

User Guide

Sanitary Process Refractometer

PR-43-AC/AP



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Table of contents

1.	About this document	5
1.1	Version information.....	5
1.2	Related manuals.....	5
1.3	Documentation conventions.....	5
1.4	Trademarks.....	6
2.	Product overview	7
2.1	Vaisala Sanitary Process Refractometers PR-43-AC and PR-43-AP.....	7
2.2	Safety.....	7
3.	Installation	9
3.1	Choosing mounting location.....	9
3.2	Checklist for pipe mounting.....	9
3.3	Checklist for mounting in tank, vessel or large pipe.....	10
3.4	Mounting guide.....	11
3.5	Electrical connections.....	12
4.	Prism wash	16
4.1	Prism coating.....	16
4.2	Prism wash.....	16
4.2.1	Recommended wash pressures and times.....	17
4.2.2	Prism wash systems.....	18
4.2.3	Prism wash nozzles.....	22
5.	Technical data	25
5.1	Compatibility.....	25
5.2	Refractometer rangeability.....	25
5.3	Sanitary process refractometer PR-43-AC.....	25
5.3.1	PR-43-AC model code.....	26
5.3.2	PR-43-AC mounting hardware model code.....	28
5.3.3	PR-43-AC specifications.....	32
5.3.4	PR-43-AC parts list.....	34
5.3.5	PR-43-AC mounting specifics.....	37
5.3.6	Mounting specifics for EHEDG certified PR-43-AC configuration.....	44
5.3.7	3-A Sanitary Standard compliance.....	44
5.4	Sanitary process refractometer PR-43-AP.....	46
5.4.1	PR-43-AP model code.....	47
5.4.2	PR-43-AP mounting hardware model code.....	49
5.4.3	PR-43-AP specifications.....	50
5.4.4	PR-43-AP parts lists.....	52
5.4.5	PR-43-AP mounting specifics.....	55
5.4.6	Mounting specifics for EHEDG certified PR-43-AP configuration.....	58
5.4.7	3-A Sanitary Standard compliance.....	59
Appendix A: Refractometer verification		60

Appendix B: PR-43 refractometer verification form.....62

Appendix C: EU declaration of conformity..... 63

Warranty..... 65

Technical support..... 65

Recycling..... 65

List of figures

Figure 1	Refractometer models.....	7
Figure 2	PR-43-AC and PR-43-AP mounting guide.....	11
Figure 3	The M12 connector.....	12
Figure 4	Connecting refractometer cable to refractometer.....	13
Figure 5	Wiring with analogue output only.....	13
Figure 6	Wiring options with both analogue and digital outputs.....	14
Figure 7	Wiring options with both analogue and digital outputs and RJ45 ethernet connector.....	14
Figure 8	Connections in M12 and RJ-45 connectors.....	15
Figure 9	Prism wash system for steam.....	19
Figure 10	Wiring for prism wash system for steam.....	20
Figure 11	Prism wash system for high pressure water.....	21
Figure 12	Wiring for prism wash system for high pressure water.....	22
Figure 13	Wash nozzles for flowcell AFC-HSS-XXX-XX-NC.....	22
Figure 14	Process connection of wash nozzle in flowcell.....	24
Figure 15	PR-43-AC rangeability.....	25
Figure 16	PR-43-AC dimensions.....	26
Figure 17	Refractometer cover assembly.....	34
Figure 18	PR-43-AC assembly.....	36
Figure 19	Mounting with sanitary ferrule, pipe diameter 80 mm (3 in) or more.....	37
Figure 20	Flow cell AFC-HSS-H10 for pipe diameter 25 mm (1 in) and H15 for pipe diameter 40 mm (1.5 in).....	38
Figure 21	Flow cell AFC-HSS- with wash nozzle connection (-NC) H10 for pipe diameter 25 mm (1 in) and H15 for pipe diameter 40 mm (1.5 in).....	39
Figure 22	Flow cell AFC-HSS-H20 for pipe diameter 50 mm (2 in) and H25 for pipe diameter 65 mm (2.5 in).....	40
Figure 23	Flow cell AFC-HSS- with wash nozzle connection (-NC) H20 for pipe diameter 50 mm (2 in) and H25 for pipe diameter 65 mm (2.5 in).....	41
Figure 24	Side flow cells.....	42
Figure 25	I-Line fitting for PR-43-AC.....	43
Figure 26	Mounting with sanitary ferrule, pipe diameter 80 mm (3 in) or more EHEDG certified configuration.....	45
Figure 27	Dimensions of an inserted refractometer PR-43-AP-H25-L170.....	46
Figure 28	Flush mounted refractometer PR-43-AP-T10-L00.....	47
Figure 29	Refractometer cover assembly.....	52
Figure 30	PR-43-AP assembly.....	54
Figure 31	Insertion of probe refractometer PR-43-AP-H25.....	56
Figure 32	Flush mounting probe refractometer PR-43-AP-T10-L100.....	57
Figure 33	I-Line fitting for PR-43-AP.....	58
Figure 34	EHEDG certified PR-43-AP.....	59
Figure 35	Universal sample holder PR-1012.....	60

List of tables

Table 1	Document versions (English).....	5
Table 2	Related manuals.....	5
Table 3	Wash medium parameters for integral wash nozzles in PR-43-AP.....	17
Table 4	Wash medium parameters for flowcell wash nozzle AFC.....	17
Table 5	Flowcell -H10 or -H15.....	23
Table 6	Flowcell -H20 or -H25.....	23
Table 7	Flowcell -H30.....	23
Table 8	Flowcell -H40.....	23
Table 9	Prism wash nozzle selection.....	24
Table 10	Sanitary compact refractometer for pipelines.....	27
Table 11	Mounting hardware without wash nozzles.....	28
Table 12	EHEDG certified mounting hardware.....	28
Table 13	Mounting hardware with wash nozzles.....	29
Table 14	Mounting hardware, mini flow cell.....	30
Table 15	Mounting hardware, Varivent DN65 connection.....	30
Table 16	Mounting hardware.....	31
Table 17	PR-43-AC specifications.....	32
Table 18	Refractometer cover assembly parts list.....	34
Table 19	PR-43-AC assembly parts list.....	36
Table 20	I-Line fitting for PR-43-AC.....	43
Table 21	Mounting materials.....	45
Table 22	SANITARY PROBE REFRACTOMETER for large pipelines and vessels.....	47
Table 23	SANITARY PROBE REFRACTOMETER with prism wash for large pipelines and vessels.....	49
Table 24	Mounting hardware for PR-43-AP refractometer.....	50
Table 25	PR-43-AP specifications.....	50
Table 26	Refractometer cover assembly parts list.....	52
Table 27	PR-43-AP assembly parts list.....	54
Table 28	Verification results display.....	62

1. About this document

1.1 Version information

This document provides instructions for installing and using the Vaisala K-PATENTS® Sanitary Process Refractometers PR-43-AC and PR-43-AP.

This product manual is delivered to the end user with a Vaisala K-PATENTS® product. Information in this manual is subject to change without notice. When the manual is changed, a revised copy is published at www.kpatents.com.

Table 1 Document versions (English)

Document Code	Date	Description
M212438EN-C	April 2020	Manual updated to new format, template, and document code. Minor changes to content.
IM-EN-PR43ACAP 2.00	September 2019	Changed K-Patents to Vaisala.
IM-EN-PR43ACAP 1.12	June 2018	IP rating updated.

1.2 Related manuals

Table 2 Related manuals

Document Code	Name
M212455EN	<i>Sanitary Process Refractometer PR-43 Series User Guide</i>
IM-EN-MI	<i>Multichannel User Interface MI Instruction Manual</i>
IM-EN-CI	<i>Compact User Interface CI Instruction Manual</i>
IM-EN-PR43IAAX	<i>Process Refractometer PR-43-...-IA/AX/CU Instruction Manual</i>

1.3 Documentation conventions



WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.



CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.



Note highlights important information on using the product.



Tip gives information for using the product more efficiently.



Lists tools needed to perform the task.



Indicates that you need to take some notes during the task.

1.4 Trademarks

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2. Product overview

2.1 Vaisala Sanitary Process Refractometers PR-43-AC and PR-43-AP

The sanitary refractometers PR-43-AC and PR-43-AP provide a digital interface detection system for alimentary industry.

The PR-43-AC/AP measures the refractive index n_D and the temperature of the process medium. The concentration of the process liquid is calculated from these values when the composition of the process medium is known.

The output values of the refractometer are transmitted through mA output and digitally through an Ethernet connection by using a UDP/IP protocol (for specification see *PR-43 general manual*). mA output is available with mA output cable (mA only) or with a split cable (mA and Ethernet).

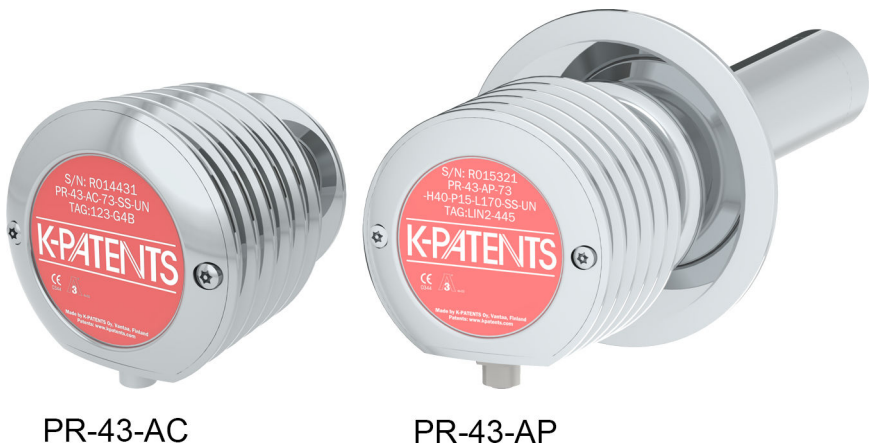


Figure 1 Refractometer models

2.2 Safety

This product has been tested for safety. Note the following precautions:



WARNING! Only licensed experts may install electrical components. They must adhere to local and state legislation and regulations.

The process medium may be hot or otherwise hazardous. Use shields and protective clothing adequate for the process medium. Do not rely on avoidance of contact with the process medium.



Wear protective eyewear.



Wear protective gloves.

Precautions when removing a sensor from the process line :

- Check that the process line is depressurized and drained
- Loosen the flowcell screws cautiously; be prepared to tighten again
- Ensure you are clear of any possible spillage and you have a clear emergency escape path

3. Installation

3.1 Choosing mounting location

The refractometer mounting location should be chosen with care to ensure reliable readings from the process.

The mounting location needs to be such that sediments or gas bubbles cannot accumulate by the refractometer. Good flow velocity is essential in keeping the prism clean.



CAUTION! If the process pipe vibrates, support the pipe. A vibrating pipe might damage the inline refractometer mounted on it.

A Vaisala K-PATENTS® inline refractometer can be located either indoors or outdoors in most climates. However, when a refractometer is located outdoors, some basic protection against direct exposure to sunlight and rain should be provided. Special care should be taken if the pipe wall is translucent (e.g. of fiberglass), as light from outside reaching the prism through the pipe wall may disturb the measurement.

The refractometer cover should not be exposed to high temperature radiation. In most cases, draft and natural convection provide sufficient air cooling if the air gets to flow freely around the refractometer head.

Additional cooling is necessary when the ambient temperature is higher than 45 °C (113 °F) or when the process temperature is above 110 °C (230 °F) and the ambient temperature is above 35 °C (95 °F). The air cooling is improved by blowing pressurized air against the refractometer cover. The pressurized air can be supplied by the ventilation system. It is also possible to mount a PR-14038 cooling cover for cooling with water.



CAUTION! Always mount the refractometer so that the interconnecting cable points downwards from the refractometer head.

3.2 Checklist for pipe mounting

The PR-43-AC and PR-43-AP are mounted in a pipe. Vaisala recommends a flow velocity between 1 and 3 m/s (3–10 ft/s). If the flow velocity exceeds 6 m/s (20 ft/s), there is a risk of cavitation. Cavitation may damage the refractometer and the piping. Too slow a flow velocity may cause erroneous measurement readings due to coating or stratification (layering) of the sample on the prism.

The diameter and form of the pipe and the process temperature all affect the measurement and need to be taken into account.

- If the process pipe diameter varies, select the *position with the smallest diameter* (and accordingly highest velocity). Then the prism stays clean better.

- If the refractometer is used in a feed-back control loop, *make the time lag short*. E.g. when a dilution valve is controlled, mount the refractometer close to the dilution point. However, make sure complete mixing has occurred at mounting location.
- If the temperature varies along the process pipe, select the *position with the highest process temperature*. That minimizes the risk of coating, because higher temperature means higher solubility and also lower viscosity.
- Often the *position with the highest process pressure* (= after pump + before valve) has favorable flow conditions without sedimentation or air trapping risks.
- The refractometer should be conveniently accessible for service.

3.3 Checklist for mounting in tank, vessel or large pipe

A probe refractometer PR-43-AP can be inserted with a flange or clamp into tanks and vessels which either don't have a scraper or where the mixer doesn't touch the vessel wall. A probe refractometer can also be flush mounted in a cooker where the scraper touches the wall.

- The inserted probe refractometer is mounted close to a stirrer to ensure representative sample of the process liquid and to keep the prism clean.
- The refractometer should be conveniently accessible for service.

3.4 Mounting guide

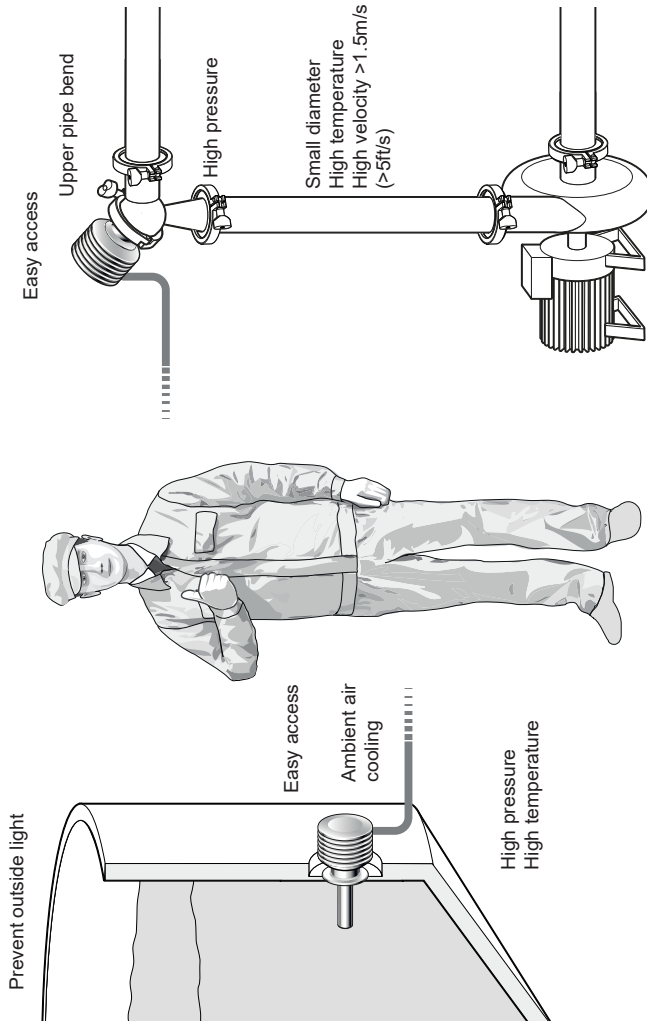


Figure 2 PR-43-AC and PR-43-AP mounting guide

3.5 Electrical connections

The refractometer has an M12 connector in the refractometer for power supply, mA output and Ethernet connections.

Figure 3 The M12 connector



PR-43 refractometers are powered with 24 VDC. For connecting the refractometer to Multichannel user interface MI, see the *Instruction manual for Multichannel User Interface MI*. For connecting the refractometer to Compact user interface CI, see the *Instruction manual for Compact User Interface CI*. See the following figure for instruction how to connect the M12 refractometer cable.

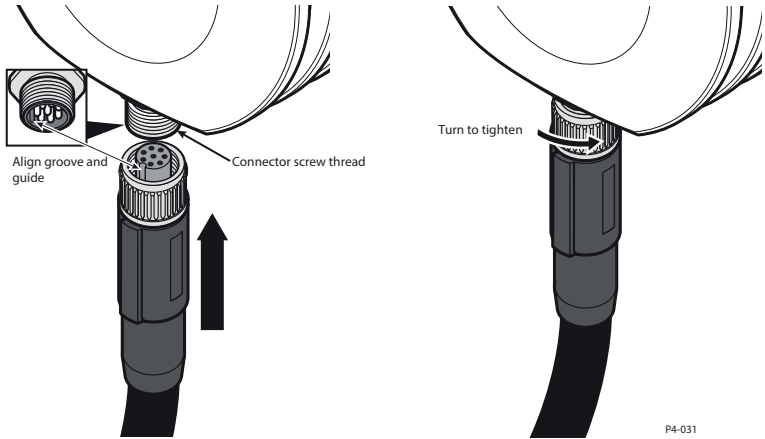


Figure 4 Connecting refractometer cable to refractometer

The PR-43 refractometer provides both analog (mA) and digital output signals. See the following figure for the wiring when only analog output is used.

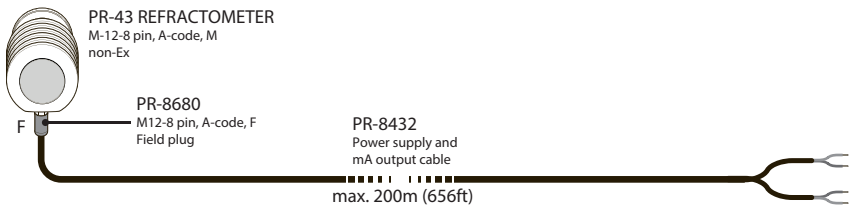


Figure 5 Wiring with analogue output only

The following figure shows the options for connecting the refractometer with both analog and digital outputs. Both Compact user interface CI and Multichannel user interface MI use the digital output signal.

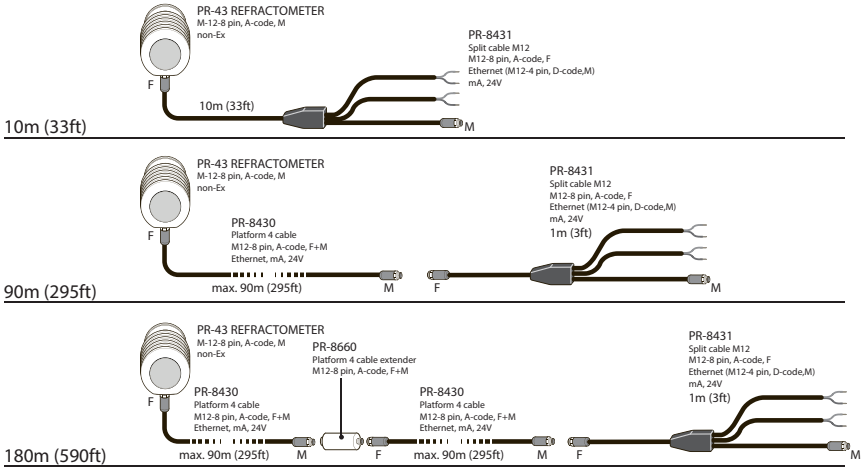


Figure 6 Wiring options with both analogue and digital outputs

The following figure shows the wiring options when both analogue and digital outputs are used, with RJ45 ethernet connector.

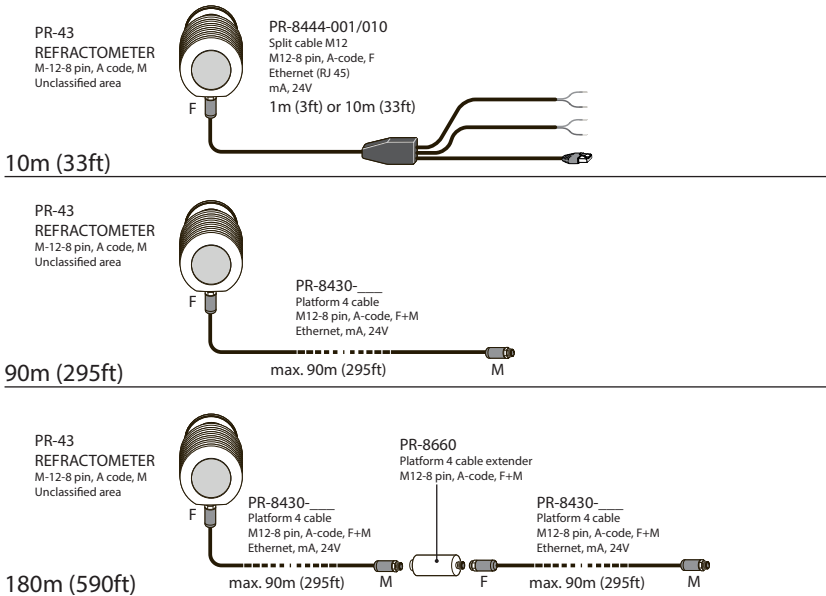


Figure 7 Wiring options with both analogue and digital outputs and RJ45 ethernet connector

RJ45				M12				Signal		
Pairs		Pin	Colour	Pairs						
1	2			1	2	3	4		Pin	Colour
x		1	wh/og	x				6	wh/og	Eth TX+
x		2	og	x				4	og	Eth TX-
					x			1	wh/bu	mA+
					x			7	bu	mA-
	x	3	wh/gn			x		5	wh/gn	Eth RX+
	x	6	gn			x		8	gn	Eth RX-
							x	2	wh/bn	VDD
							x	3	bn	GND

Figure 8 Connections in M12 and RJ-45 connectors

In split cables the power cable and the mA output cable are marked near the end of the cable.

Power cable:

- White: +24DC
- Brown: GND

mA output cable:

- White: mA+
- Brown: mA-

4. Prism wash

Prism wash requires a system for wash control and diagnostics. This can be achieved with Multichannel user interface (MI) with a relay module.

4.1 Prism coating

Deposit build-up on the prism surface disturbs the measurement. *Anabnormally high concentration reading, an upward concentration (CONC) drift, decreased QF value or increased LED value* may indicate coating.

In most applications the prism will keep clean due to the self-cleaning effect. If coating occurs, check the following:

- Sufficient flow velocity
- A temperature difference between the process fluid and refractometer probe may cause coating. This may happen with small flows if the thermal insulation is inadequate. In some cases it helps to also insulate the clamp connector.

In case of a coating problem, the preferred solution is to try to increase the flow velocity, for example, by installing a pipe portion with smaller diameter.

Installing a wash nozzle can be considered, if increasing the velocity does not provide a solution. For more information, see [Prism wash \(page 16\)](#).

4.2 Prism wash

Three alternative wash media can be used for prism wash:

- Steam
- Water
- High pressure water

Relay modules in a Multichannel user interface MI can be configured to control the prism wash cycle, see MI manual, Chapter 6, "Module cards" and Chapter 7, "Prism wash".



CAUTION! Important: In food industry applications, wash medium must be culinary steam or safe water. Shut-off valve and check valve must meet 3-A sanitary standards.

Culinary steam: Means steam produced using a system meeting criteria in the 3-A Accepted Practices for a Method of Producing Steam of a Culinary Quality, Number 609.

Safe Water: Means water from a supply properly located, protected, and operated, and shall be of safe, sanitary quality. The water shall meet the standards prescribed in the National Primary Drinking Water Regulation of the Environmental Protection Agency (EPA) as referenced in The Code of Federal Regulations (CFR), Title 40, Parts 141, 142, and 143.

4.2.1 Recommended wash pressures and times

The following tables provide the recommended wash pressures and times.

Table 3 Wash medium parameters for integral wash nozzles in PR-43-AP

	Minimum <i>above process pressure</i>	Maximum <i>above process pressure</i>	Wash time	Recovery	Interval
Steam (SN)	2 bar (30 psi)	4 bar (60 psi)	3 s	20 - 30 s	20 - 30 min
Water (WN)	2 bar (30 psi)	4 bar (60 psi)	10 s	20 - 30 s	10 - 20 min
High pressure water (WP)	15 bar (220 psi)	40 bar (600 psi)	10 s	20 - 30 s	10 - 20 min

Table 4 Wash medium parameters for flowcell wash nozzle AFC

	Minimum <i>above process pressure</i>	Maximum <i>above process pressure</i>	Wash time	Recovery	Interval
Steam (SN)	3 bar (45 psi)	6 bar (90 psi)	3 - 5 s	20 - 30 s	20 - 30 min
Water (WN)	3 bar (45 psi)	6 bar (90 psi)	10 - 15 s	20 - 30 s	10 - 20 min
High pressure water (WP)	25 bar (350 psi)	35 bar (500 psi)	10 - 15 s	20 - 30 s	10 - 20 min



CAUTION! In steam wash, do not exceed the recommended wash times, because some process media may burn to the prism surface if steamed for longer time. In case of coating, shorten the wash interval.



In water wash, water temperature should be above the process temperature.



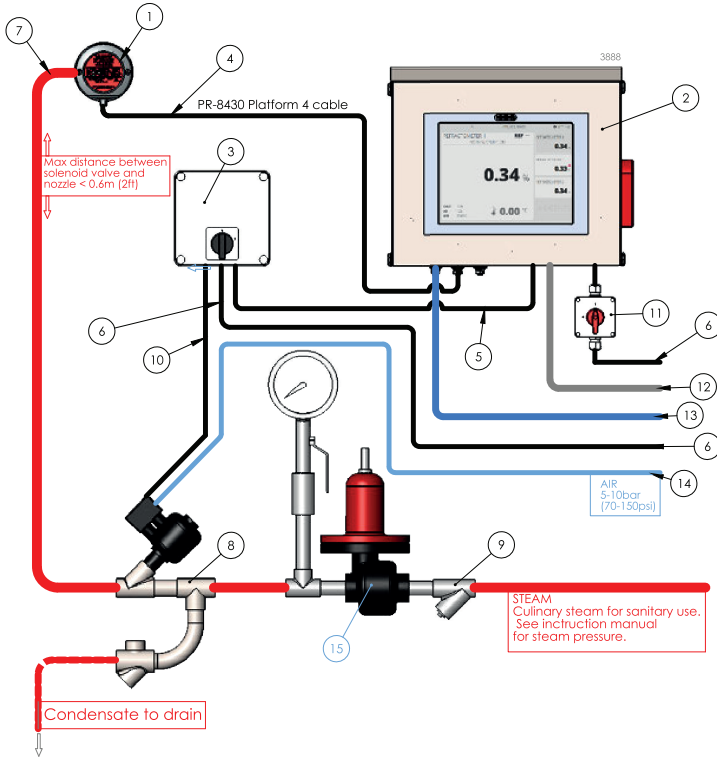
The check valve pressure drop is 0.7 bar (10 psi).

4.2.2 Prism wash systems



WARNING! In high pressure wash systems, pressure increase can occur in a closed pipe section when the high pressure pump is operated. It is recommended to mount a pressure relief valve in the pipe section. Relief pressure should be according to pipe pressure rating.

The following figures describe the prism wash system for steam.



No.	Description	Supplied by	Qty
1	PR-43 refractometer	K-Patents	1
2	Multichannel User Interface MI	K-Patents	1
3	Safety switch PR-7060	K-Patents	1
4	Platform 4 Cable PR-8430	K-Patents	1
5	Relay cable 2x1 (AWG 17)	Customer	1
6	Power Supply	Customer	1
6.1	100-240 VAC/50-60Hz		
6.2	24VDC		
7	Flexible steam pipe 1/4" x 24", PR-3515	K-Patents	1
8	Shut-off valve & Steam trap PR-3340-230/110/24VDC	K-Patents	1
9	Strainer PR-3342	K-Patents	1
10	Solenoid cable 3x1 (AWG 17)	Customer	1
11	Mains Power Switch PR-10900	K-Patents	1
12	mA-output cable	Customer	1
13	Ethernet cable for interfaces PR-8440	K-Patents	1
14	Instrument air line	Customer	1
15	Pressure reducer and gauge PR-3341-J	K-Patents	1

Figure 9 Prism wash system for steam

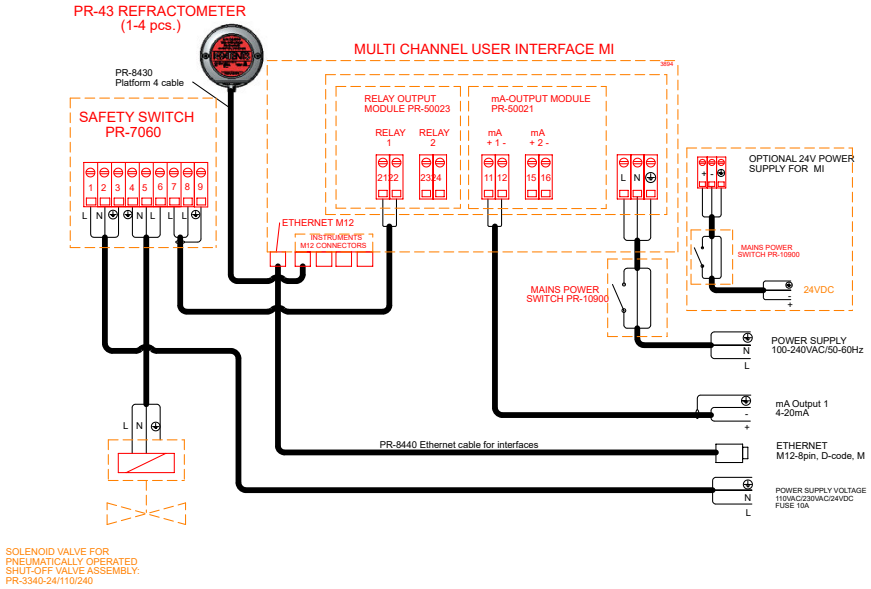
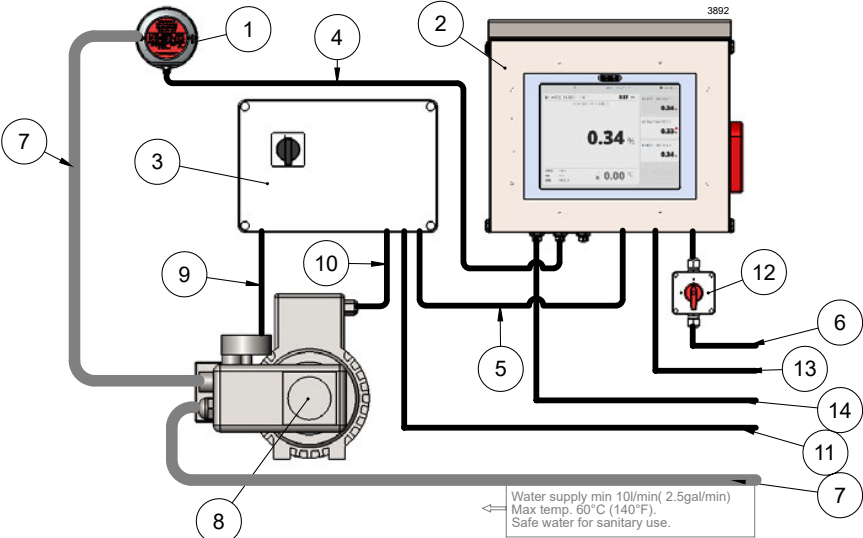


Figure 10 Wiring for prism wash system for steam

The following figures describe the prism wash system for high pressure water.



No.	Description	Supplied by	Qty
1	PR-43 refractometer	K-Patents	1
2	Multichannel user interface	K-Patents	1
3	Power relay unit PR_3603-300-U/M-230/110	K-Patents	1
4	Platform 4 cable PR-8430	K-Patents	1
5	Relay cable 3x1 (AWG 17)	Customer	1
6	Power supply for MI	Customer	1
6.1	Power supply 100-240 VAC/50-60 Hz		
6.2	Power supply 24V DC		
7	Water supply line min. 12 mm (1/2")	Customer	1
8	High pressure pump PR-3602-XXX	K-Patents	1
9	Solenoid cable 3x1 (AWG 17)	Customer	1
10	Power cable 4x2.5 (AWG 12)	Customer	1
11	Power supply 400-575 VAC/50-60 Hz	Customer	1
12	Mains power switchy PR-10900	K-Patents	1
13	mA output cable	Customer	1
14	Ethernet cable for interface PR-8840	Customer	1

Figure 11 Prism wash system for high pressure water

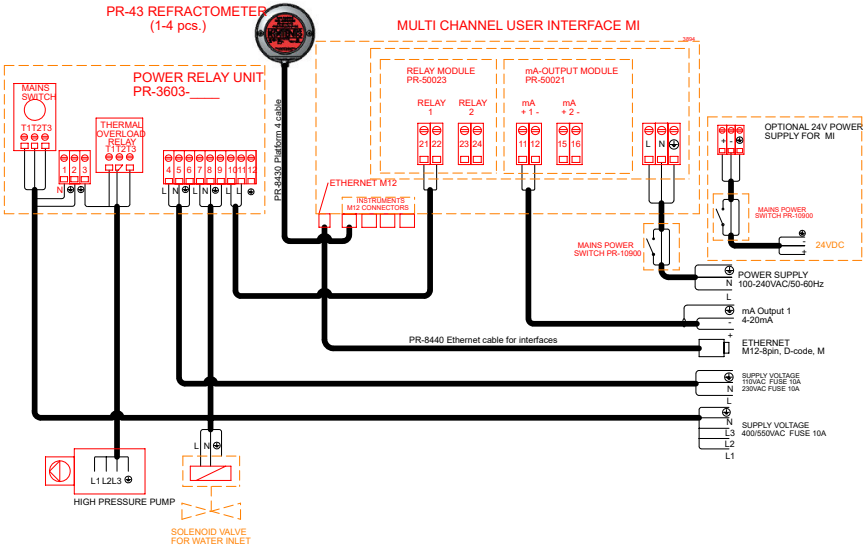


Figure 12 Wiring for prism wash system for high pressure water

4.2.3 Prism wash nozzles

When selecting a wash nozzle for PR-43-AP, take into account both the wash medium and the flowcell model: flowcells with larger pipe diameters need longer wash nozzles. The figure below shows a wash nozzle for a flowcell and gives the measurements and the tables provide part numbers for each nozzle type.

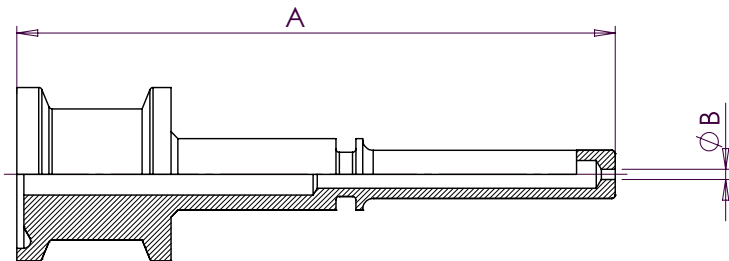


Figure 13 Wash nozzles for flowcell AFC-HSS-XXX-XX-NC

Table 5 Flowcell -H10 or -H15

	A	B	Part number
Steam	64.75	4.0	PR-3365
Water	75	2.5	PR-3369
Pressurized water	75	1.5	PR-3368

Table 6 Flowcell -H20 or -H25

	A	B	Part number
Steam	72.15	4.0	PR-3375
Water	97	2.5	PR-3379
Pressurized water	97	1.5	PR-3378

Table 7 Flowcell -H30

	A	B	Part number
Steam	103	4.0	PR-3393
Water	113	2.5	PR-3394
Pressurized water	113	1.5	PR-3395

Table 8 Flowcell -H40

	A	B	Part number
Steam	133	4.0	PR-3390
Water	143	2.5	PR-3391
Pressurized water	143	1.5	PR-3392

The following figure shows how the nozzle is mounted in a flowcell (-NC with stud for a wash nozzle).

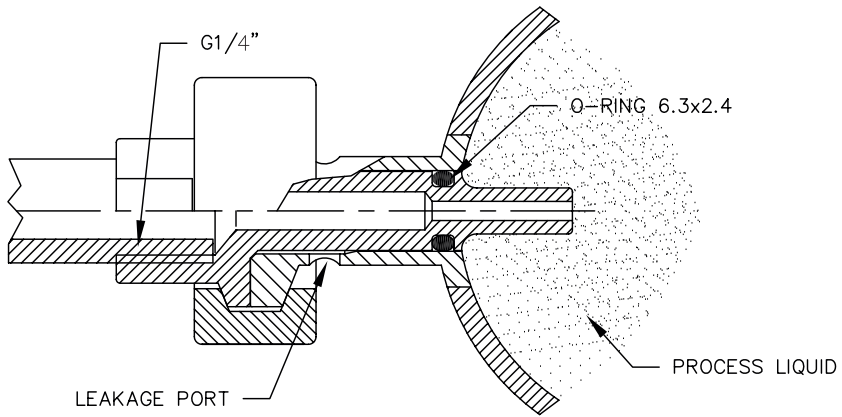


Figure 14 Process connection of wash nozzle in flowcell

For PR-43-AP, select the wash nozzle according to wash medium, see the following table.

Table 9 Prism wash nozzle selection

	PR-43-AP
Steam nozzle	PR-9321
Water nozzle	PR-9320
Pressurized water nozzle	PR-9322

5. Technical data

5.1 Compatibility

Electrically: The PR-43 refractometers are *not* interchangeable with any other refractometer model. All PR-43-AC/AP refractometers are however interchangeable with each other as long as they have the same prism. The PR-43-AC/AP refractometers are not compatible with the indicating transmitters DTR, STR or IT-R.

Mechanically: The sanitary process refractometer PR-43-AC/AP fits the same sanitary process connections as PR-23-AC/AP.

5.2 Refractometer rangeability

The refractive index standard range of a PR-43-AC/AP is 1.320-1.530 (corresponds to 0-100 Brix) with a Sapphire prism. A PR-43-AC can also be equipped with a Sapphire prism with a refractive index range 1.260-1.470.

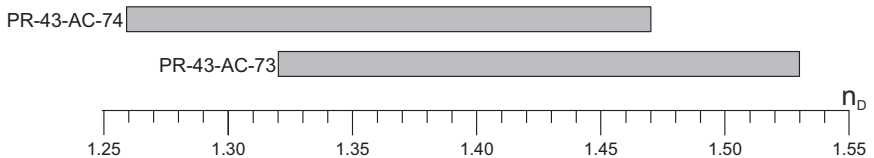


Figure 15 PR-43-AC rangeability

5.3 Sanitary process refractometer PR-43-AC

The refractometer PR-43-AC is a 3-A and EHEDG certified sanitary process refractometer for measuring concentrations in a pipeline. It is easy to install in any pipe size directly or using a flow cell. The Sanitary process refractometer is suitable for all food and beverage processing applications where real-time monitoring and control can help to improve product quality and reduce costs.

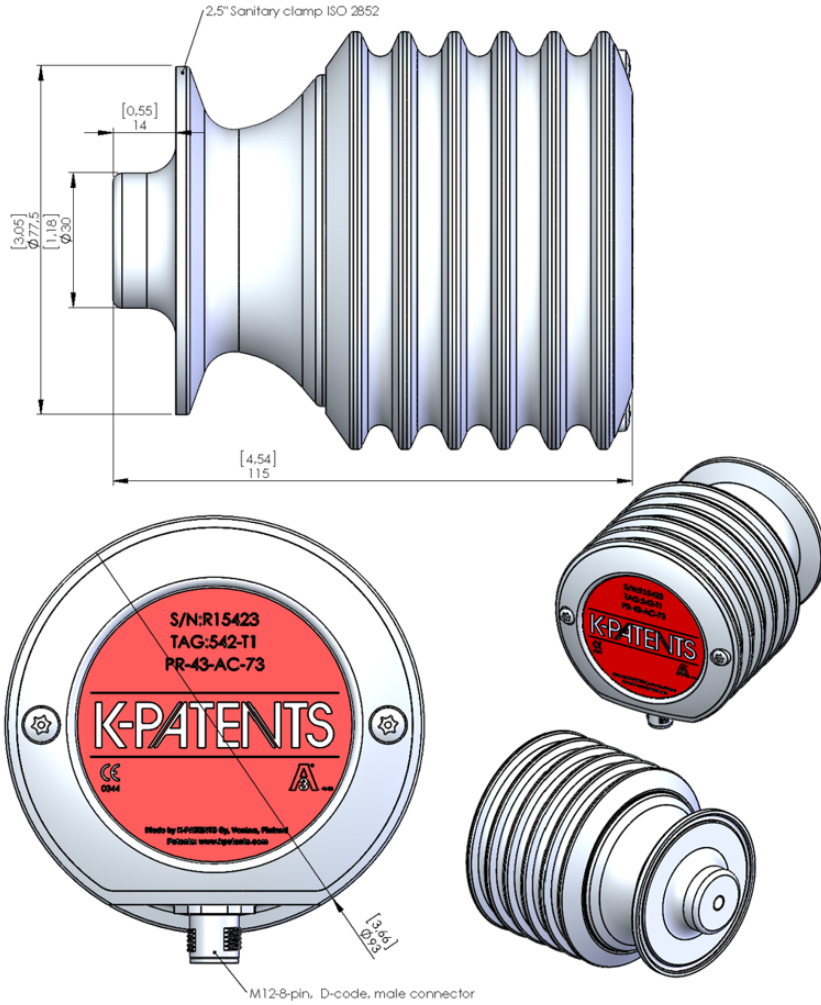


Figure 16 PR-43-AC dimensions

5.3.1 PR-43-AC model code

The following table lists the model codes for the sanitary compact refractometer for pipelines.

Table 10 Sanitary compact refractometer for pipelines

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-AC = Compact sanitary certified process refractometer, insertion length 14 mm	-AC
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D (0-100 Brix) Sapphire prism	-73
-74 = R.I. 1.260-1.470 n_D Sapphire prism	-74
Connection type and size	
-E25-P15 = Varivent DN65, 15 bar ¹⁾	-E25-P15
-H25-P15 = Sanitary 3A-clamp, 63.5 mm (2.5 in), 15 bar ¹⁾	-H25-P15
-H25-P40 = Sanitary 3A-clamp, 63.5 mm (2.5 in), High Pressure, 40 bar @ 20 °C ¹⁾	-H25-P40
-Z25-P15 = 63.5 mm (2.5 in) I-clamp, 15 bar ²⁾	-Z25-P15
Wetted parts material	
-SS = AISI 316 L	-SS
-HC = Alloy C276	-HC
Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T _{amb} -40 ... +65 °C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T _{amb} -40 ... +65 °C)	-IA
High accuracy option	
-HAC = High accuracy version in range 0-30 Brix 4 ... 30 °C	-HAC
EHEDG option	
-EH = EHEDG Type EL class I Certified Model	-EH
Polishing option	
-EP = Electropolished refractometer wetted parts (Ra 0.4 µm, 15 µ inch)	-EP

1) EHEDG certified version available

2) Sanitary 3-A certified

5.3.2 PR-43-AC mounting hardware model code

The following tables list the model codes for the sanitary compact refractometer mounting hardware.

Table 11 Mounting hardware without wash nozzles

Model and description	Model
AFC = Elbow flow cell	AFC
Refractometer connection	
-H = Sanitary 3A clamp, 2 1/2 in	-H
Construction material	
SS = AISI 316	SS
Process connection	
-H = Sanitary 3A clamp	-H
Pipe section diameter	
<ul style="list-style-type: none"> • 10 = 25 mm (1 in) ¹⁾ • 15 = 40 mm (1 1/2 in) • 20 = 50 mm (2 in) • 25 = 65 mm (2.5 in) ¹⁾ • 30 = 80 mm (3 in) ¹⁾ • 40 = 100 mm (4 in) ¹⁾ 	<ul style="list-style-type: none"> • 10 • 15 • 20 • 25 • 30 • 20

1) With -SI option only

Table 12 EHEDG certified mounting hardware

Model and description	Model
AFC = Elbow flow cell	AFC
Refractometer connection	
-H = Sanitary 3A clamp, 2.5 in	-H
Construction material	
SS = AISI 316	SS
Process connection	
-H = Sanitary 3A clamp	-H
Pipe section diameter	
20 = 50 mm (2 in)	20
Flow cell inlet type	

Model and description	Model
-SI = Straight pipe	-SI
EHEDG	
-EH = EHEDG Type EL Class I Certified model	-EH
Polishing option	
-EP = Electropolished process wetted parts (Ra 0.4 µm, 15 µ in)	-EP



For EHEDG certified refractometers use ISO2852 type EHEDG certified gasket PR-9202-EH (2½ inch) or PR-9272-EH (4 inch).

Table 13 Mounting hardware with wash nozzles

Model and description	Model
AFC = Elbow flow cell	AFC
Refractometer connection	
-H = Sanitary 3A clamp, 2.5 in	-H
Construction material	
SS = AISI 316	SS
Process connection	
-H = Sanitary 3A clamp	-H
Pipe section diameter	
<ul style="list-style-type: none"> • 10 = 25 mm (1 in) • 15 = 40 mm (1.5 in) • 20 = 50 mm (2 in) • 25 = 65 mm (2.5 in) ¹⁾ • 30 = 80 mm (3 in) ¹⁾ • 40 = 100 mm (4 in) ¹⁾ 	<ul style="list-style-type: none"> • 10 • 15 • 20 • 25 • 30 • 40
Flow cell inlet type	
-SI = Straight pipe	-SI
-RI = Reduced pipe (cone)	-RI
Wash nozzle connection	
-NC = Nozzleconnection	-NC
Wash nozzles for 10/15 flow cells	
-SN = Steam nozzle, threads G ¼ in female	-SN

Model and description	Model
-WN = Water nozzle, threads G ¼ in female	-WN
-WP = Pressurized water nozzle, threads G ¼ in female	-WP
-PG = Plug for nozzle connection	-PG

1) With -SI option only

Example:

- Refractometer: PR-43-AC-73-H25-P15
- Flowcell: AFC-HSS-H20-SI



Prism wash control and diagnostics require the use of a Multichannel user interface MI (or customer's own control system).

Table 14 Mounting hardware, mini flow cell

Model and description	Model
MFC = Mini flow cell	MFC
Refractometer connection	
-H = Sanitary 3A clamp, 2.5 in	-H
Construction material	
SS = AISI 316	SS
Process connection	
-H = Sanitary 3A clamp	-H
Pipe section diameter	
05 = 15 mm (½ in)	05

Table 15 Mounting hardware, Varivent DN65 connection

Model and description	Model
TDN = Varivent®in-line access unit clamp DN65 Type N ¹⁾	TDN
Pipe section diameter	

Model and description	Model
<ul style="list-style-type: none"> • 40 = 100 mm (4 in) • 50 = 50 mm (2 in) • 65 = 65 mm (2.5 in) • 80 = 80 mm (3 in) • 100 = 100 mm (4 in) • 125 = 125 mm (5 in) • 150 = 150 mm (6 in) 	<ul style="list-style-type: none"> • -40 • -50 • -65 • -80 • -100 • -125 • -150
Counter flange options	
-SN = Steam nozzle, threads G ¼ in female	-SN
-WN = Water nozzle, threads G ¼ in female	-WN
-WP = Pressurized water nozzle, threads G ¼ in female	-WP
-PG = Varivent blind flange type N	-PG

1) Includes one 2.5 in Type N blind flange with 2.5 in EPDM gasket and 2.5 in Varivent clamp Type N

Table 16 Mounting hardware

Model and description	Model
SFC = Side flow cell ¹⁾	SFC
Refractometer connection	
-HH = Sanitary 3A clamp, 2.5 in	-HH
Construction material	
SS = AISI 316	SS
Process connection	
-H = Sanitary 3A clamp	-H
Pipe section diameter	
<ul style="list-style-type: none"> • 10 = 25 mm (1 in) • 15 = 40 mm (1.5 in) • 20 = 50 mm (2 in) • 25 = 65 mm (2.5 in) ¹⁾ 	<ul style="list-style-type: none"> • 10 • 15 • 20 • 25
Flow cell inlet and outlet orientation	
-090 = Elbow, 90 degree bend	-090
-180 = Straight pipe, 180 degree	-180

1) Includes one 2.5 in blind flange with 2.5 in EPDM gasket and 2.5 in sanitary clamp is included

5.3.3 PR-43-AC specifications

The following table lists the standard and optional specifications for the PR-43-AC refractometer.

Table 17 PR-43-AC specifications

	Standard	Optional
REFRACTOMETER PR-43-A Models	PR-43-AC Compact model for small pipelines.	
Refractive Index range	Full range, $n_D = 1.3200 \dots 1.5300$ corresponds to hot water...100 Brix or % by weight.	$n_D 1.2600 \dots 1.4700$.
Accuracy	Across the full range of 0-100 Brix: Refractive Index $n_D \pm 0.0002$ corresponds typically to ± 0.1 Brix or % by weight	High accuracy version -HAC in the range of 0-30 Brix and 4-30 °C: <ul style="list-style-type: none"> • ± 0.05 Brix or % by weight. • ± 0.02 Brix or % by weight (in set-point applications).
Repeatability	Across the full range of 0-100 Brix: $n_D \pm 0.00004$ (corresponds typically to ± 0.02 Brix or % by weight).	
Speed of response	1 s undamped, damping time selectable up to 5 min	
Calibration	With NIST traceable Cargille standard R.I. liquids over full range	
Patented CORE-Optics	No mechanical adjustments and digital measurement with 3648 pixel CCD element, sodium D-line light emitting diode (LED) built-in Pt-1000 temperature sensor (linearization according to IEC 751).	
Temperature compensation	Automatic, digital compensation.	
Instrument verification	With NIST traceable Cargille standard R.I. liquids and guided procedure, including a printable verification report.	
Process connection	Sanitary 3A-clamp 2.5 in; Varivent in-line access unit clamp DN65 or via elbow flow cell (for line sizes of 2.5 in and smaller); 2.5 in I-clamp.	
Hygienic design certification	3-A Sanitary Standard 46-04 certified and EHEDG (European Hygienic Engineering & Design Group) Type EL Class I certified.	
Process pressure	Sanitary 3A and I-clamp max. 15 bar (200 psi) at 20 °C (70 °F)/ 9 bar (125 psi) at 120 °C (250 °F). High pressure Sanitary 3A clamp HP 40 bar.	
Process temperature	-40 °C ... 130 °C (-40 °F ... 266 °F)	
Ambient temperature	Min. -40 °C (-40 °F), max. 45 °C (113 °F)	

	Standard	Optional
Process wetted parts	AISI 316L stainless steel, prism sapphire, prism gasket modified PTFE (Teflon), gasket EPDM for Sanitary 3-A and ISO2852 type EHEDG certified gasket for EHEDG certified refractometers.	Alloy C276
Refractometer protection class	IP67, Type 4X	
Refractometer weight	1.6 kg (3.5 lbs)	
Current output	Isolated 4-20 mA, max. load 1000 Ohm, galvanic isolation 1000 VDC or AC (peak), hold function during prism wash.	
Remote and Ethernet connections	10/100 BaseT Ethernet, web server for configuration and diagnostics, UDP/IP Protocol connection for data acquisition.	
Power supply	+24 VDC \pm 10 %, max. 2 VA	
INTERCONNECTING CABLES	Standard length 10 m. Single cable maximum length 90 m, with cable extender PR-8660 maximum length 90 + 90 m.	

5.3.4 PR-43-AC parts list

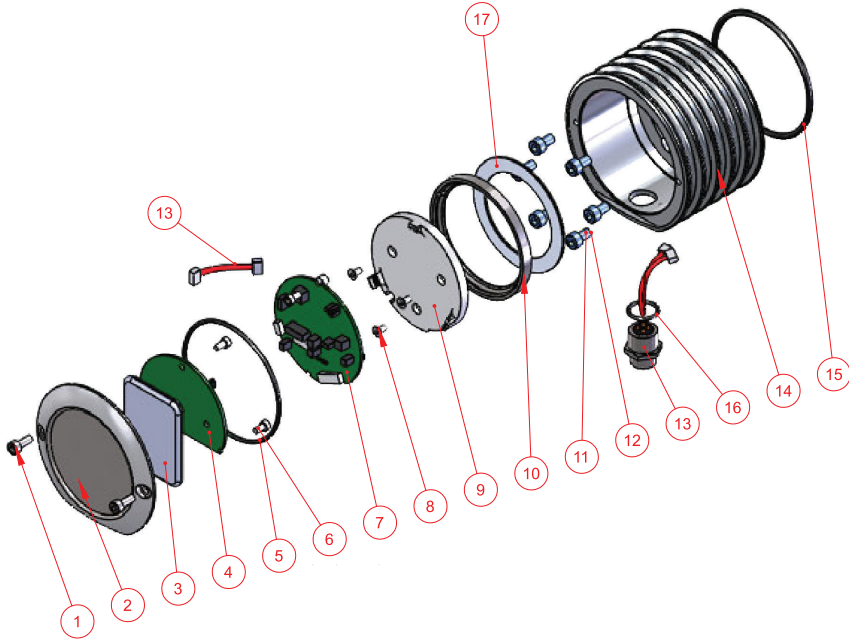


Figure 17 Refractometer cover assembly

Table 18 Refractometer cover assembly parts list

Item	Description	Part number	Quantity
1	Screw M4x10 DIN7380 Torx tamper proof	PR-14003	2
2	PR-43 end plate	PR-14001	1
3	Dryer pack	PR-9108	1
4	PR-43 sensor interface card		1
4.1	PR-43 interface card (Ex ia)	PR-50011	
4.2	mA-output card (general purpose, Ex nA)	PR-50033	
5	O-ring for PR-43 end plate FPM	PR-14002-FPM	2
6	Screw M3x6 DIN7985 TX A2		3

Item	Description	Part number	Quantity
7	PR-43 sensor processor card		1
7.1	Ex processor card (Ex ia)	PR-50012	
7.2	General purpose and Ex nA	PR-50038	
8	Screw M3x10 DIN965 TX A2		3
9	PR-33/PR-43-A card holder	PR-14050	1
10	PR-33/PR-43-A disk spring ring		1
11	Screw M5x10 ISO 14583 TX A2		6
12	Nord-Lock washer NL5ss		6
13	PR-43 connector & cable set		1
13.1	P4 connector & cable set (general purpose, Ex nA)	PR-14101	
13.2	P4 connector & cable set (Ex ia)	PR-14101-EX	
14	PR-43 sensor cover	PR-14000	1
15	O-ring 68x3 FPM	PR-10048	1
16	O-ring 14x1,78 FPM	PR-14102-FPM	1
17	Disk spring		1

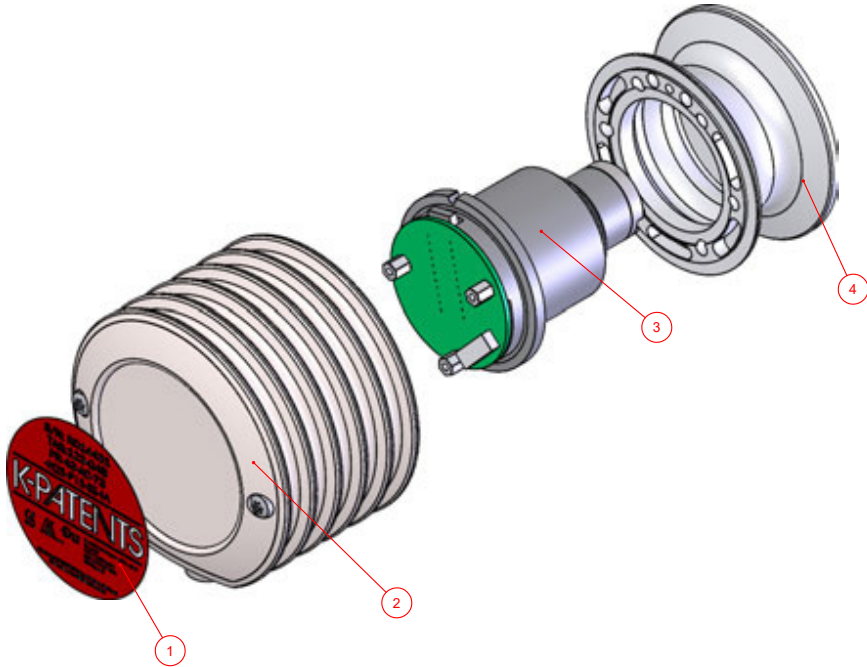
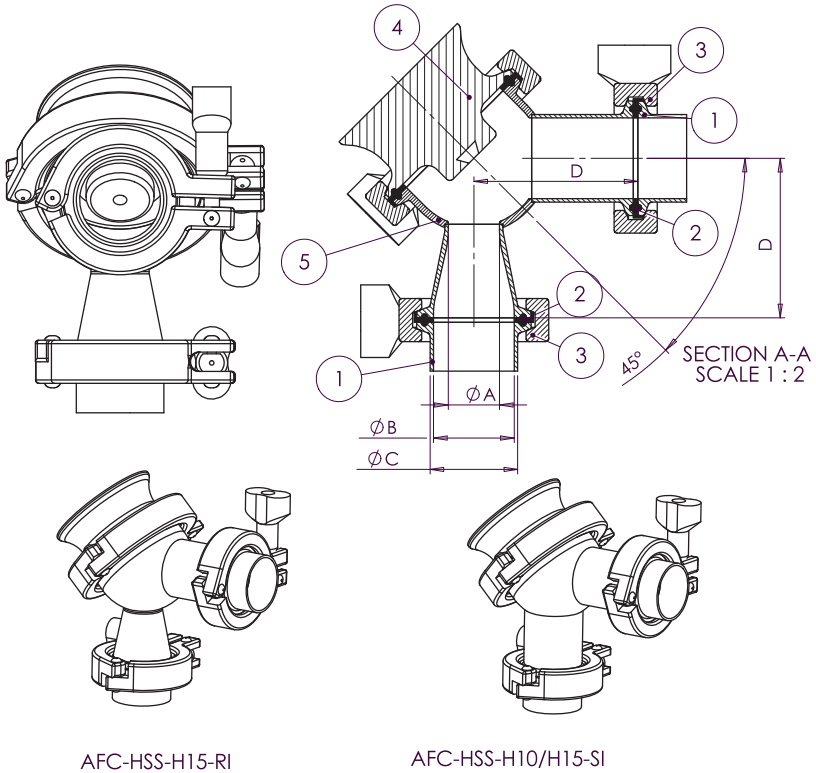


Figure 18 PR-43-AC assembly

Table 19 PR-43-AC assembly parts list

Item	Description	Part number	Quantity
1	PR-43-AC nameplate	PR-14404	1
2	PR-43 base assembly		1
3	PR-43 compact core		1
3.1	H73 Optics module	PR-14020	
3.2	H74 Optics module	PR-14022	
4	Sensor head		1
4.1	PR-43-AC-H25-SS head	PR-10001	
4.2	PR-43-AC-E25-SS head	PR-10028	1
4.3	PR-43-AC-H25-HC head	PR-10001-HC	1
4.4	PR-43-AC-E25-HC head	PR-10028-HC	
4.5	PR-43-Z25-SS head		

For smaller pipe diameters, flow cells are available, see the following figures. The flow cells are exchangeable with standard 90° bend pieces.



Flow cell type	A	B	C	D
AFC-H10-SI	22.6 [0.890]	22.6 [0.890]	25.6 [1.008]	50.8 [2]
AFC-H15-RI	22.6 [0.890]	35.6 [1.402]	38.6 [1.520]	70.3 [2.768]
AFC-H15-SI	35.6 [1.402]	35.6 [1.402]	38.6 [1.520]	70.3 [2.768]

Figure 20 Flow cell AFC-HSS-H10 for pipe diameter 25 mm (1 in) and H15 for pipe diameter 40 mm (1.5 in)

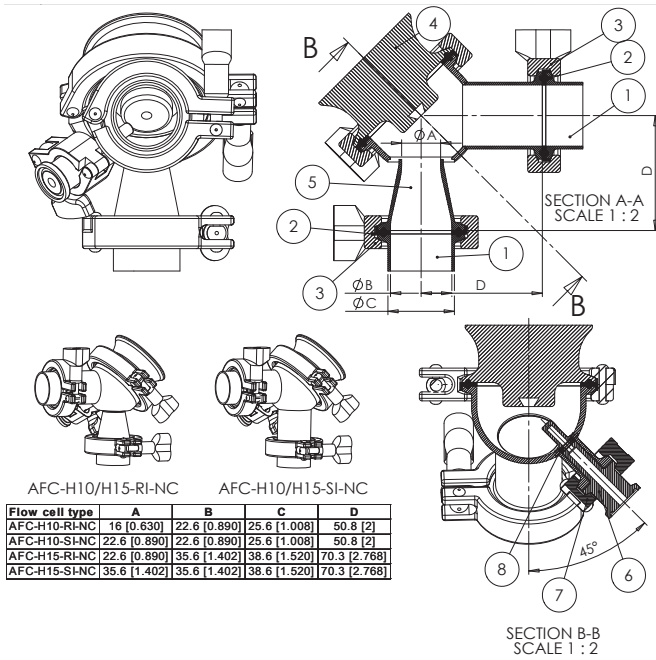
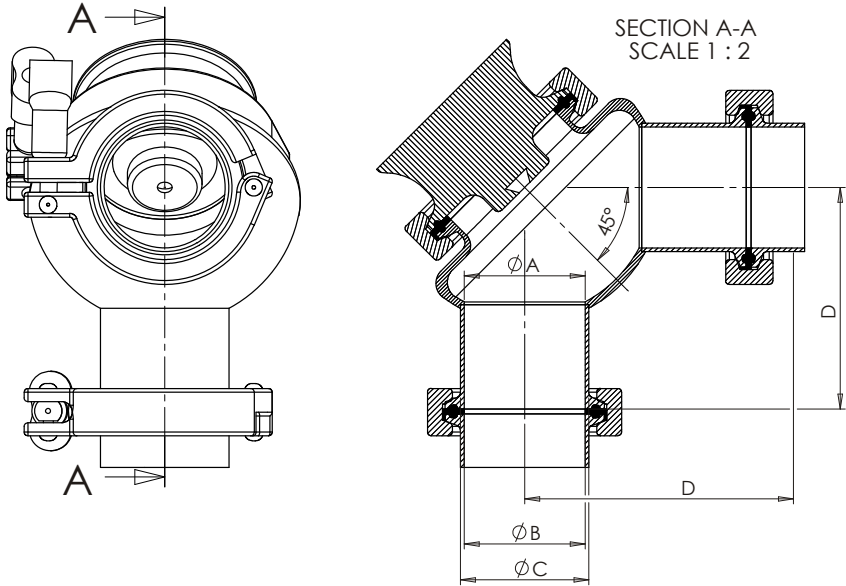


Figure 21 Flow cell AFC-HSS- with wash nozzle connection (-NC) H10 for pipe diameter 25 mm (1 in) and H15 for pipe diameter 40 mm (1.5 in)



Flow cell type	A	B	C	D
AFC-HSS-H20-SI	48.6	48.6	51.6	89.0
AFC-HSS-H20-RI	35.6	48.6	51.6	89.0
AFC-HSS-H25-SI	60.3	60.3	64.1	108.0

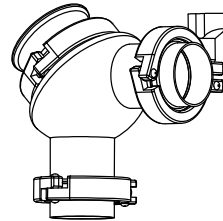


Figure 22 Flow cell AFC-HSS-H20 for pipe diameter 50 mm (2 in) and H25 for pipe diameter 65 mm (2.5 in)

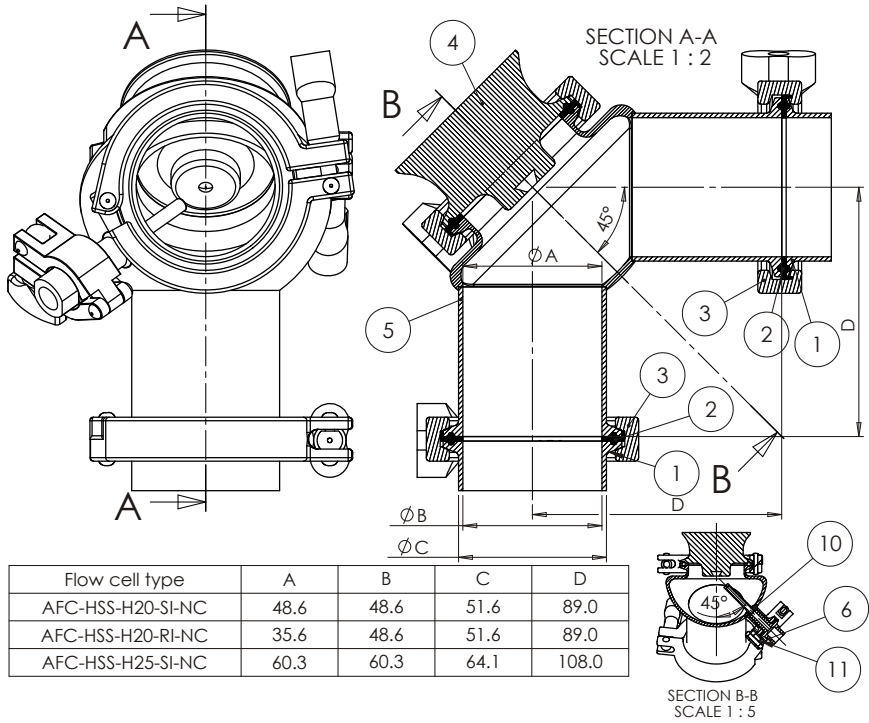
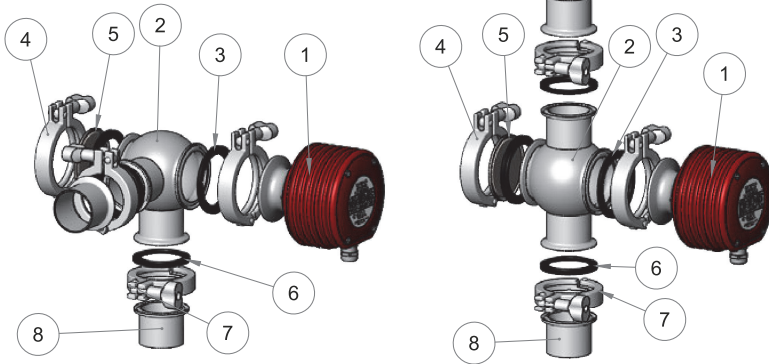
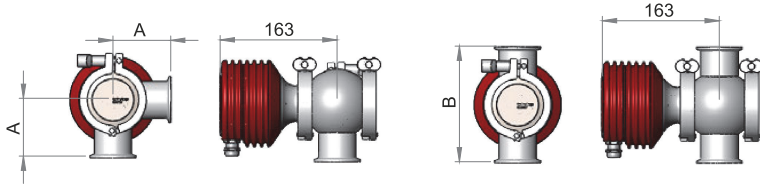


Figure 23 Flow cell AFC-HSS- with wash nozzle connection (-NC) H20 for pipe diameter 50 mm (2 in) and H25 for pipe diameter 65 mm (2.5 in)



Size	A	B
1"	66	132
1,5"	86	173
2"	80	161
2,5"	98	197

Size	Angle	1	2	3	4	5	6	7	8			
		Sensor	Flow cell	Sanitary gasket	Sanitary clamp	Sanitary blind flange	Sanitary gasket	Sanitary clamp	Customer's pipe			
1"	90°	Sanitary refractometer	SFC-HHSS-H10-090	PR-9202	PR-9201	PR-9200	PR-9246	PR-9211	-			
	180°		SFC-HHSS-H10-180						-			
1,5"	90°		SFC-HHSS-H15-090				PR-9222	PR-9221	-			
	180°		SFC-HHSS-H15-180						-			
2"	90°		SFC-HHSS-H20-090				PR-9202	PR-9201	PR-9200	PR-9222	PR-9221	-
	180°		SFC-HHSS-H20-090									-
2,5"	90°	SFC-HHSS-H25-090	PR-9202	PR-9201	PR-9200	PR-9202	PR-9201	-				
	180°	SFC-HHSS-H25-090						-				

Figure 24 Side flow cells

Sanitary Refractometer PR-43-AC-Z is mounted using 3-A Sanitary certified 2.5 in CherryBurrell I-Line fittings that are made of interlocking flat face ferrules, a flat gasket and a clamp. This interlocking, metal-to-metal design eliminates over compression by the clamp not allowing the gasket to be extruded into the product contact side. The sensor is male part of the connection.

Refractometer wetted parts material is AISI 316L or Alloy C, gaskets EPDM.

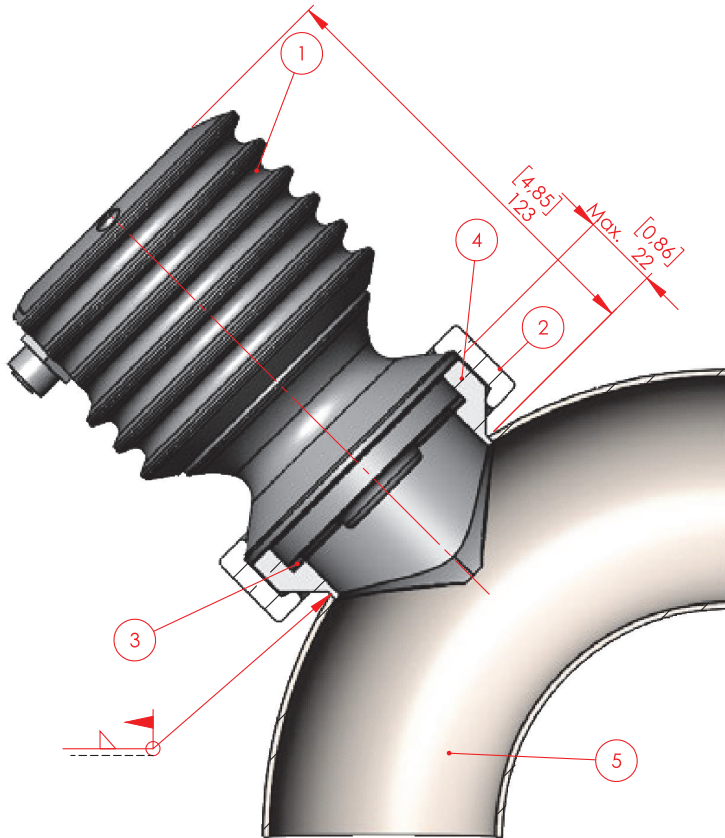


Figure 25 I-Line fitting for PR-43-AC

Table 20 I-Line fitting for PR-43-AC

Item	Name	Material	Supplied by	Quantity
1	Refractometer PR-43-AC-Z25	AISI316L	K-Patents	1
2	65 mm (2.5 in) I-clamp	AISI304	Customer	1
3	65 mm (2.5 in) I-clamp gasket	EPDM	Customer	1

Item	Name	Material	Supplied by	Quantity
4	65 mm (2.5 in) I-clamp ferrule	AISI616L	Customer	1
5	65 mm (2.5 in) pipe or larger	AISI616L	Customer	1

5.3.6 Mounting specifics for EHEDG certified PR-43-AC configuration

Vaisala offers certain PR-43-AC configurations which have been certified to fulfill the sanitary requirements published by the EHEDG (European Hygienic Engineering & Design Group) organization. During this certification the hygienic characteristics of both the refractometer and the process connection were evaluated against the applicable requirements.

To ensure EHEDG compliant installation, follow the mounting specifics provided on the mounting drawing supplied by Vaisala with each PR-43-AC refractometer ordered with the -EH option.

An example of such mounting guideline is shown in [3-A Sanitary Standard compliance \(page 44\)](#).

5.3.7 3-A Sanitary Standard compliance

Ensure that the refractometer is not a source of contamination due to damaged or worn product contact surfaces. Misuse (for example a too-long prism wash time or too high wash pressure) or mishandling may result in metal scratches or roughened surfaces. Such surfaces may not stay clean in processing.

Vaisala offers a 3-A Sanitary Standard Accepted repair and maintenance package in which all wetted parts, prism, gaskets and dryer are replaced.



This repair service can be completed by 3-A authorized service center only.

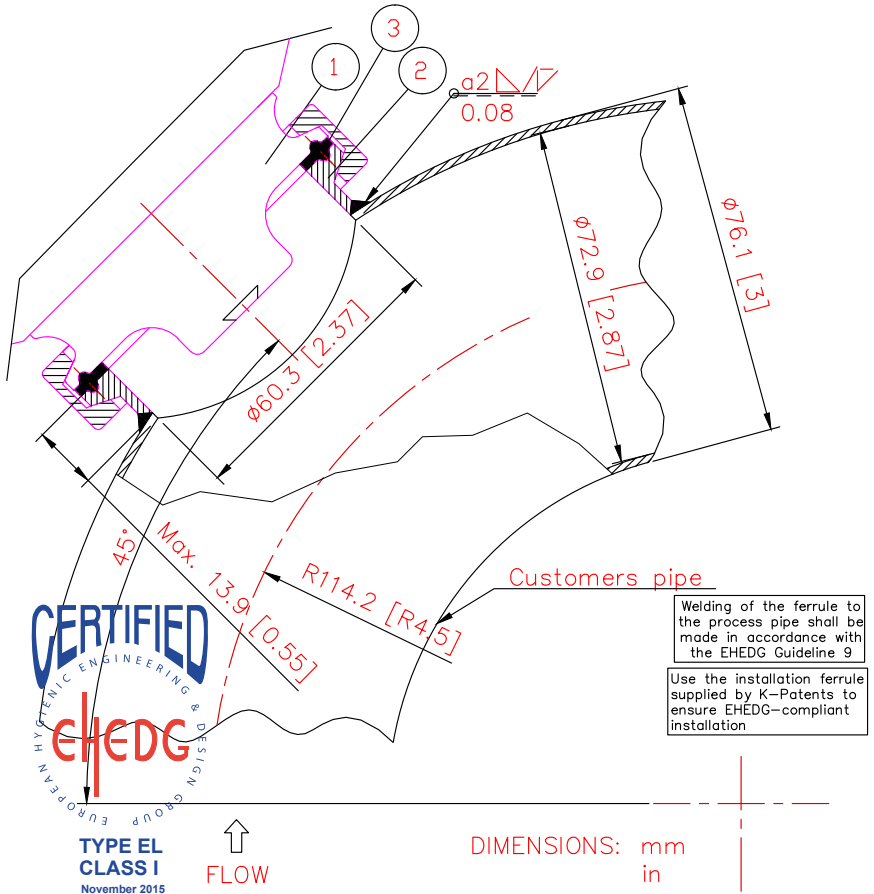


Figure 26 Mounting with sanitary ferrule, pipe diameter 80 mm (3 in) or more EHEDG certified configuration

The following table lists the parts in the figure above and the materials of the mounting hardware.

Table 21 Mounting materials

Number	Item	Material	Quantity
1	Sensor PR-43-AC		1
2	Sanitary ferrule 65 mm (2.5 in) ISO 2852	AISI 316L	1

Number	Item	Material	Quantity
3	Sanitary gasket 65 mm (2.5 in)	ISO2852 type EHEDG certified	1

5.4 Sanitary process refractometer PR-43-AP

Sanitary probe refractometer PR-43-AP provides an accurate in-line Brix measurement in cookers, tanks and large pipelines. The PR-43-APT refractometer version can be installed through an APV Tank bottom flange. It is flush mounted in the side wall and it allows the use of scrapers and mixers. It can also be installed through a steam jacket.

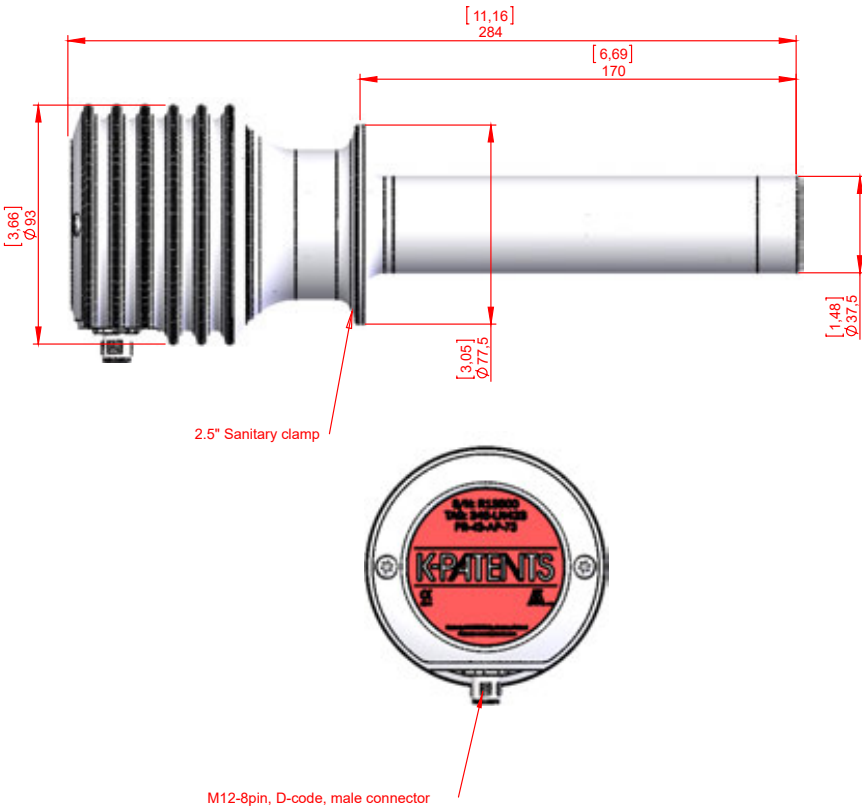


Figure 27 Dimensions of an inserted refractometer PR-43-AP-H25-L170

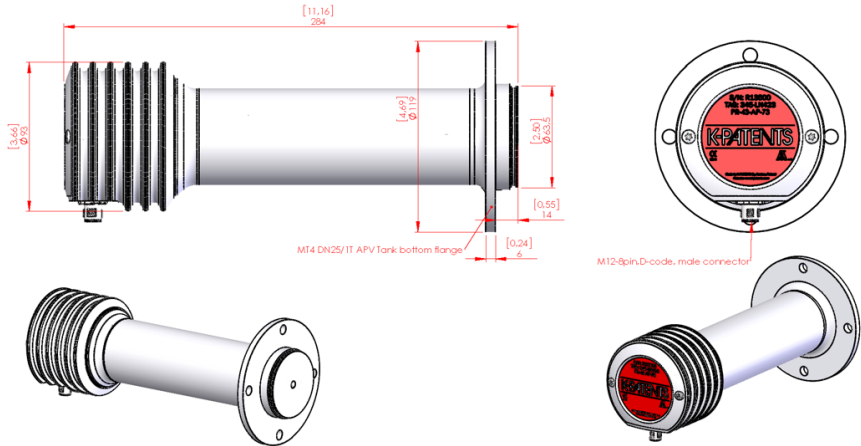


Figure 28 Flush mounted refractometer PR-43-AP-T10-L00

5.4.1 PR-43-AP model code

The following table lists the model codes for the sanitary probe refractometer for large pipelines and vessels.

Table 22 SANITARY PROBE REFRACTOMETER for large pipelines and vessels

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-AP = Sanitary process refractometer, probe	-AP
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D (0-100 Brix) Sapphire prism	-73
Connection type and size	
-E25-P15 = Varivent DN65, 15 bar	-E25-P15
-H25-P15 = Sanitary 3A-clamp, 63.5 mm (2.5 in), 15 bar	-H25-P15
-H25-P40 = Sanitary 3A-clamp, 63.5 mm (2.5 in), High Pressure, 40 bar @ 20°C	-H25-P40
-H40-P15 = Sanitary 3A-clamp, 101.6 mm (4 in), 15 bar -	--H40-P15
T10-P15 = MT4 DN25/IT APV tank bottom flange, flush mounted 1" DN10	-T10-P15
-V25-P15 = 63.5 mm (2.5 in), 15 bar with O-ring for refractometer head	-V25-P15

Model and description	Model
-Z25-P15 = 63.5 mm (2.5 in) I-clamp, 15 bar	-Z25-P15
Insertion length, models H25-P15/P40	
-L14 = insertion length 14 mm (0.55 in) ^{1) 2)}	-L14
-L42 = insertion length 42 mm (1.65 in) ^{1) 2)}	-L42
-L140 = insertion length 140 mm (5.5 in) ³⁾	-L140
-L170 = insertion length 170 mm (6.69 in) ^{1) 2)}	-L170
Insertion length, models H40-P15	
-L63 = insertion length 63 mm (2.48 in) ^{1) 2)}	-L63
-L170 = insertion length 170 mm (6.69 in) ^{1) 2)}	-L170
Insertion length, models T10-P15	
-L00 = flush mount insertion length ²⁾	-L100
-L170 = insertion length 170 mm (6.69 in) ³⁾	-L170
Insertion length, models E25-P15	
-L170 = insertion length 170 mm (6.69 in) ^{1) 2)}	-L170
Insertion length, models V25-P15	
-L170 = insertion length 170 mm (6.69 in) ³⁾	-L170
Insertion length, models I-clamp Z25-P15	
-L178 = insertion length 178 mm (7 in) ²⁾	-L178
Wetted parts material	
-SS = AISI 316 L	-SS
Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T _{amb} -40 ... +65 °C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T _{amb} -40 ... +65 °C)	-IA
EHEDG option	
-EH = EHEDG Type EL Class I Certified Model ⁴⁾	-EH

1) EHEDG certified versions available

2) Sanitary 3-A certified

3) Design according to Sanitary 3-A

4) For models with EHEDG certified versions available

Table 23 SANITARY PROBE REFRACTOMETER with prism wash for large pipelines and vessels

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-AP = Sanitary process refractometer, probe	-AP
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D (0-100 %) Sapphire prism	-73
Connection type and size	
-H40-P15 = Sanitary 3A-clamp, 101.6 mm (4 in), 15 bar	-H40-P15
Insertion length	
-L170 = insertion length 170 mm (6.69 in)	-L170
Wetted parts material	
-SS = AISI 316 L	-SS
Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T_{amb} -40 ... +65 °C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T_{amb} -40 ... +65 °C)	-IA
Prism wash	
-NC = integral nozzle connection	-NC
-SN = integral steam cleaning nozzle	-SN
-WP = integral high pressure water cleaning nozzle	-WP
-WN = integral warm water cleaning nozzle	-WN
-YC = no integral nozzle connection	-YC



Prism wash control and diagnostics require use of Multichannel user interface MI (or customer's own control system).

5.4.2 PR-43-AP mounting hardware model code

The following tables list the model codes for the refractometer mounting hardware.

Table 24 Mounting hardware for PR-43-AP refractometer

Part number and description	Model
VFMA-T10 = MT4 DN25/1T APV tank bottom flange for PR-43-AP T10	VFMA-T10
VFBP-T10 = blind flange for MT4 DN25/1T APV tank bottom flange	VFBP-T10
VFME-V25 = mount adaptor for PR-43-AP V25 HEXNUT type	VFME-V25
VFMF-V25 = mount adaptor for PR-43-AP V25 HEXNUT extended	VFMF-V25



For EHEDG certified refractometers, use EHEDG certified gasket PR-9202-EH 63.5 mm (2.5 in) or PR-9272-EH 101.6 mm (4 in).

5.4.3 PR-43-AP specifications

The following table lists the standard and optional specifications for the PR-43-AP refractometer.

Table 25 PR-43-AP specifications

REFRACTOMETER PR-43-A Models	PR-43-AP probe model for large pipelines and vessels
Refractive Index range	Full range, $n_D = 1.3200 \dots 1.5300$ corresponds to hot water...100 Brix or % by weight.
Accuracy	Across the full range of 0-100 Brix: Refractive Index $n_D \pm 0.0002$ corresponds typically to ± 0.1 Brix or % by weight
Repeatability	Across the full range of 0-100 Brix: $n_D \pm 0.00004$ (corresponds typically to ± 0.02 Brix or % by weight).
Speed of response	1 s undamped, damping time selectable up to 5 min
Calibration	With NIST traceable Cargille standard R.I. liquids over full range
Patented CORE-Optics	No mechanical adjustments and digital measurement with 3648 pixel CCD element, sodium D-line light emitting diode (LED) built-in Pt-1000 temperature sensor (linearization according to IEC 751).
Temperature compensation	Automatic, digital compensation.
Instrument verification	With NIST traceable Cargille standard R.I. liquids and guided procedure, including a printable verification report.
Process connection	Sanitary 3A-clamp 63.5 mm (2.5 in); Varivent in-line access unit clamp DN65 or via elbow flow cell (for line sizes of 63.5 mm (2.5 in) and smaller); 63.5 mm (2.5 in) I-clamp.

REFRACTOMETER PR-43-A Models	PR-43-AP probe model for large pipelines and vessels
Hygienic design certification	3-A Sanitary Standard 46-04 certified and EHEDG (European Hygienic Engineering & Design Group) Type EL Class I certified.
Process pressure	Sanitary 3A and I-clamp max. 15 bar (200 psi) at 20 °C (70 °F)/ 9 bar (125 psi) at 120 °C (250 °F). High pressure Sanitary 3A clamp HP 40 bar.
Process temperature	-40 °C ... 130 °C (-40 °F ... 266 °F)
Ambient temperature	Min. -40 °C (-40 °F), max. 45 °C (113 °F)
Process wetted parts	AISI 316L stainless steel, prism sapphire, prism gasket modified PTFE (Teflon), gasket EPDM for Sanitary 3-A and ISO2852 type EHEDG certified gasket for EHEDG certified refractometers.
Refractometer protection class	IP67, NEMA 4, 4X, 6, 6P
Refractometer weight	2.9 kg (6 lbs)
Current output	Isolated 4-20 mA, max. load 1000 Ohm, galvanic isolation 1000 VDC or AC (peak), hold function during prism wash.
Remote and Ethernet connections	10/100 BaseT Ethernet, web server for configuration and diagnostics, UDP/IP Protocol connection for data acquisition.
Power supply	+24 VDC ±10 %, max. 2 VA
INTERCONNECTING CABLES	Standard length 10 m. Single cable maximum length 90 m, with cable extender PR-8660 maximum length 90 + 90 m.

5.4.4 PR-43-AP parts lists

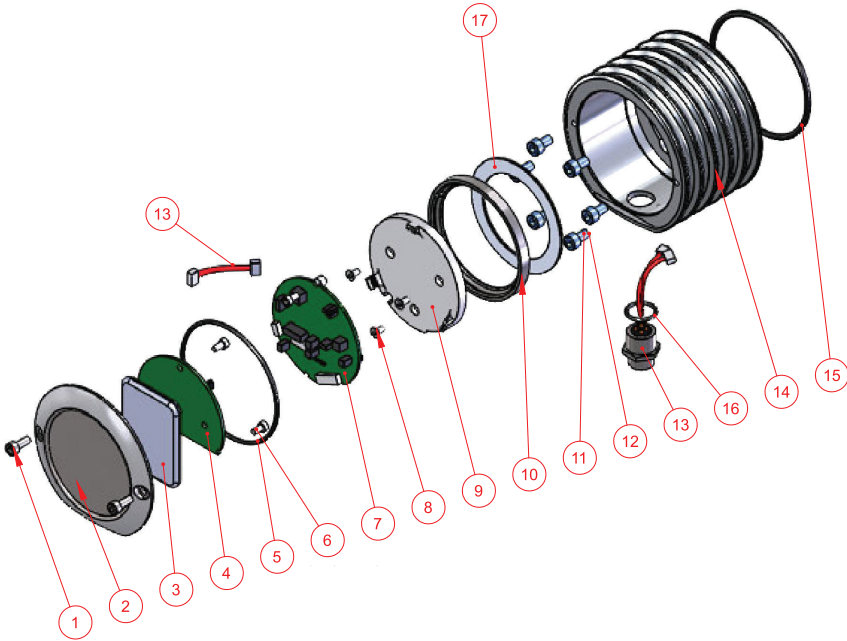


Figure 29 Refractometer cover assembly

Table 26 Refractometer cover assembly parts list

Item	Description	Part number	Quantity
1	Screw M4x10 DIN7380 Torx tamper proof	PR-14003	2
2	PR-43 end plate	PR-14001	1
3	Dryer pack	PR-9108	1
4	PR-43 sensor interface card		1
4.1	PR-43 interface card (Ex ia)	PR-50011	
4.2	mA-output card (general purpose, Ex nA)	PR-50033	
5	O-ring for PR-43 end plate FPM	PR-14002-FPM	2
6	Screw M3x6 DIN7985 TX A2		3

Item	Description	Part number	Quantity
7	PR-43 sensor processor card		1
7.1	Ex processor card (Ex ia)	PR-50012	
7.2	General purpose and Ex nA	PR-50038	
8	Screw M3x10 DIN965 TX A2		3
9	PR-33/PR-43-A card holder	PR-14050	1
10	PR-33/PR-43-A disk spring ring		1
11	Screw M5x10 ISO 14583 TX A2		6
12	Nord-Lock washer NL5ss		6
13	PR-43 connector & cable set		1
13.1	P4 connector & cable set (general purpose, Ex nA)	PR-14101	
13.2	P4 connector & cable set (Ex ia)	PR-14101-EX	
14	PR-43 sensor cover	PR-14000	1
15	O-ring 68x3 FPM	PR-10048	1
16	O-ring 14x1,78 FPM	PR-14102-FPM	1
17	Disk spring		1

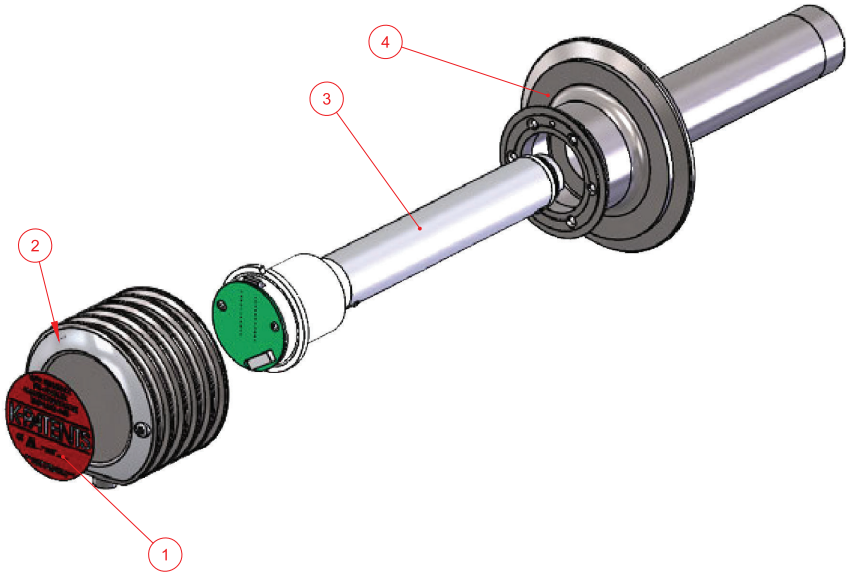


Figure 30 PR-43-AP assembly

Table 27 PR-43-AP assembly parts list

Item	Description	Part number	Quantity	Product code
1	PR-43-AP name plate		1	
2	PR-43-base assembly		1	
3	HX3 core assembly	PR-14021	1	
4	Sensor head		1	
4.1	PR-23-AP-PSS head	PR-10006		PR-43-AP-T10-P15-L00
4.2	PR-23-AP-RSS head	PR-10007		PR-43-AP-H40-L170
4.3	PR-23-AP-TSS head	PR-10008		PR-43-AP-H25-L170
4.4	PR-23-AP-RSS-NC head	PR-10013		PR-43-AP-H40-L170-NC
4.4.1	Nozzles and plug, contra nut, O-rings 9.3 and 5.2			
4.5	PR-23-AP-VSS head	PR-10016		PR-43-AP-V25-P15
4.5.1	O-ring			

Item	Description	Part number	Quantity	Product code
4.6	PR-23-AP-QSS head	PR-10018		PR-43-AP-H25-L140
4.7	PR-23-AP-SSS head	PR-10024		PR-43-AP-H40-L63
4.8	PR-23-AP-ISS head	PR-10025		PR-43-AP-H25-L42
4.9	PR-23-AP-BSS head	PR-10026		PR-43-AP-T10-L170
4.10	PR-23-AP-HSS head	PR-10027		PR-43-AP-H25-L14
4.11	PR-23-AP-CSS head (DN65 Varivent head)	PR-10029		PR-43-AP-E25-L170
4.12	PR-23-AP-ZP head	PR-10046		PR-43-AP-Z25-L178

5.4.5 PR-43-AP mounting specifics

The probe refractometer PR-43-AP is primarily designed for mounting in a tank wall. To ensure that the measurement is representative and that the prism stays clean, the probe should be installed close to a stirrer.

Probe refractometer type PR-43-AP-H25 is connected to the process by a 63.5 mm (2.5 in) 3-A sanitary clamp.



For higher process (or ambient) temperature, use instead a flush mounted refractometer, where the electronics in the refractometer head are farther away from the process heat.

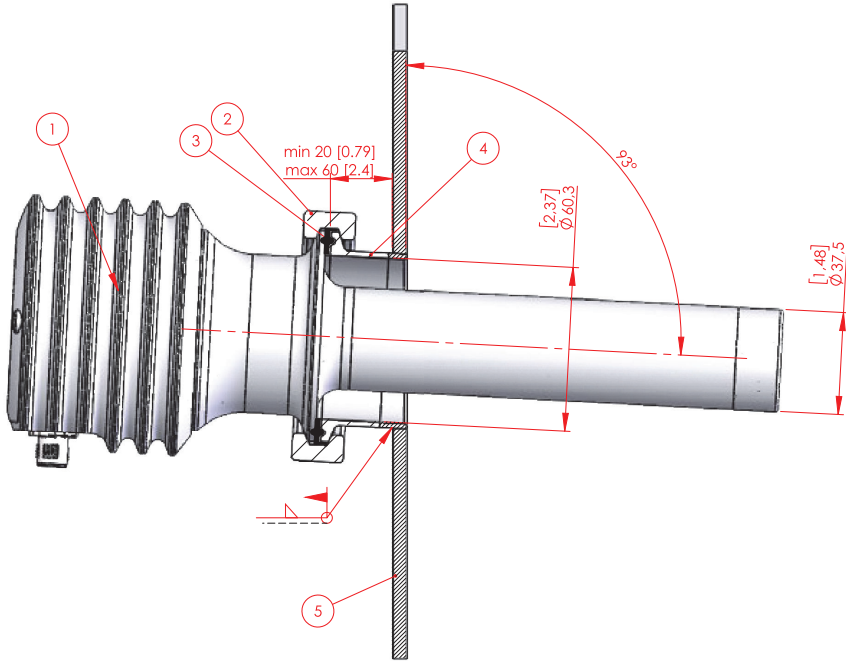
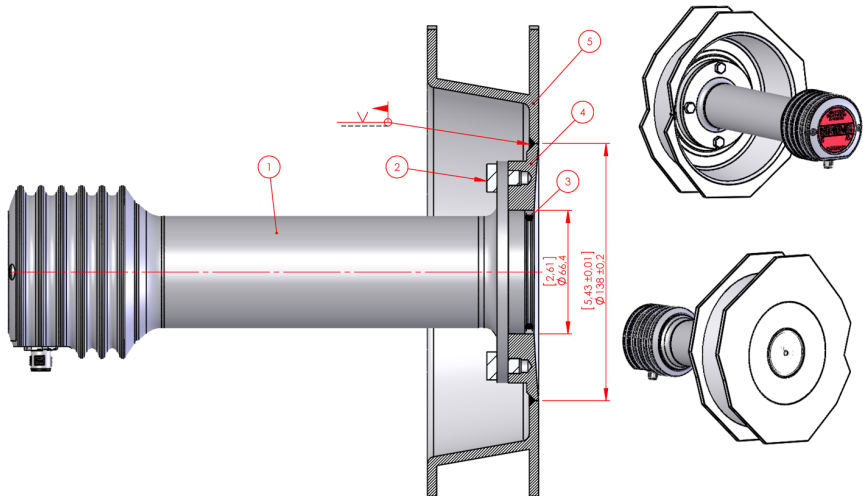


Figure 31 Insertion of probe refractometer PR-43-AP-H25

The refractometer type PR-43-AP-T10-L00 is flush mounted using a sanitary APV tank bottomflange. The refractometer can be flush mounted in the side wall, which allows the use of a scraper. It is also easily installed through a steam jacket.



Item no.	Name	Material	Supplied by	Pcs.
1	Refractometer PR-43-AP-T10-L00	AISI316L	K-Patents	1
2	Bolt M8x12 A4 DIN931	AISI316L	Patents/Customer	4
3	APV gasket MT4 DN25/1T	EPDM	K-Patents	1
4	MT4 DN25/1T APV tank bottom flange	AISI316L	K-Pat/Customer	1
5	Pipe/Vessel/Steam jacket	AISI316L	Customer	1

Figure 32 Flush mounting probe refractometer PR-43-AP-T10-L100

Sanitary Refractometer PR-43-AP-Z is mounted using 3-A Sanitary certified 63.5 mm (2.5 in) CherryBurrell I-Line fittings that are made of interlocking flat face ferrules, a flat gasket and a clamp. This interlocking, metal-to-metal design eliminates over compression by the clamp not allowing the gasket to be extruded into the product contact side. The sensor is the male part of the connection.

Refractometer wetted parts material is AISI 316L or Alloy C, gaskets EPDM.

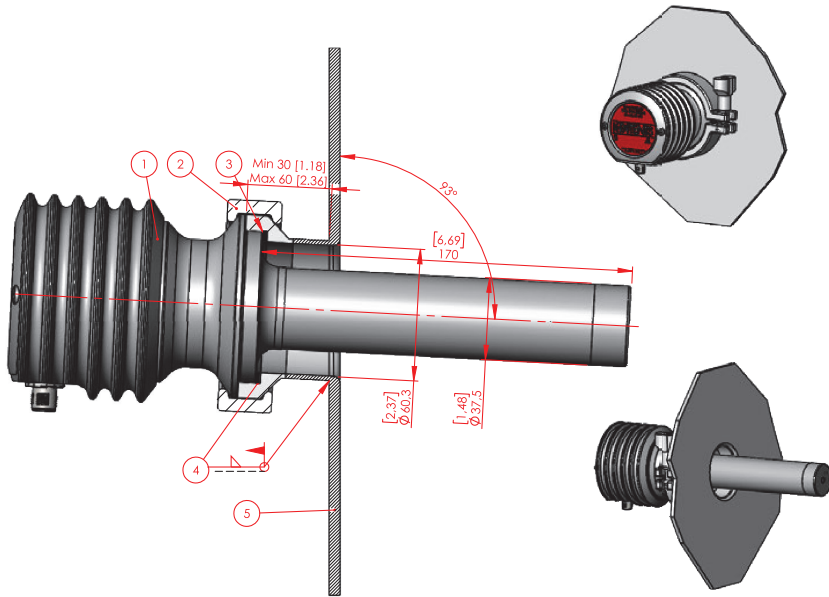


Figure 33 I-Line fitting for PR-43-AP

5.4.6 Mounting specifics for EHEDG certified PR-43-AP configuration

Vaisala offers certain PR-43-AP configurations which have been certified to fulfill the sanitary requirements published by EHEDG (European Hygienic Engineering & Design Group) organization. During this certification the hygienic characteristics of both the refractometer and the process connection were evaluated against the applicable requirements.

To ensure EHEDG compliant installation, follow the mounting specifics provided on the mounting drawing supplied by Vaisala with each PR-43-AP refractometer ordered with the -EH option.

The following figure shows an example of such mounting guideline.

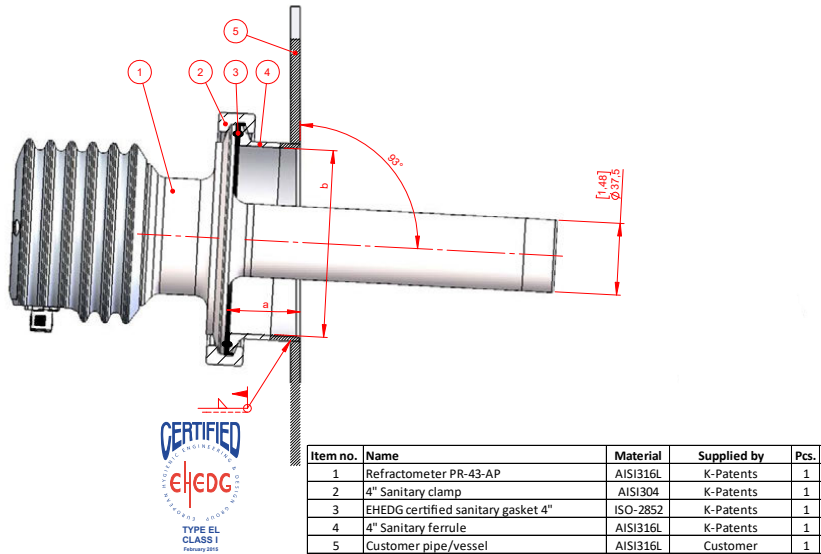


Figure 34 EHEDG certified PR-43-AP

Notes for EHEDG compliant installation:

- The distance a shall be less than the diameter b per the EHEDG guideline 10
- For other installation specifications see the web address: <http://ehedg.org/index.php?nr=110&lang=en>

5.4.7 3-A Sanitary Standard compliance

Ensure that the refractometer is not a source of contamination to product due to damaged or worn product contact surfaces. Misuse (for example, too long prism wash time or too high wash pressure) or mishandling may result in metal scratches or roughened surfaces. Such surfaces may not stay clean in processing.

Vaisala offers a 3-A Sanitary Standard accepted repair and maintenance package in which all wetted parts, prism, gaskets and dryer are replaced.



This repair service can be completed by 3-A authorized service center only (Vaisala factory and selected regional offices).

Appendix A. Refractometer verification

Each Vaisala K-PATENTS® refractometer is provided with a calibration certificate comparing a set of standard liquids to the actual refractometer output. Therefore, the calibration and accuracy can be easily verified on-site with the certified refractive index liquids and menu guided verification procedure.

For verification you need:

- Universal sample holder PR-1012 (see the figure below). The sample holder keeps the sample on the prism surface and also keeps the ambient light out.
- A set of standard refractive index liquids.
- Cleaning solution (ethanol) to clean the refractometer prism and the sample holder.



Figure 35 Universal sample holder PR-1012

The verification of the PR-43 refractometer calibration is made using a set of standard refractive index liquids with the nominal values at 25 °C:

- 1.330
- 1.370
- 1.420
- 1.470
- 1.520

The accuracy of the certified standard refractive index liquids is ± 0.0002 and they can be traced back to national standards: NIST Standards # 1823 and # 1823II. As the specified accuracy of PR-43 is ± 0.0002 , then the representative level is the sum of the two accuracy specifications, that is, ± 0.0004 .

Vaisala provides a set of standard R.I. liquids, PR-2300, containing these five liquids. The set can be ordered directly from Vaisala or through your representative.

A verification can be done by connecting to the refractometer over ethernet or by using a Multichannel user interface MI or Compact user interface CI.

In the web interface, choose **Verification** on the **Main** menu and follow the instructions on the page.

In MI, tap the 54 PR-43-AC/AP instruction manual three dots in the app for the refractometer to be verified, then choose **Verification**. Tap the question mark in the **Verification** display to get verification instructions.

In CI, choose **Verification** in the **Main** menu and follow the instructions on screen.



For a successful verification, the refractometer and the standard refractive index liquids must be at room temperature (25 ± 5 °C).

To check that the standard liquid is properly wetting the prism, the optical image can be monitored during the verification procedure. The optical image should show a sharp shadow edge.

The instrument measures each verification data point ten times and uses the average of these measurements. Measuring each verification liquid takes a few seconds, during which the measurement progress display is shown. Please wait until the verification step 2 display reappears before proceeding to next verification liquid. The limit for acceptance is that all measurements must be within ± 0.0004 of the nominal values.

If message is **VERIFICATION FAILED**, first check that the prism and the sample holder are absolutely clean and the sample holder sits tightly on the refractometer tip before a standard liquid is applied. Make sure the standard liquids are in good condition and not past their expiration date. Also, inspect the prism surface, checking that it is flat and glossy without any scratches. Repeat the verification procedure. If the verification still fails, fill in the PR-43 refractometer verification form, found at the end of this manual. The refractometer serial number is shown in the upper right corner of each display. The list of CCD and TEMP values are found on the Verification results display. Send the form to your Vaisala K-PATENTS® representative or email the collected data to helpdesk@vaisala.com and wait for further instructions.

Appendix B. PR-43 refractometer verification form

Fill in this form and email it to helpdesk@vaisala.com or to your local service representative.

Refractometer serial no:

Customer:

Address:

Fax:

Email:

Date:

Verification made by:

Table 28 Verification results display

Sample number	Nominal n_D	Measured n_D	CCD	Temp
1	1.330			
2	1.370			
3	1.420			
4	1.470			
5	1.520			

Appendix C. EU declaration of conformity

VAISALA

2019-09-01/JAMO

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EU DECLARATION OF CONFORMITY

Manufacturer: Vaisala Oyj
Mail address: P.O. Box 26, FI-00421 Helsinki, Finland
Street Address: Vanha Nurmiärväentie 21, Vantaa, Finland

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration:

K-Patents Process Refractometer PR-43 series

The object of the declaration described above is in conformity with Directives:

RoHS Directive (2011/65/EU)
EMC Directive (2014/30/EU)

The conformity is declared using the following standards:

EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use – EMC requirements – intended for use in industrial locations

Signed for and on behalf of Vaisala Oyj, in Vantaa, on 1st September 2019



Jukka Lyömiö
Standards and Approvals Manager

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Technical support



Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Recycling



Recycle all applicable material.



Follow the statutory regulations for disposing of the product and packaging.

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www.vaisala.com

