

Model 3031200 Environmental Sampling System Field Setup with Model 3031 Ultrafine Particle Monitor

Application Note UFP-002

List of Components

The Model 3031200 is shipped partly assembled and contains following components:

- PM₁₀ Inlet
- PM₁ Sharp Cut Cyclone
- Flow Splitter
- Nafion[®] Dryer
- Particle Filter
- Pressure Gauge Assembly
- Needle Valve
- Polyethylene (PE) Tubing (10 ft)
- Conductive Silicone Tubing (3 ft)

Since some items will vary depending on a particular installation, the 3031200 Environmental Sampling System does not include some parts (see Table 1) potentially needed to install the system at the sampling location.

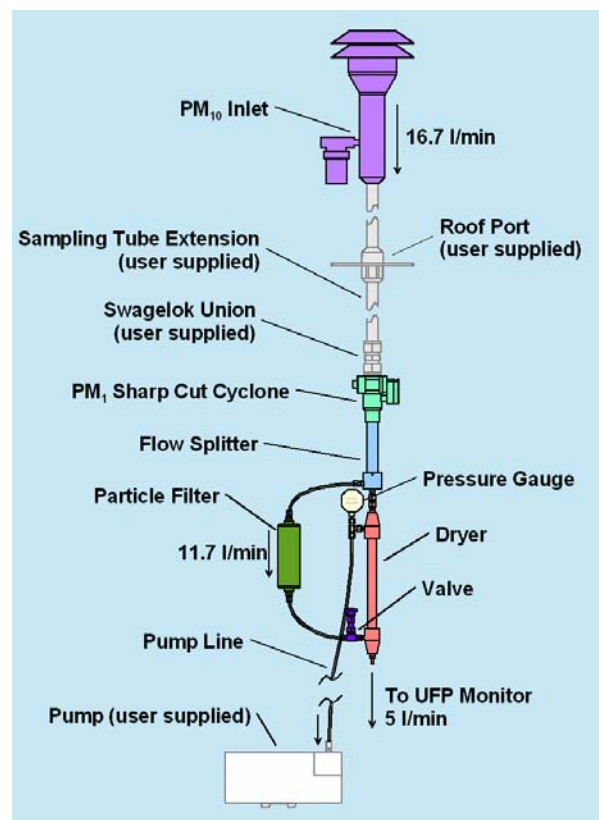


Figure 1. Schematic of the Environmental Sampling System, showing all components in a typical field setup.



Table 1. User-supplied parts for Environmental Sampling System

Description	Qty.
1/4" diameter Stainless Steel tubing (extension between PM ₁₀ inlet and PM ₁ cyclone).	As needed
Roof port to feed sampling tube through roof of shelter	1
1/4" diameter Swagelok union (Swagelok part # SS-2000-6)	As needed (1 per tubing extension)
A tripod or guy-wires to stabilize the PM ₁₀ inlet on the roof.	As needed
Hardware to mount the dryer and filter and to provide support to the stainless steel tubing.	As needed
Vacuum pump (TSI Model 3033 Oil-free vacuum pump is recommended)	1
TSI 4140 Flowmeter or equivalent	As needed
Swagelock 1/4" Tube Fitting Union (SS-400-6, TSI 1601275) to couple TSI 4140 Flowmeter to supplied PE tubing	1

Assembling the Environmental Sampling System

Make sure you have all TSI supplied components and the required user-supplied parts (see Table 1) before assembling the system. The roof port should be installed prior to installing the system.

Refer to Figures 1 and 2 to begin assembling the Environmental Sampling System.

1. Mount the dryer system and particle filter securely on a rack (see figure 2).
2. Attach the flow splitter to the dryer system with the 3/8" Swagelok connector at the top of the dryer.
3. Attach the PM₁ Sharp Cut Cyclone to the top of the flow splitter.
4. If an extension is needed for the sampling system, mount the 1/4" stainless steel tube through the roof port. Attach the tube to the sampling system with a 1/4" Swagelok union.
5. Install the PM₁₀ inlet on the end of the 1/4" diameter stainless steel tube. Make sure the end of the stainless-steel tube has been cleaned and machined with a 30-45 degree chamfer to prevent damaging the O-rings and to provide a good sealing surface for the O-rings in the PM₁₀ inlet. The PM₁₀ inlet sits on top of the stainless steel tubing. Depending on the roof port and height of the PM₁₀ inlet above the roofline, a tripod or guy-wires may be required to stabilize the PM₁₀ inlet on the roof. Ensure that the PM₁₀ inlet head is at least 2 m above the horizontal surface (roof).
6. Connect the particle filter between the side port of the flow splitter and the needle valve at the bottom of the dryer tube using the supplied polyethylene tubing. Observe the correct orientation (flow from top to bottom) of the filter (flow direction indicated on filter).
7. Connect the system to a pump using the supplied polyethylene tubing. Connect the tube to the bottom port of the Swagelok tee mounted to the vacuum gauge.

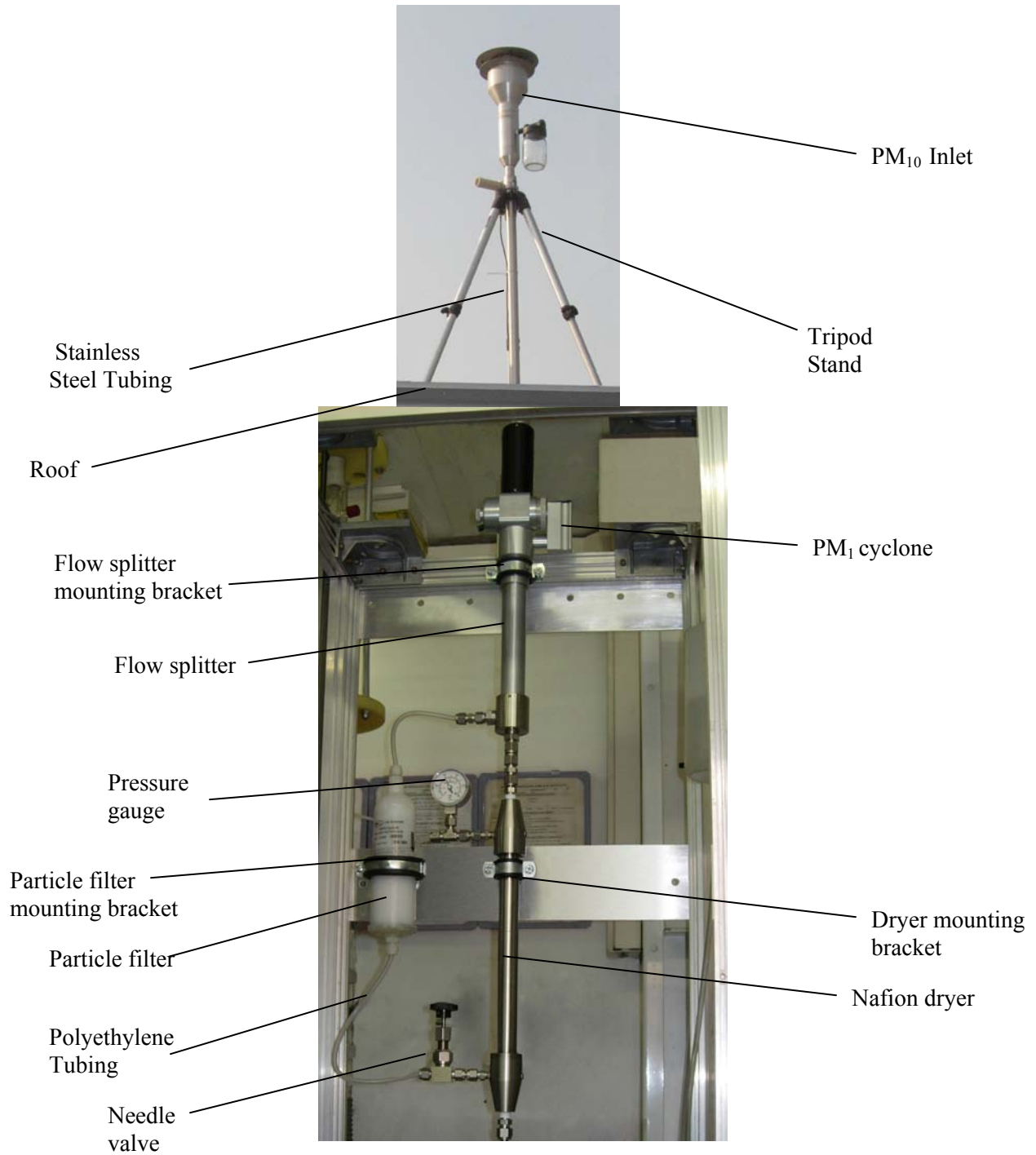


Figure 2. The Environmental Sampling System installed in a sampling station.

Leak Testing the Environmental Sampling System

Before running the Model 3031200 Environmental Sampling System, it is recommended to leak test the system. To run a leak test, follow the steps below:

1. Remove the PM₁₀ inlet and plug the sampling tube.
2. Remove the connection between the Nafion[®] dryer and the sampling instrument. Plug the connection at the dryer.
3. With the needle valve fully open, turn on the pump for the purge flow. The pressure should drop to about -0.9 bar on the pressure gauge.
4. Turn off the pump, reconnect the sampling system to the sampling instruments, unplug the sampling tube and reconnect the PM₁₀ inlet.

If this test reveals a leak (pressure drop less than -0.9 bar), check all connections and o-rings. If necessary, replace o-rings and/or tighten Swagelok connections. Do not overtighten the Swagelok connections, as nylon ferrules are used in most places.

Running the Environmental Sampling System with Ultrafine Particle Monitor

To use the Model 3031200 Environmental Sampling System with the Ultrafine Particle (UFP) Monitor:

1. Turn on the vacuum pump to draw air through the dryer. The dryer purge flow rate has to be adjusted based on the sample flow rate of 5 L/min for UFP Monitor. The total flow rate of the sampling system is 16.7 L/min. Using a flowmeter, adjust the dryer purge flow with the needle valve to a makeup flow of 11.7 L/min. The dryer purge flow should be measured upstream of the particle filter in order to take into account any pressure drop induced by the filter.

Note: For the Nafion[®] dryer to work correctly, the pressure reading for the purge flow (pressure gauge at the top of the dryer) needs to read -0.5 bar or lower (total pressure 0.5 bar or lower).

2. Connect the outlet port of the dryer to the UFP Monitor inlet using supplied silicone tubing.
3. Turn on the UFP Monitor and begin sampling.
4. Measure the flow downstream of the PM₁₀ inlet to ensure a total flow rate of 16.7 L/min.



Figure 3. Model 3031 UFP Monitor with the Environmental Sampling System.

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