



## Operating Instructions

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# Soap Film Flowmeter Cat. No. 303

### Principle of Operation

The air sampling pump to be calibrated is connected to and pulls air through the flowmeter's volumetric glass tube where a flat soap bubble (film) is interposed into the flow path. As the airflow causes the film to move up the volume marks, travel time is measured using a stopwatch. Flow rate can be calculated using the travel time and known tube volume. The 303 Portable Flowmeter Kit is calibrated to within  $\pm 2\%$  of the volumes marked on the flowmeter.

### Assembly

SKC Model 303 is shipped ready to use. Film solution is supplied as well as a length of rubber tubing to connect the flowmeter to the pump.

### Preparing for Operation

1. Remove the flowmeter from the case, and place it upright on a level surface.
2. Remove the large rubber stopper from the top of the flowmeter.
3. Tip the flowmeter at an angle, and pour a small amount of film solution into the top of the glass tube. The liquid should run down into the rubber bulb at the bottom.
4. Continue adding film solution until it completely fills the bulb and rises to just below the side arm inlet. Squeeze the rubber bulb occasionally to release trapped air.
5. Replace the stopper on top of the flowmeter.

### Wetting the Walls of the Tube

The interior walls of the flowmeter must be wet for the film to travel without rupture. There are two methods:

#### Method 1

1. Tip the flowmeter to a horizontal position. Allow the film solution to run out of the rubber bulb and into the tube.
2. Maintaining the horizontal position, rotate the flowmeter so that film solution coats the entire inside surface of the glass. **Caution:** Do not allow the solution to enter the metal tube in the rubber stopper at the top of the flowmeter.
3. Return the flowmeter to an upright position and allow the liquid to flow back down into the rubber bulb. Squeeze the bulb occasionally to release trapped air.

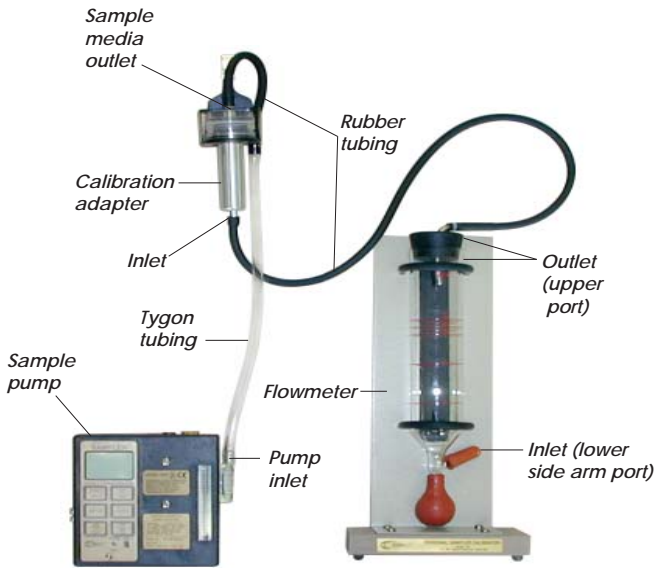
#### Method 2

1. Connect a pump to the flowmeter (see Connecting the Pump).
2. Turn on the pump. Each successive film that rises up the tube will wet the glass. The walls are sufficiently wet when the film bubbles successfully reach the highest volume mark on the flowmeter.

## Connecting the Pump

**Note:** If the pump to be calibrated **draws** air, connect it to the rubber tubing on the flowmeter's top rubber stopper. If the pump **blows** air, use rubber tubing to connect it to the lower side arm near the base of the flowmeter.

1. Remove the rubber cap from the side arm inlet near the base of the flowmeter.
2. Using rubber tubing, connect one end to the appropriate port on the flowmeter and the other end to the inlet of the sampling medium to be used (if applicable).
3. Using flexible tubing, connect the outlet of the sampling medium to the inlet of the pump.



## Measuring the Flow

1. Turn on the pump.
2. Squeeze the rubber bulb on the flowmeter to force the liquid above the inlet. Bubbles (film) will form.
3. Using a stopwatch, start timing the film as it passes the zero line and stop timing as the bubble reaches the 100 ml line. For best results, form several bubbles, five to six seconds apart, and time the last bubble.

**Caution:** Do not squeeze the bulb continuously. This causes froth to form on the walls, making timing difficult.

The flow rate can be determined from the Flow Chart on the back page, or calculated using the following equation:

$$\text{Flow (ml/min)} = \frac{60 \times (\text{volume traveled})}{\text{Time (in seconds)}}$$

## Storage or Transport

Disconnect the pump and replace the rubber cap on the lower inlet of the flowmeter. The instrument can be placed in any position without solution loss. SKC recommends that it be transported in its case.

## Volumetric Calibration of Hand Pumps

SKC Model 303 Flowmeter can be used to determine the volume of manual hand pumps such as the bellows or piston pumps used with detector tubes. Follow these procedures:

### Bellows Pumps (i.e., Dräger®)

1. Connect a detector tube to the pump according to the manufacturer's instructions.
2. Connect the inlet of the tube to the rubber hose on top of the flowmeter.
3. Compress the bellows pump and release slowly. Squeeze the rubber bulb on the flowmeter. Bubbles (film) will begin to form.
4. When the film reaches the zero line on the flowmeter, compress the bellows pump completely and release. The film will move up the flowmeter and stop when the bellows pump is filled to capacity.
5. Record the point at which the film stops. Most bellows pumps are designed to draw 100 ml. Lines on the flowmeter are graduated at 90, 95, 100, 105, and 110 ml. Visually extrapolate the volume reading if the film stops between lines.
6. Calculate and record the volume.

**Note:** Pumps should be repaired if they fall outside of the 90 to 110 ml range.

### Piston Pumps (i.e., Gastec®, MSA, Kitagawa)

1. Connect a standard detector tube to the piston pump according to the manufacturer's instructions.
2. Connect the inlet of the tube to the rubber hose on top of the film flowmeter.
3. While pulling the piston slowly back, squeeze the rubber bulb on the flowmeter until bubbles (film) form.
4. Watch the film movement closely. When the film is exactly at the zero line on the flowmeter, push the pump piston all the way in. Then, draw the piston out to full capacity and lock it in place. The film will move up the flowmeter and stop when the piston pump is filled to capacity.
5. Record the point at which the film stops. Most piston pumps are designed to draw 100 ml. Lines on the flowmeter are graduated at 90, 95, 100, 105, and 110 ml. Visually extrapolate the volume reading if the film stops between lines.
6. Calculate and record the volume.

**Note:** Pumps should be repaired if they fall outside the 90 to 110 ml range.

## SKC Limited Warranty and Return Policy

SKC products are subject to the SKC Limited Warranty and Return Policy, which provides SKC's sole liability and the buyer's exclusive remedy. To view the complete SKC Limited Warranty and Return Policy, go to <http://www.skcinc.com/warranty.asp>.

## Flow Chart for 303 Calibrator

100 ml line		100 ml line		100 ml line		100 ml line	
Time (sec)	Flow (ml/min)	Time (sec)	Flow (ml/min)	Time (sec)	Flow (ml/min)	Time (sec)	Flow (ml/min)
		43	139	90	67	83	36
12	500	44	137	92	65	85	35
13	462	45	133	94	64	87	34
14	429	46	130	96	62	90	33
15	400	47	128	98	61	93	32
16	375	48	125	100	60	96	31
17	353	49	122	102	59	100	30
18	333	50	120	104	58	104	29
19	316	51	118	106	57	108	28
20	300	52	115	108	56	112	27
21	286	53	113	110	55	116	26
22	273	55	111	112	54	120	25
23	261	55	109	114	53	125	24
24	250	56	107	116	52	130	23
25	240	57	105	118	51	135	22
26	231	58	103	120	50	140	21
27	222	59	101	50 ml line		150	20
28	214	60	100	Time (sec)	Flow (ml/min)	160	19
29	207	62	97	60	50	170	18
30	200	64	94	61	49	180	17
31	193	66	91	62	49	190	16
32	187	68	88	63	47	200	15
33	182	70	86	65	46	210	14
34	176	72	83	66	45	225	13
35	171	74	81	68	44	250	12
36	167	76	79	70	43	275	11
37	162	78	77	72	42	300	10
38	158	80	75	74	41	330	9
39	154	82	73	76	39	365	8
40	150	84	71	78	38	425	7
41	146	86	70	81	37	500	6
42	143	88	68			600	5

## Accessories and Spare Parts

Description	Cat. No.
Film Solution, 1 pint, (473 ml)	302-4011