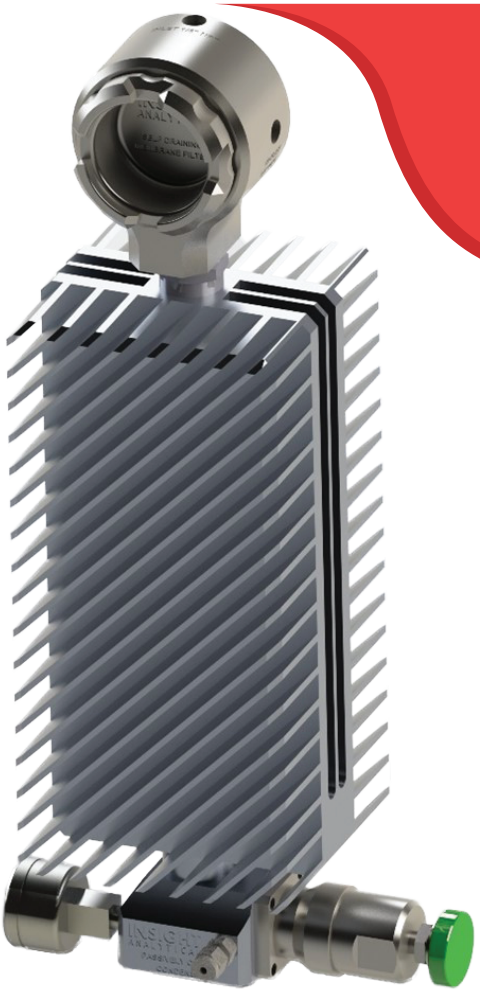
INSIGHT ANALYTICAL

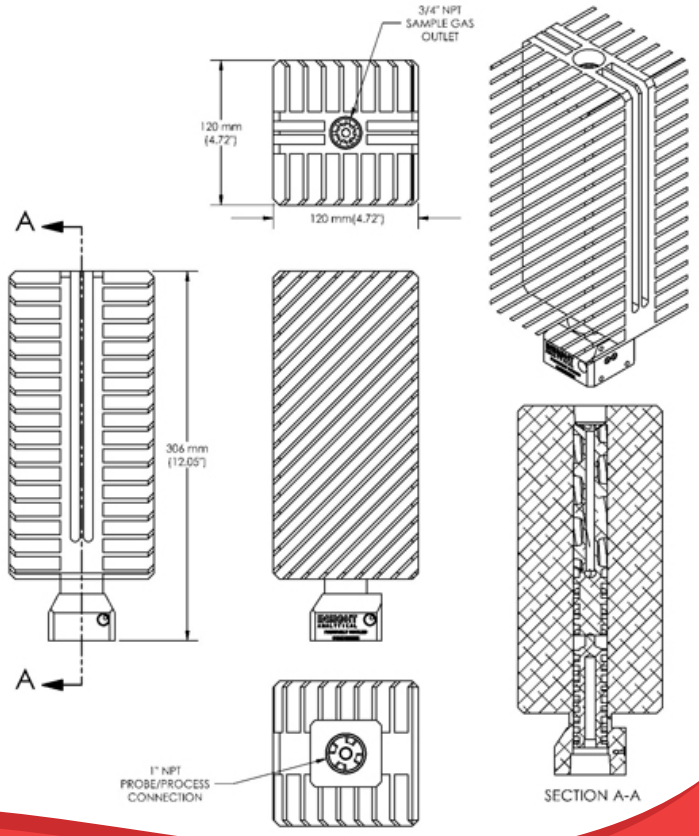
Passive Probe Condenser



Compact, cost-effective control of sample gas dew point temperature in analytical sample systems.

The Insight Analytical Passive Probe Condenser is designed to limit the dew point temperature of sample gas in analytical sample systems when mounted on the outlet of quill type sample probes. The operation of this condenser is similar to distillation/reflux type sample probes, tube-in-tube heater exchangers, and shell and tube heat exchangers, except it has passive cooling fins to dissipate heat to the surroundings, so does not require cooling air or liquid flow. If the dew point temperature of the sample gas is higher than the condenser body temperature, liquids are condensed and will drain back down through the sample probe and into the process.

The condenser is mounted vertically at the process sample point above the sample probe with an isolation valve between the probe and condenser. Mounting of the condenser on the isolation valve is via a 1" NPT female thread on the bottom of the aluminum condenser inner core. Process gas flowing up through the probe is cooled as it contacts the aluminum insert inside of the condenser body. The lowest half of the insert is a reflux section and includes sixteen staggered rows of saddle shaped fins which function as both reflux/distillation saddles and cooling fins. The upper half of the insert is a condenser section with the gas flowing through seven parallel helical grooves. The grooves are inclined at a 70° angle to the horizontal to provide the best compromise between maximizing condensed liquid quantity, drainage, and contact surface area, while minimizing response time and vertical velocity. The insert is coated with SilcoTek Dursan® hydrophobic and oleophobic coating to improve drainage and provide abrasion and corrosion resistance. After coating, the insert is permanently installed in the electroless nickel plated aluminum condenser body via a shrink fit, which maximizes the heat transfer between the two parts.



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Making Measurements Matter.

The design of the diagonal fins machined on the outside of the condenser body was optimized using CFD (computational fluid dynamics) software to achieve the highest heat dissipation and lowest sample gas outlet temperature within a compact size footprint. The thermal resistance of the condenser is about 0.43 °C/W in a 20°C (68°F) ambient temperature. For example, if the cooling load is estimated to be 20 W, then the condenser outlet temperature would be about 8.6°C above ambient temperature. Figure 1 can be used to estimate the cooling load for 1 NLPM of dry condenser outlet gas at various inlet temperatures and water contents for applications where water is the primary liquid being condensed.

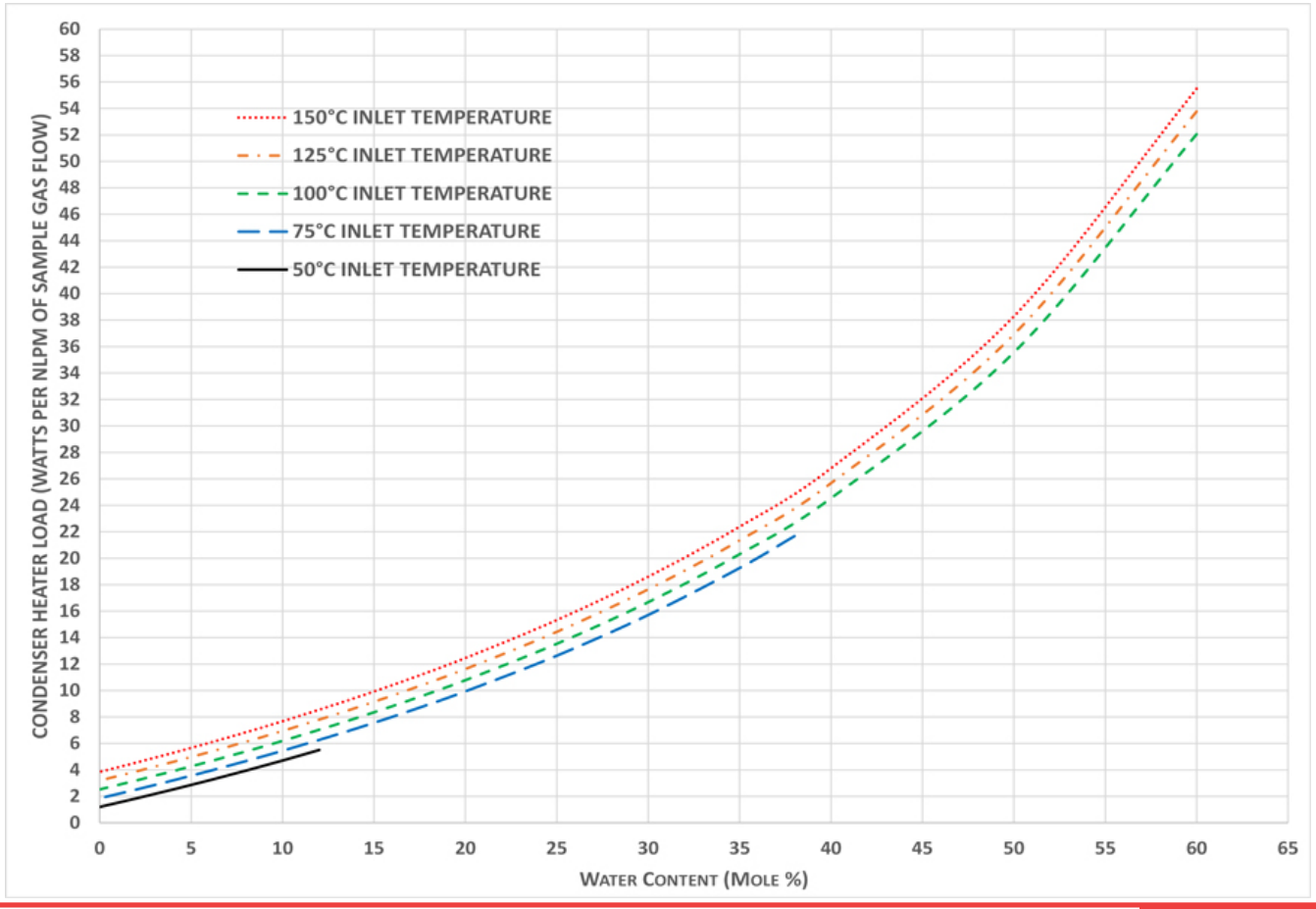
There are a lot of variables in installation details that can affect the condenser performance including radiation from the sun and hot process pipes, air circulation/wind, and ambient temperature range. The Electroless Nickel Plating finish on the condenser minimizes the heating of the condenser by external radiation but insulating the process pipe in the area around where the probe is installed and minimizing sun exposure can improve performance.

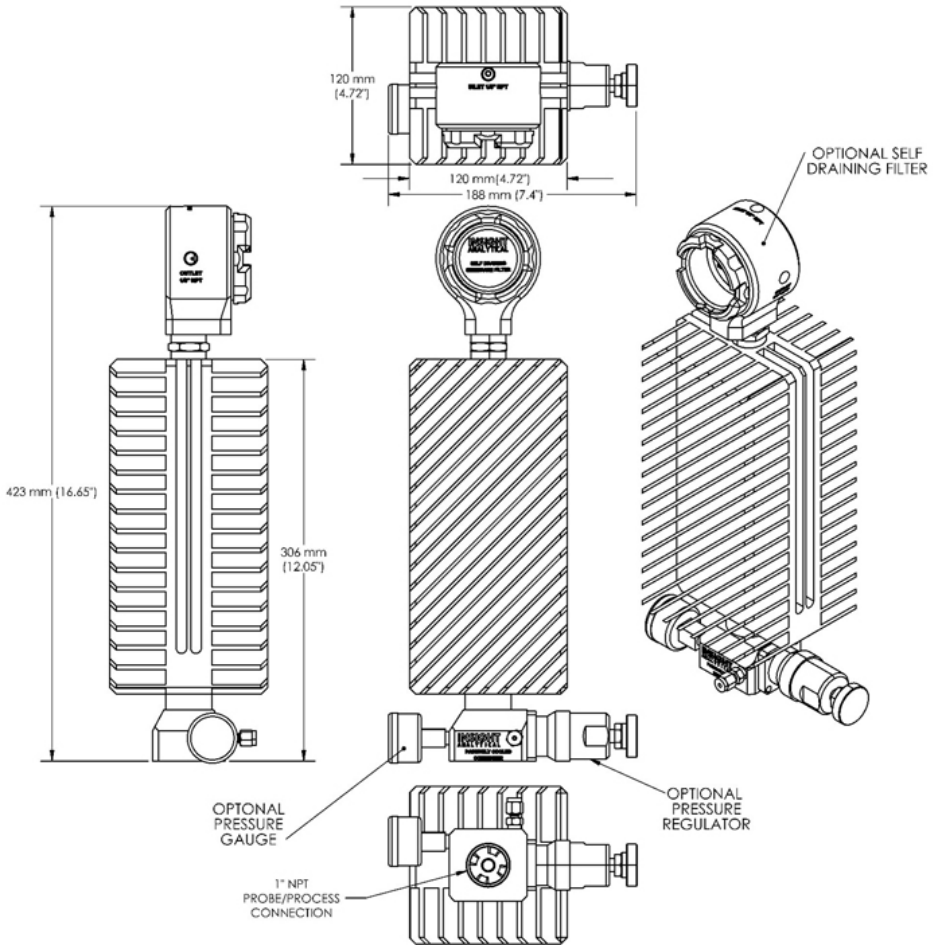
This condenser is ideal for applications where a sample chiller or distillation/reflux probe might be used, but a more compact and cost-effective solution is required, and an outlet dew point temperature slightly higher than ambient temperature is still acceptable. This product should only be used in applications where the sample gas, any entrained liquids, and the cooling fluid are compatible with the electroless nickel plated aluminum material of construction. It is also important to ensure that the maximum temperature is not exceeded and that the minimum ambient temperature is safely above the freezing point of any liquids that are being condensed from the gas sample.

An optional self draining membrane filter can be mounted on the outlet of the condenser to remove any mist or aerosols present in the condenser outlet gas. If required the outlet of the membrane filter can be connected to a SP76 compliant pressure regulator mounted on the base of the condenser. The temperature of the base of the condenser normally significantly higher than the outlet, and this provides passive heating of the pressure regulator.

Passive Probe Condenser Insert

Figure 1 – Condenser Heat Load Estimates for 1 NLPM of Dry Condenser Outlet Flow as a Function of Inlet Temperature and Water Vapor Content





Technical Specifications	
Maximum Pressure Rating	10340 kPag (1500 psig)
Temperature Range	-30°C to 149°C (-22°F to 300°F)
Internal Sample Volume	88 cm^3 (5.4 in^3)
Recommended Sample Flow	0.5 to 10 NLPM (1 to 20 scfh)
Effective Thermal Resistance	0.43 °C/W at 20°C Ambient Temperature
Dimensions and Weight	306 mm L x 120 mm D x 120 mm W (12.05" L x 7.4" W x 7.4" D), 3.8 kg (8.4 lbs)
Sample Inlet Port Size	1" NPT female thread
Sample Outlet Port Size	¾" NPT female thread
Sample Wetted Materials	Electroless nickel plated 6061 T6 aluminum and Dursan™ coated 6061 T6 aluminum
Condenser External Surface	Electroless nickel plated 6061 T6 aluminum
NACE compliance	NACE MR0175/ISO 15156 and MR0103 Compliant.
RoHS Compliance	Yes