

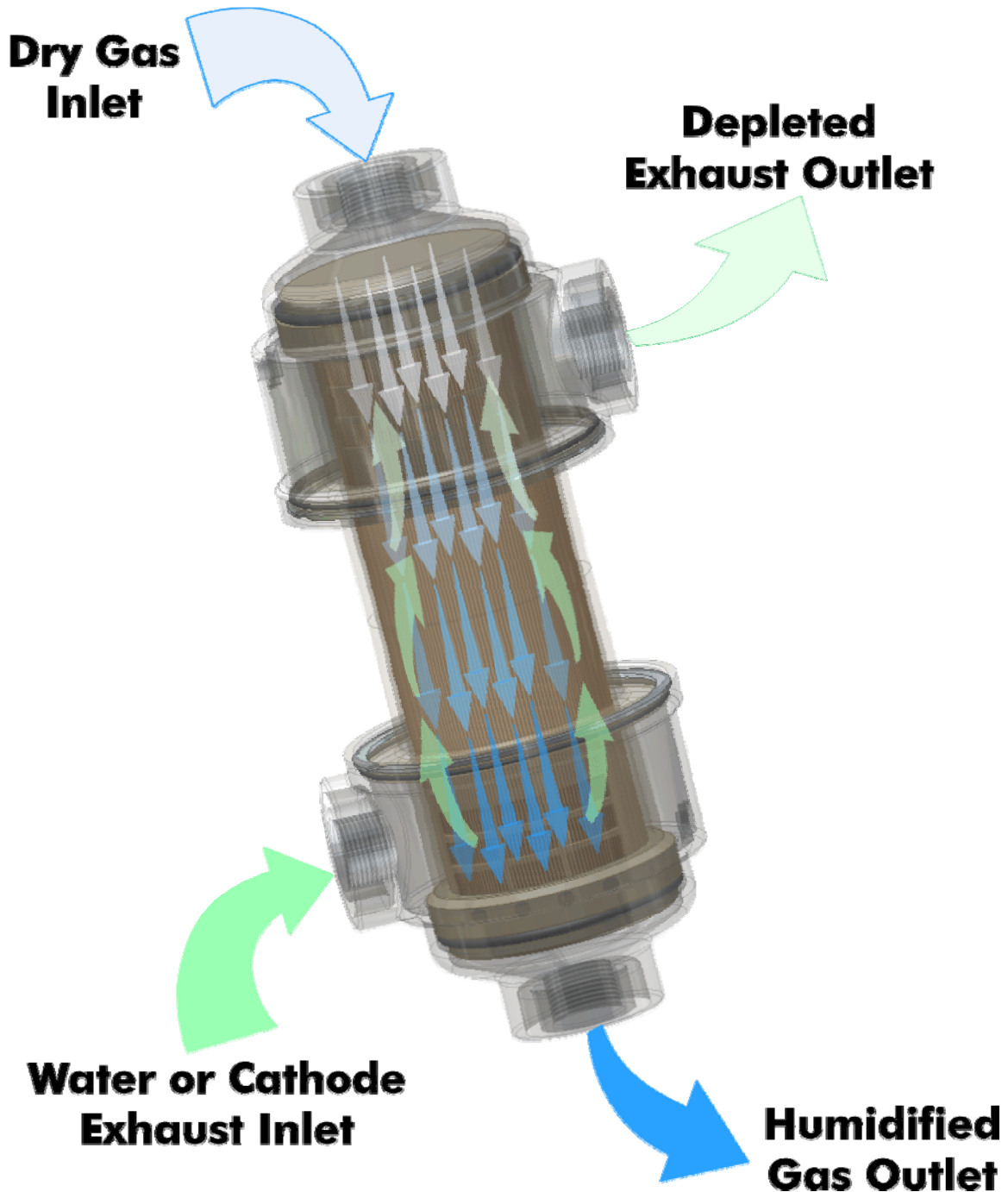
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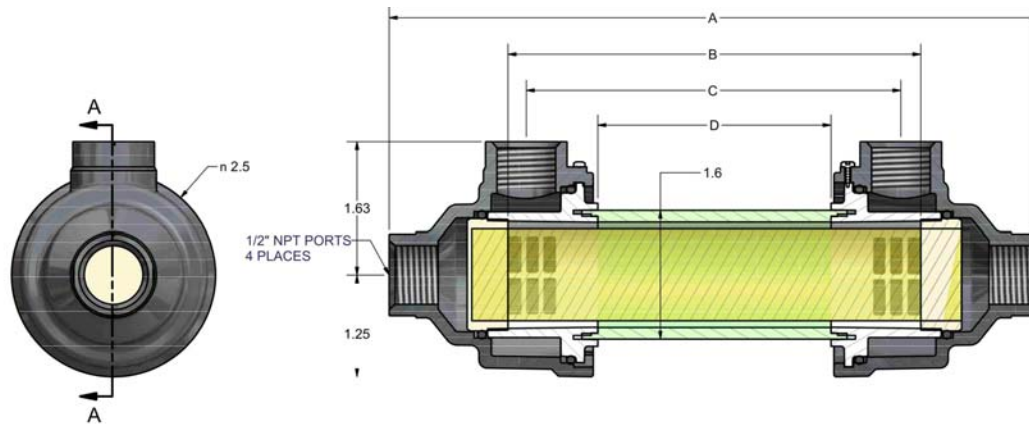
Section 1: Principle of Operation

FC™-Series Humidifiers are shell and tube moisture exchangers that allow transfer of water vapor. Humidifiers can be setup Gas-to-Gas or Water-to-Gas. Water molecules are absorbed into walls of the Nafion® tube and transferred to dry gas stream. This transfer is driven by the difference in partial pressures of water vapor on opposing sides.



Section 2: Specifications

Model FC125



Model Number	A		B (Nom.)		C		D	
	inch	mm.	inch	mm.	inch	mm.	inch	mm.
FC125-240-5MP	7.9	200.7	5	127	4.6	116.8	2.9	73.7
FC125-240-7MP	9.9	251.5	7	177.8	6.6	167.6	4.9	124.5
FC125-240-10MP	12.9	327.7	10	254	9.6	243.8	7.9	200.7

Materials of construction:

Housing – Shell – Polypropylene, End caps – GE Noryl
Seals – EPDM (peroxide cured)
Tube bundle headers – Thermoset polyurethane
Membrane tubing – Nafion®

Operating fluid pressure range: 0 to 172 kPa (0 to 25 psig) @ 80°C (176°F)

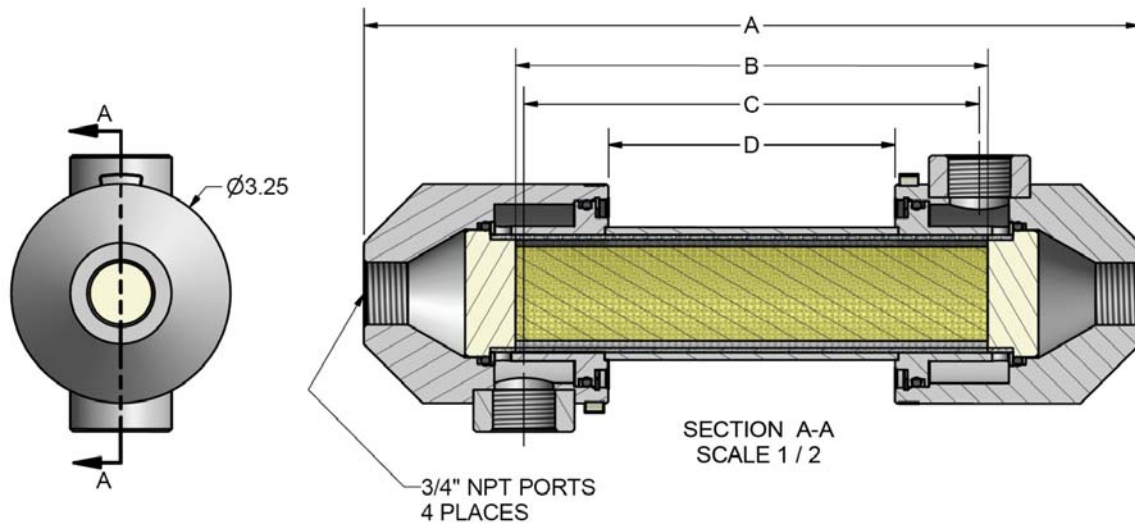
Operating fluid temperature range: 1 to 80°C (33 to 176°F)

Pressure differential on tubing: 35 kPa (0 to 5 psid) @ 80°C (176°F)
Negative pressure differential will collapse tubing and must be avoided

Storage temperature range: -30 to 60°C (-22 to 140°F)

Fittings: Due to differing rates of expansion, metal fittings are not recommended.
ABS or Nylon fittings are preferred.

Model FC150



Model Number	A		B (Nom.)		C		D	
	<i>inch</i>	<i>mm.</i>	<i>inch</i>	<i>mm.</i>	<i>inch</i>	<i>mm.</i>	<i>inch</i>	<i>mm.</i>
FC150-480-7PP	11.5	292.1	7	177.8	6.75	171.5	4.3	109.2
FC150-480-10PP	14.5	368.3	10	254	9.75	247.7	7.3	185.4
FC150-480-15PP	19.5	495.3	15	381	14.75	374.7	12.3	312.4

Materials of construction:

Housing – Polypropylene
Seals – EPDM (peroxide cured)
Tube bundle headers – Thermoset polyurethane
Membrane tubing – Nafion®

Operating fluid pressure range: 0 to 172 kPa (0 to 25 psig) @ 80°C (176°F)

Operating fluid temperature range: 1 to 80°C (33 to 176°F)

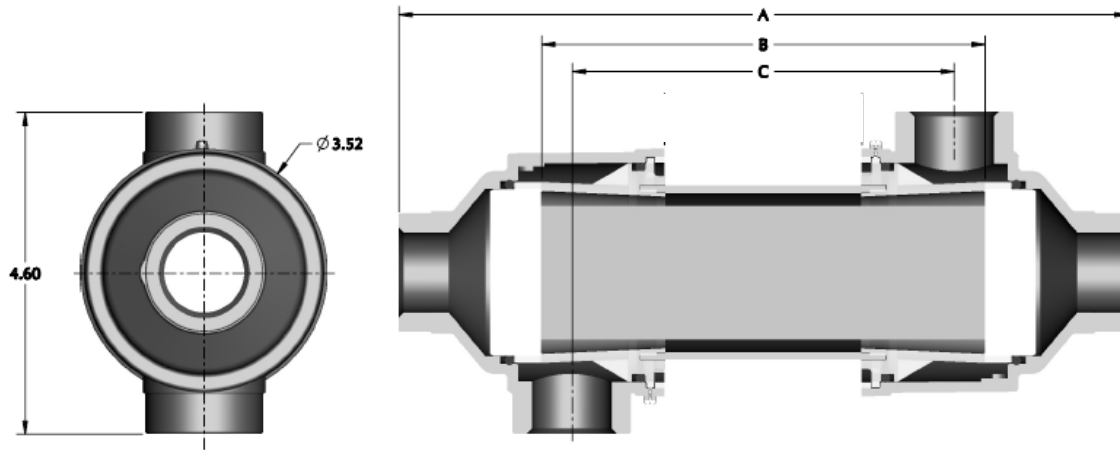
Pressure differential on tubing: 35 kPa (0 to 5 psid) @ 80°C (176°F)

Negative pressure differential will collapse tubing and must be avoided

Storage temperature range: -30 to 60°C (-22 to 140°F)

Fittings: Due to differing rates of expansion, metal fittings are not recommended.
ABS or Nylon fittings are preferred.

Model FC 200



Model Number	A		B (Nom.)		C	
	inch	mm.	inch	mm.	inch	mm.
FC200-780-7MP	11.1	281.9	7	177.8	6.16	156.5
FC200-780-10MP	14.1	358.1	10	254	7.16	181.9

Shell diameter: 2.48 inches (63mm)

Materials of construction:

Housing – Shell – Polypropylene, End caps - GE Noryl
Seals – EPDM (peroxide cured)
Tube bundle headers – Thermoset polyurethane
Membrane tubing – Nafion®

Maximum operating pressure: 3 Bar Absolute

Operating fluid temperature range: 1 to 80°C (33 to 176°F)

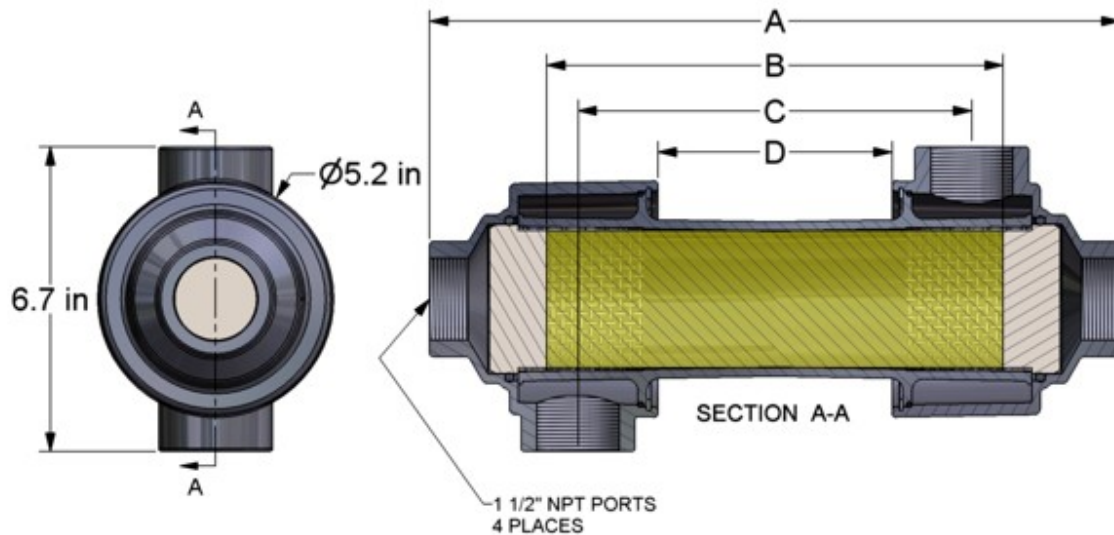
Pressure differential on tubing: 35 kPa (0 to 5 psid) @ 80°C (176°F)

Negative pressure differential will collapse tubing and must be avoided

Storage temperature range: -30 to 60°C (-22 to 140°F)

Fittings: Due to differing rates of expansion, metal fittings are not recommended. ABS or Nylon fittings are preferred.

Model FC 300



Model	A		B (Nom.)		C		D	
	inch	mm.	inch	mm.	inch	mm.	inch	mm.
FC300-1660-7LP	12.1	307.3	7	177.8	5.6	142.2	2.1	53.3
FC300-1660-10LP/HP	15.1	383.5	10	254	8.6	218.4	5.1	129.5
FC300-1660-15LP	20.1	510.5	15	381	13.6	345.4	10.1	256.5

Shell diameter 3.4 inches (86.4mm)

Materials of construction:

Housing – GE Noryl

Seals – EPDM (peroxide cured)

Tube bundle headers – Thermoset polyurethane

Membrane tubing – Nafion®

Maximum operating pressure: LP models to 10 psig; HP models to 45 psig

Operating fluid temperature range: 1 to 90°C (33 to 212°F)

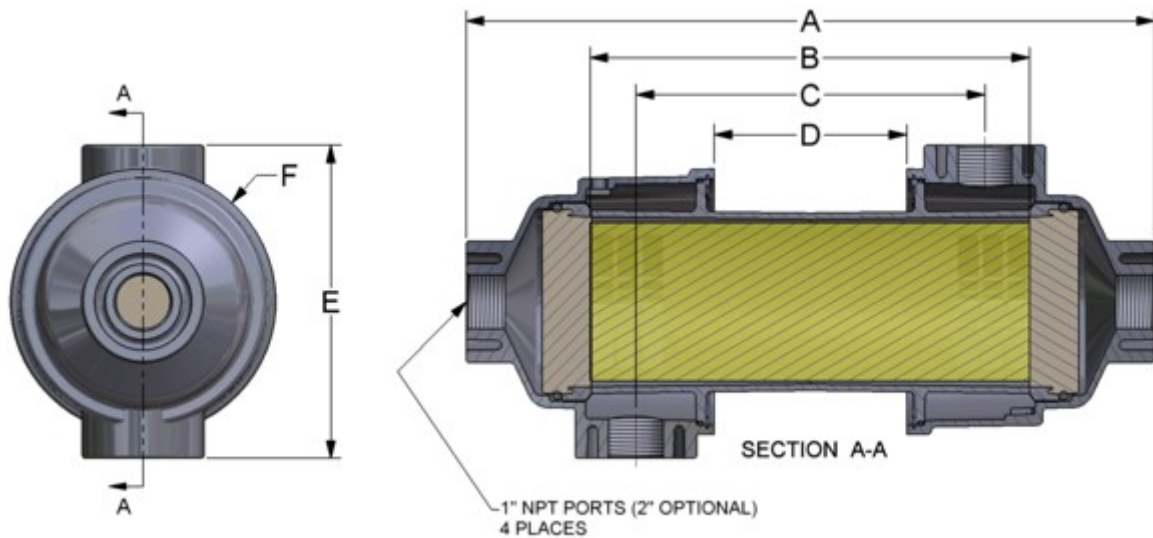
Pressure differential on tubing: 35 kPa (0 to 5 psid) @ 80°C (176°F)

Negative pressure differential will collapse tubing and must be avoided

Storage temperature range: -30 to 60°C (-22 to 140°F)

Fittings: Due to differing rates of expansion, metal fittings are not recommended. ABS or Nylon fittings are preferred.

Model FC 400



Model Number	A		B (Nom.)		C		D	
	inch	mm.	inch	mm.	inch	mm.	inch	mm.
FC400-2500-7LP/HP	12.8	325.1	7	177.8	5.0	127	1.4	35.56
FC400-2500-10LP	15.8	401.3	10	254	8.0	203.2	4.4	111.8

E: 7.20 inches (182.9 mm)

F: 6.11 inches (155.2 mm)

Shell diameter 4.5 inches (114.3 mm)

Optional 3/8" NPT drain port available

Materials of construction:

Housing – GE Noryl

Seals – EPDM (peroxide cured)

Tube bundle headers – Thermoset polyurethane

Membrane tubing – Nafion®

Maximum operating pressure: LP models to 10 psig; HP models to 45 psig

Operating fluid temperature range: 1 to 90°C (33 to 212°F)

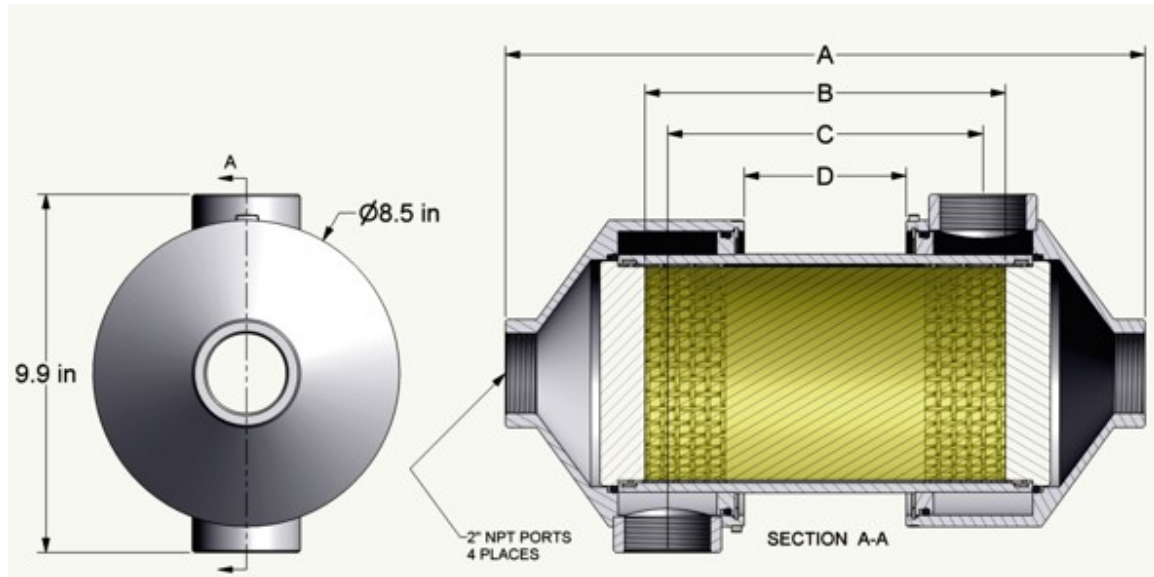
Pressure differential on tubing: 35 kPa (0 to 5 psid) @ 80°C (176°F)

Negative pressure differential will collapse tubing and must be avoided

Storage temperature range: -30 to 60°C (-22 to 140°F)

Fittings: Due to differing rates of expansion, metal fittings are not recommended. ABS or Nylon fittings are preferred.

Model FC 600



Model Number	A		B (Nom.)		C		D	
	inch	mm.	inch	mm.	inch	mm.	inch	mm.
FC600-7000-7PP	14.75	374.7	7	177.8	5.75	146.1	1.5	38.1
FC600-7000-10PP	17.75	450.9	10	254	8.75	222.3	4.5	114.3
FC600-7000-15PP	22.75	577.9	15	381	13.75	349.3	9.5	241.3

Materials of construction:

Housing - Polypropylene
Seals – EPDM (peroxide cured)
Tube bundle headers – Thermoset polyurethane
Membrane tubing – Nafion®

Operating fluid pressure range: 0 to 35 kPa (0 to 5 psig) @ 80°C (176°F)

Operating fluid temperature range: 1 to 80°C (33 to 176°F)

Negative pressure differential will collapse tubing and must be avoided

Storage temperature range: -30 to 80°C (-22 to 176°F)

Fittings: Due to differing rates of expansion, metal fittings are not recommended. ABS or Nylon fittings are preferred.

Section 3: Options

Port Orientation

When ordering, please specify the orientation of the end caps.



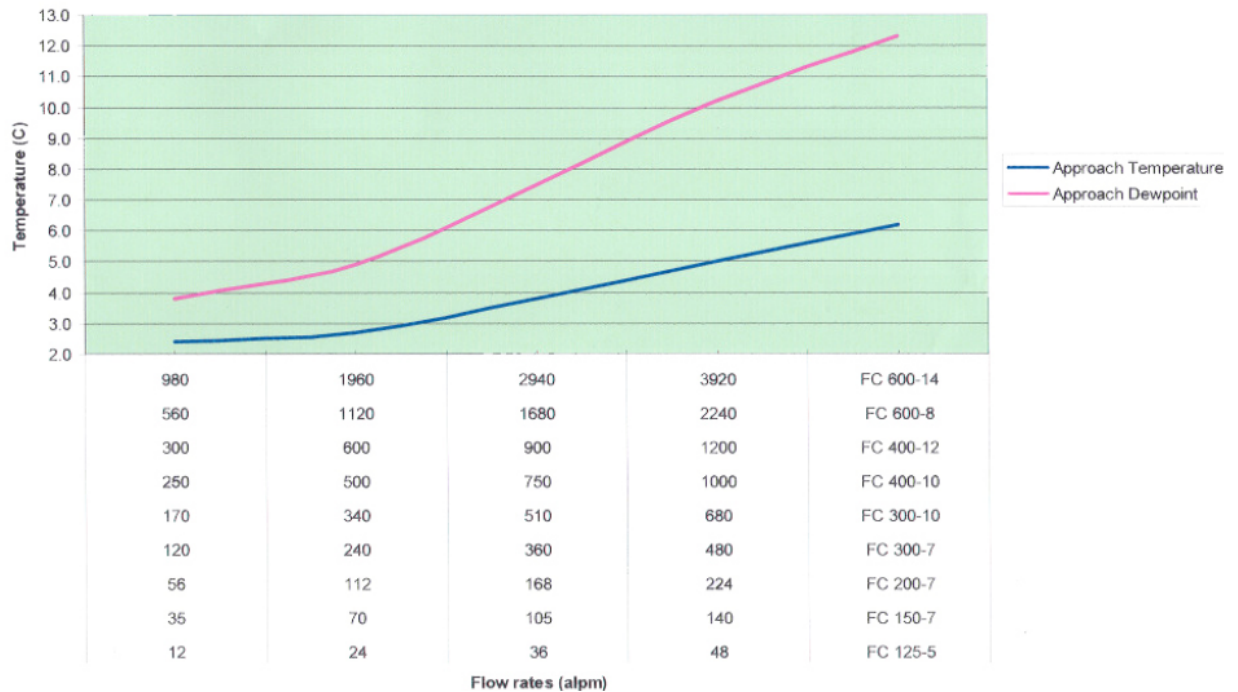
Drain Port

Drain port in end cap

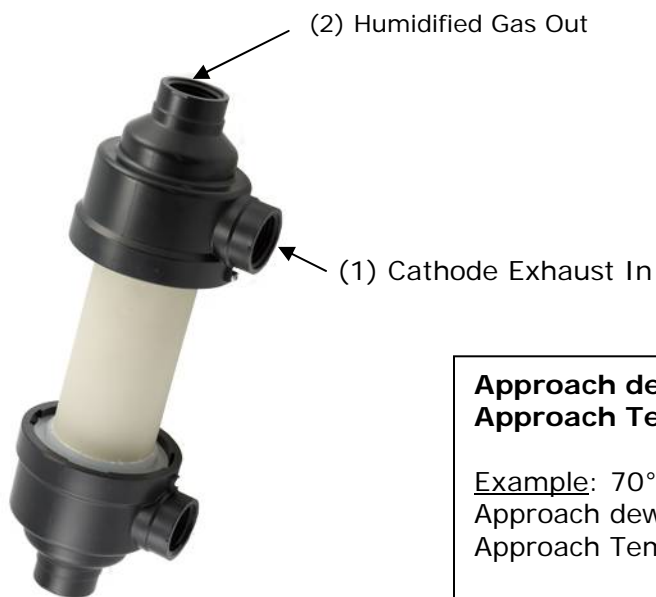


Due to differing rates of expansion, metal fittings are not recommended. ABS or Nylon fittings are preferred.

Section 4: Performance: GAS-to-GAS



Units are expressed as flow rate of air (alpm) in relation to approach dew point temperature. Approach temperature is defined as difference between wet gas entering humidifier and humidified stream outlet. For example, for FC125-240-10MP at 25 lpm, wet gas enters humidifier at 70°C at Approached Temperature of 4° humidified stream outlet would be 66°C.



Approach dew point = $dp1 - dp2$
Approach Temp = $T1 - T2$

Example: 70°C cathode exhaust
 Approach dew point = 4°C
 Approach Temp = 2.5°C

Humidifier outlet
 66°C dew point
 67.5°C Temp
 93% RH

Section 5: Performance: Water-to-GAS

Performance can be controlled by increasing heat or by decreasing sample flow. Chart below shows performance of various models.



Section 6: Setup: Water-to-GAS

In Water-to-Gas setup, heated water needs to be continuously circulated. Flow with greater pressure needs to be flowing inside tubes to prevent tubing collapse. DI water should be circulated at 4 LPM for 100 LPM of dry gas flow.

Due to differing rates of expansion, metal fittings are not recommended. ABS or Nylon fittings are preferred.

