

# Instruction Manual

Vaisala K-PATENTS®  
Sanitary Process Refractometer  
**PR-43-AC/AP**



PUBLISHED BY

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Visit our Internet pages at [www.vaisala.com](http://www.vaisala.com).

## General safety considerations



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.



**Precautions when removing a refractometer from the process line :**

- Check first that the process line is depressurized and drained.
- Ensure you stay clear of any possible spillage and you have a clear emergency escape path.

It is the user's responsibility to follow manufacturer's safety and operating instructions. The client's organization has the responsibility to develop and maintain occupational safety and create a safety culture where individuals are expected to follow safety instructions at all times. Any negligence towards safety instructions or failure to comply with safe practices should not be tolerated. It is the manufacturer's responsibility to produce goods that are safe to use when instructions are followed.

## Disposal

When wishing to dispose of an obsolete refractometer or any parts of a refractometer, please observe local and national regulations and requirements for the disposal of electrical and electronic equipment.



## Symbols and terms used in this manual:



This indicates a **warning**. It provides safety precaution information needed to avoid injury while operating the refractometer system.



This indicates that something is **important** for the operation of the refractometer system.

**Note.** Notes contain additional information and hints.

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

## Warranty

For standard warranty terms and conditions, see [www.vaisala.com/warranty](http://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](mailto:helpdesk@vaisala.com). Provide at least the following supporting information:

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

For more information, see [www.vaisala.com/support](http://www.vaisala.com/support).



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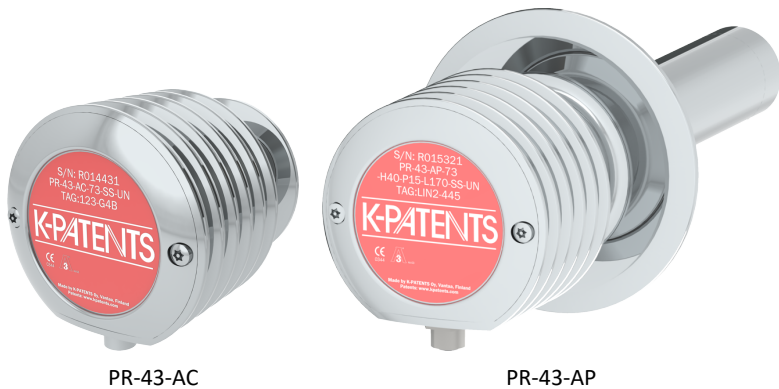
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# 1 Refractometer

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

The PR-43-AC/AP (figure 1.1) 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 (see the general manual for specifications). mA output is available with mA output cable (mA only) or with a split cable (mA and Ethernet).



**Figure 1.1** Refractometer models

## 2 Mounting

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

### 2.1 Choosing the mounting location

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.



**Important:** If the process pipe vibrates, support the pipe. A vibrating pipe might damage the in-line refractometer mounted on it.

A Vaisala K-PATENTS<sup>®</sup> 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.



**Important:** Always mount the refractometer so that the interconnecting cable points downwards from the refractometer head.

### 2.2 Check list 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 of stratification (layering) of the sample on the prism.

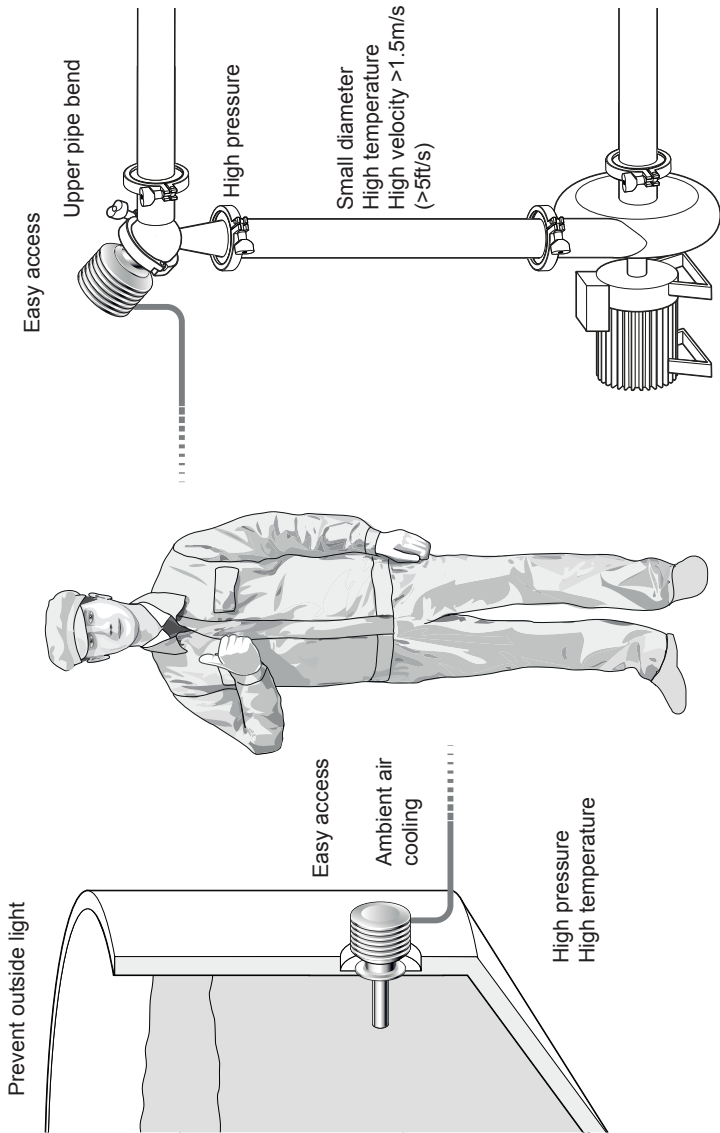
The diameter and form of the pipe and the process temperature all affect the measurement and need to be taken into account.

- 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.

## 2.3 Check list for mounting in a tank, a vessel or a 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.



## 2.4 Electrical connections

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



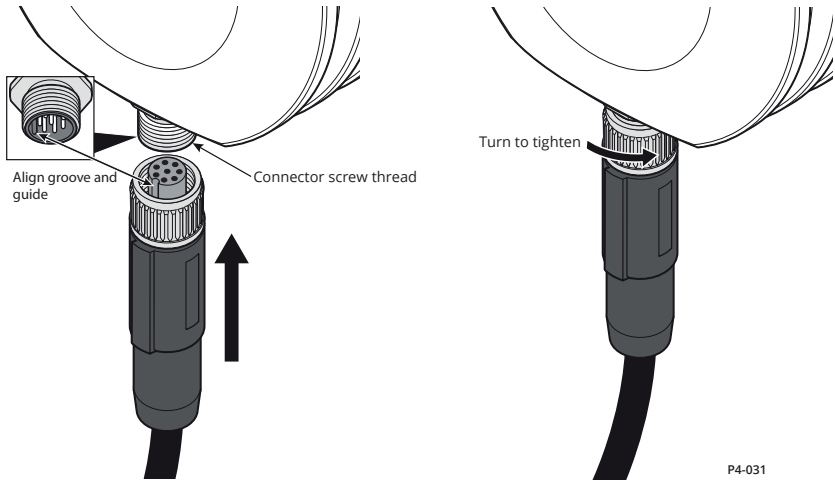
**Figure 2.1** The M12 connector

PR-43 refractometers are powered with 24 VDC. For connecting the refractometer to Multichannel user interface MI, see the manual for Multichannel user interface. For connecting the refractometer to Compact user interface CI, see the manual for Compact user interface. See Figure 2.2 for instruction how to connect the M12 refractometer cable.

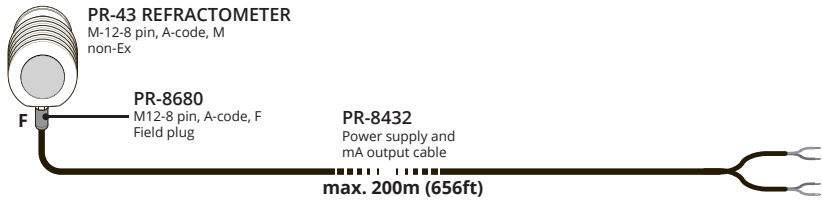
### 2.4.1 Wiring options

The PR-43 refractometer provides both analogue (mA) and digital output signals. See Figure 2.3 for the wiring when only analogue output is used.

Options for connecting the refractometer with both analogue and digital outputs are shown in Figure 2.4. Both Compact user interface CI and Multichannel user interface MI use the digital output signal.



**Figure 2.2** Connecting the refractometer cable to the refractometer



**Figure 2.3** Wiring with analogue output only

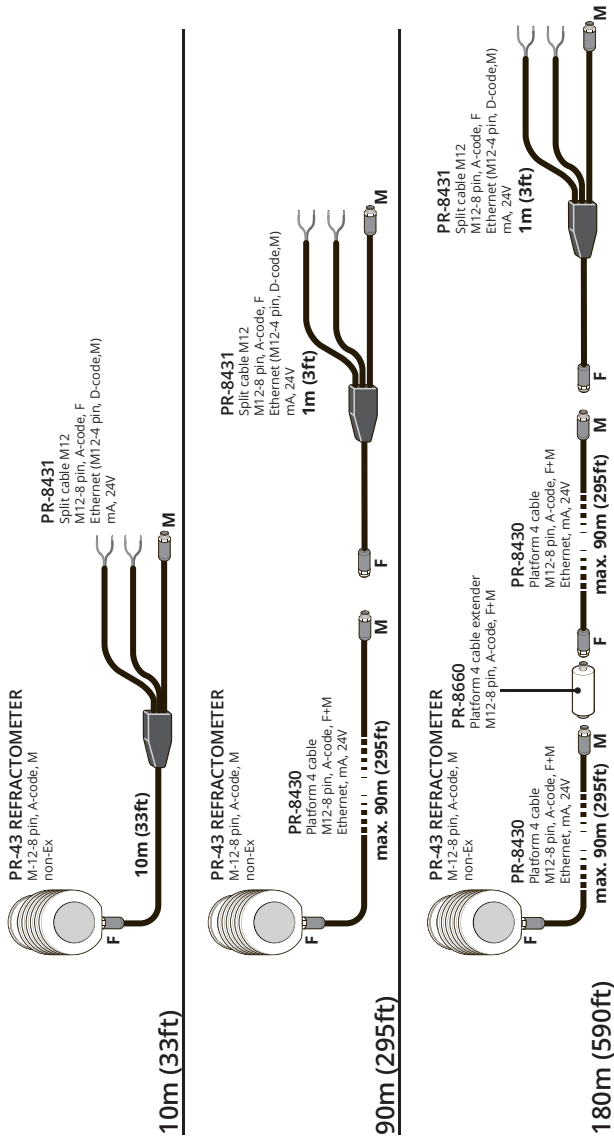
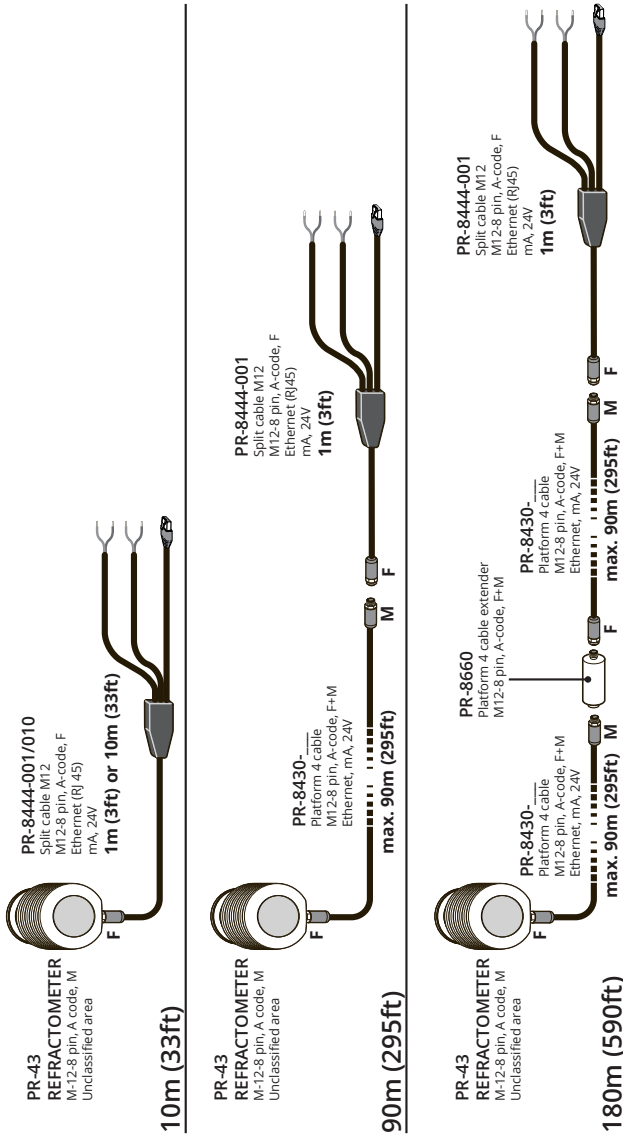


Figure 2.4 Wiring options when both analogue and digital outputs are used



**Figure 2.5** Wiring options when both analogue and digital outputs are used, with RJ45 ethernet connector

RJ45				M12						
Pairs				Pairs						
1	2	Pin	Colour	1	2	3	4	Pin	Colour	Signal
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 2.6** 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: +24 DC
- brown: GND

mA output cable:

- white: mA+
- brown: mA-

## 3 Specifications

### 3.1 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.

### 3.2 Refractometer rangeability

The refractive index standard range of a PR-43-AC/AP is 1.320-1.530 (corresponds to 0-100 Brix), Figure 3.1, 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.

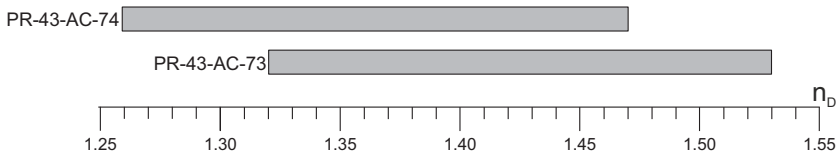


Figure 3.1 PR-43-AC rangeability

### 3.3 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.



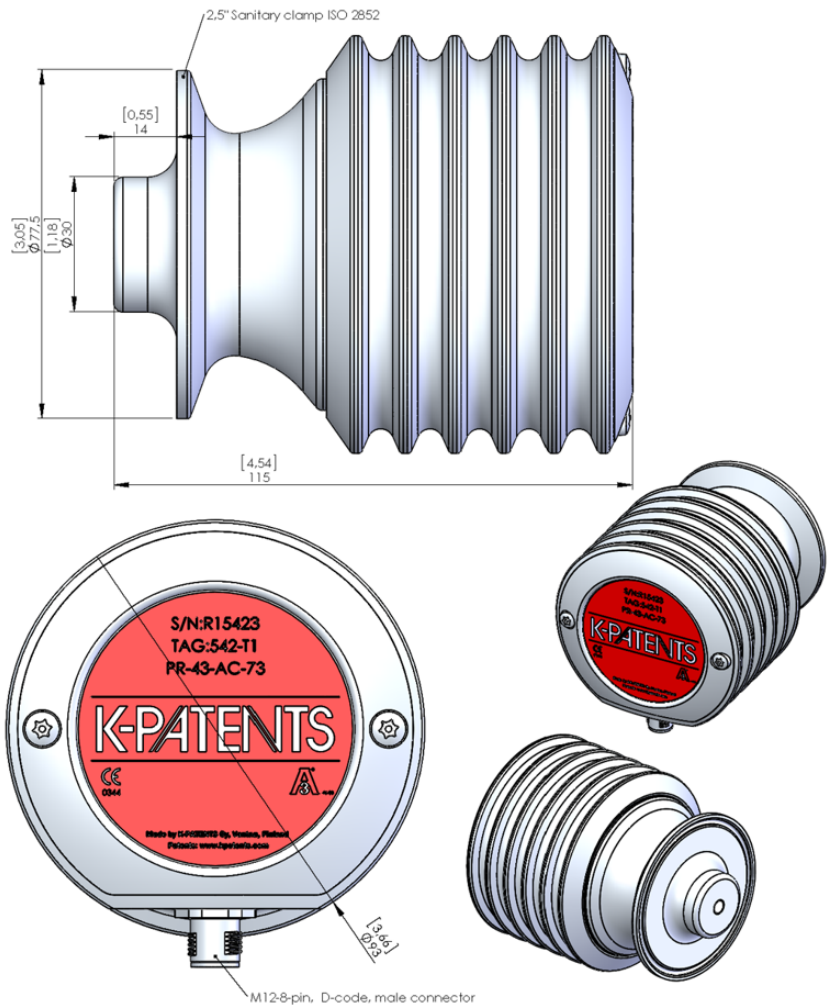


Figure 3.2 PR-43-AC dimensions

### 3.3.1 PR-43-AC model code

#### SANITARY COMPACT REFRACTOMETER for pipelines

Model and description	Model
PR-43 = Refractometer	PR-43
<b>Refractometer model</b>	
-AC = Compact sanitary certified process refractometer, insertion length 14 mm	-AC
<b>Prism material and Refractive Index range limit</b>	
-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
<b>Connection type and size</b>	
-E25-P15 = Varivent DN65, 15 bar (A)	-E25-P15
-H25-P15 = Sanitary 3A-clamp, 2½ inch, 15 bar (A)	-H25-P15
-H25-P40 = Sanitary 3A-clamp, 2½ inch, High Pressure, 40 bar @ 20°C (A)	-H25-P40
-Z25-P15 = 2½ inch I-clamp, 15 bar (B)	-Z25-P15
<b>Refractometer wetted parts material</b>	
-SS = AISI 316 L	-SS
-HC = Alloy C276	-HC
<b>Electrical classification</b>	
-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
<b>High accuracy option</b>	
-HAC = High accuracy version in range 0-30 Brix 4-30°C	-HAC
<b>EHEDG option</b>	
-EH = EHEDG Type EL class I Certified Model	-EH
<b>Polishing option</b>	
-EP = Electropolished refractometer wetted parts (Ra 0.4 $\mu$ m, 15 $\mu$ inch)	-EP

(A) EHEDG certified version available

(B) Sanitary 3-A certified

### 3.3.2 PR-43-AC mounting hardware model code

#### Mounting hardware (without wash nozzles)

MODEL AND DESCRIPTION	MODEL
AFC = Elbow flow cell	AFC
<b>Refractometer connection</b> -H = Sanitary 3A clamp, 2 1/2 inch	-H
<b>Construction material</b> SS = AISI 316	SS
<b>Process connection</b> -H = Sanitary 3A clamp	-H
<b>Pipe section diameter</b> 10 = 25 mm (1 inch) (A) 15 = 40 mm (1 1/2 inch) 20 = 50 mm (2 inch) 25 = 65 mm (2 1/2 inch) (A) 30 = 80 mm (3 inch) (A) 40 = 100 mm (4 inch) (A)	10 15 20 25 30 20
<b>Flow cell inlet type</b> -SI = Straight pipe -RI = Reduced pipe (cone)	-SI -RI
<b>Options</b> -EP = Electropolished process wetted parts (RA 0.4µm, 15 µ inch)	-EP

(A) with -SI option only

#### EHEDG certified mounting hardware

MODEL AND DESCRIPTION	MODEL
AFC = Elbow flow cell	AFC
<b>Refractometer connection</b> -H = Sanitary 3A clamp, 2 1/2 inch	-H
<b>Construction material</b> SS = AISI 316	SS
<b>Process connection</b> -H = Sanitary 3A clamp	-H
<b>Pipe section diameter</b> 20 = 50 mm (2 inch)	20
<b>Flow cell inlet type</b> -SI = Straight pipe	-SI
<b>EHEDG</b> -EH = EHEDG Type EL Class I Certified model	-EH
<b>Polishing option</b> -EP = Electropolished process wetted parts (Ra 0.4µm, 15 µ inch)	-EP

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

**Mounting hardware with wash nozzles**

<b>MODEL AND DESCRIPTION</b>	<b>MODEL</b>
AFC = Elbow flow cell	AFC
<b>Refractometer connection</b> -H = Sanitary 3A clamp, 2 1/2 inch	-H
<b>Construction material</b> SS = AISI 316	SS
<b>Process connection</b> -H = Sanitary 3A clamp	-H
<b>Pipe section diameter</b> 10 = 25 mm (1 inch) 15 = 40 mm (1 1/2 inch) 20 = 50 mm (2 inch) 25 = 65 mm (2 1/2 inch) (A) 30 = 80 mm (3 inch) (A) 40 = 100 mm (4 inch) (A)	10 15 20 25 30 40
<b>Flow cell inlet type</b> -SI = Straight pipe -RI = Reduced pipe (cone)	-SI -RI
<b>Wash nozzle connection</b> -NC = Nozzle connection	-NC
<b>Wash nozzles for 10/15 flow cells</b> -SN = Steam nozzle, threads G ¼ inch female -WN = Water nozzle, threads G ¼ inch female -WP = Pressurized water nozzle, threads G ¼ inch female -PG = Plug for nozzle connection	-SN -WN -WP -PG

(A) with -SI option only

Example: Refractometer:PR-43-AC-73-H25-P15

Flow cell: AFC-HSS-H20-SI

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

**Mounting hardware, mini flow cell**

<b>MODEL AND DESCRIPTION</b>	<b>MODEL</b>
MFC = Mini flow cell	MFC
<b>Refractometer connection</b> -H = Sanitary 3A clamp, 2 1/2 inch	-H
<b>Construction material</b> SS = AISI 316	SS
<b>Process connection</b> -H = Sanitary 3A clamp	-H
<b>Pipe section diameter</b> 05 = 15 mm (½ inch)	05

**Mounting hardware, Varivent DN65 connection**

<b>MODEL AND DESCRIPTION</b>	<b>MODEL</b>
TDN = Varivent®in-line access unit clamp DN65 Type N (A)	TDN
<b>Pipe section diameter</b> 40 = 100 mm (4 inch) 50 = 50 mm (2 inch) 65 = 65 mm (2 1/2 inch) 80 = 80 mm (3 inch) 100 = 100 mm (4 inch) 125 = 125 mm (5 inch) 150 = 150 mm (6 inch)	-40 -50 -65 -80 -100 -125 -150
<b>Counter flange options</b> -SN = Steam nozzle, threads G ¼ inch female -WN = Water nozzle, threads G ¼ inch female -WP = Pressurized water nozzle, threads G ¼ inch female -PG = Varivent blind flange type N	-SN -WN -WP -PG

(A) Includes one 2½ inch Type N blind flange with 2½ inch EPDM gasket and 2½ inch Varivent clamp Type N

**Mounting hardware**

<b>MODEL AND DESCRIPTION</b>	<b>MODEL</b>
SFC = Side flow cell (A)	SFC
<b>Refractometer connection</b> -HH = Sanitary 3A clamp, 2 1/2 inch	-HH
<b>Construction material</b> SS = AISI 316	SS
<b>Process connection</b> -H = Sanitary 3A clamp	-H
<b>Pipe section diameter</b> 10 = 25 mm (1 inch) 15 = 40 mm (1 1/2 inch) 20 = 50 mm (2 inch) 25 = 65 mm (2 1/2 inch) (A)	10 15 20 25
<b>Flow cell inlet and outlet orientation</b> -090 = Elbow, 90 degree bend -180 = Straight pipe, 180 degree	-090 -180

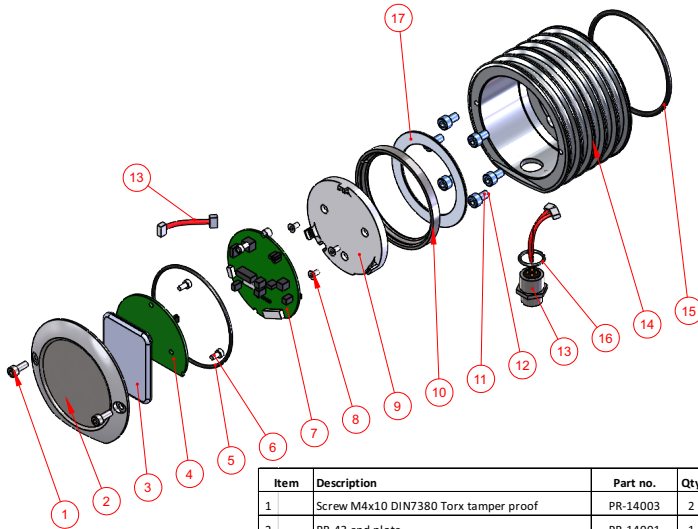
(A) Includes one 2½ inch blind flange with 2½ inch EPDM gasket and  
2½ inch sanitary clamp is included

**3.3.3 PR-43-AC specifications**

	<b>Standard</b>	<b>Optional</b>
<b>REFRACTOMETER PR-43-A Models</b>	PR-43-AC Compact model for small pipelines	
<b>Refractive Index range</b>	Full range, $n_D = 1.3200...1.5300$ corresponds to hot water...100 Brix or % by weight.	$n_D 1.2600...1.4700$ .
<b>Accuracy</b>	Across the full range of 0-100 Brix: Refractive Index $n_D \pm 0.0002$ corresponds typically to $\pm 0.1$ Brix or % by weight	High accuracy version -HAC in the range of 0-30 Brix and 4-30°C: $\pm 0.05$ Brix or % by weight. $\pm 0.02$ Brix or % by weight (in set-point applications).
<b>Repeatability</b>	Across the full range of 0-100 Brix: $n_D \pm 0.00004$ (corresponds typically to $\pm 0.02$ Brix or % by weight).	
<b>Speed of response</b>	1 s undamped, damping time selectable up to 5 min	
<b>Calibration</b>	With NIST traceable Cargille standard R.I. liquids over full range	

	<b>Standard</b>	<b>Optional</b>
<b>Patented CORE-Optics</b>	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).	
<b>Temperature compensation</b>	Automatic, digital compensation.	
<b>Instrument verification</b>	With NIST traceable Cargille standard R.I. liquids and guided procedure, including a printable verification report	
<b>Process connection</b>	Sanitary 3A-clamp 2.5"; Varivent in-line access unit clamp DN65 or via elbow flow cell (for line sizes of 2.5" and smaller); 2.5" I-clamp.	
<b>Hygienic design certification</b>	3-A Sanitary Standard 46-03 certified and EHEDG (European Hygienic Engineering & Design Group) Type EL Class I certified	
<b>Process pressure</b>	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.	
<b>Process temperature</b>	-40°C...130°C (-40°F...266°F)	
<b>Ambient temperature</b>	Min. -40°C (-40°F), max. 45°C (113°F)	
<b>Process wetted parts</b>	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
<b>Refractometer protection class</b>	IP67, Type 4X	
<b>Refractometer weight</b>	1.6 kg (3.5 lbs)	
<b>Current output</b>	Isolated 4-20 mA, max. load 1000 Ohm, galvanic isolation 1000 VDC or AC (peak), hold function during prism wash	
<b>Remote and Ethernet connections</b>	10/100BaseT Ethernet, web server for configuration and diagnostics, UDP/IP Protocol connection for data acquisition.	
<b>Power supply</b>	+24 VDC ±10%, max. 2 VA	
<b>INTERCONNECTING CABLES</b>	Standard length 10 m. Single cable maximum length 90 meters, with cable extender PR-8660 maximum length 90+90 meters.	

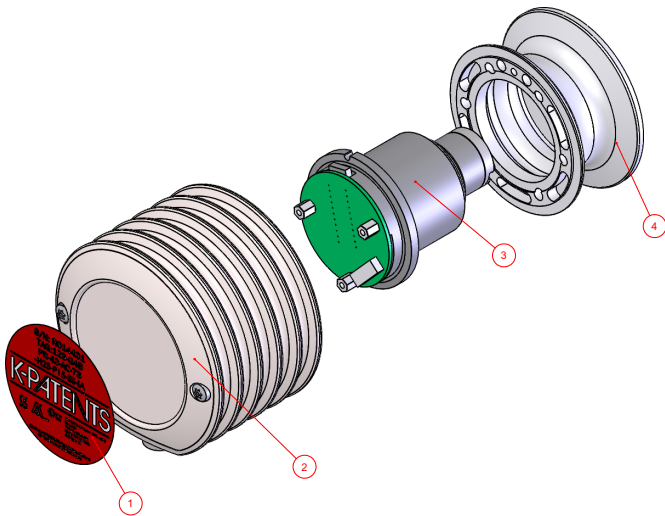
### 3.3.4 PR-43-AC parts list



Item	Description	Part no.	Qty
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
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 3.3** Refractometer cover assembly





Item	Description	Part no.	Qty
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		

**Figure 3.4** PR-43-AC assembly

### 3.3.5 PR-43-AC mounting specifics

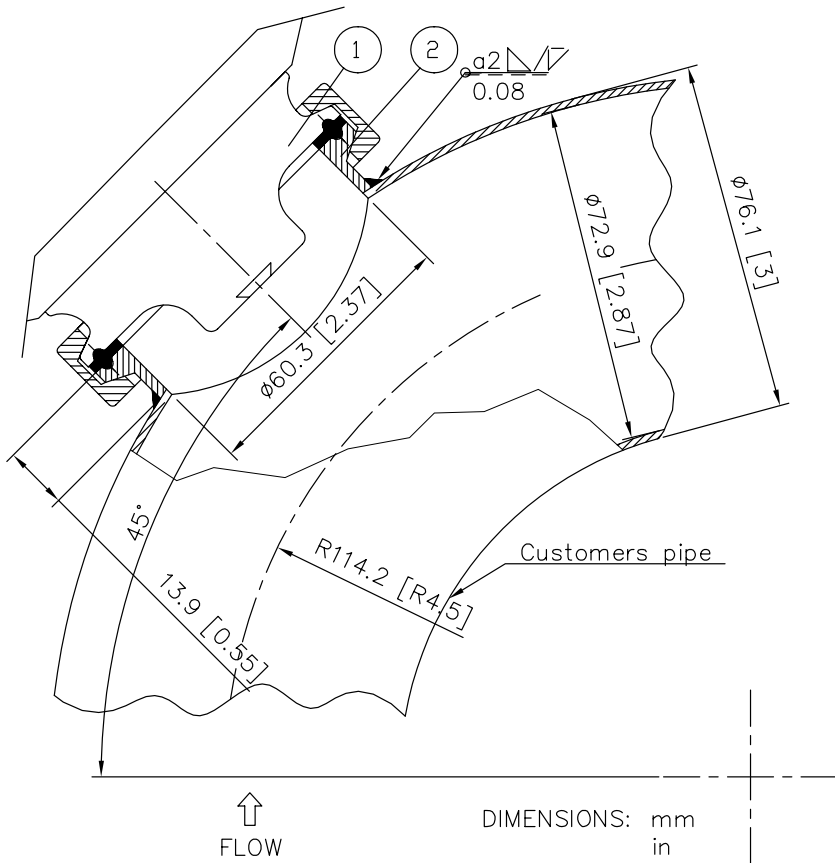
Sanitary process refractometer PR-43-AC is connected to the process by a 2 1/2" 3A sanitary clamp. The recommended mounting is *in a pipe bend, with a vertical flow upwards before the refractometer, and a horizontal pipe after*. This mounting ensures

1. Self-cleaning of the prism due to the flow directed against its surface.
2. Efficient drainage when the pipe is emptied.

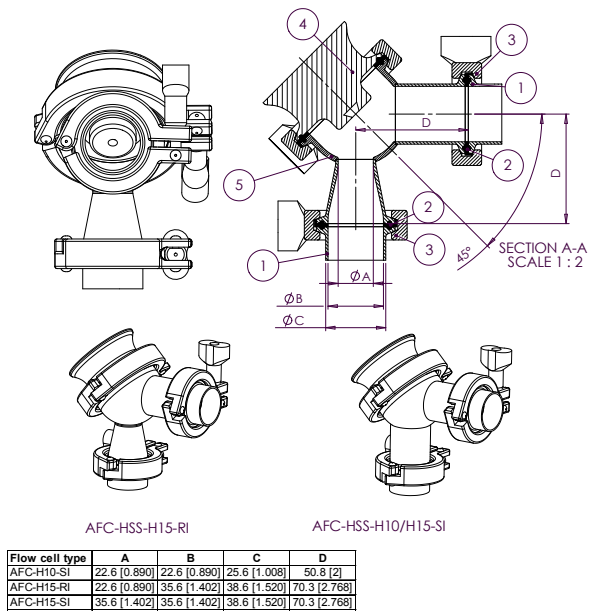
*For pipe diameters of 3" or above*, a ferrule is welded directly to the pipe wall, Figure 3.5 (a ferrule, length 21.5 mm, is delivered with standard refractometer delivery).

*For smaller pipe diameters*, flow cells are available, Figures 3.6, 3.7, 3.8 and 3.9.

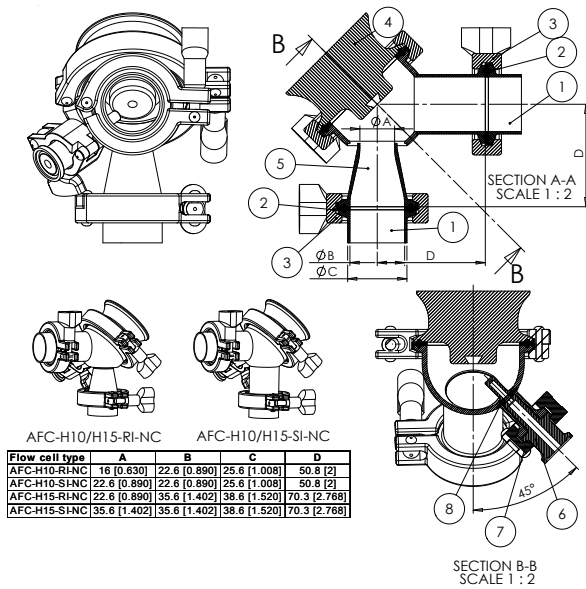
The flow cells are exchangeable with standard 90° bend pieces.



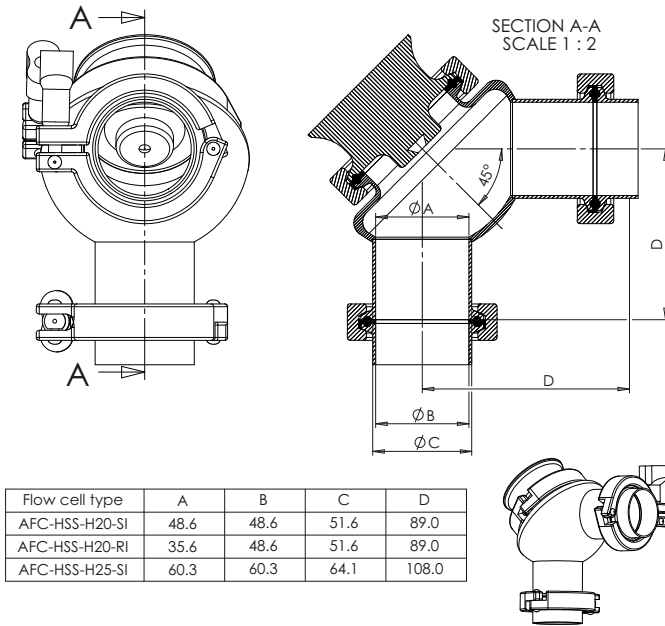
**Figure 3.5** Mounting with sanitary ferrule  
*Pipe diameter 3" (80 mm) or more*



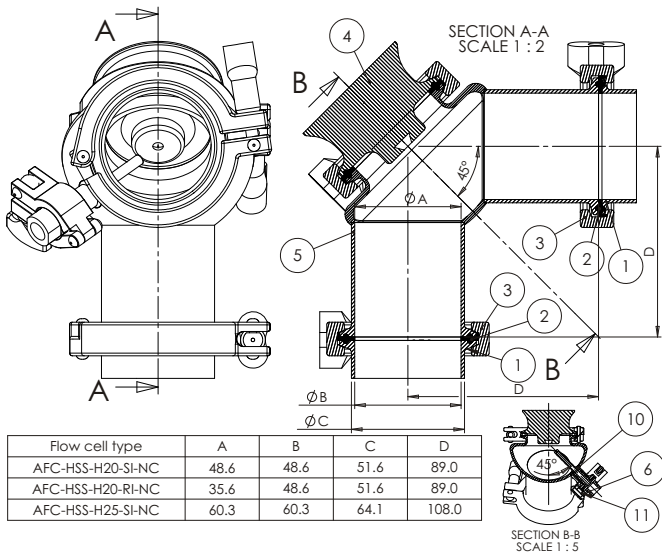
**Figure 3.6** Flow cell AFC-HSS-  
H10 for pipe diameter 1" (25 mm) and H15 for pipe diameter 1 1/2" (40 mm)



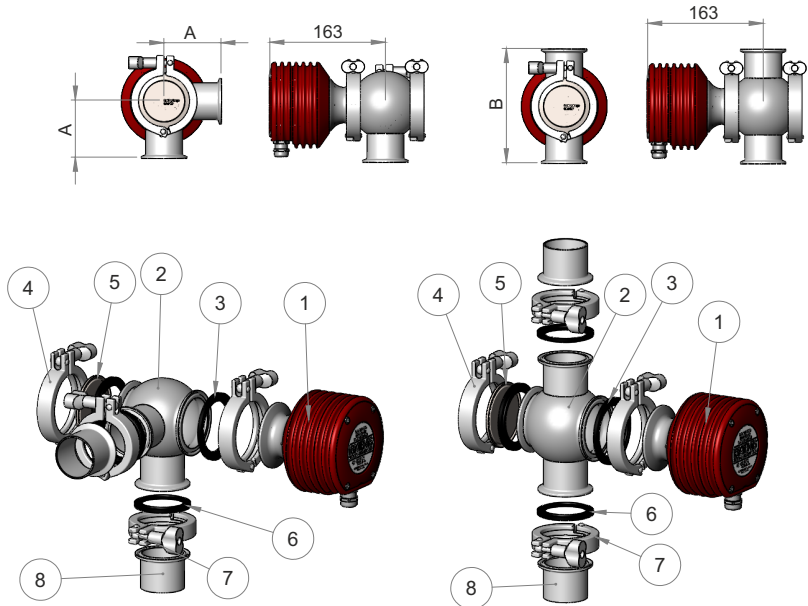
**Figure 3.7** Flow cell AFC-HSS- with wash nozzle connection (-NC)  
*H10 for pipe diameter 1" (25 mm) and H15 for pipe diameter 1 1/2" (40 mm)*



**Figure 3.8** Flow cell AFC-HSS-  
H20 for pipe diameter 2" (50 mm) and H25 for pipe diameter 2 1/2" (65 mm)



**Figure 3.9** Flow cell AFC-HSS- with wash nozzle connection (-NC)  
*H20 for pipe diameter 2" (50 mm) and H25 for pipe diameter 2 1/2" (65 mm)*



Size	A	B
1"	66	132
1.5"	86	173
2"	80	161
2.5"	98	197

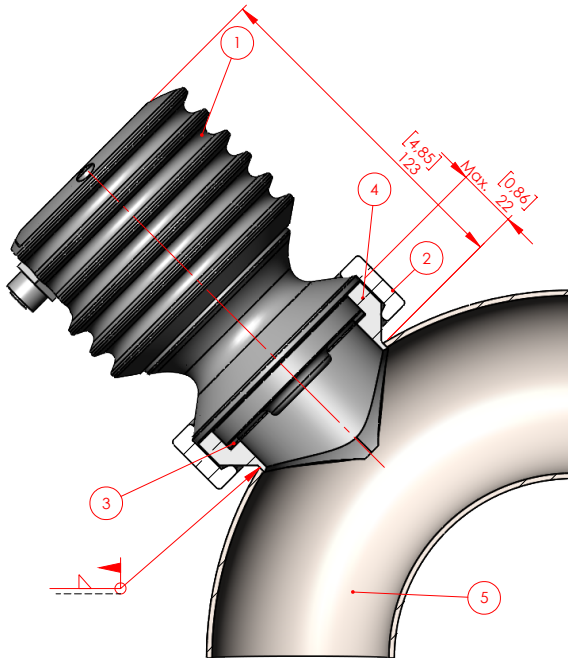
		1	2	3	4	5	6	7	8			
Size	Angle	Sensor	Flow cell	Sanitary gasket	Sanitary clamp	Sanitary blind flange	Sanitary gasket	Sanitary clamp	Customer's pipe			
1"	90°	Sanitary refractometer	SFC-HHSS-H10-090	PR-9202	PR-9201	PR-9200	PR-9246	PR-9211	-			
	180°		SFC-HHSS-H10-180						-			
1.5"	90°		SFC-HHSS-H15-090				PR-9202	PR-9201	PR-9200	PR-9212	PR-9211	-
	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 3.10 Side flow cells



Sanitary Refractometer PR-43-AC-Z is mounted using 3-A Sanitary certified 2.5 inch Cherry Burrell 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.



Item no.	Name	Material	Supplied by	Pcs.
1	Refractometer PR-43-AC-Z25	AISI316L	K-Patents	1
2	2.5" I-clamp	AISI304	Customer	1
3	2.5" I-clamp gasket	EPDM	Customer	1
4	2.5" I-clam ferrule	AISI316L	Customer	1
5	2.5" Pipe or larger	AISI316L	Customer	1

**Figure 3.11** I-Line fitting for PR-43-AC

### **3.3.6 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 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.

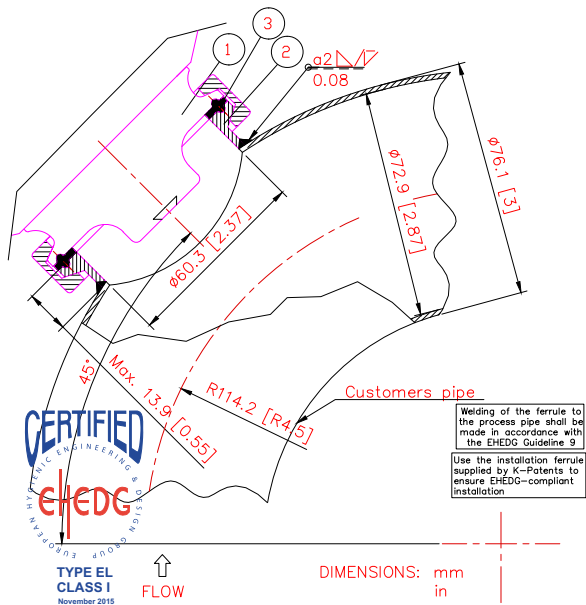
To ensure EHEDG compliant installation, follow the mounting specifics provided on the mounting drawing supplied by Vaisala with each PR-43-AC refractometer ordered with the -EH option.

An example of such mounting guideline is shown in the Figure 3.12.

### **3.3.7 3-A Sanitary Standard compliance**

The user should ensure that the refractometer is not a source of contamination to product due to damaged or worn product contact surfaces. Misuse (e.g. 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. Note that this repair service can be completed by 3-A authorized service center only.

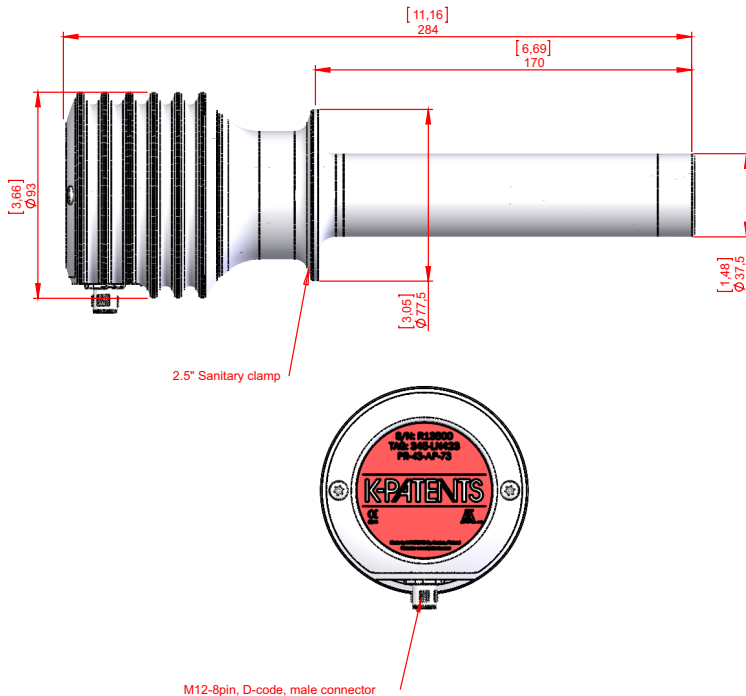


No	Item	Material	Pcs
1	Sensor PR-43-AC		1
2	Sanitary ferrule 2 1/2" ISO 2852	AISI 316L	1
3	Sanitary gasket 2 1/2"	ISO2852 type EHDG certified	1

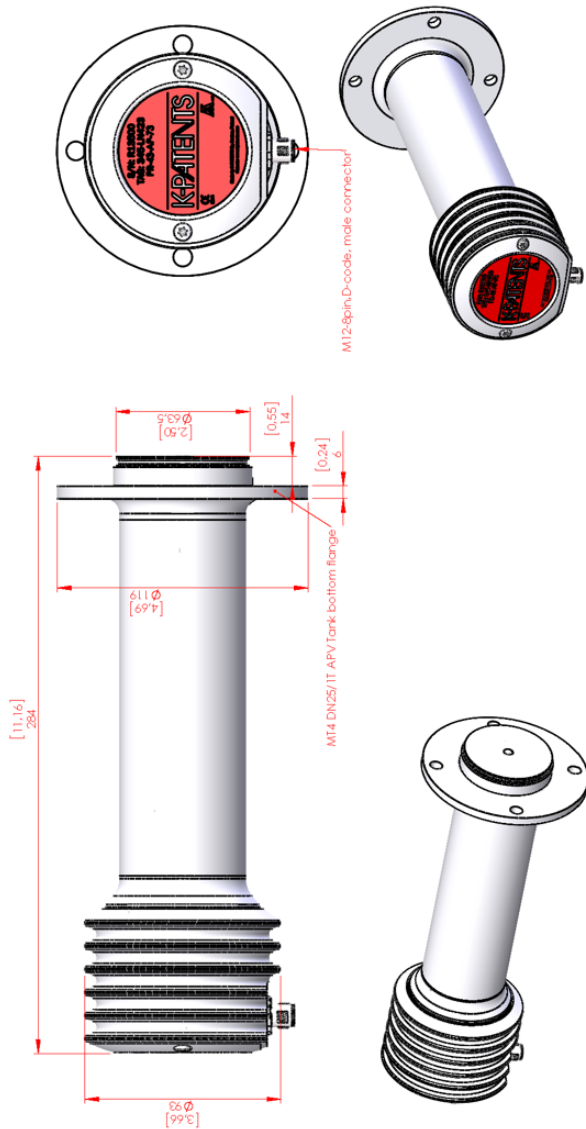
**Figure 3.12** Mounting with sanitary ferrule  
 Pipe diameter 3" (80 mm) or more  
 EHDG certified configuration

### 3.4 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 3.13** Dimensions of an inserted refractometer PR-43-AP-H25-L170



**Figure 3.14** Flush mounted refractometer PR-43-AP-T10-L00

### 3.4.1 PR-43-AP model code

#### SANITARY PROBE REFRACTOMETER for large pipelines and vessels

<b>Model and description</b>	<b>Model</b>
PR-43 = Refractometer	PR-43
<b>Refractometer model</b>	
-AP = Sanitary process refractometer, probe	-AP
<b>Prism material and refractive index range limit</b>	
-73 = R.I. 1.320-1.530 n <sub>D</sub> (0-100 Brix) Sapphire prism	-73
<b>Connection type and size</b>	
-E25-P15 = Varivent DN65, 15 bar	-E25-P15
-H25-P15 = Sanitary 3A-clamp, 2½inch, 15 bar	-H25-P15
-H25-P40 = Sanitary 3A-clamp, 2½inch, High Pressure, 40 bar @ 20°C	-H25-P40
-H40-P15 = Sanitary 3A-clamp, 4 inch, 15 bar	-H40-P15
-T10-P15 = MT4 DN25/1T APV tank bottom flange, flush mounted 1" DN10	-T10-P15
-V25-P15 = 2½inch, 15 bar with O-ring for refractometer head	-V25-P15
-Z25-P15 = 2½inch I-clamp, 15 bar	-Z25-P15
<b>Insertion length, models H25-P15/P40</b>	
-L14 = insertion length 14 mm <b>(A) (C)</b>	-L14
-L42 = insertion length 42 mm <b>(A) (C)</b>	-L42
-L140 = insertion length 140 mm <b>(B)</b>	-L140
-L170 = insertion length 170 mm <b>(A) (C)</b>	-L170
<b>Insertion length, models H40-P15</b>	
-L63 = insertion length 63 mm <b>(A) (C)</b>	-L63
-L170 = insertion length 170 mm <b>(A) (C)</b>	-L170
<b>Insertion length, models T10-P15</b>	
-L00 = flush mount insertion length <b>(C)</b>	-L100
-L170 = insertion length 170 mm <b>(B)</b>	-L170

<b>Insertion length, models E25-P15</b>	
-L170 = insertion length 170 mm <b>(A) (C)</b>	-L170
<b>Insertion length, models V25-P15</b>	
-L170 = insertion length 170 mm <b>(B)</b>	-L170
<b>Insertion length, models I-clamp Z25-P15</b>	
-L178 = insertion length 178 mm <b>(C)</b>	-L178
<b>Refractometer wetted parts material</b>	
-SS = AISI 316 L	-SS
<b>Electrical classification</b>	
-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
<b>EHEDG option</b>	
-EH = EHEDG Type EL Class I Certified Model <b>(D)</b>	-EH

**(A)** EHEDG certified versions available

**(B)** Design according to Sanitary 3-A

**(C)** Sanitary 3-A certified

**(D)** for models with (A) note

**SANITARY PROBE REFRACTOMETER with prism wash for large pipelines and vessels**

<b>Model and description</b>	<b>Model</b>
PR-43 = Refractometer	PR-43
<b>Refractometer model</b>	
-AP = Sanitary process refractometer, probe	-AP
<b>Prism material and refractive index range limit</b>	
-73 = R.I. 1.320-1.530 $n_D$ (0-100%) Sapphire prism	-73
<b>Connection type and size</b>	
-H40-P15 = Sanitary 3A-clamp, 4 inch, 15 bar	-H40-P15
<b>Insertion length</b>	
-L170 = insertion length 170 mm	-L170
<b>Refractometer wetted parts material</b>	
-SS = AISI 316 L	-SS
<b>Electrical classification</b>	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = Ex end 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
<b>Prism wash</b>	
-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

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



### 3.4.2 PR-43-AP mounting hardware model code

#### Mounting hardware for PR-43-AP refractometer

Part number and description	Part No.
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

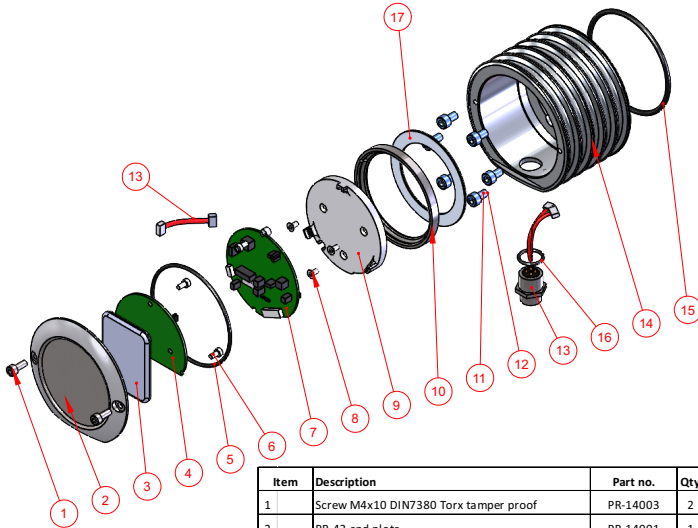
**Note:** For EHEDG certified refractometers use EHEDG certified gasket PR-9202-EH (2½ inch) or PR-9272-EH (4").

### 3.4.3 PR-43-AP specifications

<b>REFRACTOMETER PR-43-A Models</b>	<b>PR-43-AP probe model for large pipelines and vessels</b>
<b>Refractive Index range</b>	Full range, $n_D = 1.3200 \dots 1.5300$ corresponds to hot water...100 Brix or % by weight.
<b>Accuracy</b>	Across the full range 0-100 Brix; Refractive Index $n_D \pm 0.0002$ corresponds typically to $0.1 \pm$ Brix or % by weight.
<b>Repeatability</b>	Across the full range of 0-100 Brix: $n_D \pm 0.00004$ (corresponds typically to $\pm 0.02$ Brix or % by weight).
<b>Speed of response</b>	1 s undamped, damping time selectable up to 5 min
<b>Calibration</b>	With NIST traceable Cargille standard R.I. liquids over full range
<b>Patented CORE-Optics</b>	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).
<b>Temperature compensation</b>	Automatic, digital compensation.
<b>Instrument verification</b>	With NIST traceable Cargille standard R.I. liquids and guided procedure, including a printable verification report
<b>Process connection</b>	Sanitary 3A-clamp 2.5"; Sanitary 3A-clamp 4" or MT4 DN 25/1T APB tank bottom flange; 2.5" I-clamp
<b>Hygienic design certification</b>	3-A Sanitary Standard 46-03 certified and EHEDG (European Hygienic Engineering & Design Group) Type EL Class I certified

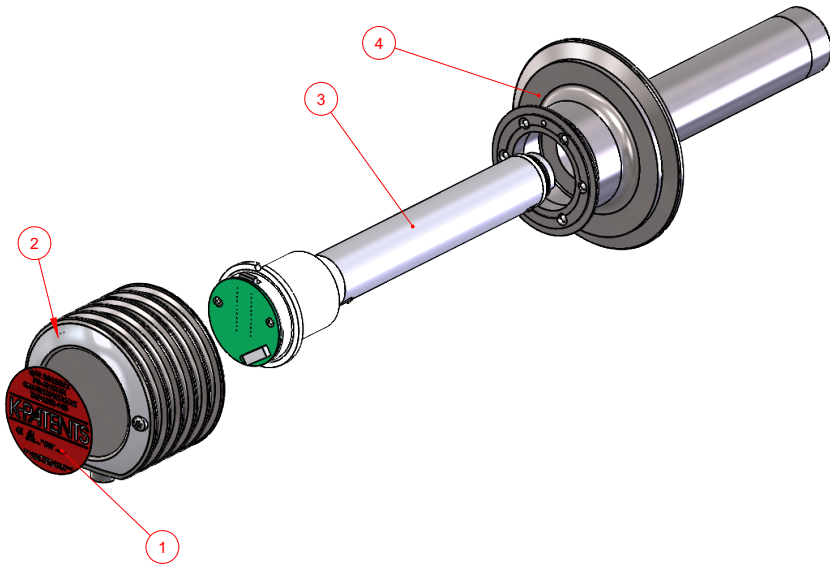
<b>Process pressure</b>	Sanitary 3A and I-clamp max. 15 bar (200 psi) at 20°C (70°F)/9 bar (125 psi) at 120°C (250°F). High pressure Sanitary 3A clamp HP 40 bar.
<b>Process temperature</b>	-40°C...150°C (-40°F...302°F)
<b>Ambient temperature</b>	Min. -40°C (-40°F), max. 45°C (113°F)
<b>Process wetted parts</b>	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.
<b>Refractometer protection class</b>	IP67, NEMA 4, 4X, 6, 6P
<b>Refractometer weight</b>	2.9 kg (6 lbs)
<b>Current output</b>	Isolated 4-20 mA, max. load 1000 Ohm, galvanic isolation 1000 VDC or AC (peak), hold function during prism wash
<b>Remote and Ethernet connections</b>	10/100BaseT Ethernet, web server for configuration and diagnostics, UDP/IP Protocol connection for data acquisition.
<b>Power supply</b>	+24 VDC ±10%, max. 2 VA
<b>INTERCONNECTING CABLES</b>	Standard length 10 m. Single cable maximum length 90 meters, with cable extender PR-8660 maximum length 90+90 meters.

3.4.4 PR-43-AP parts lists



Item	Description	Part no.	Qty
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
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 3.15 Refractometer cover assembly



Item	Description	Part no.	Qty	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			
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

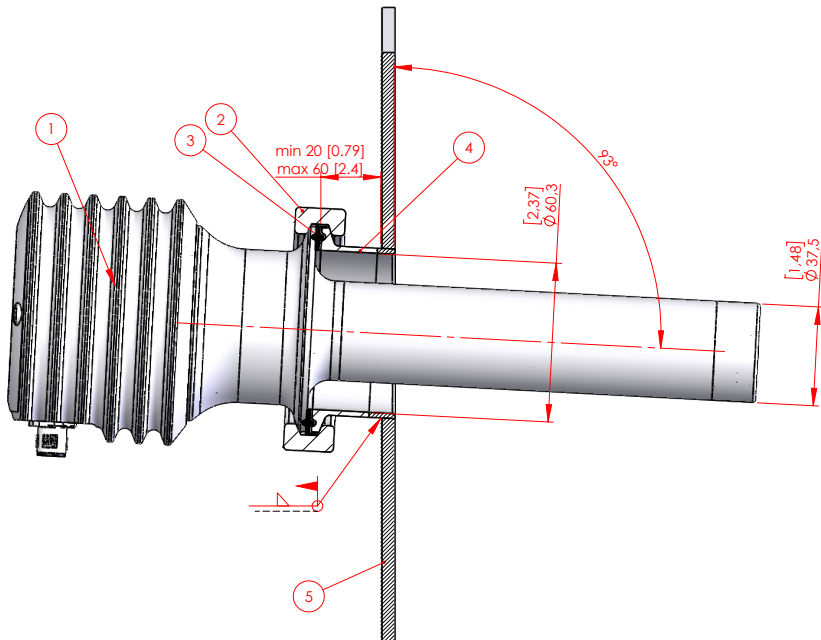
**Figure 3.16** PR-43-AP assembly

### 3.4.5 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.

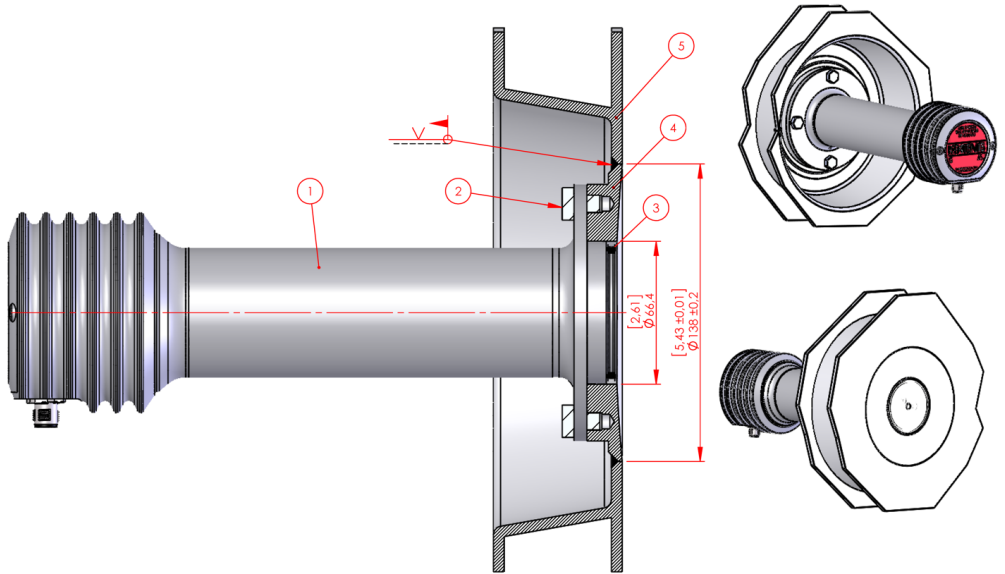
Probe refractometer type PR-43-AP-H25 is connected to the process by a 2½ inch 3-A sanitary clamp.

**Note:** 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 3.17** Insertion of Probe refractometer PR-43-AP-H25

The refractometer type PR-43-AP-T10-L00 is flush mounted using a sanitary APV tank bottom flange. 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.

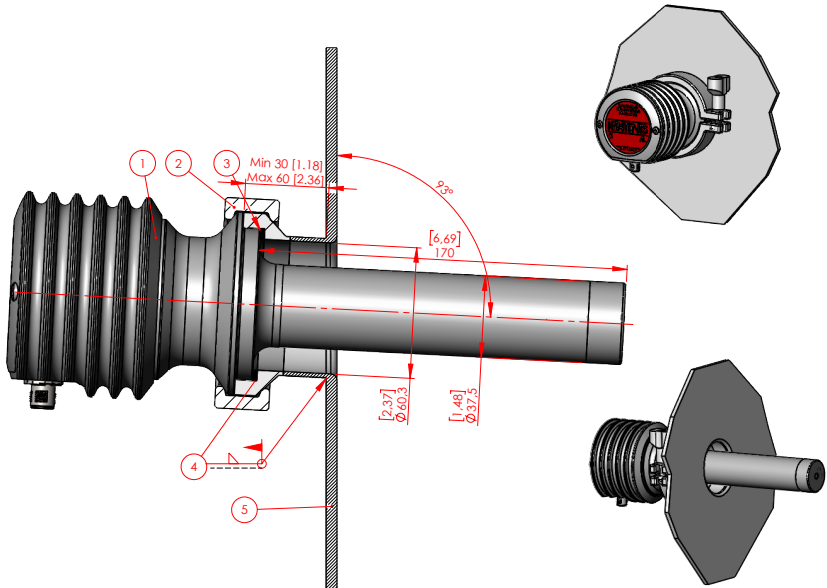


Item no.	Name	Material	Supplied by	Pcs.
1	Refractometer PR-43-AP-T10-L00	AISI316L	K-Patents	1
2	Bolt M8x12 A4 DIN931	AISI316L	Patents/Custom	4
3	APV gasket MT4 DN25/1T	EPDM	K-Patents	1
4	MT4 DN25/1T APV tank bottom flange	AISI316L	K-Pat/Customer	1
5	Pipe/Vessel/Steam jacket	AISI316L	Customer	1

**Figure 3.18** Flush mounting Probe refractometer PR-43-AP-T10-L100

Sanitary Refractometer PR-43-AP-Z is mounted using 3-A Sanitary certified 2.5 inch Cherry Burrell 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.



Item no.	Name	Material	Supplied by	Pcs.
1	Refractometer PR-43-AP-Z25-L178	AISI316L	K-Patents	1
2	2.5" I- clamp	AISI304	K-Patents	1
3	2.5" I-clamp gasket	EPDM	K-Patents	1
4	2.5" I-clamp ferrule	AISI316L	K-Patents/Customer	1
5	Pipe/Vessel/Steam jacket	AISI316L	Customer	1

**Figure 3.19** I-Line fitting for PR-43-AP





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.

K-Patents offers a 3-A Sanitary Standard accepted repair and maintenance package in which all wetted parts, prism, gaskets and dryer are replaced. Note that this repair service can be completed by 3-A authorized service center only (K-Patents factory or regional headquarters).

## 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. *An abnormally 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 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, e.g. by installing a pipe portion with smaller diameter.

Installing a wash nozzle can be considered, if increasing the velocity does not provide a solution (Section 4.2).

### 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".



**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:* Shall mean 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:** Shall mean 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 recommended wash pressures and times are given in the tables below.

Wash medium parameters for integral wash nozzles in PR-43-AP					
	Minimum above process pressure	Maximum above process pressure	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

Wash medium parameters for flowcell wash nozzle AFC					
	Minimum above process pressure	Maximum above process pressure	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



**Important:** 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.

**Note:** In water wash, water temperature should be above the process temperature.

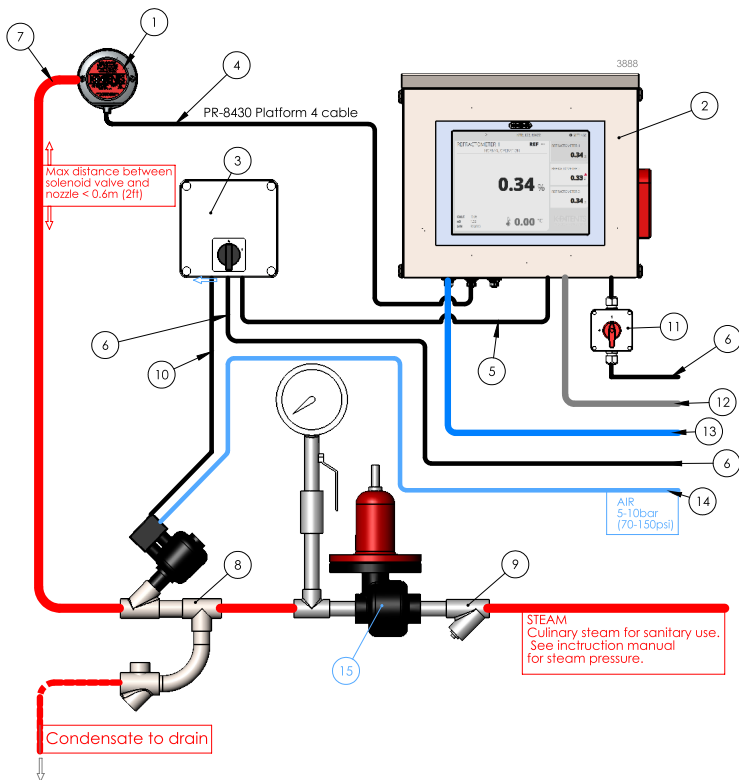
**Note:** The check valve pressure drop is 0.7 bar (10 psi).

#### 4.2.2 Prism wash systems

The prism wash system for steam is described in Figure 4.1. The prism wash system for high pressure water is described by Figure 4.3.

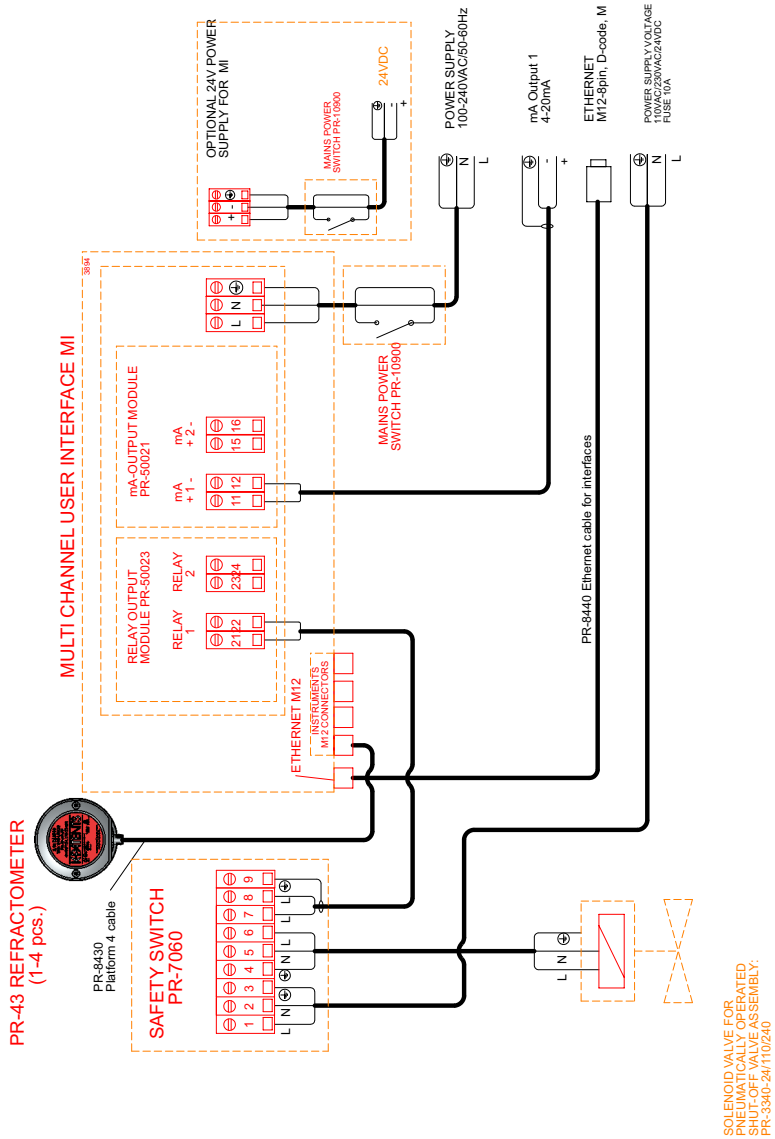


**Warning!** In high pressure wash systems, pressure increase can occur in a closed pipe section when the high pressure pump is operated. It is recommended to mount a pressure relief valve in the pipe section. Relief pressure should be according to pipe pressure rating.

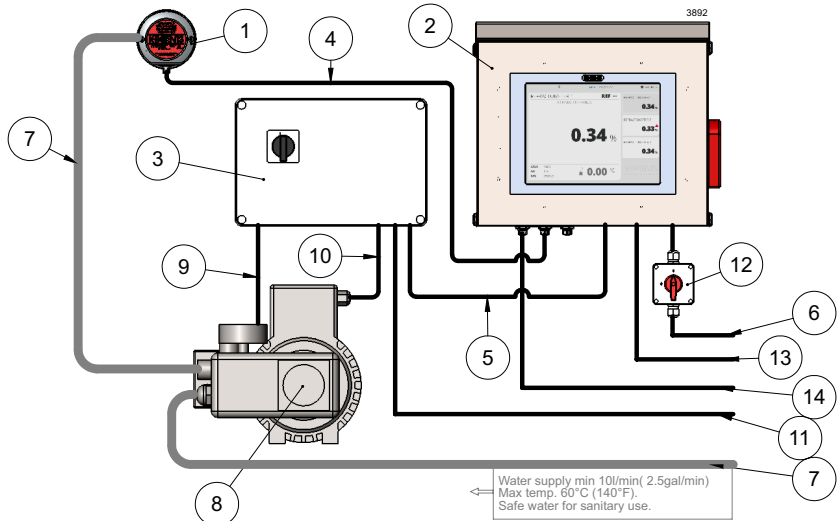


No.	Description	Supplied by	Qty
1	PR-43 refractometer	K-Patents	1
2	Multichannel User Interface MI	K-Patents	1
3	Safety switch PR-7060	K-Patents	1
4	Platform 4 Cable PR-8430	K-Patents	1
5	Relay cable 2x1 (AWG 17)	Customer	1
6	Power Supply	Customer	1
6.1	100-240 VAC/50-60Hz		
6.2	24VDC		
7	Flexible steam 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 4.1 A prism wash system for steam



**Figure 4.2** Wiring for a prism wash system for steam



Water supply min 10l/min( 2.5gal/min)  
 Max temp. 60°C (140°F).  
 Safe water for sanitary use.

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 4.3** A prism wash system for high pressure water

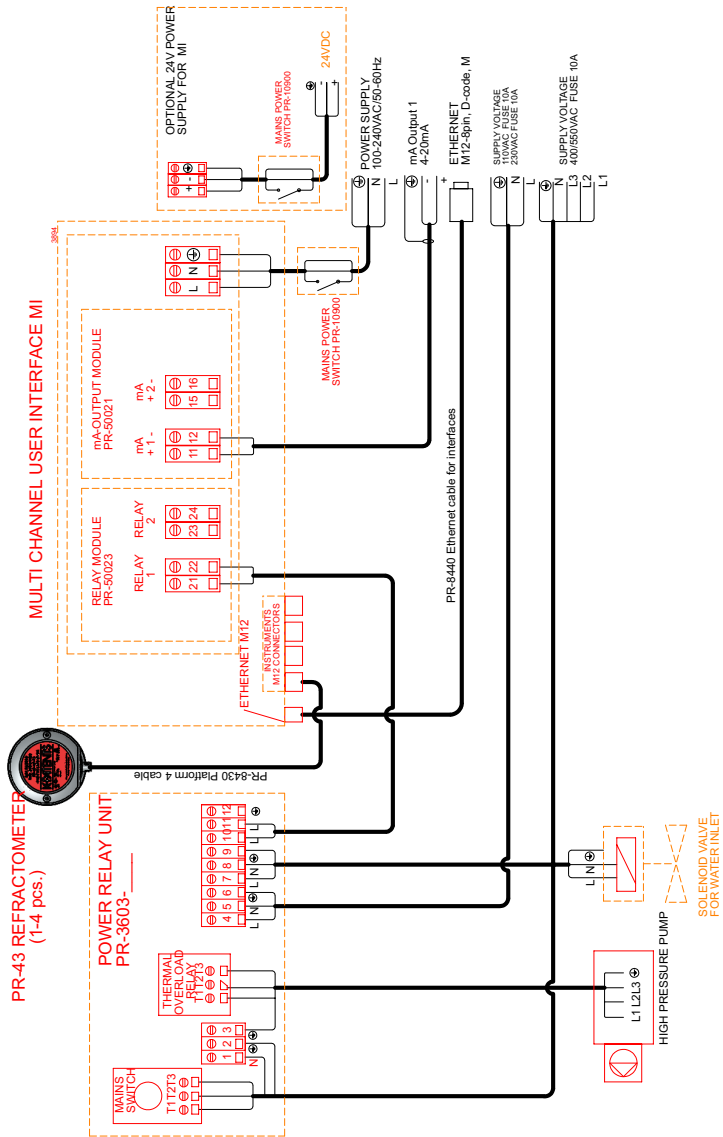


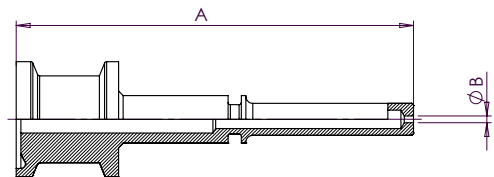
Figure 4.4 Wiring for a prism wash system for high pressure water



### 4.2.3 Prism wash nozzles

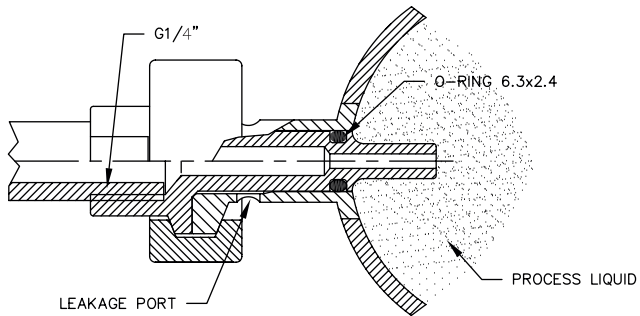
When selecting a wash nozzle for PR-43-AP, take into account both the wash medium and the flowcell model: flowcells with larger pipe diameters need longer wash nozzles. Figure 4.5 below shows a wash nozzle for a flowcell and gives the measurements and part numbers for each nozzle type.

Flowcell -H10 or -H15			
	A	B	part nr
steam	64.75	4.0	PR-3365
water	75	2.5	PR-3369
pressurized water	75	1.5	PR-3368
Flowcell -H20 or -H25			
	A	B	part nr
steam	72.15	4.0	PR-3375
water	97	2.5	PR-3379
pressurized water	97	1.5	PR-3378
Flowcell -H30			
	A	B	part nr
steam	103	4.0	PR-3393
water	113	2.5	PR-3394
pressurized water	113	1.5	PR-3395
Flowcell -H40			
	A	B	part nr
steam	133	4.0	PR-3390
water	143	2.5	PR-3391
pressurized water	143	1.5	PR-3392



**Figure 4.5** Wash nozzles for flowcell AFC-HSS-XXX-XX-NC

Figure 4.6 shows how the nozzle is mounted in a flowcell (-NC with stud for a wash nozzle).



**Figure 4.6** Process connection of a wash nozzle in a flowcell

For PR-43-AP, select the wash nozzle according to wash medium, see Table 4.1 below.

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

**Table 4.1** Prism wash nozzle selection

## 5 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 Figure 5.1 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.

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  $\pm 0.0002$  and they can be traced back to national standards: NIST Standards # 1823 and # 1823 II. As the specified accuracy of PR-43 is  $\pm 0.0002$ , then the representative level is the sum of the two accuracy specifications, that is,  $\pm 0.0004$ .

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



**Figure 5.1** Universal sample holder PR-1012

three dots in the app for the refractometer to be verified, then choose Verification. Tap question mark in the Verification display to get verification instructions. In CI, choose Verification in the Main menu and follow the instructions on screen.



**Important:** For a successful verification, the refractometer and the standard refractive index liquids must be in room temperature ( $25 \pm 5$  °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  $\pm 0.0004$  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's 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 [info@kpatents.com](mailto:info@kpatents.com) and wait for further instructions.

## PR-43 refractometer verification form

Fill in this form and email (or fax) it to your local service representative.

Refractometer serial no: \_\_\_\_\_

Customer: \_\_\_\_\_

Address: \_\_\_\_\_

Fax: \_\_\_\_\_

Email: \_\_\_\_\_

Date: \_\_\_\_\_

Verification made by: \_\_\_\_\_

VERIFICATION RESULTS DISPLAY				
Sample no	Nominal $n_D$	Measured $n_D$	CCD	Temp
1	1.330			
2	1.370			
3	1.420			
4	1.470			
5	1.520			



# EU declaration of conformity



2019-09-01/JJAMO

1 (1)

## EU DECLARATION OF CONFORMITY

Manufacturer: Vaisala Oyj  
Mail address: P.O. Box 26, FI-00421 Helsinki, Finland  
Street Address: Vanha Nurmijärventie 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 1<sup>st</sup> September 2019

Jukka Lyömiö  
Standards and Approvals Manager





**VAISALA**

[www.vaisala.com](http://www.vaisala.com)