Precooler PC1

In extractive analysis of process and flue gases, reliable and constant reduction of sample gas humidity is essential. Bühler Technologies offers a custom range of gas coolers based on Peltier and compressor technology. Process-based cooling temperature control guarantees maximum dew point stability. This allows highest quality industrial gas analysis.

Bühler Technologies developed the extremely compact PC1 precooler to further increase the energy efficiency of the above main coolers. It is used as a small passive cooling level upstream from the main cooler. The PC1 very effectively uses the ambient air supplied by the fan as a coolant. In moderate ambient temperatures (up to 104 °F) it therefore allows the use of small, cost-effective main coolers.

The intelligent gas path in the interchangeable precooling heat exchanger further ensures very low washout of water-soluble gases (e.g. SO_2/complies with EN 15267). Optional PC1 heat exchangers with built-in acid meter connection (H3PO4) complete the concept.

- High precooling output (up to approx. 40 W or 133 Btu/h)
- Very small, compact design
- Allows the use of small, cost-effective main coolers
- Low SO_2 washout (complies with EN 15267)
- Option acid meter connection
- Easy to replace glass heat exchanger
- Accessories: peristaltic pump (condensate and dosing pump)

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Overview

Precooler components:

- Stainless steel housing with fan,
- Glass heat exchanger (replaceable without tools).

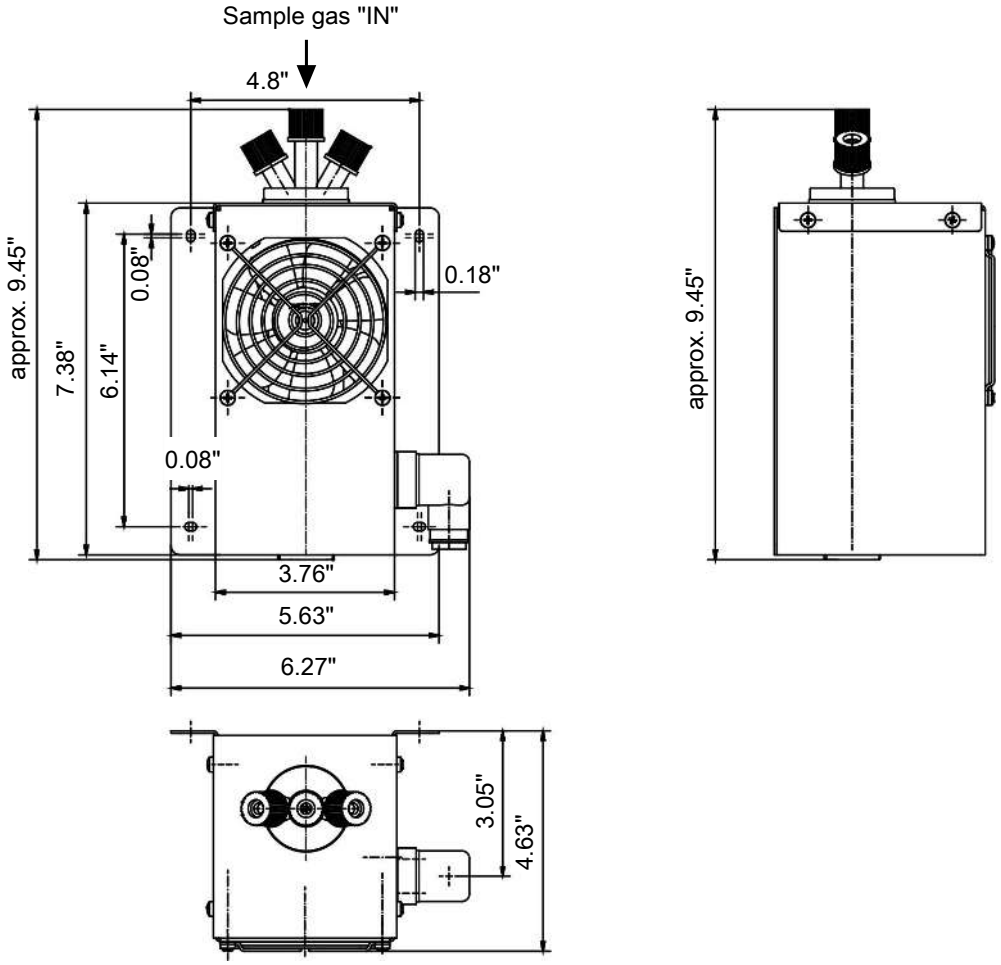
The precooler can generally be equipped with two different heat exchanger styles:

1. Precooling heat exchanger with two gas connections (gas in, gas out).
2. Precooling heat exchanger with three connections (gas in, gas out, acid meter connection).

The precooler can optionally be equipped with the following components:

- Condensate drain via peristaltic pump or condensate pre-separator.
- Dosing pump for dosing phosphoric acid (max. 15 %) into the heat exchanger.

Dimensions

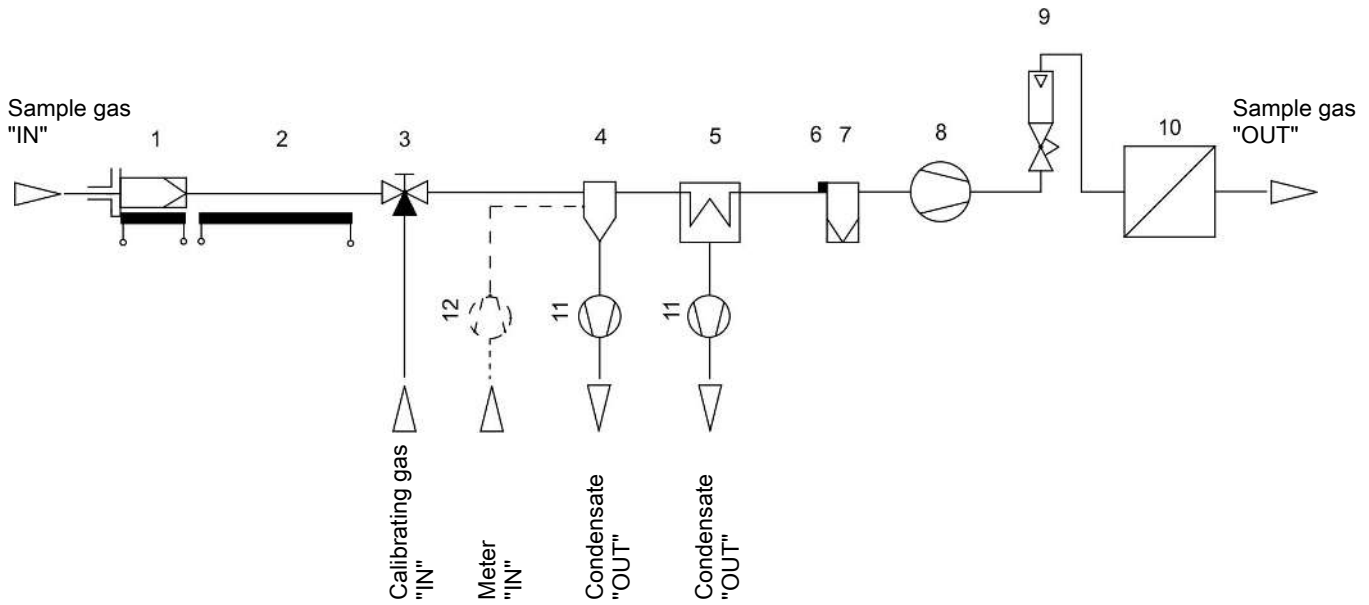


Detailed description of functions

The precooler is a passive cooling unit (without active cooling temperature control). The fan supplies the high efficiency precooling heat exchanger designed specifically for this with ambient air. This provides the initial relevant sample gas cooling to below the dew point. The majority of water is removed from primarily very moist sample gases or gases with high dew point using minimal electricity (approx. 6 W fan) (see diagrams 1a and 1b).

This allows the use of very small, regulated main coolers downstream from the precooler (see typical installation diagram). This increases the energy efficiency of the entire cooling system considerably. Condensate is drained at the corresponding connection for the precooling heat exchanger as usual. The proven Bühler peristaltic pumps or condensate pre-separators are available for this purpose. The already washout optimised precooling heat exchangers (≤ 4 % SO_2 washout input available) are further optionally available with acid meter connection. The Bühler dosing pump thus allows for highly efficient yet highly effective dosing of phosphoric acid. This results in minimal washout of highly water-soluble gases to below the detection limits typical in industrial applications.

Diagram typical installation



1	Sample gas probe	2	Sample gas line
3	Reversing tap	4	PC1 Precooler
5	Sample gas cooler	6	Moisture detector
7	Fine mesh filter	8	Sample gas pump
9	Flow meter	10	Analyser
11	Condensate pump	12	Dosing pump

Technical Data

PC1 Precooler Technical Data	
Ready for operation	Ready for use immediately after switching on
Ambient temperature	41 °F to 104 °F
IP rating	IP 20
Housing	Stainless steel
Packaging dimensions	approx. 13 in (L) x 6.7 in (H) x 9.8 in (W)
Weight incl. heat exchanger	approx. 2.8 lb
Max. inlet dew point	158 °F
Max. pressure	14.5 psi
Max. gas temperature	284 °F
Dead volume	4.88 cu. in.
Operating voltage	230 VAC / 24 VDC
Electrical Connections	Plug per EN 175301-803
Gas connections (metric)	GL 14 (6 mm)
Gas connections (US)	GL 14 (1/4")
Condensate out connection (metric)	GL 25 (12 mm)
Condensate out connection (US)	GL 25 (1/2")
Acid meter connection	GL 14 (6 mm)
Parts in contact with media Heat exchanger:	 Duran glass and borosilicate glass beads

Heat exchanger overview

Heat exchanger	PG1 (2 connections)	PG2 (with acid meter connection)
Version/Material	Duran glass	Duran glass
Max. inlet dew point	158 °F	158 °F
Gas inlet temperature	284 °F	284 °F
Gas pressure p_{max}	14.5 psi	14.5 psi
Pressure drop Δp (v=3.3 lpm) total	0.06 psi	0.06 psi
Dead volume V_{tot} total	4.88 cu. in.	4.88 cu. in.
Gas connections (metric)	GL 14 (6 mm)	GL 14 (6 mm)
Gas connections (US)	GL 14 (1/4")	GL 14 (1/4")
Condensate out connection (metric)	GL 25 (12 mm)	GL 25 (12 mm)
Condensate out connection (US)	GL 25 (1/2")	GL 25 (1/2")
Acid connection	---	GL 14 (6 mm)

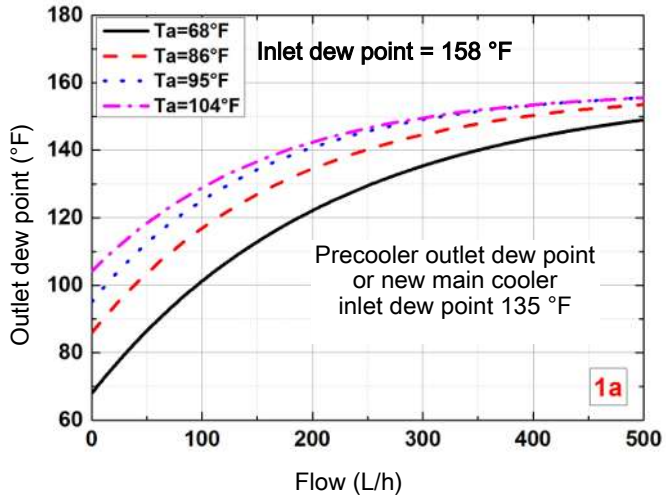
Cooling characteristics/aftercooler configuration

The outlet dew point of the precooler can be determined using the flow outlet dew point diagram (see diagrams 1a and 1b). This should be used as the inlet dew point for a downstream main cooler. Along with the gas flow parameters determined by the application and the ambient temperature the downstream main cooler can be configured for the required cooling capacity (also see cooler calculator at www.buehler-technologies.com). We will gladly also provide you with a personal consultation and configure the cooling units required for your application.

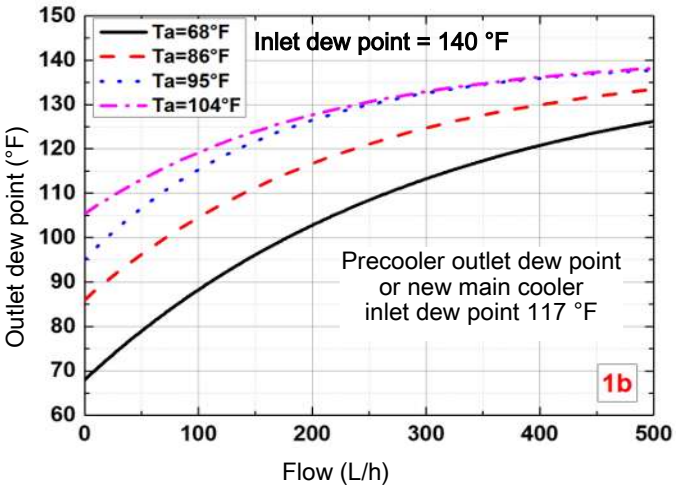
Examples for determining the precooler outlet dew point:

1. Diagram 1a: Precooler inlet dew point = 158 °F, flow = 200 L/h T_a = 86 °F; precooler outlet dew point = 135 °F (corresponds to approx. 30 W precooling capacity). The new inlet dew point for the downstream main cooler is therefore 135 °F.
2. Diagram 1b: Precooler inlet dew point = 140 °F, flow = 200 L/h, T_a = 86 °F; precooler outlet dew point = 117 °F (corresponds to approx. 18 W precooling capacity). The new inlet dew point for the downstream main cooler is therefore 117 °F.

Flow outlet dew point diagram for TP_{IN} = 158 °F



Flow outlet dew point diagram for TP_{IN} = 140 °F



Tab. 1: Precooler outlet dew point varies by sample gas flow (at inlet dew point 158 °F (1a left) and 140 °F (1b right) and different ambient temperatures T_a)

Ordering Instructions

The item number is a code for the configuration of your unit. Please use the following model key:

45002	X	2	0	0	X	0	Product Characteristics
							Voltage
	0						115 - 230 VAC
	4						24 VDC
							Heat exchanger
		2	0				Glass
							Options (acid meter)
				0	0	0	without acid meter
				0	1	0	ready for acid meter

Spare Parts and Accessories

Item no.	Description
45002014	Heat exchanger glass cartridge with inlet markings
45002015	Pack of borosilicate glass beads
45002007	Ball lock
4460028	230 VAC Fan
4460029	24 VDC fan
45002013	Dosing hose (acid meter)
4382006	Laboratory screw connection GL 14 (acid meter)
45100144	Seal for GL 14
45100134E	Seal for GL 14 DN 4/6
45100137E	Seal for GL 25 DN 5/8
4510028	Automatic condensate drain AK 5.5
4410004	Automatic condensate drain AK 20
see data sheet 450020	Peristaltic Pump CPsingle, CPdouble