

WÖHLER

Operation manual
Leakage Tester

Wöhler DP 700



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1 General Information

1.1 Operation Manual Information

This operation manual allows you to work safely with the Wöhler DP 700 Leakage Tester. Please keep this manual for your information.

The Wöhler DP 700 Leakage Tester should be employed by professionals for its intended use only.

Liability is void for any damages caused by not following this manual.

1.2 Notes



WARNING!

Not following this warning can cause injury or death.



ATTENTION!

Not following this note can cause permanent damage to the device.



NOTE!

Useful information

1.3 Intended Use

The Wöhler DP 700 leakage tester is designed to verify the airtightness of duct systems and single components, but can also be used to test other enclosures (air conditioning units, climate chambers, electrical cabinets, furnaces, etc.).

It is especially designed for leakage tests according to DIN EN 12599 - Test procedures and measurement methods to hand over air conditioning and ventilation systems according to DIN EN 14134 - Performance testing and installation checks of residential ventilation systems. The tightness is valued according to the tightness classes of DIN EN 16798-3, DIN EN 13779 (identical to DIN EN 12237, 1507, 15727, 13403, 1751, 13180).

The Wöhler DP 700 can be used to measure positive and negative pressure.

The Wöhler DP 700 is not approved for continuous use for long periods in an attempt to locate leakages.

Do not use the meter for any other use than set out in this manual.

1.4 Scope of supply

Meter	Scope of supply Basic Set
Wöhler DP 700	Leakage Tester with Calibration Certificate
	Pressure hose 10 m
	Air hose 3.75 m
	Air hose 4 m for adapter 0.3
	Adapter 0.3
	Mains cable 2.5 m
	2 brass nipples
	Hose connection for negative pressure
	Filterpads in pack of 5
	Silicone grease
	Plastic case Wöhler DP 700
	Transport case XXL for accessories

1.5 Transport

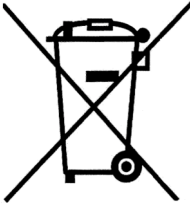


ATTENTION!

Improper transport can harm the instrument.

Always transport the instrument in the provided carrying case in order to prevent damage.

1.6 Information on disposal



Electronic equipment does not belong into domestic waste, but must be disposed in accordance with the applicable statutory provisions.

You may hand in any defective batteries taken out of the unit to our company as well as to recycling places of public disposal systems or to selling points of new batteries or storage batteries.



1.7 Manufacturer

Wöhler Technik GmbH

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 Fax: +49 2953 7396-250
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2 Technical Data

Pressure	
Measurement principle	Piezoresistive semiconductor sensor
Range	± 7000 Pa
Resolution	0.1 Pa to ±900 Pa, then 1 Pa
Accuracy	± 0.5 Pa or ± 2.5 % of the test value whichever is greater

Flow rate measurement (based on 1013 hPa and 20 °C)	
Measurement principle	Hot film anemometer
Range	
230 V, 50Hz	0.0000 to 55.00 l/s
110 V, 50Hz	0.0000 to 40.00 l/s
Resolution	0.0001 l/s to 0.3000 l/s, 0.001 l/s to 3.000 l/s, 0.01 l/s > 3.00 l/s
Accuracy	± 0.0009 l/s or ± 5 % of the test value, whichever is higher
Measuring range of adapter	
Adapter 0.3	< 0.3000 l/s
no Adapter	0.30 to 55.00 l/s
General technical data	
Power supply	230 V, 50 to 60 Hz
	110 V, 60 HZ with reduced flow rate (40 l/s)
Current consumption	max. 9 A
Operating Temperature	5 °C to 40 °C
Storage Temperature	-20 °C to +50 °C
Size	33 x 36 x 15 cm
Weight (without accessories)	9.5 kg

3 Parts and Connections

3.1 Device

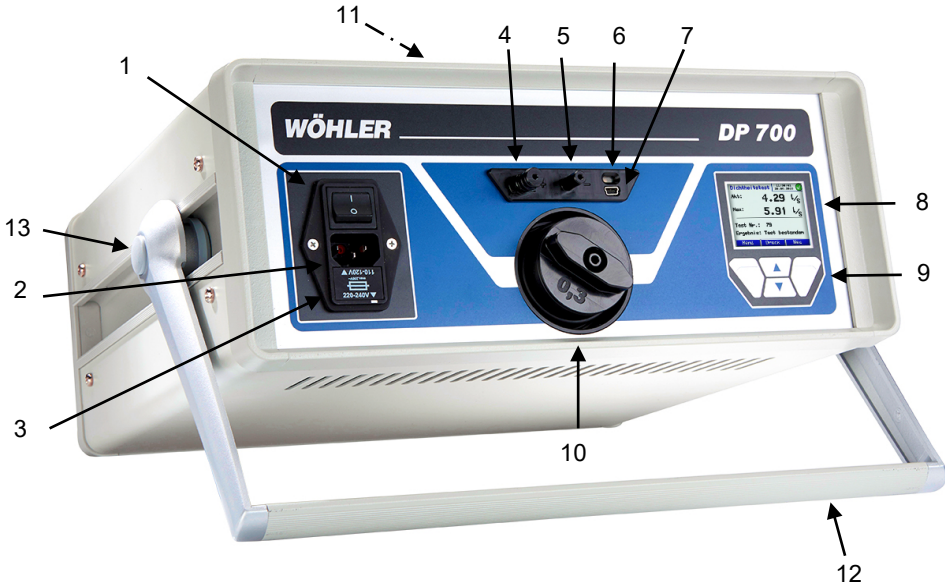


Fig. 1: Overview

- | | | | |
|---|---------------------------------------|----|--|
| 1 | Power switch | 7 | USB port |
| 2 | Power supply | 8 | OLED color display |
| 3 | Fuse switch
(Microfuse T10, 250 V) | 9 | Keypad |
| 4 | Bayonet connection for test pressure | 10 | Air connection - Ø 55 mm positive pressure (here with adapter) |
| 5 | Connection for differential pressure | 11 | Air connection - Ø 55 mm negative pressure (at the top of the meter, not visible in the picture) |
| 6 | Infrared interface for Wöhler TD 100. | 12 | Pivoting carrier |
| | | 13 | Pressure point for adjusting the carrier (on both sides) |

3.2 Connections

3.2.1 Positive pressure measurement with flow rate ≥ 0.3 l/s

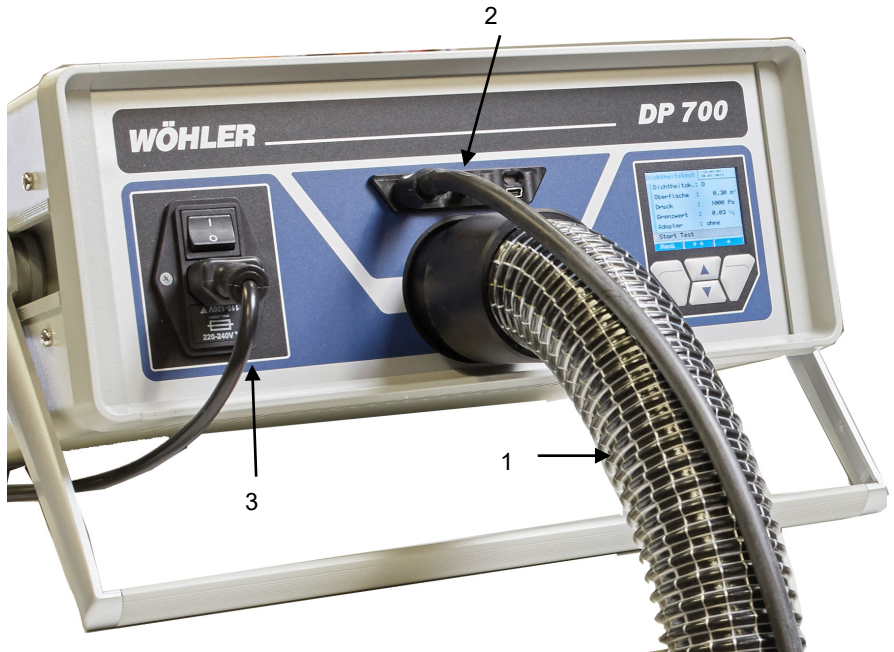


Fig. 2: Hose connections without adapter

- 1 Air hose
- 2 Pressure hose
- 3 Power cable

3.2.2 Positive pressure measurement with flow rate < 0,3 l/s

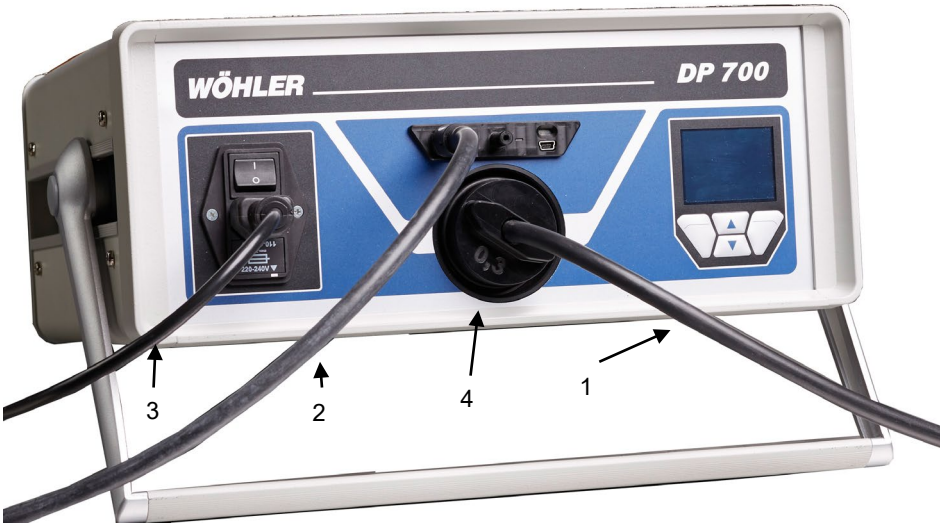
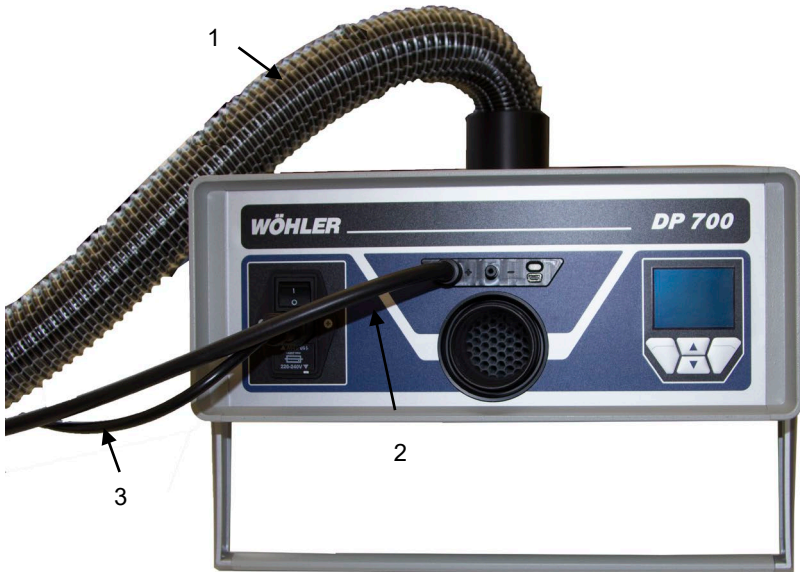


Fig. 3: Air hose with adapter

- 1 Air hose for adapter
- 2 Pressure hose
- 3 Power cable
- 4 Adapter

3.2.3 Negative pressure measurement with flow rate ≥ 0.3 l/s



- 1 Air hose
- 2 Pressure hose
- 3 Power cable

3.2.4 Negative pressure measurement with flow rate < 0.3 l/s



- 1 Air hose for adapter
- 2 Pressure hose
- 3 Power cable
- 4 Hose connection for negative pressure measurement

3.3 Adapter



NOTE!

The serial number of the adapter must match the serial number of the Wöhler DP 700. (The serial number can be found on the silver sticker on the device and adapter.)

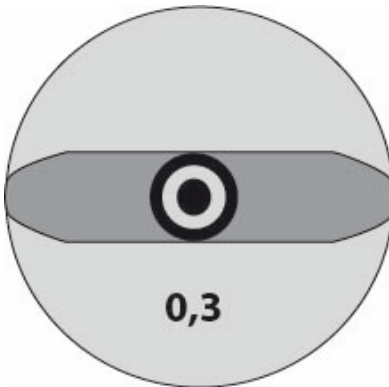


Fig. 4: Adapter 0.3

The Wöhler DP 700 features a wide measuring range of the volume flow. The adapter is necessary to guaranty the specified accuracy of the volume flow measurement when the volume flow is < 0.3 l/s.



NOTE!

The instrument does not recognize automatically if an adapter is inserted or not.

- Always start the tightness test without adapter.
- If the volume flow is < 0.3 l, insert the adapter 0.3 into the air connection (positive pressure) at the front of the meter (Fig. 1, part 10). Connect the air hose to the adapter.

3.4 Display an key pad

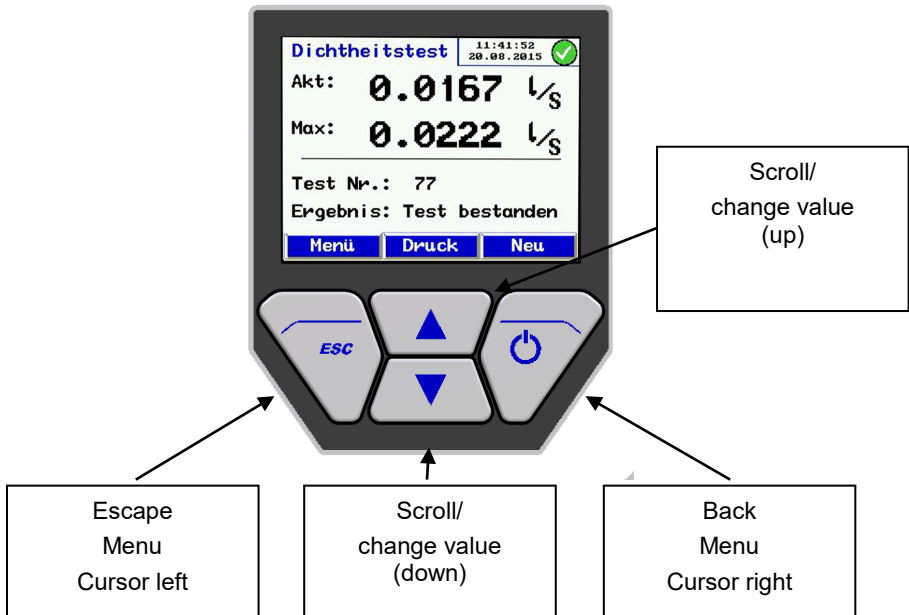


Fig. 5: Display and keys

The Wöhler DC 700 has a color display with a diagonal of 6 cm. The OLED-technology allows reading the display from almost any angle of view.

The Wöhler DP 700 is operated using four multiple function keys. The current function of the key is indicated in the menu line of the display.

MENU key: Press the MENU key once to go to the main menu and twice to open the input screen for a test.

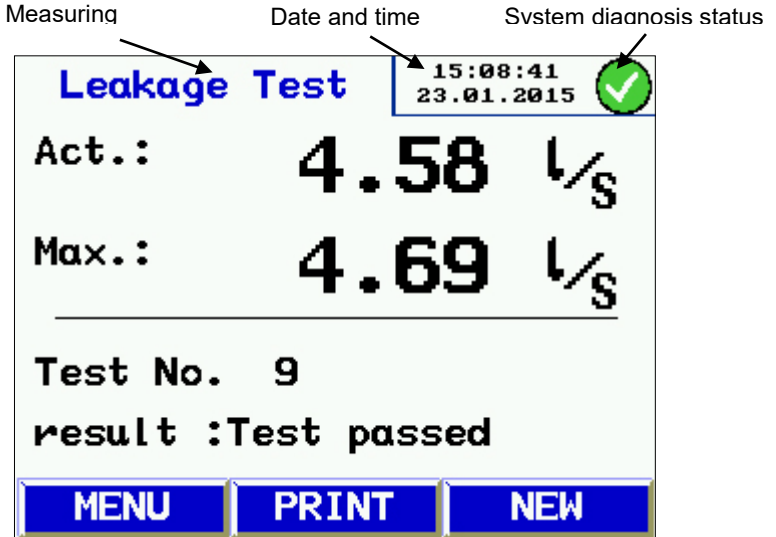


Fig. 6: Wöhler DP 700 Display

The display is divided into a status, a menu and a readings segment.
 The currently selected mode or menu is shown in the left status segment.
 The status window is shown in the right status segment. Date and time and the system diagnosis status are shown in the status segment on the right.
 The readings segment displays the readings or the menu items.
 The menu segment is situated at the bottom of the display. It consists of three soft keys.

3.5 Accessories

3.5.1 Sealing Elements



Fig. 7: Sealing-Set for round duct lines

3.5.2 Documentation and data analysis



Fig. 8: Documentation Set with software included

Sealing bladders for round air lines are not included in the base set. Nevertheless Wöhler offers many different forms and sizes.

The data can be analyzed and stored on the PC with the correspondent software (see chapter 13). The readings can be printed out directly from the meter on the thermal fast printer Wöhler TD 100. Software and printer are not included in the Standard Set.

3.6 Application

The Wöhler DP 700 leakage tester is designed to verify the airtightness of duct systems and single components. It can also be used to test other enclosures (air conditioning units, climate chambers, electrical cabinets, furnaces, etc.).

It is especially designed for leakage tests according to DIN EN 12599 - Test procedures and measurement methods to hand over air conditioning and ventilation systems according to DIN EN 14134 - Performance testing and installation checks of residential ventilation systems.

The tightness is valued according to the tightness classes of DIN EN 16798-3, DIN EN 13779 (identical to DIN EN 12237, 1507, 15727, 13403, 1751, 13180). The following table shows the relation to other (oder) norms.

Tightness class				Limit value for Leakage rate (fmax) m ³ s ⁻¹ m ⁻²
DIN EN 13779	DIN EN 16798-3	EU- ROVENT 2/2	DIN 24194 part 2	
	ATC 7			Not specified
	ATC 6			0,067 5 x p _t ^{0.65} x 10 ⁻³
A	ATC 5	A	II	0,027 x p _t ^{0.65} x 10 ⁻³
B	ATC 4	B	III	0,009 x p _t ^{0.65} x 10 ⁻³
C	ATC 3	C	IV	0,003 x p _t ^{0.65} x 10 ⁻³
D	ATC 2			0,001 x p _t ^{0.65} x 10 ⁻³
	ATC 1			0,000 33 x p _t ^{0.65} x 10 ⁻³

Table 1: Tightness classes according to different norms

The Wöhler DP 700 leakage tester can measure positive and negative pressure. To change from positive to negative pressure, only change the Ø 50 mm hose connection (see fig. 1, part 10 and 11) and select the test pressure (with negative sign "-" if applicable).

The Wöhler DP 700 can also be used to test single components, e.g. for the quality control in series production.

3.7 Measuring principle and applicable standards

The airtightness of duct systems is tested by bringing the system to a constant test pressure. The meter measures the flow rate necessary to maintain the selected test pressure in a closed system.

This flow rate corresponds to the leakage rate of the duct section being tested. The test conditions are described in DIN EN 12237 for circular ducts and in DIN EN 1507 for rectangular ducts. DIN EN 1751 contains the test conditions for dampers and valves, and DIN EN 15727 covers other air conditioning and ventilation components.

DIN EN 13180 describes the requirements on the tightness of flexible air ducts. DIN EN 13403 describes the requirements on the tightness of air ducts made of insulation sheets.

The leakage tests should be carried out in situ as described in DIN EN 12599 (usually at lower pressures as described in the product standards) – "DIN EN 12599 Test procedures and measuring methods for handing over installed ventilation and air conditioning systems". VOB C stipulates that acceptance testing must be carried out in accordance with DIN EN 12599.

The tightness of Low Profile-installations (Controlled domestic ventilation) must be tested according to DIN EN 14134.

The following diagram shows the principle of the measurement configuration. The volume flow generated by means of two turbine blowers is fed into the sealed exhaust gas system by means of a hose. As a result of incoming air, the pressure in the exhaust system rises. This pressure is fed back to the measuring device via a second hose. The turbine blowers are regulated by comparing the preset test pressure with the actual test pressure in the exhaust gas system.

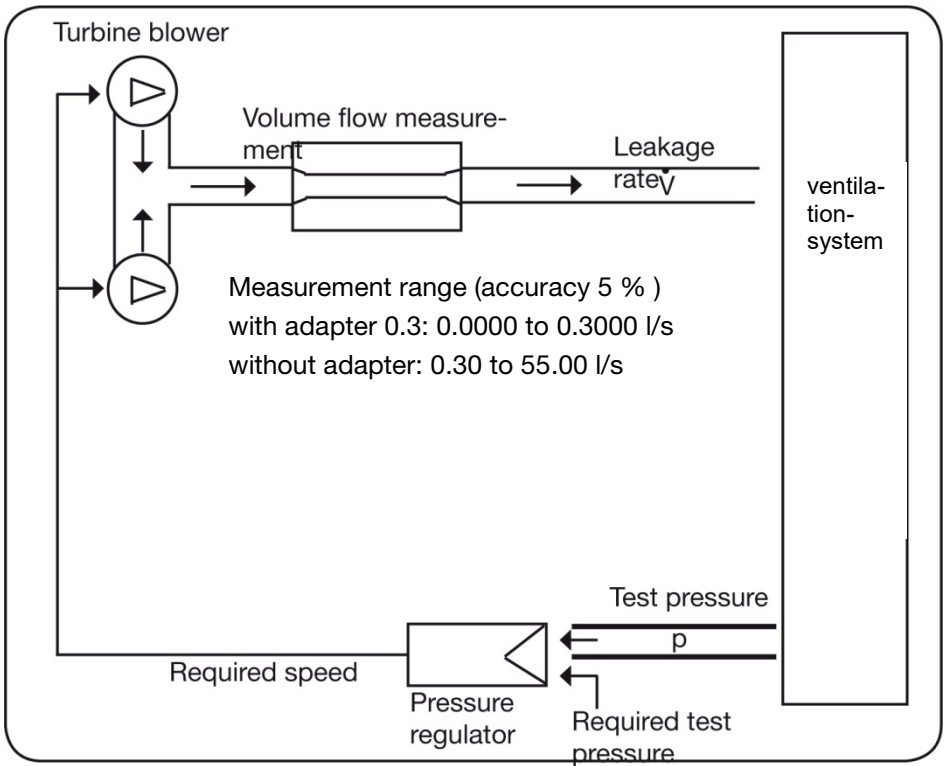


Fig. 9: Measuring principle Wöhler DP 700

4 Preparing a duct system for testing

4.1 Test location and object

The air duct system should be tested **in situ** according to the requirements of DIN EN 12599 or DIN EN 14134.



NOTE!

If possible, the duct section being tested should be brought to a positive or negative test pressure equal to the operating pressure.

A specific pressure may be stipulated as stated in the standards. (e.g. DIN EN 12599: 200 Pa, 400 Pa or 1 000 Pa positive pressure for supply duct or 200 Pa, 400 Pa or 750 Pa negative pressure for exhaust duct).

The user enter the negative or positive test pressure, as long as it is within measurement range of the meter.

4.2 Test time and object

DIN EN 12599 compliant leakage testing should be carried out while the duct system is being installed, when the ducts are still accessible (for example they have not been insulated yet).

If the duct system is particularly large or complex, leakage testing can be restricted to sections of the system. (See DIN EN 12599).

The duct surface area being tested should always be greater than 10 m². The duct surface area should be measured and calculated as defined in DIN EN 14239, and should be established in advance.



NOTE!

We recommend to estimate the anticipated leakage flow rate in advance (see the appendix).

4.3 Sealing the section of the system to be tested

- Before you start testing, seal off the duct section being tested from the rest of the system. All openings, outlets, etc. must be

carefully sealed.

It is extremely important to seal properly around the openings and the test connections. You will find sealing bladders for circular ducts in the accessories.



NOTE!

Use the Wöhler sealing elements with a blue marking for your measuring tasks.

4.4 Position of the meter



ATTENTION!

Before measuring with the device take it out of the case and place it in a free position. If you work with the device while it is in the case, the heat development will lead to dysfunctions and a safety switch off.



Fig. 10: Pressure point for adjusting the carrier

- Place the Wöhler DP 700 on a dry and flat surface and ensure a secure position.
- Adjust the carrier to a position that is favorable for you. Press the two pressure points (Fig. 1, point 13) to change the position.

Four positions of the carrier are possible.

- After that connect the probes and hoses required for the measurement, see chapter 3.2.

4.5 Connecting the meter to the duct system



Fig. 11: Example: positive pressure measurement without adapter

- The connecting points in the duct system being tested must be defined in advance. The connecting points should be about 2 m apart from each other to prevent one affecting the other.
- Use suitable joints to prepare the connections for the 50 mm air hose and the pressure hose.



ATTENTION!

Do not subject the hose connections to torsional stresses.

- Use the connection on the front (Fig.1, part 10) for positive pressure, and the connection on the top (Fig. 1, part 11) for negative pressure.



ATTENTION!

In general the adapter 0.3 is only required for

testing single components (DIN EN 15727, DIN EN 1751). In this case it always has to be installed at the front side, also in case of a negative pressure measurement.

- Next, attach the pressure hose to the pressure connection (positive pressure) (Fig. 1, part 4).
- A bayonet closure is used for the positive connection of the pressure measuring tube: Turn clockwise to lock and counter-clockwise to open.



NOTE!

The pressure hose is always attached to the positive connection (Fig. 1, part 4). The meter automatically detects positive pressure and negative pressure. The negative connection must always stay open (Fig. 1, part 5). Enter the test pressure with the correct sign (+ or -) into the meter. If no + or - is entered, the measurement will not start.

- Always start the tightness test without adapter.
- If the volume flow is < 0.3 l/s, install the adapter to guaranty an exact measurement result, see chapter 3.3.

4.6 Leakage test according to DIN EN 15727

DIN EN 15727 compliant measurements usually use lower flow rates.

- Execute the measurement according to the requirements of the DIN standard. It is also possible not to follow the recommended distance of 2 m between the hose and the tube.

In case of very sealed components it may be necessary to modify the control parameters, see chapter 10.8 .(Setup).

We recommend to take always a rough measurement in the laboratory mode first, or to measure always in the laboratory mode.

The modification of the control parameters will make sense, if you regularly measure components of the same size or type.



Fig. 12: Example: Measurement according to DIN EN 15727



Fig. 13: Negative pressure measurement with flow rate <math>< 0.3 \text{ l/s}</math>

In order to take measurements on the pressure side for very small components, the thin 4 m tube can be plugged directly into the adapter instead of the 50 mm air hose, and a nipple connection is used with the component.

For the negative pressure measurement use the hose adapter as shown in the opposite figure.

Next, connect the air hose 4 m to the hose adapter.



NOTE!

In DIN EN 1751 and DIN EN 15727 a virtual surface is defined that must be considered when testing single components.

5 Turning on the Wöhler DP 700

- When all necessary accessories have been connected as described, connect the Wöhler DP 700 to the mains power with the mains cable delivered with the device.



WARNING!

Risk of electrical shock!

The meter is supplied with a voltage of 230 VAC , 50 HZ or 110 V, 60 HZ. Touching electrically live components can be lethal.

Never touch the power supply with wet hands!

Do not unplug the power supply by pulling the cable!

Do not use the meter when the voltage requirements of the meter and the supply do not match!

- Switch on the Wöhler DP 700 with the Power switch (Fig. 1, part 1).

6 Test procedure according to DIN EN 12599

- If possible, the duct section being tested should be brought to a positive or negative test pressure equal to the operating pressure p_{design} .
- According to the norm the test pressure must be maintained within $\pm 5\%$ for five minutes. The test cycle can be stopped at any time.



NOTE!

Today the five-minutes-requirement is not valid any more, because the modern meters reach stable measurement conditions much earlier.

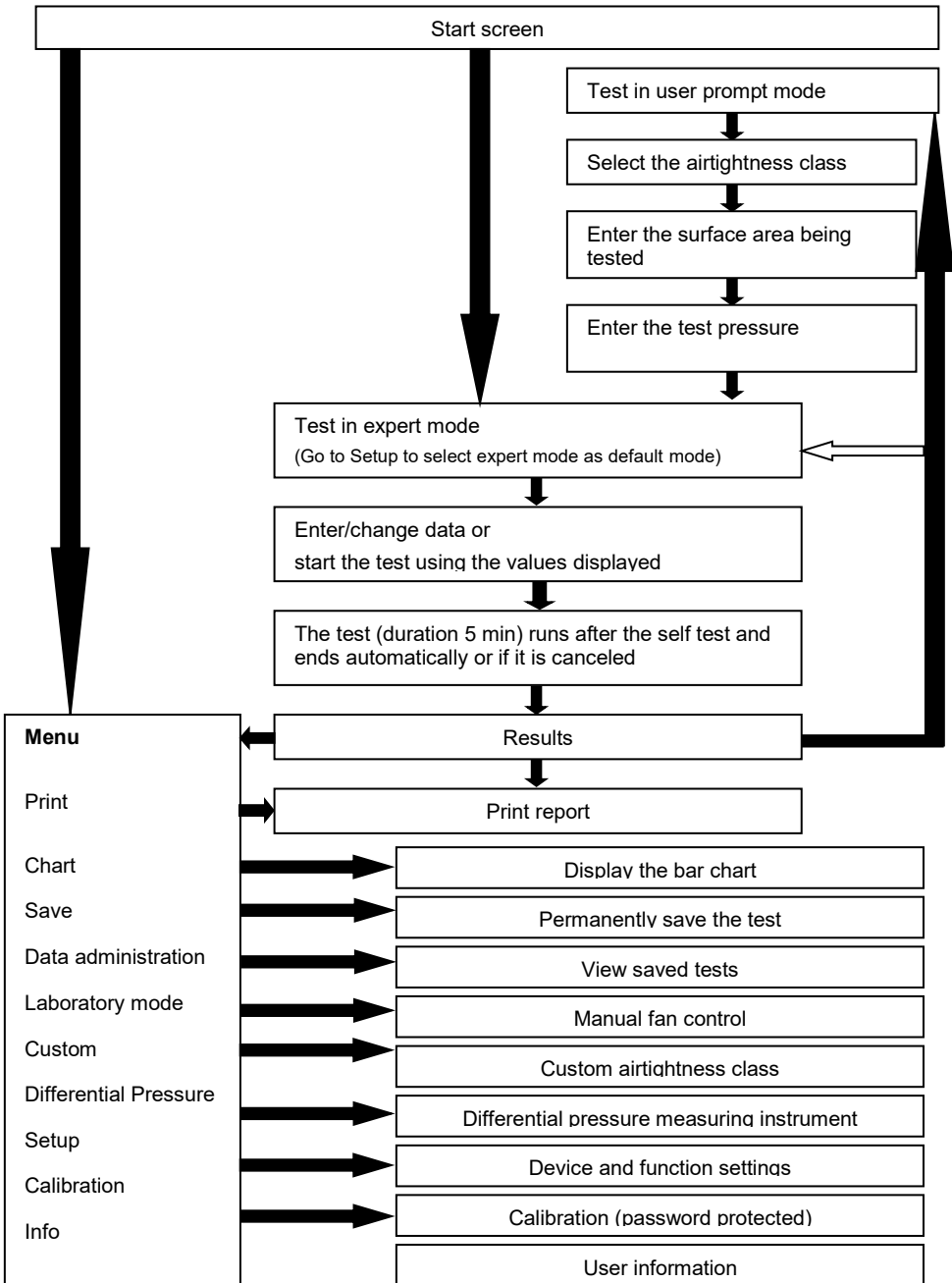
It is not necessary to correct the readings because of the temperature or pressure influence.



NOTE!

Please note the recommendations and notes in DIN EN 1507, DIN EN 12237, DIN EN 1507, DIN EN 13180, DIN EN 13403, DIN EN 1751, DIN EN 15727 and DIN EN 12599 or DIN EN 14134.

7 Menu navigation



8 Leakage test



Fig. 14: Start screen

After the device has been switched on the version is displayed.

If the meter is used for the first time the device automatically starts in the guided mode. If not the operation mode selected in the setup will appear.

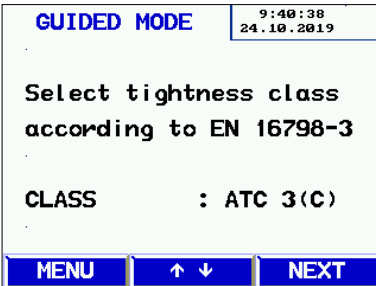


Fig. 15: Select tightness class

The device automatically starts in user prompt mode:

- Follow the prompts and select the airtightness class for the test using the \uparrow - or \downarrow -key.
- Press the "Next" key.

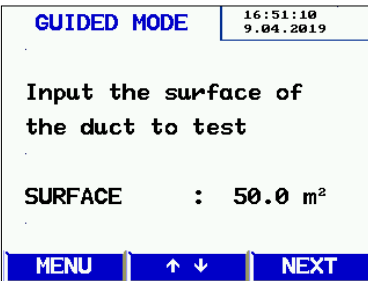


Fig. 16: Entering the duct surface

- Enter the duct surface using the \uparrow - or \downarrow -key.
- Press the "Next" key.

Leakage test

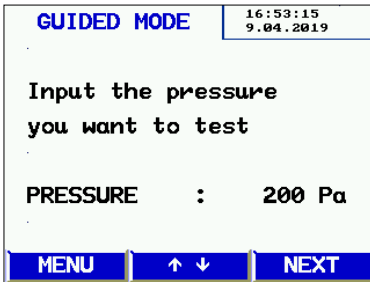


Fig. 17: Entering the test pressure

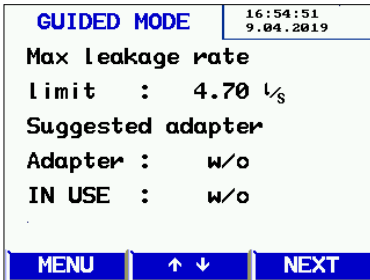


Fig. 18: Maximum permitted leakage flow rate



NOTE!

From here, the display is the same in the guided mode and in expert mode.

Follow the further instructions or adjust the parameters as described in the chapter "Expert mode".

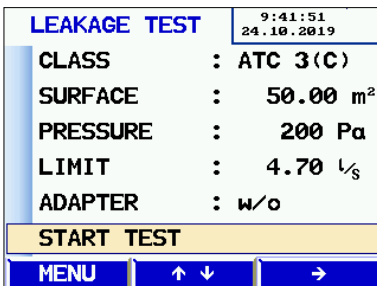


Fig. 19: Before starting the measurement

- Enter the test pressure using the \uparrow - or \downarrow -key.



NOTE!

Enter the plus or minus sign correctly !

- Attach the 50 mm air hose depending on the selected pressure (negative pressure > top of case, positive pressure > front of case).
- Always attach the pressure measuring tube to "+".
- Press the "Next" key.

The preliminary calculation of the maximum permitted leakage flow rate appears here.

The display suggests, if to measure with or without adapter and if the adapter is already installed.

- If necessary, install the adapter.
- Press the "Next" key.

The selected parameters and the maximum permitted leakage flow rate (limit value) are shown.

- Press the \rightarrow -key to start the test.

A self test is carried out before the test starts. The test starts once the selected pressure is reached, and continues for five minutes.



NOTE!

You can interrupt the test at any time by pressing Stop. After the interruption of the test, the result will be displayed.

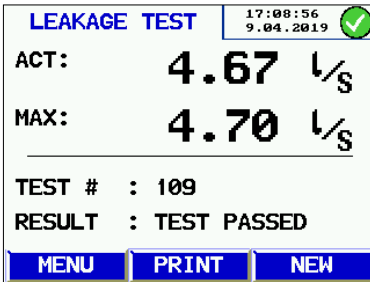


Fig. 20: Results

8.1 Printing the report

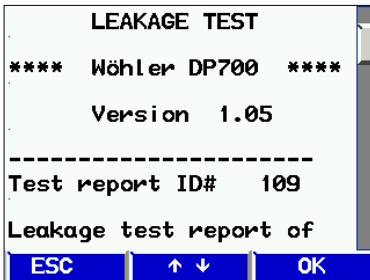


Fig. 21: Print preview

While the test is running, the achieved pressure and the current flow rate are displayed.

After the test duration of 300 s, the device stops automatically. (Standardized test duration)

The device indicates whether the test has passed or failed with the specified parameters.

- Press the "Print" key to print the report .
- Or press the "New" key to start a new test.

Before printing, the report is displayed.

- Use the ↑ or ↓-key to scroll through the report.
- Switch on the Wöhler TD 100 printer and place it close to the IR interface (Fig.1, part 6).
- Press OK to start printing.



NOTE!

Note: The report is not permanently stored unless you select "Save" on the menu.

8.2 Chart

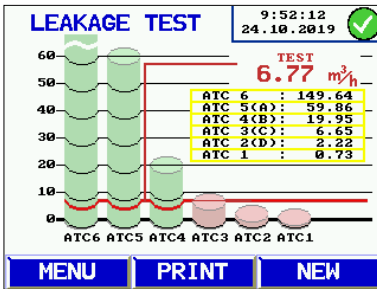


Fig. 22: Bar chart

To view the chart proceed as follows:

- Press the MENU key and press the ↑ or ↓-key to select Chart from the menu.
- Confirm by pressing →-key.
- Press the "Print"-key to print the report on the Wöhler TD 100.
- To return to the menu press the "Menu" or "New" key once.
- To start a new test, press the "Menu " key twice.

About the chart:

The bar chart shows the permitted leakage flow rate for the airtightness classes, with the specified m² and the actual test pressure. The test value appears as a red line.

Compliant airtightness classes are shown with green bars. Non-compliant classes are shown with red bars.

8.3 Expert mode

If you select expert mode in setup (see chapter 10.8), the meter will display the following input screen when it starts up.

You can enter your input or change the displayed parameters directly, as illustrated below using the airtightness class and the surface area as examples:

8.3.1 Entering/changing the airtightness class:

LEAKAGE TEST		9:49:57 24.10.2019
CLASS	:	ATC 3 (C)
SURFACE	:	50.00 m ²
PRESSURE	:	200 Pa
LIMIT	:	4.70 l/s
ADAPTER	:	w/o
START TEST		
MENU	↑ ↓	→

- Use the ↑- or ↓-key to select a particular line (the airtightness class in this example).
- Press the →-key to change the airtightness class.
- Press the ↑- or ↓-key to select another line.
- To start the test, select the bottom line and press the →-key.

Fig. 23: Select the airtightness class

8.3.2 Entering/changing the surface area

LEAKAGE TEST		9:47:47 24.10.2019
CLASS	:	ATC 3 (C)
SURFACE	:	50.00 m ²
PRESSURE	:	200 Pa
LIMIT	:	4.70 l/s
ADAPTER	:	w/o
START TEST		
MENU	↑ ↓	→

- Use the →-key to select the digit.
- Press the ↑- or ↓-key to change the selected digit.
- To leave the current input line, press ←- or →-key until you reach the end of the line.
- Press the ↑- or ↓-key to select the next input line you want to change.

Fig. 24: Entering the surface area

9 Messages

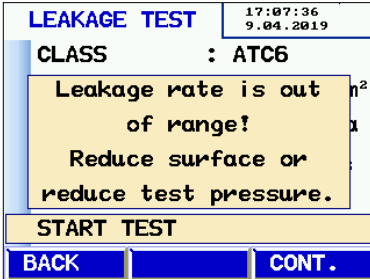


Fig. 25: Message "Leakage rate is out of range"

If the leakage flow rate calculated in advance exceeds the maximum output of the device, the following message will appear: "Leakage rate is out of range! Reduce surface or reduce test pressure."

- Change the test conditions by pressing the "Back" key.



NOTE!

Press the "Next" key to skip the message and start the test anyway. In this case it may not be possible to finish the test.

Other messages:

"Sensor error " during self test

- Switch off the device and restart it.
- If the error message appears again, the device needs to be serviced.

"Overheat!"

If the device is used for a long time at very high speeds, a safety cutout may be triggered.

- Remove the adapter from the device. You can start using the device again after it has cooled down.

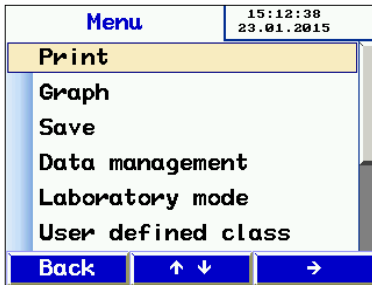
10 Main menu

To select a menu proceed as follows:

- Press the ↑ or ↓-key to move to a different menu entry.
- Press the →-key to select a menu entry.
- Press the MENU key to open the input screen for a new test.

10.1 Print

Report of the last test (see chapter 8.1).



NOTE!

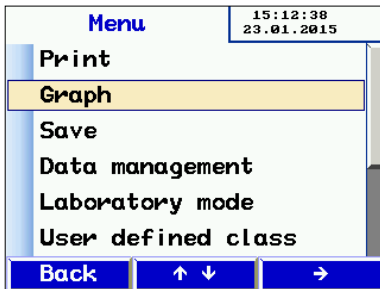
This point will only be available, if a test has been stored and the device has not been switched off after that.

- Use the ↑ or ↓-key to scroll through the report.
- Press the Back key to exit the menu or press OK to start printing.

Fig. 26: Print

10.2 Graph

Shows the chart of the most recent test. (see chapter 0).



NOTE!

This point will only be available if a test has been stored and the device has not been switched off after that.

Fig. 27: Chart

10.3 Recording

Save		15:15:00 23.01.2015
name:Maier		
no.: 1		
New Line		
Test	23.01.2012	
Back	↑ ↓	→

Fig. 28: Data administration

Save		15:40:51 23.01.2015
new customer		
BDA		
Back	↑ ↓	→

Fig 29: Data administration

customer new		15:26:16 23.01.2015
name:customer 1		
no.: 1		
LineLine 1		
Create customer		
Back	↑ ↓	→

Fig. 30: Set up a new customer

Press the →-key to choose “Save” from the menu – the customer administration screen appears.

On this screen the user can create a new customer or save the current test under existing customers.

- Press the →-key to select the “New customer” option.

- Enter the customer name, the sequence and the name of the measurement point.
- Proceed as follows:

Fig. 31: Entering the customer name

- Press the ←- oder →- key to move to the letter/digit you want to change. Press the ↑- or ↓-keys to change the letter/digit.
- To exit, press the →- or ←-key to move to the end of the line.
- Specify the customer number and sequence name in the same way.
- Select the "Create customer" line again and press the →-key.
- Press the Back-key to go to the list of customers.

The customer list will appear.

Fig. 32: Before saving the new customer file

- The new customer appears in the list of customers. Select the new customer by pressing the →-key.

The display now shows the available sequences that have been created for that customer.

- Press the ↑- and ↓-key to select the sequence and press the →-key to save.

Saving takes a few seconds.

Fig. 33: Measuring results saved under a customer.

As soon as the data has been saved, the test date will be displayed.

You can create another new sequence in this input screen.

10.4 Data administration

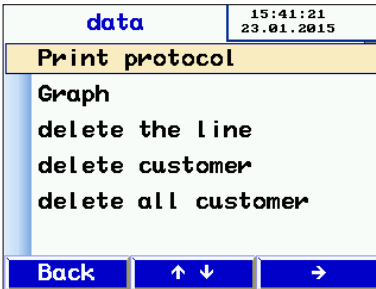


Fig. 34: Option "Data management"

Options for viewing/modifying saved data.

- Change lines by pressing the \uparrow - and \downarrow -keys. Select a line with the \rightarrow -key.

Functions

- View/print report or graph
- Delete lines/measuring points
- Delete customer records
- Delete all customer records

10.5 Laboratory mode

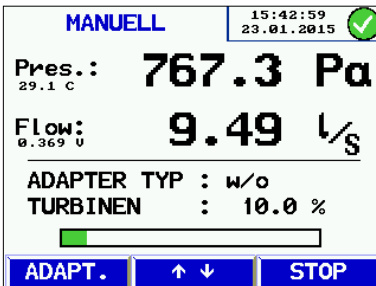


Fig. 35: Display in the laboratory mode

In laboratory mode, the test is carried out without automatic adjustment of the test pressure and without a time limit. This mode allows the test to be shortened considerably, and is particularly suitable for taking rough measurements.

After the self test, the screen shown in the opposite figure will appear.

- You can press the \uparrow - and \downarrow -keys to configure the pressure and flow rate manually.
- You can insert or remove the adapter during the test – turn down the fan, change the adapter and press the ADPT key to change the setting.
- Press "Stop" to end the test. Continue as described in chapter 8.

10.6 User-defined airtightness class

A user-defined leakage flow rate U can be selected in the start screen in addition to the standardized airtightness classifications. This means the tests can be performed in other applications that use different classifications, for example in power plants.

When the airtightness classes are selected, U only will appear if the value $\neq 0$ is defined.

The Wöhler DP 700 will consider the leakage flow rates of the following table for the different leakage classes.

DIN EN 13779	DIN EN 16798-3	Limit value for Leakage rate (f_{\max}) $\text{m}^3 \text{s}^{-1} \text{m}^{-2}$
	ATC 7	Nicht klassifiziert
	ATC 6	$0,0675 \times p_t^{0,65} \times 10^{-3}$
A	ATC 5	$0,027 \times p_t^{0,65} \times 10^{-3}$
B	ATC 4	$0,009 \times p_t^{0,65} \times 10^{-3}$
C	ATC 3	$0,003 \times p_t^{0,65} \times 10^{-3}$
D	ATC 2	$0,001 \times p_t^{0,65} \times 10^{-3}$
	ATC 1	$0,00033 \times p_t^{0,65} \times 10^{-3}$

Table 1: Density classes and their limit values

The specific limit value for each class (last column of the table) indicate the maximum value of the surface-related leakage volume flow in m^3/s per m^2 and also include the test pressure p_t . The first factor in the equations of the table does not have its own symbol in the standard. In the following, it is therefore referred to as the specific leakage coefficient C_{sL} so that the general equation for the limit value of the air leakage rate can be written in this way:

$$f_{\max} = C_{\text{sL}} \cdot p_t^{0,65} \cdot 10^{-3} \quad (1)$$

Since according to the table the specific value f_{\max} is given in $\text{m}^3 / (\text{s} \cdot \text{m}^2)$ the unit of the specific leakage coefficient C_{sL} is $\text{m}^3 / (\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0,65})$.

When entering a user-defined leakage class "U" in the leakage tester, an individual value can be specified for this specific leakage coefficient C_{sL} (note factor 1000 between U and C_{sL} , see list of symbols) in order to be able to use a leakage class that does not correspond to the pre-defined normative ATC classes.

It should be noted, however, that the test pressure (in Pa) and the surface to be tested (in m²) are also included in the air leakage rate and thus the calculated limit value deviates from the user-defined "U". In addition, "U" is entered in the leakage tester in the unit $1 / (\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0,65})$.

Example 1: Input of „U“ and resulting limit value

Input U : $0,275 \text{ 1} / (\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0,65})$
 Corresponds to $0,000275 \text{ m}^3 / (\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0,65})$

Test Pressure p_t : $50,0 \text{ Pa}$

Surface area A : $10,0 \text{ m}^2$

According to equation (1), this results in a specific limit value for air leakage of:

$$f_{\max} = 0,000275 \frac{\text{m}^3}{\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0,65}} \cdot (50,0 \text{ Pa})^{0,65} \cdot 10^{-3} = 3,4967 \cdot 10^{-6} \frac{\text{m}^3}{\text{s} \cdot \text{m}^2}$$

and together with the given surface area A the limit value is calculated to:

$$g_{\max} = f_{\max} \cdot A = 3,4967 \cdot 10^{-6} \frac{\text{m}^3}{\text{s} \cdot \text{m}^2} \cdot 10,0 \text{ m}^2 = 3,4967 \cdot 10^{-5} \frac{\text{m}^3}{\text{s}} = 0,0350 \frac{\text{l}}{\text{s}}$$

This limit value is also displayed in the measurement overview of the leakage tester after U has been entered and selected and the test pressure and surface area have been entered.

Example 2: Back-calculation to a desired limit value of the volume flow rate

If the limit value for the air leakage is to be specified instead of the specific leakage co-efficient CsL or "U", the value "U" for the user-defined leakage class must first be calculated from this, as a direct entry of the limit value is not possible in the leakage tester.

Target Limit value G_{\max} : $0,05 \text{ l/s}$

Test Pressure p_t : $50,0 \text{ Pa}$

Surface Area A : $10,0 \text{ m}^2$

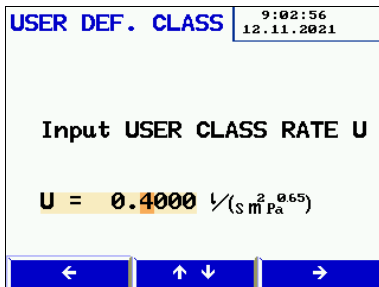
From equation (1) and the relationship $f_{\max} = g_{\max}/A$ it follows after conversion:

$$C_{sL} = \frac{g_{\max}}{A \cdot p_t^{0,65} \cdot 10^{-3}}$$

Using the equation $U = 1000 C_{sL}$, this results in the value to be entered for the user-defined tightness class U:

$$U = \frac{0,05 \frac{1}{s}}{10,0 \text{ m}^2 \cdot (50,0 \text{ Pa})^{0,65} \cdot 10^{-3}} = 0,3932 \frac{1}{\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0,65}}$$

If this value is entered for the user-defined tightness class, the desired target limit value for air leakage G_{\max} is obtained.



- Press the ←- or →- key to move to the letter/digit you want to change.
 - You can use the ↑- and ↓-keys to enter a custom leakage flow rate.
 - Save the value you entered by pressing the →-key.
- Alternatively,
- press the ←-key to exit.

Fig. 36: Entering the user defined leakage class

10.7 Differential pressure

In the idle state after the meter is switched on, the Wöhler DP 700 can be used as a differential pressure measuring instrument in order to monitor a pressure curve over time.



Fig. 37: Capillary hoses connected to the Wöhler DP 700 for the differential pressure measurement

- If you want to measure the differential pressure between two test connections (e.g. for iris diaphragms, filter pressure drops, etc.) connect one capillary hose to the positive pressure connection (fig. 1, part 4) and the other capillary hose to the negative pressure connection (fig. 1, part 5).

You will find suitable capillary hoses in the chapter "Accessories".

The scale is self-scaling, showing a 120 s block that is continuously updated, overwriting the old test curve.

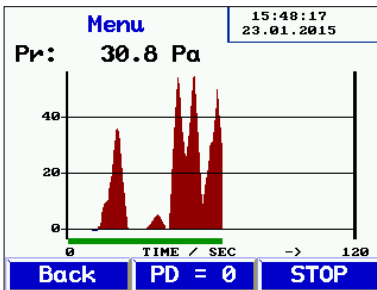


Fig. 38: Pressure curve

- Press the PD = 0 key to reset the display.
- Press the Back key to return to the menu.
- Press the Stop key to end the test.
- You can then press "Print" to print the graph on the Wöhler TD 100, see chapter 8.1.

10.8 SETUP

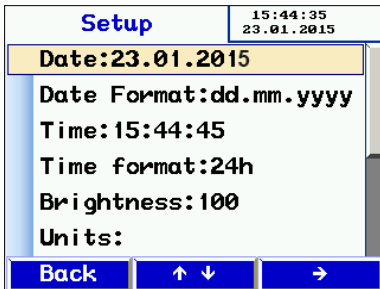


Fig. 39: Setup menu, upper display

- Press the **↑**- and **↓**-key to scroll up and down.
- Press the **→**-key to select the parameter.
- Press the **←**- and **→**-keys to select a letter or digit to change.
- Change the letter or digit by pressing the **↑**- and **↓**-keys.
- To exit, press the **→**-key to move to the end of the line.

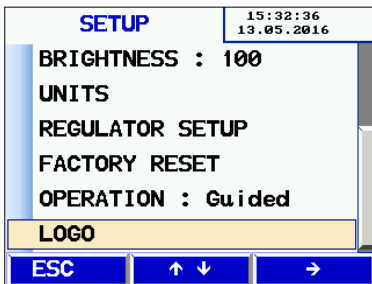


Fig. 40: Setup menu, lower display

If necessary the following functions can be changed in the Setup menu:

- Date and time
- Brightness: The Brightness option adjusts the screen brightness.
- Units: Various options for the units of measurement, explained in chapter 10.8.1.
- Regulator Setup: allows the PI controller to be customized for automatic measurement, if required. Standard values can be selected.
- Factory Reset: Reset to factory settings
- Operation: Use the **→**- key to toggle between guided mode and expert mode.
- LOGO: you can enter customer-specific text here, to appear at the top of the report printout

10.8.1 Select the pressure unit

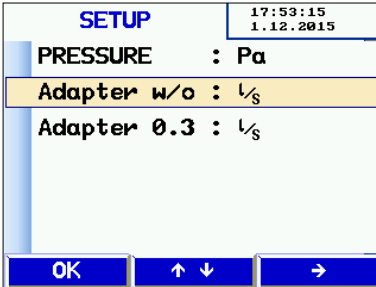


Fig. 41: Select the unit

Select the units of measurement for the display. The device always bases its internal calculations on the units l/s and Pa.

- Select the menu entry by pressing the ↑- and ↓-keys.
- Press the →-key to select the unit.

Available units:

- Pressure
pascal (Pa), hectopascal (hPa), millibar (mBar), water column (mm H₂O and "wc)
- Leakage flow rate: l/s, m³/h, l/min, l/h, CFM, l/s m² (leakage air standardized to 1 m²)

- Exit by pressing OK.

10.9 Calibration

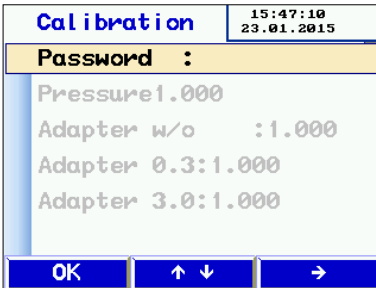


Fig. 42: Calibration menu locked by a password

! ATTENTION!

Only authorized service centers may calibrate the device. Improper changes may lead to incorrect results.

This menu can only be entered with a pass word.

10.10 Info

Device information for service.


INFO		9:58:15 10.04.2019
CYCLES	: 111	
TOTAL h	: 7:18	
PRODUCTION:	28.09.2018	
CALIB.	: 6.12.2018	
FIRMWARE	: V1.05	
	(9.04.2019)	
ESC	↑ ↓	→

Fig. 43: Info Display

11 Content of report printout

12

LEAKAGE TEST	LEAKAGE TEST	Notes on the printout
<p>**** Wöhler DP700 **** Version 1.05</p>	<p>**** Wöhler DP700 **** Version 1.05</p>	Device Type
----- Test report ID# 116	----- Test report ID# 117	Firmware Version
Leakage test report of air ducts in accordance to EN 12237, EN 1507, EN 12599 and EN 16798-3	Leakage test report of air ducts in accordance to EN 12237, EN 1507, EN 12599 and EN 16798-3	Consecutive test number
----- Test object information	----- Test object information	Specified surface area
<p>Surface area :121.20 m² Tightness cl : ATC4 Rate factor RF: 9 l/s 1/m² Adapter type: w/o Pressure : 100Pa</p>	<p>Surface area :121.20 m² Tightness cl : U Rate factor RF: 8 l/s 1/m² Adapter type: w/o Pressure : 200Pa</p>	Selected airtightness class
<p>Testpressure: 99Pa Leakage rate: 11.20l/s Endurance : 117 sec</p>	<p>Testpressure: 207Pa Leakage rate: 15.65l/s Endurance : 300 sec</p>	Leakage flow rate used for analysis
<p>Limit at ATC6 :162.49 Limit ATC5 (A): 65.00 Limit ATC4 (B): 21.67 Limit ATC3 (C): 7.22 Limit ATC2 (D): 2.41 Limit at ATC1 : 0.79</p>	<p>Limit at ATC6 :261.60 Limit ATC5 (A):104.64 Limit ATC4 (B): 34.88 Limit ATC3 (C): 11.63 Limit ATC2 (D): 3.88 Limit at ATC1 : 1.28 Limit at U : 31.00</p>	Specified adapter type
Result:	Result:	Preset Pressure
Test object TEST PASSED	Test object TEST PASSED	Mean pressure actually achieved---
Date: 10.04.2019	Date: 10.04.2019	Actual leakage flow rate in l/s
Time: 13:45	Time: 13:51	Test duration (not in laboratory mode)
Signature:	Signature:	
-----	-----	



The printout on the left is an automatic test with airtightness class ATC 4, which was stopped after 117 s. (The automatic test duration is 300 s.)

The printout on the right is a test in laboratory mode with a variable (non-standard) airtightness class of 8 l/s m², printed after an arbitrary test duration.

13 Data transfer with the PC or notebook

The data can be transferred from the Wöhler DP 700 to a PC or notebook via a USB cable. For the data transfer the user needs the software included in the documentation set (see chapter "Accessories"). The user can use the software to create customer files and measuring points/sequences in advance and upload them to the Wöhler DP 700 before starting the measurement.

The software can also be used to install updates of the Wöhler DP 700 firmware as well as the PC software itself.

- Connect the USB cable to the USB port of the Wöhler DP 700 (fig. 1, part 7) and the other end of the cable to the USB port of the PC.
- Start the software on your PC.
- On the PC, click on "Receive" to start the data transfer from the device to the PC.

13.1 Data transfer from the Wöhler DP 700 to the PC



NOTE!

If the Program receives data, all customer data in the program will be replaced by those stored in the instrument. To avoid this, save the existing data under a different name.

After the data transfer the text "Transmission succeeded" will appear and the number of transferred sequences is indicated.

- You will find more detailed description in the software manual.

13.2 Data transfer from the PC to the Wöhler DP 700

- On the PC, click on "Send" to send the selected data from the computer to the device.



NOTE!

If you transfer data from the PC to the meter, all data stored on the meter before will be deleted.

14 Maintenance

The Wöhler DP 700 contains no parts that can be serviced. Therefore the meter should never be opened by the user.





WARNING!

The meter may only be opened by a Wöhler Service Employee.

Caution - Danger to Life

230V 50 Hz

14.1 Maintenance work

Interval	Maintenance work
Depends on the usage, but at least once a year	Slightly grease all o-rings of the pressure and air connection and of the adapter.
In case of pollution	Change the filter pads in the air connection (under pressure), see fig. 1, part 11
If necessary	change the primary fuse - Disconnect the power cord from the wall socket. - Remove the fuse holder by pulling the upper edge.
<p> ATTENTION! Only replace the fuse by another of the same type.</p>	
Once a year	Control and calibration of the device by Wöhler or an authorized service center.
<p> ATTENTION! Only Wöhler service employees can calibrate the Wöhler DP 700 in the factory.</p>	

15 Warranty and Service

15.1 Warranty

Each Wöhler DP 700 Leakage Tester will be tested in all functions and will leave our factory only after extensive quality control testing. The final control will be recorded in detail in a test report and delivered with any unit.

If used properly, the warranty period for the Wöhler DP 700 will be twelve month from the date of sale. Ware parts, e.g. filters are not covered by this warranty.

This warranty does not cover the freight and packing costs when the device is sent to the factory for repair.

Service by non authorized personnel or making modifications to the analyzer voids any warranty.

15.2 Service

Wöhler has built our reputation on excellence in customer service. Therefore, of course, we are readily available to assist you after the warranty period ends.

- Send us the device and we will repair it and return it to you with our package service.
- Immediate help is provided by our technical staff over the telephone.

16 Accessories

Sets

Sealing Element Set for round air ducts with hand pump and 5 sealing bladders type 3, 5 sealing bladders type 5 and 5 sealing bladders type 10 Order no. 7103

Documentation set for the data analysis with the PC software USB cable, Wöhler TD 100 Thermal Printer, Thermal Paper Order no. 7112

Capillary hoses for the differential pressure measurement

Capillary hose, positive connection Order no. 2604

Capillary hose, negative connection Order no. 2672

Hose

Air hose 10 m, Ø 50 mm Order no. 22235

Consumables

Filter Pad Wöhler DP 700 , package of 5 Order no. 2617

Thermal Paper, 10 rolls for Wöhler TD 100 Thermal Printer Order no. 4145

17 Declaration of Conformity

The manufacturer:

Wöhler Technik GmbH
Wöhler-Platz 1, D-33181 Bad Wünnenberg

declares that the product

product name: Leakage Tester
model number: Wöhler DP 700

complies with the key safety requirements set down in the guidelines of the Council for the Harmonization of the Legal Requirements of the Member States in relation to the electromagnetic compatibility 2014/130/EU and the low voltage 2014/35/EU.

The following standards were availed of to evaluate the product in respect of the electromagnetic compatibility:

EN 61000 (electromagnetic compatibility EMC)
EN 55011, classe B, EN 55014, EN 55016, EN 55022 (radio interference)

18 UKCA Declaration of Conformity

The manufacturer:

Wöhler Technik GmbH

Wöhler-Platz 1, D-33181 Bad Wünnenberg

hereby declares that the following product:

Product: Leakage Tester

Model: Wöhler DP 700

is in conformity with the requirements of the following legislation:

Electromagnetic Compatibility Regulations 2016 and
Electrical Equipment (Safety) Regulations 2016

The following standards were used to assess the products in terms of electromagnetic compatibility:

BS EN 61000 (electromagnetic compatibility EMC)

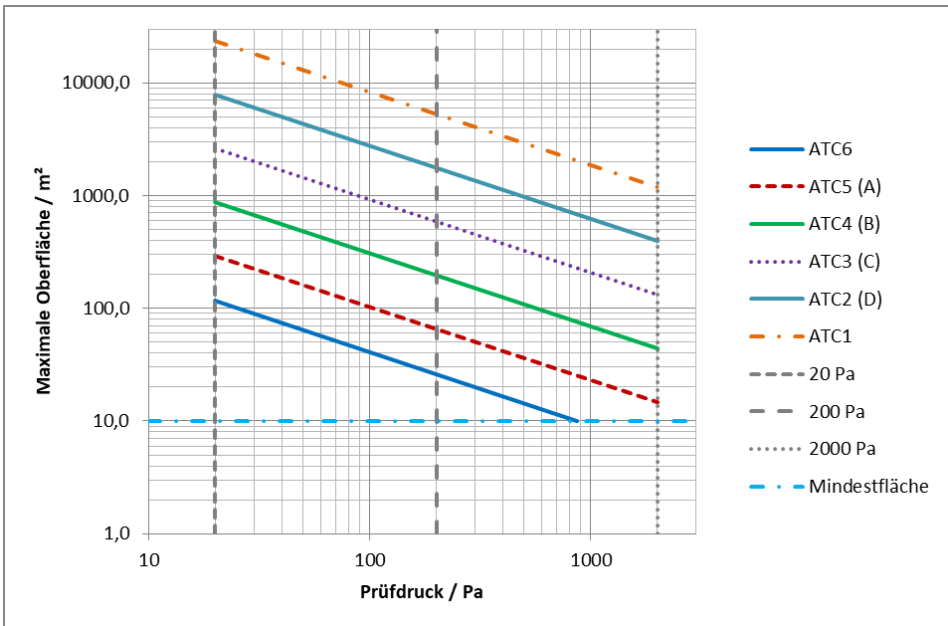
BS EN 55011, classe B, BS EN 55014, BS EN 55016, BS EN 55022 (radio interference)

19 Appendix

Theoretical measuring range limits at 230 V 50 Hz

Tightness class	ATC6	ATC5 (A)	ATC4 (B)	ATC3 (C)	ATC2 (D)	ATC1
20 Pa	115 m ²	290 m ²	870 m ²	2600 m ²	7800 m ²	23770 m ²
200 Pa	26 m ²	65 m ²	195 m ²	580 m ²	1750 m ²	5320 m ²
2000 Pa	5 m ²	15 m ²	44 m ²	130 m ²	390 m ²	1190 m ²

Table 2: Theoretical measuring range limits at 230 V 50 Hz



An Excel spreadsheet containing a rough estimate of the anticipated leakage flow rate is available on request.

DIN EN 12599 compliant leakage test using the Wöhler DP 700

Test pressure pt Surface Area A

200 Pa

20 m²

Tightness class DIN EN 16798-3	Tightness class DIN EN 13779	Max. permitted leakage flow rate	Adapter
ATC 6		42,27 l/s	no Adapter
ATC 5	A	16,91 l/s	no Adapter
ATC 4	B	5,64 l/s	no Adapter
ATC 3	C	1,88 l/s	no Adapter
ATC 2	D	0,63 l/s	Adapter 0,3
ATC 1	-	0,21 l/s	Adapter 0,3

Table 3: Example with 200 Pa and 200 m² duct surface area.

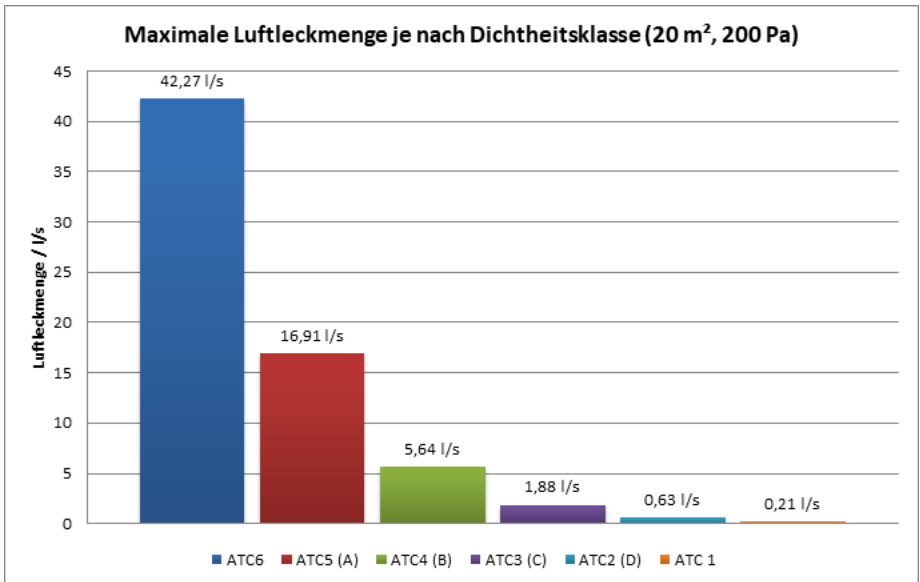


Fig. 44: Chart of the test pressure depending on the surface according to the leakage classes

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