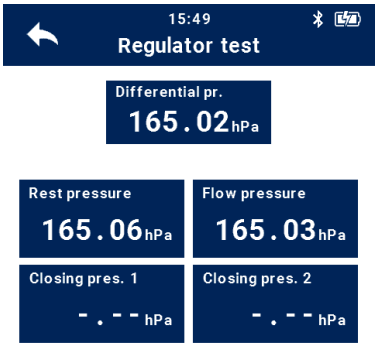


Fig. 50: Regulator test with measured rest pressure and flow pressure

The closing pressure of a safety shut-off valve is checked by increasing the pressure on the low pressure side of the safety shut-off valve until the valve is tripped.

- Tap the field “Closing pres. 1”

The pressure is now applied via the integrated pumps of the Wöhler Pressure Meter. The pump output can be adjusted via the +/- buttons.

- Tap the white square in the footer as soon as you can clearly hear the valve close.

The tripping pressure obtained in this way is applied.

- Proceed in the same way to measure closing pressure 2.

After the measurement has been performed the skip button is displayed in the footer.

- Tap the skip button to go to the results display screen.

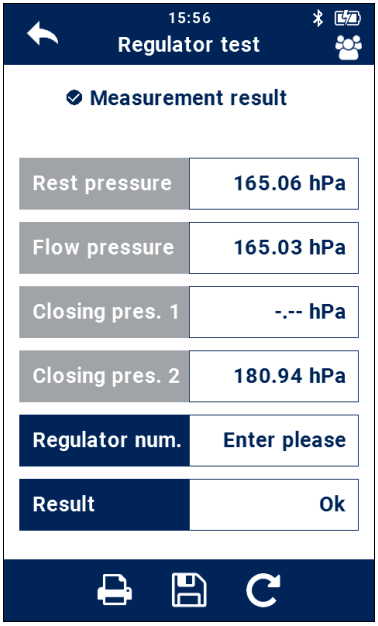


Fig. 51: Results display for the regulator test

- In the results display, enter the regulator number shown on the regulator.
- Select whether the result is “OK” or “Not OK.” To do this, tap the white field next to “Result”.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.

9 Measurements on water pipes

The tests can be carried out on the complete length of the pipe or one after the other on sections of the pipe.

WARNING!
*Due to the compressibility of gases, for physical and technical safety reasons the relevant accident prevention regulations (Germany: "Arbeiten an Gasanlagen" / Work on Gas Systems and Equipment) and the set of rules "Technische Regeln für Gasinstallationen DVGW-TRGI" (Technical Rules for Gas Installations issued by the German Association for Gas and Water) must be complied with when performing pressure tests with air. **

** ZVSHK: Leak tightness tests on drinking water installations. St. Augustin 2017*

9.1 Leak tightness tests performed with air on drinking water pipes

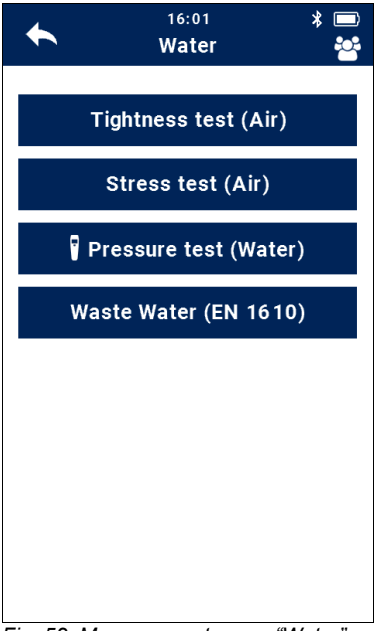


Fig. 52: Measurement menu "Water"

The leak tightness test should be performed **with air** if:

- there will be a longer period of non-use after the leak tightness test before commissioning is performed, particularly if average ambient temperatures > 25°C are to be expected, in order to prevent the risk of potential bacterial growth,
- the pipeline cannot remain completely filled after the leak tightness test until commissioning is performed, e.g. due to periods of frost,
- the corrosion resistance of a material in a partially emptied pipe is endangered.

(ZVSHK: Information sheet – Leak tightness tests on drinking water installations. St. Augustin 2017)

9.1.1 Preparations for the measurement

Fig. 53: Inflating the water pipe with air; the leak tightness test fittings are connected via stepped high-pressure plugs to the water pipe

The leak tightness test is performed with a test pressure of 150 hPa before the stress test.

WARNING!
When testing with air, never apply a test pressure > 0.3 MPa (3 bar) to the pipeline. Otherwise poor pipe connections could slide apart.

- Prior to the measurement, disconnect fittings or pressure vessels from the pipeline if their volume could potentially impact on the safety and measuring accuracy of the measurement.
- Seal all pipe openings with metal plugs, blank disks, or blind flanges.

NOTE!
Closed shut-off fittings do not count as leak-tight closures.

- Install sufficient breather valves to release the test pressure in positions where the air can be safely discharged.
- Use a suitable test connection (e.g. stepped high-pressure plug).

- Switch on the Wöhler Pressure Meter.
- Wait for the unit to complete the zeroing phase.
- After the zeroing phase, connect the (+) pressure connection to the test connection using a hose and adapter.
- In the measurement menu select: Water > Leak tightness test air.

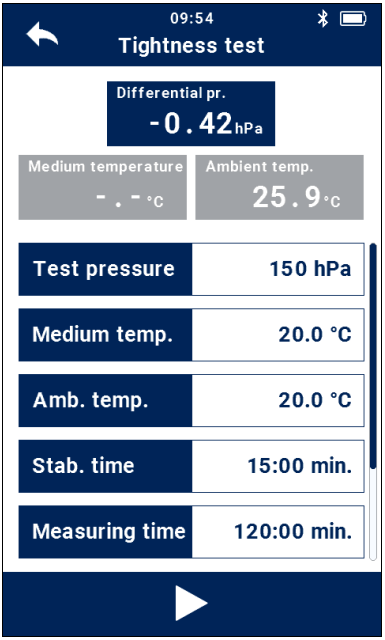


Fig. 54: Presets for leak tightness tests on water pipes using air

.

- Tap the field “Differential pr.” if you wish to zero the pressure sensor.

If the ambient temperature and water temperature are also to be stated in the test report, proceed as follows:

- Connect a temperature clamp probe to temperature connection T1 and measure the temperature of the medium.
- Tap the blue field “Medium temp.”

The medium temperature is now applied.

- Connect a temperature sensor of type “K” to temperature connection T2 and measure the ambient temperature.
- Tap the blue field “Amb. temp.”

The ambient temperature is now applied.

The user can individually adjust all further presets by tapping the white or blue fields.

- Tap the blue field “Measuring time” to view the measuring requirements from DIN EN 806-4.
- Choose the defaults that correspond to the pipe volume under measurement.

NOTE!
Up to a test pressure of 300 hPa the Wöhler Pressure Meter can automatically inflate the gas pipe via the integrated pumps. If this is not required, the user can also pump in air manually.

If a hand pump is to be used for inflation, make the connections using the leak tightness testing set for gas pipes.

- Tap the play button in the footer to start the leak tightness test.
- Setting: “Inflate – Automatic.” The unit inflates up to the preset test pressure and the stabilization time starts. Afterwards the Wöhler Pressure Meter starts the measurement automatically.
- Setting: “Inflate – Manual.” The user uses an air pump to inflate up to the preset test pressure. In this case the connections should be

made in the same way as for the stress test. This is followed by the stabilization time.

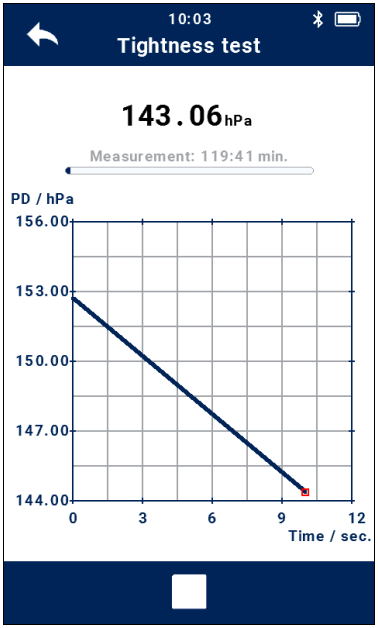


Fig. 55: Display during the leak tightness test

After the end of the stabilization time the measurement starts automatically.

The current pressure values can be seen in a graphic. The remaining measuring time is displayed above the graphic.

- Only tap the exit button in the footer if you want to stop the measurement early. The measurement will then no longer be compliant with the applicable standards.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

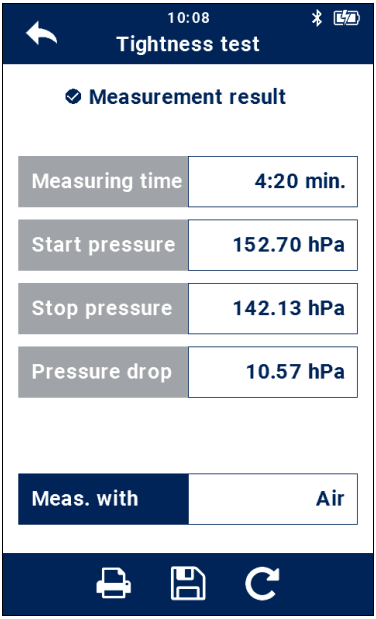


Fig. 56: Measurement results for the leak tightness test

The measurement results are then displayed. The test result is OK if the following conditions are satisfied:

1. The start pressure is greater than or equal to the set test pressure.
2. The measuring time was observed.
3. The pressure drop during the measurement is less than 1 hPa.

If the above requirements have not been met, the message “Result: OK” is not displayed. The selection “OK” or “Not OK” appears in the report printout; it is up to the user to make the assessment.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

- Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to create the customer first – see part 2 of the operating manual.

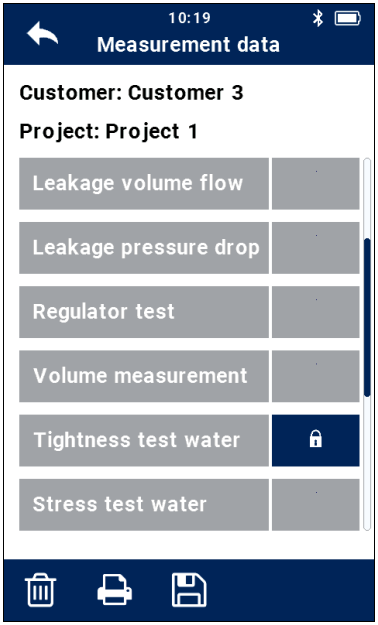


Fig. 57: Measurement data menu

In the measurement data menu of the customer (see part 2 of the operating manual) a padlock symbol now appears after the subpoint “Leak tightness test” to show that this measurement has already been performed.

9.2 Stress tests performed with air on drinking water pipes

After the leak tightness test the stress test is performed. Here, the leak tightness of the drinking water pipe is checked with an increased pressure of 3 bar.

This high test pressure in comparison to the operating pressure requires the application of pressure to the drinking water pipe via an external compressed air connection (manual air pump or electric compressor).

CAUTION!
For reasons of hygiene, make sure that the compressor or manual air pump are oil-free.

NOTE!
A compressed air pump (possibly an electric compressor), a cross T-piece or a valve block, connecting hoses, and stepped high-pressure

plugs are required for the stress test. We recommend using the Wöhler leak tightness testing set.

Fig. 58: Connection example using the Wöhler leak tightness testing set for gas pipes for the stress test

- Seal the pipe and insert a suitable test plug.

WARNING!
Due to the high test pressure, the pipe must always be sealed with a stepped high-pressure plug.

- Switch on the Wöhler M 603.
- In the measurement menu select: Water > Stress test (air)
- Tap the field “Differential pr.” to zero the pressure sensor.
- Connect the (+) pressure connection via a hose to the test plug.
- Use a second hose and a cross T-piece or the Wöhler leak tightness testing set to connect a compressed air pump.

NOTE!
If you are using the Wöhler leak tightness testing set for gas pipes to make the necessary connections, refer to the operating manual for the Wöhler leak tightness testing set for gas pipes.

NOTE!
In the stress test the test pressure depends on the pipe diameter.

The stress test is performed with a maximum test pressure of 0.3 MPa (3 bar).

Nominal diameters up to DN 50: 0.3 MPa max. (3 bar)

Nominal diameters over DN 50 - DN 100: 0.1 MPa max. (1 bar)

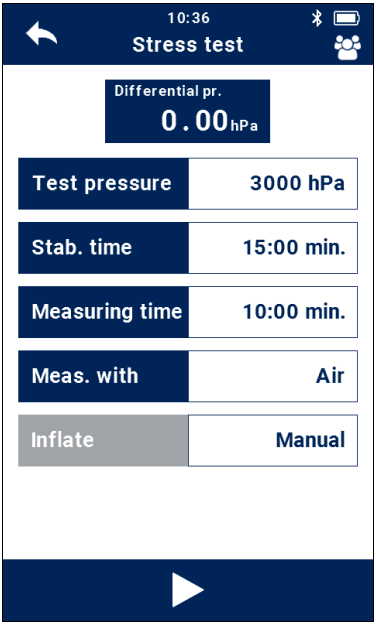


Fig. 59: Presets for stress tests on water pipes

The preset test pressure, stabilization time, and measuring time are now displayed.

The user can individually adjust the presets by tapping the white fields.

- Tap the blue field “Test pressure” if you would like to view the test pressure requirements from DIN EN 806-4 again.
- Tap the white fields if you wish to change the presets.

NOTE!
The field “Inflate: Manual” cannot be changed. Due to the high test pressure, inflation must be performed manually using a hand pump or a compressor.

- Tap the play button to start the measurement.

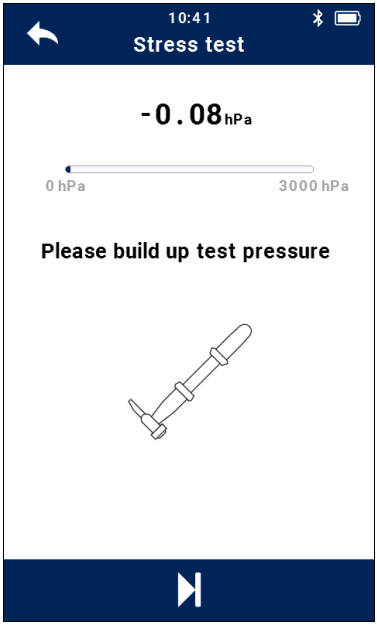


Fig. 60: Prompt asking you to inflate up to the test pressure

A prompt appears asking you to inflate to the preset test pressure.

- Use the air pump to keep pumping air into the pipe until the Wöhler M 603 displays the required test pressure.

! CAUTION!
As soon as a pressure of more than 3.2 bar is applied to the pressure sensor the message “Caution – overload” is displayed. In this case you must immediately reduce the pressure to avoid damaging the pressure sensor.

Once the preset test pressure has been attained the stabilization time starts (stabilization time = 15 minutes).

NOTE!
The stabilization phase ends automatically when the test pressure drops below 90% of the preset test pressure value. In this case the measurement cannot be performed and the connections will need to be checked as the first step.

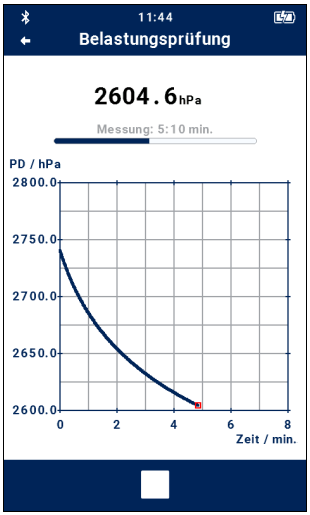


Fig. 61: Display of the pressure curve during the stress test

Afterwards the Wöhler M 603 starts the measurement automatically. During the measurement (duration: 10 minutes) the pressure curve is displayed as a graphic on the display.

- Tap the exit button in the footer if you would like to stop the measurement early. The measurement will then no longer be compliant with the applicable standards.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

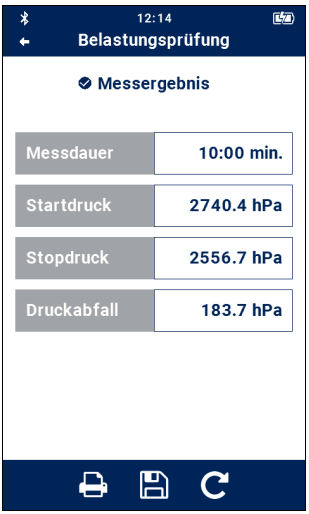


Fig. 62: Display of results after the stress test with pressure

The test result is OK if the following conditions are satisfied:

- The stop pressure is greater than or equal to the set test pressure.
- The measuring time was observed.
- The pressure drop during the measurement is less than 100 hPa.

If the above requirements have not been met during the measurement, the message “Result: OK” is not displayed. The selection “OK” or “Not OK” appears in the report printout; it is up to the user to make the assessment.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to create the customer first – see part 2 of the operating manual.

In the measurement data menu of the customer (see part 2 of the operating manual) a tick symbol now appears after the subpoint “Usability meas-

urement / leakage volume" to show that this measurement has already been performed.

9.3 Pressure testing with water on water pipes

NOTE!
The procedure set out in the information sheet "Leak tightness tests on drinking water installations using compressed air, inert gas, or water" is assumed here as the basis for the performance of leak tightness testing using water (January 2017). This follows test method B according to DIN EN 806-4.

A leak tightness test with water should be performed immediately prior to commissioning. If this is not possible then the system must remain completely filled until commissioning is performed. In this case it must be ensured that the water is exchanged at regular intervals (at the latest after 7 days) until the commissioning of the drinking water installation is performed.

If this is not possible, carry out the test with compressed air or inert gases.

CAUTION!
The Wöhler SC 660 unit is required in order to perform pressure testing with water. Due to the high pressure of 11 bar, under no circumstances is it permitted to connect the Wöhler M 603 to the pipe while the test is being performed.

- Switch on the Wöhler M 603 and the Wöhler SC 660.
- Make sure that the Bluetooth functionality is enabled in the Wöhler M 603 (Bluetooth icon in the header – if necessary, you can enable it via the settings menu).
- In the measurement menu of the M 603 select: Water > Pressure test (water).
- The unit will now briefly search for Smart Connect devices in the surroundings and then displays a list of the devices found.
- Select your Wöhler SC 660 in order to establish a Bluetooth connection between the Wöh-

ler M 603 and the Wöhler SC 660.

If the “Pressure test (water)” menu is called up again subsequently then the devices will connect automatically.

As soon as the connection is established, a Bluetooth connection icon appears at the top right of the display of the M 603.

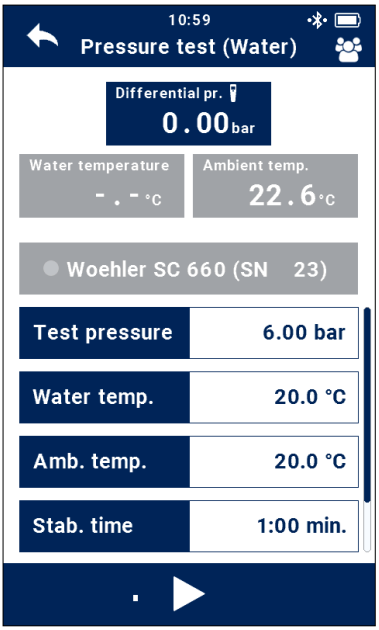


Fig. 63: Presets for pressure testing (water)

- Tap the field “Differential pr.” if you wish to zero the pressure sensor.

Water temperature:

- In the second row of measured values the water temperature is displayed in the gray field if a temperature clamp probe is connected to the Wöhler SC 660.
- Use the temperature clamp probe to measure the temperature of the water pipe.
- On the display of the Wöhler M 603, tap the blue field “Water temp.” to apply the measured temperature value.

Ambient temperature:

- Proceed in the same way again for the ambient temperature.

On the display of the Wöhler M 603, the connected Wöhler SC 660 unit, the preset test pressure, the stabilization time, and the measuring time are now displayed.

- Tap the white fields if you wish to change the presets.
- If you would like to test whether the pressure remains constant over a measuring period, tap the blue field “Test pressure” to apply the measured differential pressure as the test pressure.

Stabilization time

- Tap the blue field “Stab. time” to view information about the stabilization time as set out in DIN EN 806-4.
- Tap the white field next to “Stab. time” if you would like to change the stabilization time.

Measuring time

- Tap the blue or white “Measuring time” field if you wish to change the measuring time.

Fig. 64: Example – connection of a Wöhler SC 660 to a water pipe

- Connect the Wöhler SC 660 to the water pipe as instructed in the operating manual of the device.
- Tap the play button on the display of the Wöhler M 603 to start the measurement.

A prompt appears to build up the required test pressure.

- Open the water tap until the Wöhler M 603 unit displays the required test pressure.

NOTE!
The stabilization phase starts as soon as the test pressure is reached. It ends automatically when the test pressure drops below 90% of the preset test pressure value. In this case the measurement cannot be performed and the connections will need to be checked as the first step.

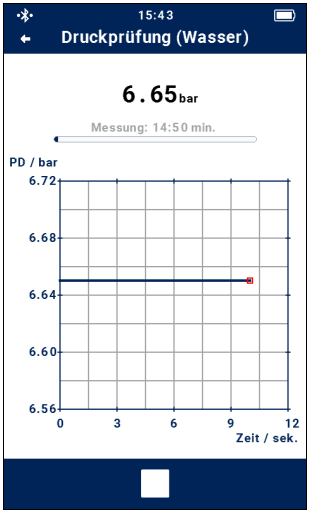


Fig. 65: Display of the pressure curve during the stress test

Afterwards the measurement starts automatically. During the measurement (duration: 10 minutes) the pressure curve is displayed as a graphic on the display.

- Tap the exit button in the footer if you would like to stop the measurement early. The measurement will then no longer be compliant with the applicable standards.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

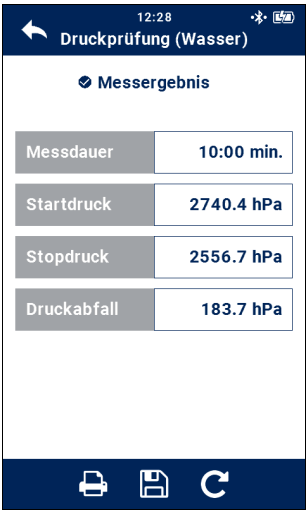


Fig. 66: Display of results after the stress test with pressure

The test result is OK if the following conditions are satisfied:

- The start pressure is greater than or equal to the set test pressure.
- The measuring time was observed.
- The pressure drop during the measurement is less than 100 hPa..

If the above requirements have not been met during the measurement, the message “Result: OK” is not displayed. The selection “OK” or “Not OK” appears in the report printout; it is up to the user to make the assessment.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

Tap the printer icon again to start data transfer to the printer.

- Tap the save icon if you would like to save the measurement data under a customer.
- You need to create the customer first – see part 2 of the operating manual..

In the measurement data menu of the customer (see part 2 of the operating manual) a padlock symbol now appears after the subpoint “Pressure test (water)” to show that this measurement has already been performed.

9.4 Leak tightness testing of wastewater pipes in accordance with DIN EN 1610

9.4.1 Sensors and connection components

Fig. 67: Accessories for wastewater pipe leak tightness testing

The following accessories are required for the leak tightness test:

Sealing bladder and test bladder

Valve block

Connecting hoses

Compressed air pump, steel rope with snap hook

Fiberglass push rod

! CAUTION!

Silicone hoses should not be used for higher pressure ranges, as with this material perforation can already become evident in the form of an additional leak from an overpressure of 1000 hPa or higher. Suitable fabric hoses are included in the Wöhler sealing set.

9.4.2 Operating principle

According to DIN EN 1610, leak tightness testing of pipes is to be performed either with water or air. With the Wöhler M 603 it is possible to perform this testing with air. To do this, the pressure drop is determined at a specified test pressure over a defined measuring period taking into account the pipe diameter.

The user initially enters the pipe diameter into the unit and selects a suitable test method. The test pressure and test time are then automatically specified by the unit in accordance with DIN EN 1610. If the subsequently measured pressure drop Δp is below the maximum permitted value defined in DIN EN 1610 then the wastewater pipe is deemed to be leak-tight.

.

9.4.3 Sealing the pipe section

Fig. 68: Accessories for sealing the pipe section

NOTE!
For sealing you will need an inflatable sealing bladder without gas feedthrough, a test bladder with gas feedthrough, a valve block, a fiberglass push rod, a steel rope, and various hoses. We recommend the Wöhler leak tightness testing set for wastewater pipes.

NOTE!
It is permissible for the pipe section that is being tested to be accessible from only one end.

WARNING!
The shut-off elements must be secured so that they cannot be forced out or fly out. The corresponding regulations of the employers' liability insurance association “BGI 802: Safety information for work with provisional pipe shut-off devices” must always be referred to and complied with.

Inserting the inflatable sealing bladder into the wastewater pipe

- Choose the diameter of the inflatable sealing bladder and test bladder appropriately to match the pipe diameter.

NOTE!
The inflatable sealing bladder must not have a gas feedthrough and must have a bush for a push rod. We recommend the Wöhler inflatable sealing bladder.

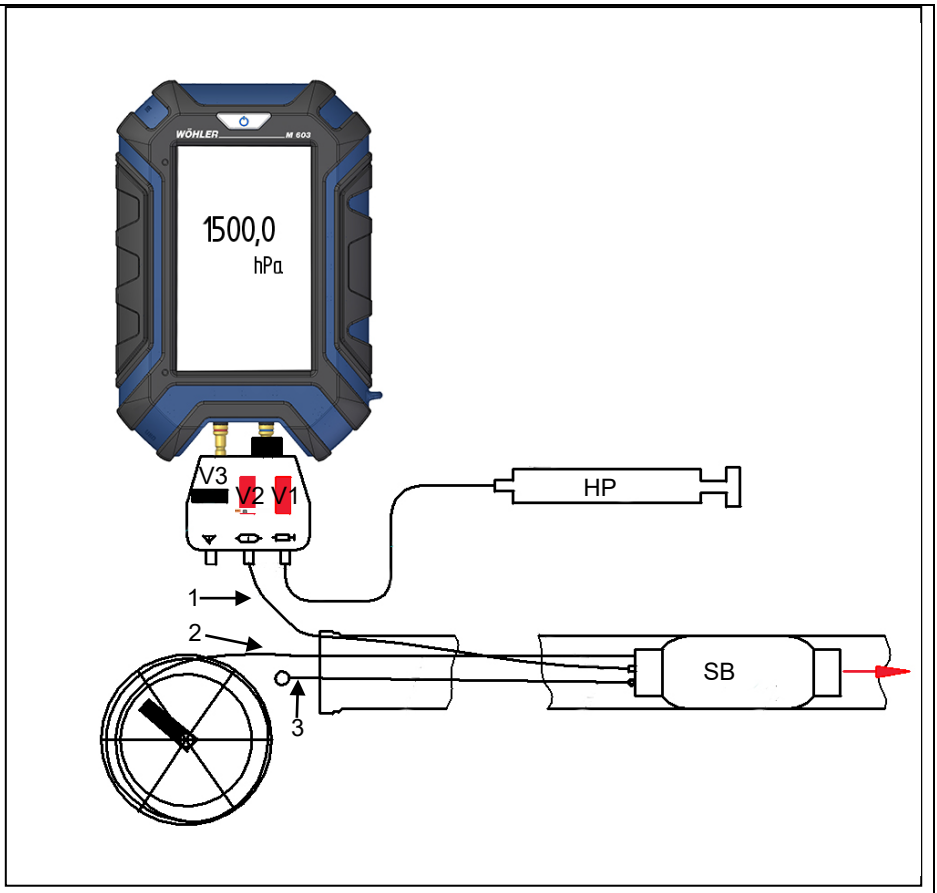


Fig. 69: Inserting the inflatable sealing bladder into the wastewater pipe

Key

SB	Inflatable sealing bladder with pushing device (fiberglass push rod)
HP	Hand pump
V1-3	Valves 1-3
1	Hose
2	Push rod
3	Steel rope

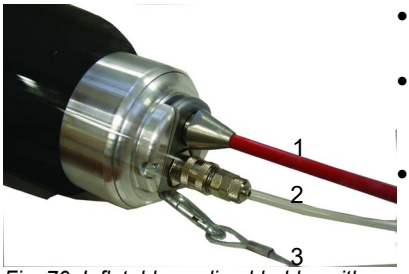


Fig. 70: Inflatable sealing bladder with push rod (1), hose (2), and steel rope (3)

- Connect a connecting hose (2) to the inflatable sealing bladder.
- Attach the steel rope (3) to the eyelet of the clamping device of the inflatable sealing bladder.
- Connect the push rod (1) to the inflatable sealing bladder. To do this, insert the end piece of the push rod through the opening of the clamping device into the adapter up to the stop.

Fig. 71: Positioning the inflatable sealing bladder in the pipe

- Use the push rod to push the bellows to the required position in the pipe.

Fig. 72: Valve block with connections to the Wöhler M 603, to the air pump, and to the inflatable sealing bladder

1 Air pump connection

2 Hose connection for inflation of the inflatable sealing bladder

3 Connection to the gas feedthrough of the test bladder

4 Negative connection to the measuring device (with air outlet)

5 Positive connection to the measuring device

6 Adjustment valve

NOTE!
After the measurement, the adjustment valve can be opened by rotating it in order to vent the bladder.

- Connect the Wöhler M 603 to the valve block.
- Connect the hose that is connected to the sealing bladder to the middle connection of the valve block (V2) and the air pump to the connection (V1).
- Open the valves to the air pump (V1) and sealing bladder (V2) and close the valve (V3).

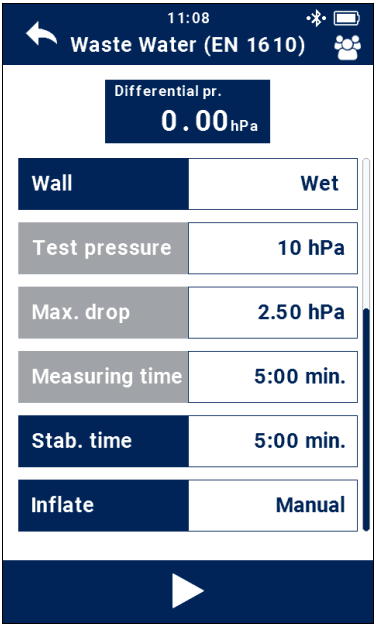


Fig. 73: Settings for the wastewater leak test

- Switch on the Wöhler M 603 and select “Wastewater (EN 1610)” in the measurement menu.

The Wöhler M 603 displays the pressure of the sealing bladder on the parameter input screen.

Fig. 74: Pulling off the push rod

- Manually inflate the sealing bladder to the nominal pressure of the sealing bladder (this depends on the bladder; with the Wöhler sealing bladders 65 - 100 and 75 - 150 this is typically 1,500 hPa).

! CAUTION!
Never inflate the sealing bladder beyond the nominal pressure stated on the bladder.

- Close the valve V2 to the sealing bladder.

After inflation the bladder is fixed in the wastewater pipe.

- Disconnect the push rod from the bladder by first holding and pulling on the steel rope and then pulling on the push rod.

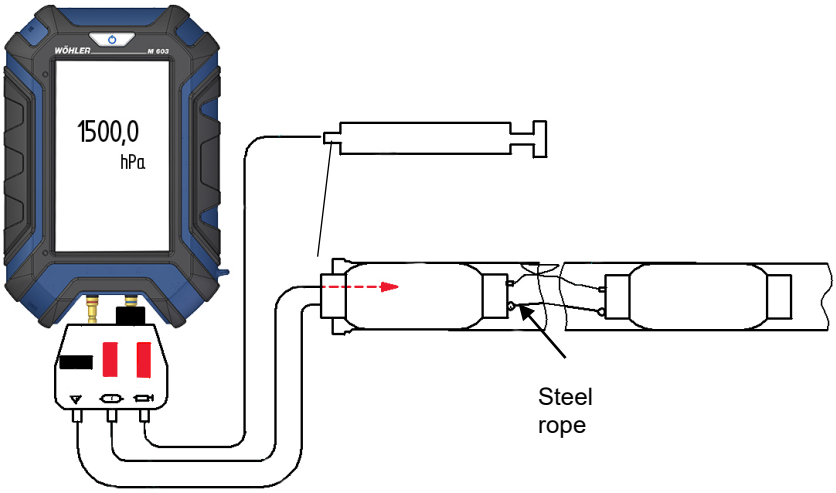


Fig. 75: Positioning the test bladder

Fig. 76: Hooking in the steel rope

- Now insert a test bladder with a gas feed-through. To do this, proceed as follows:
- Disconnect the connecting hose from the valve and connect it to the test bladder (on the blind plug). Hook the free end of the steel rope into the eyelet of the test bladder.

NOTE!
Doing this prevents the rope or hose ends from being lost in the wastewater pipe and from being soiled.

Fig. 77: Test bladder with measuring hose and hose to the air pump

- At the other end of the test bladder, connect a hose for inflation and a measuring hose.
- Open valve V2, position the test bladder and inflate it with the hand pump up to the nominal pressure of the test bladder (this depends on the bladder; with the Wöhler sealing bladders 65 - 100 and 75 - 150 this is typically 1,500 mbar).
- Close the valve V2.

The pipe section to be tested is now completely sealed.

9.4.4 Presets

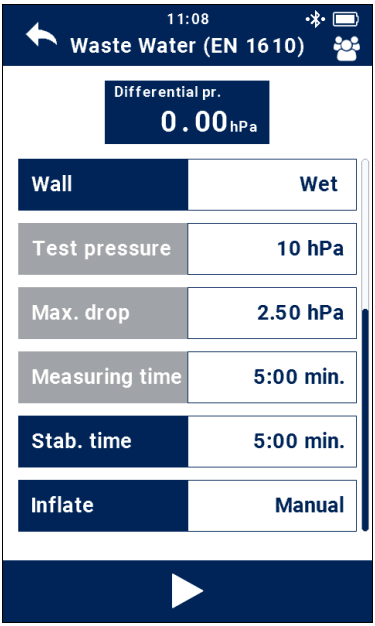


Fig. 78: Presets for leak tightness tests on a wastewater pipe

- Switch on the Wöhler M 603.
- In the measurement menu of the M 603 select: Wastewater (EN 1610).

The window opposite opens with the presets for the measurement.

- Tap the field “Differential pr.” if you wish to zero the pressure sensor.

Method

- Choose the test method to be used.

Method	Test pressure in mbar	Permissible pressure drop in mbar
LA	10	2.5
LB	50	10
LC	100	15
LD	200	15

With the specified test methods LA, LB, LC and LD as defined in DIN EN 1610, the parameters “Test pressure,” “Measuring time,” and “Maximum pressure drop” required for the test method are programmed into the unit, which means that they also contribute to the evaluation (result “OK” or result “Not OK”).

NOTE!
In addition to the four methods based on DIN EN 1610, there is also a manual method in which all the parameters can be adjusted by the user.

Diameter

- Enter the pipe diameter.

Length

- Enter the pipe length.

Volume

The Wöhler M 603 automatically calculates the pipe volume from its diameter and length.

Wall

- Select whether the wall is wet or dry.

Test pressure, **Max. drop, Measuring time**

Specified in accordance with DIN EN 1610

Stab. time

The stabilization time is defined on the basis of DIN EN 1610, but it can also be freely changed.

Inflate

Up to a test pressure of 300 hPa the Wöhler M 603 can automatically inflate the pipe via the integrated pumps. If this is not required, the user can also pump in air manually.

9.4.5 Measurement

- Tap the play button in the footer to start the test.
- Setting: “Inflate – Automatic.” The unit inflates up to the preset test pressure and the stabilization time starts. Afterwards the Wöhler Pressure Meter starts the measurement automatically.
- Setting: “Inflate – Manual.” The user uses an air pump to inflate up to the preset test pressure. This is followed by the stabilization time.

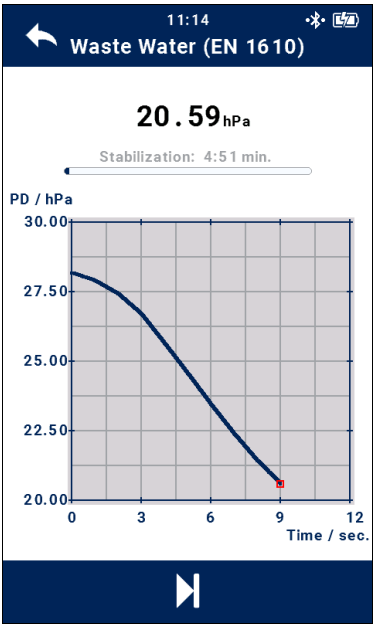


Fig. 79: Measuring phase, measuring curve shown in the graphic

After the end of the stabilization time, the device automatically switches to the measurement phase The pressure curve continues to be displayed in the graphic, but from the start of the measurement phase on the background is white.

- Tap the exit button if you would like to stop the measurement early.

When the end of the measuring time is reached, or if you stop the measurement early, the skip button appears under the graphic.

- Tap the skip button to go to the results display screen.

NOTE!
Once you call up the results display screen it is no longer possible to display the graphic anymore.

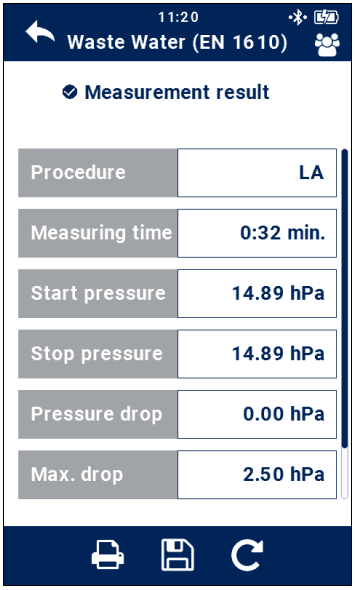


Fig. 80: Measurement results for the leak tightness test (wastewater test)

The result is “OK” if the pressure drop is below the maximum drop specified in DIN EN 1610 and the measuring time requirements have been fully complied with.

- Tap the printer icon if you would like to print out the measurement result on the Wöhler thermal printer.

A print preview will then appear on the display.

- Tap the print icon again to start data transfer to the printer.

In the measurement data menu of the customer (see part 2 of the operating manual) a padlock symbol now appears after the subpoint “Wastewater (EN 1610)” to show that this measurement has already been performed.

Logger measurement

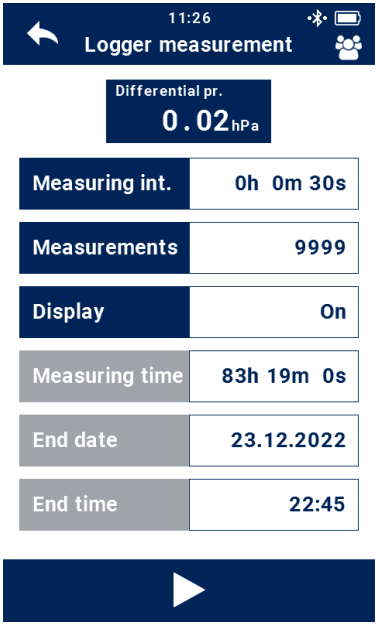


Fig. 81: Adjustment of the measurement interval and the number of measurements for the logger measurement

The menu item “Logger measurement” enables continuous recording and graphical representation of measurement data in the Wöhler Pressure Meter. The following measured values are logged:

Differential pressure, internal temperature, temperature 1 and 2 (only if an external temperature sensor is connected), absolute pressure, relative humidity

- In the measurement menu select “Logger measurement.”
- Adjust the measuring interval and the number of measurements by tapping the relevant field.

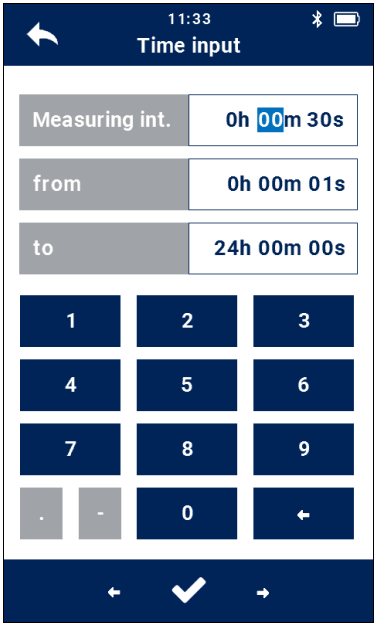


Fig. 82: Input field for measuring interval

An input window opens in which the active field is shown with a light blue background.

- Use the number field to input your entry. Here, the existing entries are automatically overwritten.

Tap an input field to activate or deactivate it.

From the presets, the unit calculates the measuring time, the end date, and the end time.

- Select “Display ON” or “Display OFF” to extend battery performance as required.

NOTE!
If the display is to be switched off between the measuring cycles, a measuring interval of at least 20 seconds must be selected.

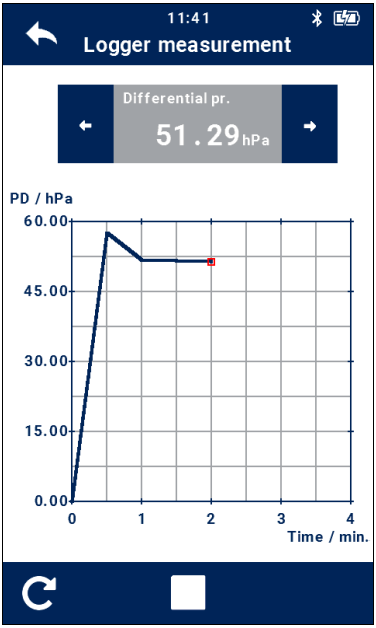


Fig. 83: Display of the measuring curve during logging

- Tap the play button in the footer to start the logger measurement.

NOTE!
On longer measurements make sure that the unit is plugged into the mains.

The display shows a graphic with the representation of the recorded values.

With the aid of the arrow buttons next to the current measured value you can switch between the measured variables.

Once the preset measuring time has finished, the following 3 icons appear in the footer:

- Tap the arrow buttons to change the measuring channel.

You have the option of viewing the graphical curves for all recorded measured data again.

- Tap the “restart” icon to start a new logger measurement.

- Tap the printer icon to first view the print preview and then start the printout.

- Tap the save icon if you would like to save the measurement data under a customer.
- To do this, create the customer as described in part 2 of the operating manual..

10 Live measurement

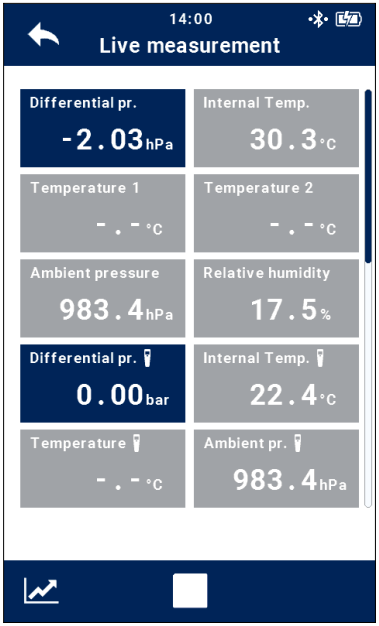


Fig. 84: Display of the current measured values

Under the menu item “Live measurement” you can perform a simple differential pressure measurement. The display shows all currently measured data. The measurement data is updated once a second.

NOTE!
Temperature 1 and Temperature 2 are only displayed if the corresponding temperature sensors for external temperature are connected.

NOTE!
The relative humidity depends on the temperature. If a temperature sensor is connected to the connection for “Temperature 2,” the measuring device will correct the internally measured humidity on the basis of the externally measured temperature and display the corrected humidity value.

Both the measured data of the Wöhler M 603 and the measured data of connected Wöhler SC 660 units are displayed.

To connect a Wöhler SC 660 to the Wöhler M 603, proceed as described in section 7.

- Tap the graphic icon in the footer to go to the graphical measured value display screen. Here you can use the arrow buttons next to the display of the current measured value to switch between the different measured values.
- To return from the graphical display back to the numerical measured value display, tap the back arrow in the header.
- Tap the stop button in the footer to exit the live measurement.

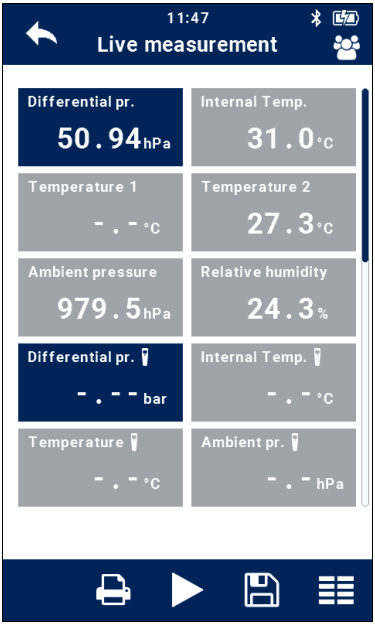


Fig. 85: Stopped live measurement

- With the measurement stopped, tap in the footer

- on the printer icon to view the print preview and then start the printout on the thermal printer;

- on the play button to continue the live measurement;

- on the save icon to save the currently measured data under a customer; see part 2 of the operating manual;

- on the display icon to go to the display configuration screen. For display configuration see BDA, part 2, section 2.

Display configuration

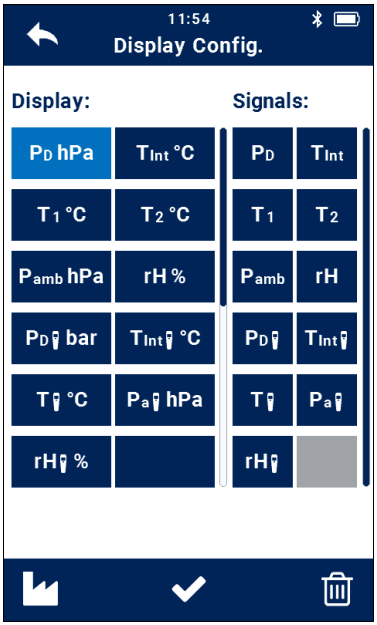


Fig. 86: Configuration of the display

Here the user can configure the measurement display to suit his/her requirements.

- Tap “Modify” to access the screen shown opposite.
- In the left-hand column (Display), tap the button with the measured variable you no longer want to see at this position in the display.

The button is now shown with a light blue background.

- Afterwards tap in the right-hand column (Signals) on the measured variable you would like to take the place of the selected variable in the left-hand column.

The tapped measured variable then moves to the position of the button shown with a light blue background in the display.

- To change the unit, tap several times in the left-hand column (Display) on the button for which you wish to change the unit.

NOTE!
The units cannot be selected for all measured values.

The buttons in the footer have the following functions:

11 Pipe location

By using the Wöhler M 603 in combination with a Wöhler L 200 Locator it is possible to locate a pipe made of metal. To do this, the Wöhler M 603 outputs a sinusoidal signal with a frequency of 9.2 kHz onto the pipe. The Wöhler L 200 Locator receives the signal. A cursor in the display of the Wöhler L 200 and an acoustic signal then enable accurate location of the pipe run.

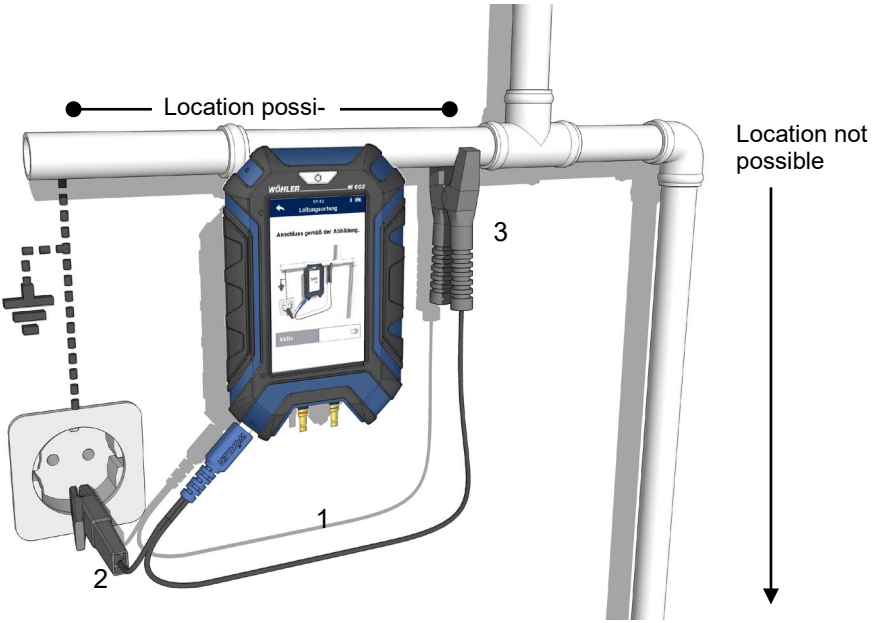


Fig. 87: Connections for pipe location

1 Locating cable for pipe location
2 Contact clamp (small)
3 Contact clamp (large)

11.1.1 Preparations

So that the pipe can be located, it needs to be part of an electrical circuit between the two locating cables of the Wöhler M 603. To enlarge the circuit, on grounded pipelines the protective conductor of the in-house electrical installation can also be used. The circuit therefore consists of the pipe that is to be located and the protective conductor.

Stub branches that branch off from the circuit cannot be located.

- Connect the Wöhler M 603 to the pipe and to the mains socket as shown in Fig. 87 opposite. When doing this, you should try to create a preferably long electricity circuit.
- Therefore, connect the Wöhler M 603 as far as possible from the point at which the pipe you wish to locate is grounded; see Fig. 87, example B. Use e.g. a water tap and a nearby mains socket as connection points.

☞ *NOTE!*
If the unit is connected as in example A directly in the heating room, the circuit is very short and does not include the pipe that is to be located. Location is then only possible on the short pipe section that is part of the electricity circuit.

Pipe location

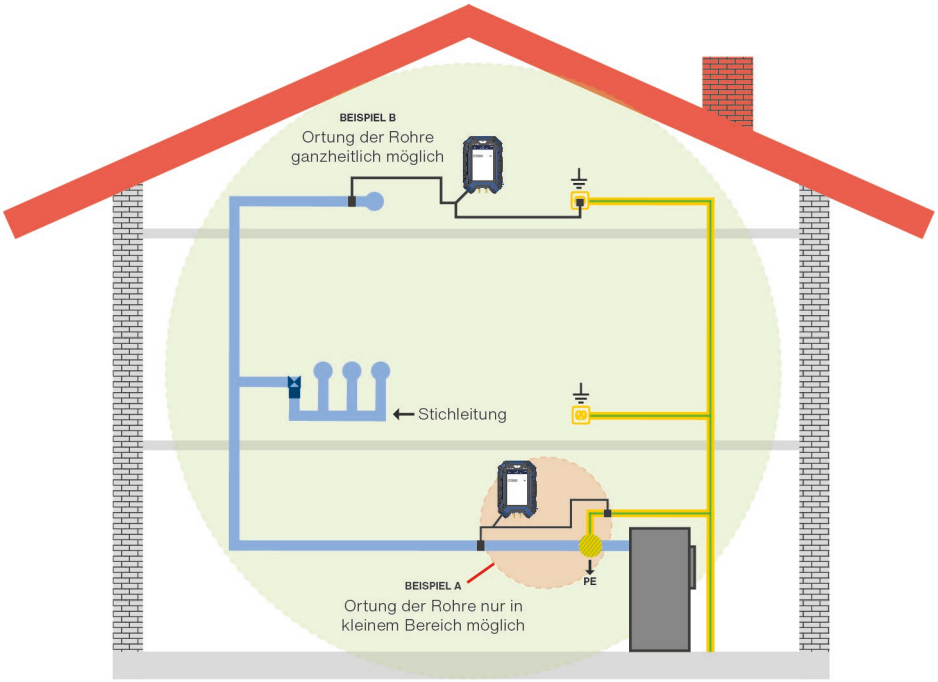


Fig. 88: Connection examples for pipe location. We recommend example B.

If the pipe is properly grounded, proceed as follows (see Fig. 86):

- Connect the locating cable to the USB C port of the Wöhler M 603.
- Connect the two free ends of the locating cable with the large contact clamp.
- Then attach the clamp to the pipe to make electrical contact.
- Connect the other end of the cable to the small contact clamp and mount this on the protective conductor in the mains socket.

If the pipe is not grounded, proceed as follows:

- Connect the locating cable to the USB C port of the Wöhler M 603.
- Connect each of the two free ends of the locating cable to separate large contact clamps.
- Then attach the two clamps to the pipe to make electrical contact; this should be at the entry into the brickwork and at the exit. The pipe section between the clamps can then be located.

11.1.2 Pipe location

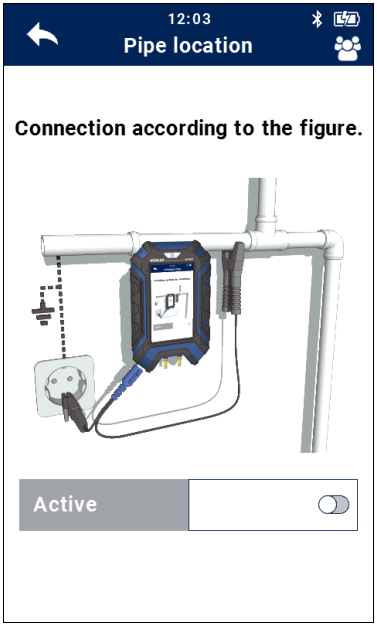


Fig. 89: Pipe location

- In the measurement menu select “Pipe location.”
- Enable pipe location so that a signal is sent to the pipe.
- Locate the pipe with the Wöhler Locator L 200 following the instructions in the operating manual of the Locator.