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Operating Instructions for Masterflex® Fixed-Speed Pump Drive and Easy-Load Pump Heads**BAA Guide 07-03****October 1, 2007****Introduction**

Peristaltic pumps are relatively inexpensive systems for the pumped collection of VOCs onto sorbent tubes for indoor air quality investigations. They additionally have the advantages of permitting the collection of multiple samples using a single pump and allowing the measurement of sampling air flow rates at the pump exhaust. This guide describes the operation of a simple, fixed-speed, peristaltic pump fitted with dual pump heads.

System Description

The Masterflex® pump drive, pump heads, accessories, and tubing can be purchased from Cole-Parmer Instrument Co., Vernon Hills, IL, 800-323-4340 (www.coleparmer.com). Table 1 provides ordering information and pricing for a 60-rpm, dual head pump and tubing based on the 2007-2008 catalog listings. **BAA** has a limited number of 30-rpm, dual head pumps available on a rental basis. Please contact the laboratory for availability and pricing.

Table 1. Purchase specifications for Masterflex® dual-head pump system

Catalog No.	Description	2007 Price
EW-07540-60	Fixed speed drive, 60 rpm, 115 VAC	\$205.00/ea
EW-77202-50	Two-Channel Easy-Load® II pump head, Includes hardware (only 1 required)	\$215.00/ea
EW-07596-61	Pulse dampener	\$61.00/ea
EW-06402-14	Size 14 Norprene® food grade tubing	\$40.00/50 ft
EW-06402-16	Size 16 Norprene® food grade tubing	\$44.00/25 ft
EW-06402-25	Size 25 Norprene® food grade tubing	\$59.00/25 ft
EW-06290-05	Straight disconnect, 1/8" to 7/32"	\$23.20/20

Loading the Flexible Tubing in the Pump Head

1. When changing the tubing size, retract both tubing retainers by pushing them in and upwards. These are the small black levers on both sides of the pump head. No adjustment is required when using the two-channel Easy-Load head.
2. Lock a short section (approximately 1 ft) of flexible tubing in place in the pump head by pushing the loading lever 180° to the right. This is the large lever on the top of the pump head.
3. On the inlet side of the pump head, adjust the tubing retainer downward and firmly against the tubing. Repeat this step on the outlet side of the head. No adjustment is required when using the two-channel Easy-Load head.
4. To remove or replace the tubing, rotate the loading lever 180° to the left position.

Operation of the 30-rpm Pump

1. The pump drive available from **BAA** has a fixed speed of 30 rpm. The drive shaft rotates clockwise.
2. Table 2 gives the approximate flow rates and the sample times needed to collect a 6-L sample (typical size for most building investigations) for three different tubing sizes.
3. Operate the pump for about 5 minutes with the flexible tubing in place but prior to installing the samplers to warm up the motor and stabilize the air flow rates. Check that the tubing retainers are properly adjusted so that the tubing does not "creep" through the pump heads.

Table 2. Sampling times for 30-rpm fixed-speed pump system

Tubing Size	Flow Rate (mL min ⁻¹)	Time for 6-L Sample (h/min)
14	6.3	15 h 50 min
16	24.0	4 h 10 min
25	50.0	2 h

Operation of the 60-rpm Pump

1. The pump drive recommended in Table 1 has a fixed speed of 60 rpm. The drive shaft rotates clockwise.
2. Table 3 gives the approximate flow rates and the sample times needed to collect a 6-L sample (recommended size for most building investigations) for three different tubing sizes.
3. Operate the pump for about 5 minutes with the flexible tubing in place but prior to installing the samplers to warm up the motor and stabilize the air flow rates.

Table 3. Sampling times for 60-rpm fixed-speed pump system

Tubing Size	Flow Rate (mL min ⁻¹)	Time for 6-L Sample (h/min)
14	13	7 h 40 min
16	48	2 h 5 min
25	100	1 h

Collection of Samples

1. The dual-head configuration of the pump allows for the simultaneous collection of duplicate samples of VOCs on multisorbent samplers.
2. Attach lengths of ¼-in polyethylene or Teflon tubing fitted with ¼-in Swagelok unions to the flexible tubing on the inlet sides of the pump heads. For the No. 14 and 16 tubing sizes, this connection can be made conveniently with the male end of a polyethylene straight disconnect and a short section of No. 25 tubing.
3. Connect a sampler to the Swagelok union using a nut and ¼-in Teflon ferrules. Do **not** use metal ferrules. The nut should be hand tightened so that the sampler cannot be pulled from the union. Be sure that the inlet of the sampler (e.g., the end with the two engraved rings) is pointed away from this connection.
4. Alternately, use a short section of No. 25 tubing to connect a sampler to the ¼-in tubing.
5. Install both samplers, and initiate sampling by plugging in the pump to a 115 VAC outlet. Record the start time. Alternatively, a timer can be used to control the pump.
6. Make air flow rate measurements at the outlet sides of the flexible tubing in the pump heads using a bubble flow meter, calibrated rotameter or other device. A pulse dampener may be required to reduce pulsation in the output flow. Do not make the measurements upstream of the samplers as this can result in sample contamination. At a minimum, make flow rate measurements near the beginning and end of each sampling period. Measure the flow rates at both pump heads. The beginning and ending flow rates for a sample should be within 15%, or better. The flow rate for a sample can be calculated as the average of the beginning and ending values. Measure and record the air temperature and atmospheric pressure so that the sample volumes can be corrected to standard indoor conditions (i.e., 25° C, 1 atm).
7. At the end of the sampling period, terminate sampling by either removing the samplers from the Swagelok unions or by unplugging the pump. Record the stop time.