



## Operating Instructions

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# Flowmeter Catalog No. 303

*SKC primary standard flowmeters are designed, manufactured, and tested for accuracy; no calibration is needed. Read the operating instructions thoroughly before operating the flowmeter.*

### 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.

### 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.

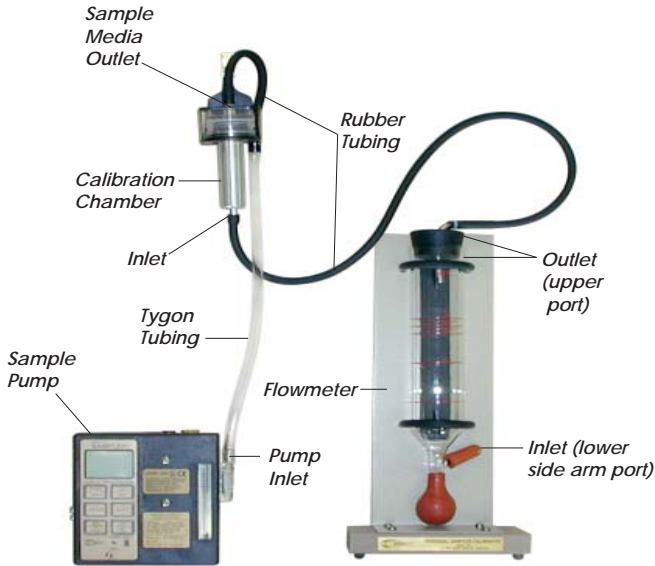
#### Method 2

1. Connect a pump to the flowmeter (see Connecting a 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 Time Flow (sec) (ml/min)	100 ml line Time Flow (sec) (ml/min)	100 ml line Time Flow (sec) (ml/min)	100 ml line Time Flow (sec) (ml/min)
Using 100 ml line	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		150 20
28 214	60 100	Time & Flow Rate using 50 ml line	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
Precision Digital Stopwatch	303-01-1
Replacement Connecting Hose (2 pieces)	P3032101
Replacement Squeeze Bulb	P3032311
Replacement Flowmeter Sidearm Cap	P3032312