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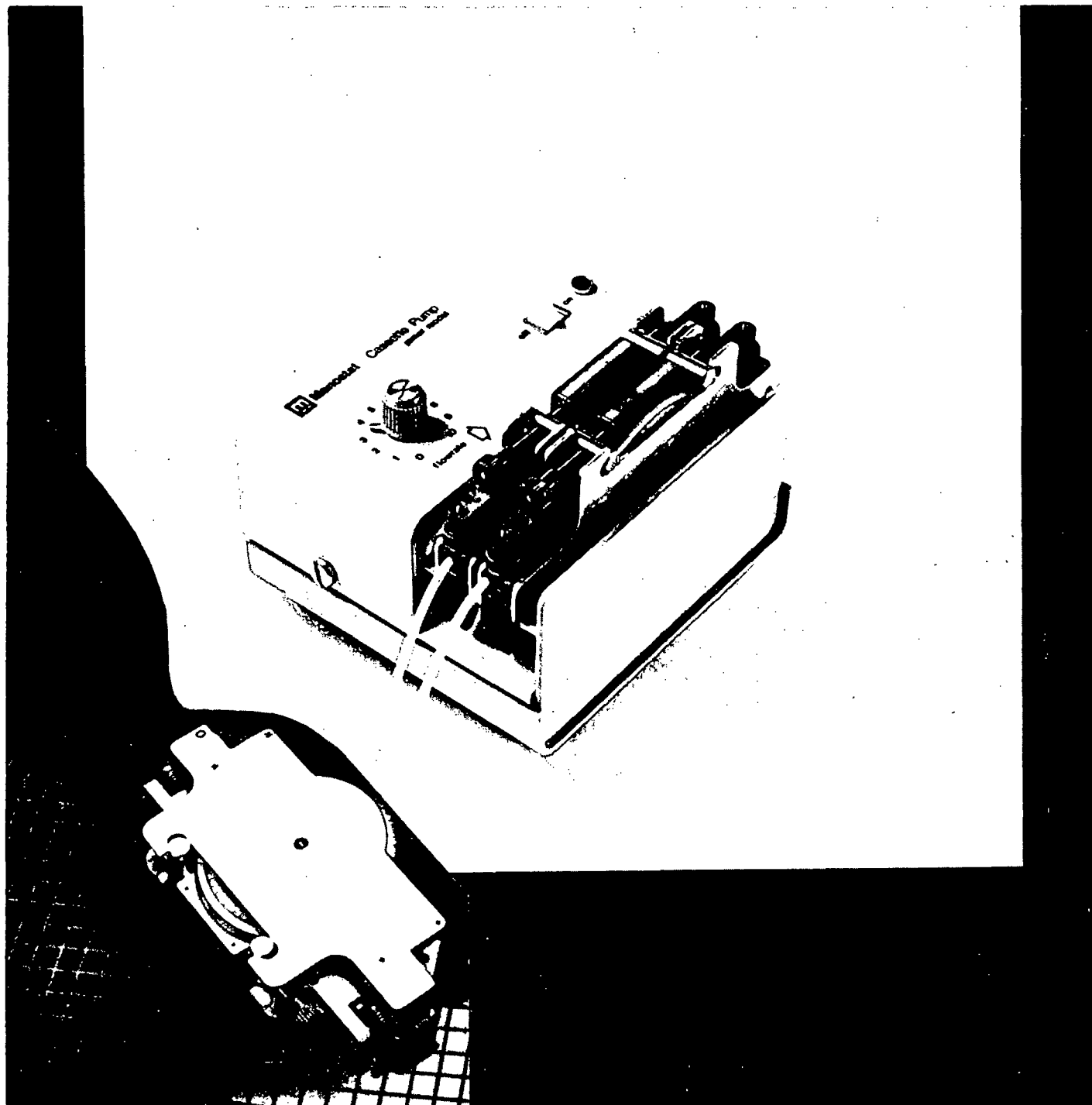
Operating Instructions

CASSETTE[®] PUMP DRIVE UNIT - Junior Model

Catalog No. 72-510-000 - 115 VAC, 50/60 Hz model
72-510-220 - 220 VAC, 50/60 Hz model

PUMPING CASSETTE

Catalog No. 72-550-000



Manostat

519 Eighth Avenue
New York, N.Y. 10018
(212) 594 - 6262

A. PRINCIPLE OF OPERATION

The squeezing action of rollers on tubing causes the peristaltic pumping action. The flow is proportionate to the speed of the rollers and the inside diameter of the tubing, both of which can be varied.

Pumping channels are in the form of individual Cassette^R modules. They can be inserted into the drive unit upon demand.

B. SPECIFICATIONS

1. Power: 115 Volt, 60 Cycles, 0.4 Amp. steady.
220 Volt, 50 Cycles, 0.2 Amp. steady.
2. Outside Dimensions: Width: 7 in. (18 cm.)
Depth: 6 in. (16 cm.)
Height: 4 in. (10 cm.)
Weight: 6 lbs. (2.75 kg.)
3. Range of Flow: 1-1/2 to 90 ml./hr. average at 0 head.

.015" I.D. Tubing - 1 - 2 ml./hr.
.020" I.D. Tubing - 1 1/2 - 3 1/2 ml./hr.
1/32" I.D. Tubing - 2 1/3 - 6 1/2 ml./hr.
1/16" I.D. Tubing - 8 - 30 ml./hr.
3/32" I.D. Tubing - 12 - 26 ml./hr.
1/8" I.D. Tubing - 16 - 64 ml./hr.
5/32" I.D. Tubing - 23 - 82 ml./hr.
3/16" I.D. Tubing - 27 - 90 ml
Versatube - 20 - 35 ml./hr.

An approximately 40% increase can be achieved by removing every second roller from the Cassette^R module. See instructions given in paragraph F. However, it is more practical to operate Cassette^R modules in pairs to achieve desired volume.

Each module can accommodate two tubings of up to 3/32" I.D. or one tubing of up to 3/16" I.D.

Although the Cassette^R pump is not a pressure pump, a suction and discharge head can be accommodated. Flowrate will drop to about half its initial value at 12 feet of suction head or at 10 feet of discharge head.

4. Repeatable Accuracy: $\pm 5\%$. It can be improved by following instructions in Section D.6.
5. Tubing: Any flexible tubing with a maximum durometer hardness 60 Shore A with a 1/32" wall and an inside diameter from .015" to 3/16".

Manostat pumps are supplied with a length of flexible tubing. However, Manostat offers tubing in a range of sizes and materials. For example:

ManogonTM: A special Tygon^R formulation developed for peristaltic pumping. Tubing is clear, smooth and it provides a broad range of corrosion resistance. Good tubing life. It is recommended for most applications.

ManosilTM: Silicone rubber with good resistance to most harsh chemicals, some solvents, fuels and oils. Tubing is resistant to oxidation, can be used under wide temperature extremes, and is autoclavable. Excellent tubing life.

Hypalon^R: Excellent resistance to dilute and concentrated acids, weak and strong alkalies. Good resistance to concentrated mineral acids. Medium tubing life.

Viton^R: Excellent resistance to oils, solvents, and most chemicals at elevated temperatures. Medium tubing life.

VersatubeTM: A silicone covered Teflon^R tubing which offers complete chemical resistance to all acids, solvents and alkalies. Relatively short tubing life. (use Catalog No. 75-100-020.)

Selection of tubing material depends on the chemical being pumped. For the correct choice consult the Chemical Resistance Chart (enclosed) and Manostat's Tubing Bulletin (enclosed).

C. INSERTING CASSETTE^R MODULES

1. Hold Cassette^R module by its blue locking tabs and lower it into the opening of the drive unit so that the gear of the module engages one of the gear rods of the drive unit. Push the locking tabs towards each other until they snap into place. There is no special slot for each modules; they can be put anywhere on the drive unit.
2. When inserting the Cassette^R module while the pump is running, run the drive unit at slow speed while inserting the module. This allows easier gear engagement.
3. Note that the gear in the Cassette^R module is off center so that it engages the gear rod only if inserted one way and does not if flipped around the other way.
4. To disengage a Cassette^R module for temporary or permanent storage, raise it slightly and snap the lower grooves of the locking tabs in place. This will keep the Cassette^R module gear from engaging the drive gear rod.
5. Up to two Cassette^R pumping element can be operating or stored in the drive unit.

D. INSERTING TUBING

Please use Figure 2 as a guide for working with the Cassette^R module.

1. Turn knurled knob at the end of locking screw until locking cylinders are completely retracted against each other.
2. Lift pressure plate up and out. Retract both tubing clamps completely by turning their knobs. When retracted they should be in line with the bottom of the pressure plate.
3. Place tubing of the required size into the Cassette^R module keeping the tubing as straight as possible.
4. Replace pressure plate, insuring that the pins face the gear on the Cassette^R module. Lock it in place by turning knurled knob until locking cylinders are wedged firmly into the top of the module side plates. Make sure tubing remains straight and fairly taut under the pressure plate.

5. Clamp tubing at intake side only by turning tubing clamp knob until clamp lightly compresses tubing. Should tubing show a tendency to crawl during operation, increase clamping force slightly.

Do not clamp tubing at the output side as this will cause bunching of the tubing and damage to the Cassette^R module.

6. Flow rate variation between Cassette^R modules can be reduced by varying tubing clamping force slightly.
7. Tubing can be inserted either with module in hand or while it is in place in the drive unit.

E. OPERATION

1. Start pump by setting power switch to "on" position. Increase speed by turning flowrate control toward higher numbers. If tubing is stiff or pumping load is high, pumping action may not begin when flowrate knob is turned too low. It may be necessary to turn to 4 or 5 to begin pumping action.
2. When using tubing for the first time, wet inside of tubing to facilitate priming. Always prime at maximum speed.

Tolerance of small tubing are such that they may cause very slow priming. If such is the case, increase tubing clamping force slightly (input side only). If this is still insufficient, add a thin strip like scotch tape to the inside surface of the pressure plate where it comes in contact with the tubing. This increases the squeezing action on the tubing.

3. For optimum tubing life observe the following:
 - a. Move tubing to a different spot along the rollers periodically. This will avoid excessive wear at a given point.
 - b. Use a small amount of neutral lubricant on the outside of the tubing.

NOTE: Do not use silicone fluid or silicone grease as they swell and weaken the silicone tubing.

4. If pulsating delivery is objectionable, use a long coil of tubing or a reservoir at the discharge end and constrict the tubing at the outlet slightly with a pinch clamp away from the Cassette^R module.
5. If accurate flow control is important, allow pump to warm up for about 5 minutes to achieve stable flow conditions.
6. If identical flowrates are desired from parallel Cassette^R modules, they can be fine tuned by slight tightening of tubing clamp.
7. This pump is equipped with an overcurrent circuit breaker which will automatically disconnect the current when pump is overloaded. The load may be excessive if the tubing is hard or the flow of liquid is too restricted at the output end.
8. Break in new pump by allowing it to run at less than full capacity for the first few hours.

F. INCREASING CASSETTE PUMPING ELEMENT CAPACITY

Flow capacity of each Cassette^R module can be increased by approximately 40% by removing every second roller. To do so:

1. Remove pressure plate from Cassette^R module.
2. Place module flat on the table with the side near the gear facing down.
3. Remove top metal side plate by removing the four screws.
4. Note: Each pumping element is carefully assembled and inspected for best roller concentricity. Mark each roller and its post before removal so that it may be put back on the same post.
5. Lift out every second roller.
6. Tighten wear guard strip by removing its anchor clip, which lifts straight up, and pulling both ends of the strip until it is snug against the remaining rollers. Replace anchor clip while holding the ends of the strip.

7. Replace metal side plate insuring that both locking tabs are correctly in place.

G. SAFETY

1. Observe safety precautions at all times, especially when pumping dangerous liquids or when Cassette^R unit leaves the gear rod exposed. In general, protect the pump area from accidental spillage of the liquid.
2. If any tubing runs unusually noisily, or bunching up can be observed, check wear guard strip and clamping. If these are in order, replace tubing.
3. The Cassette^R pump should be well grounded.

H. MAINTENANCE

1. Drive unit requires no maintenance other than general cleaning. During the initial break-in period, Cassette^R module gears may leave a small amount of residue on the drive unit gear rod. This can be brushed off.
2. When plastic wear guard strip on the Cassette^R module wears out it must be replaced. Follow procedures given in section F. 1, 2, 3, 6, & 7 for taking module apart and putting it back together.
 - a. Pull off anchor clip and remove old wear guard strip. Thread new strip around rollers and pull ends until strip is snug against the rollers.
 - b. Replace anchor clip while holding ends of the strip.
3. Each pumping gear is equipped with a pivot shaft, a roller shield and eight matched rollers. Should any part of this set be lost or damaged, it is suggested that the entire set be replaced.

I. TROUBLE SHOOTING

<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>	<u>CORRECTIVE ACTION</u>
Machine won't pump, gear rod turn erratically or won't turn at all.	Damaged gear train in motor unit.	Replace motor.
Flowrate knob has no effect on pumping speed.	Faulty potentiometer or silicone rectifier.	Replace faulty part.
Unit on, no pilot light on, gears do not turn.	Circuit breaker tripped.	Press reset button which is on the side of the motor housing.
	Power switch is broken	Replace switch.
Tubing bunches up or crawls during operation.	Tubing is incorrectly clamped.	See section D. 5.

J. REPLACEMENT PARTS

Important: When ordering any spare parts for accessories, please be sure to give serial number on pump and on PC board.

DRIVE UNIT

91-062-885	On/Off Toggle Switch
91-016-071	Pilot Light
91-016-180	Resistor for Pilot Light-220V Model Only
91-058-015	Motor, 115 Volt
91-058-016	Motor, 220 Volt
91-058-025	Potentiometer, 115 Volt
91-058-030	Silicone Rectifier, 115 Volt
91-058-040	Drive Gear
91-058-080	Silicone Rectifier, 220 Volt
91-058-090	Potentiometer, 220 Volt
91-058-110	Circuit Breaker 0.5 Amp. 115 Volt
91-058-100	Circuit Breaker 0.3 Amp. 220 Volt

SPARE PARTS FOR CASSETTE^R MODULE

91-056-110	Locking Tab
91-056-190	Wear Guard Strip (Pkg of 10)
91-056-310	Gear, Shield and 8 Rollers (set)
91-056-320	Tubing Clamp Assembly
91-056-440	Aluminum Anchor Clip
91-056-540	Pressure Plate Assembly

While any spare part may be ordered individually, for your convenience you may order a Spare Parts Kit, Catalog Number 91-058-999. This kit contains an assortment of parts which are most likely to wear out with normal use. Having this replacement kit handy will assure you of continuous use of your Manostat pump.

The Spare Parts Kit for the pump unit contains:

- Switch
- Potentiometer
- 10 Wear Guard Strips
- 2 Aluminum Anchor Clip
- Silicone Rectifier

K. WIRING DIAGRAM

Figure 1

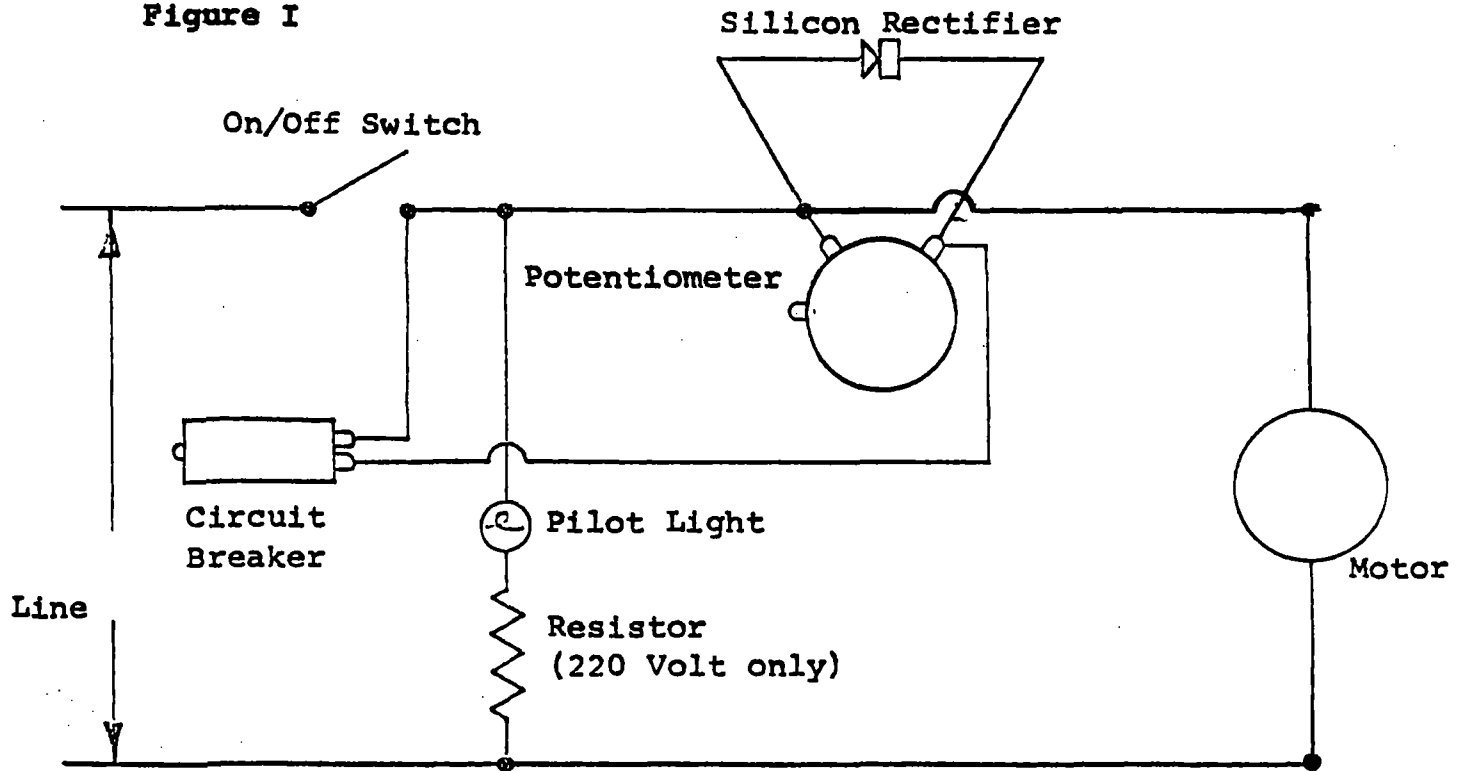
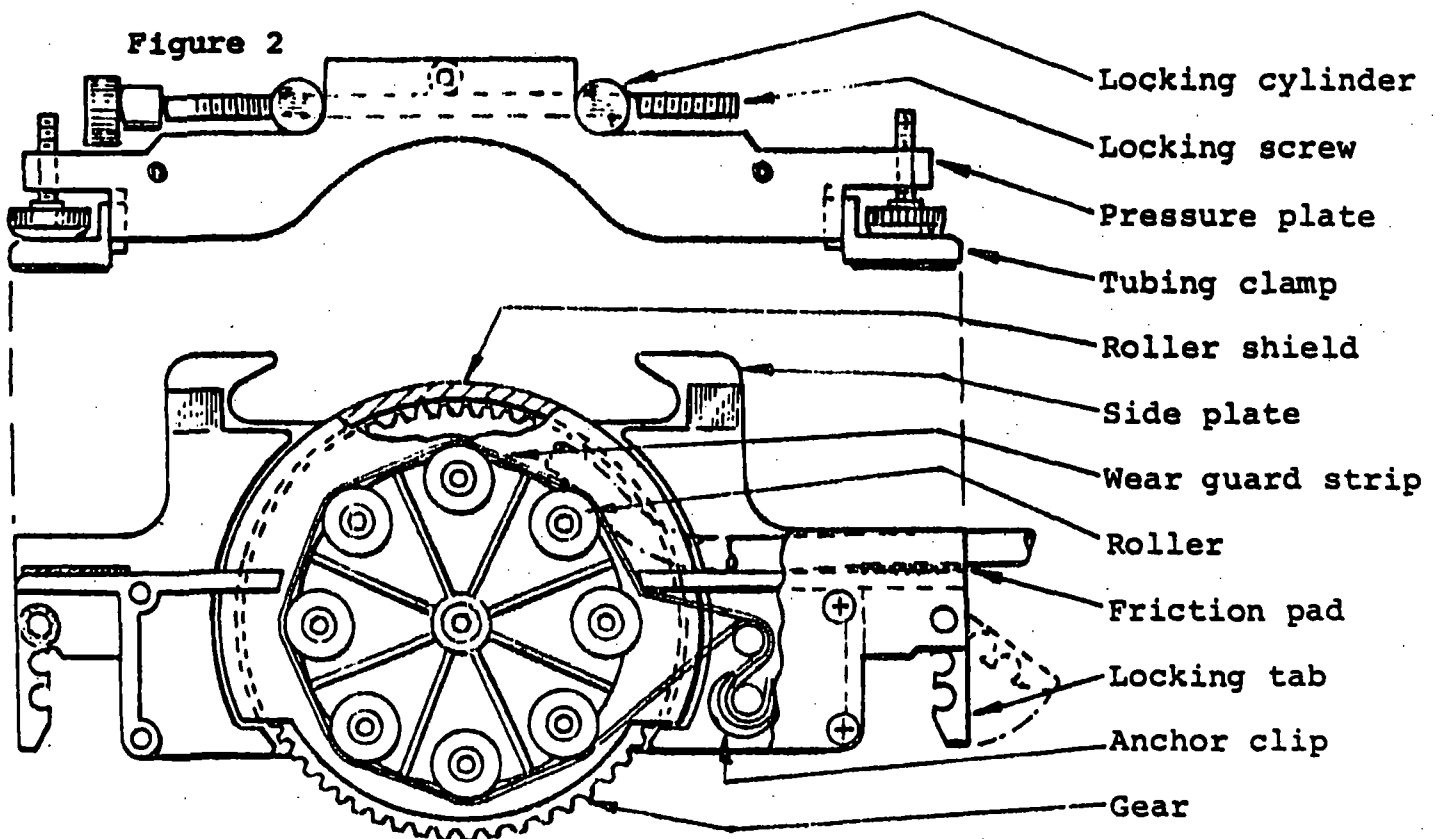


Figure 2





Manostat® Tubing

Manostat has available a wide variety of tubing to fill any laboratory pumping and flow application for liquids or gases.

There are four types available, each in various formulations, flexible tubing for use in peristaltic pumps or rigid tubing for liquid or gas flows.

Manostat also offers a complete line of connectors to enable the construction of flow systems for any reagent.

Versatube™ Teflon Lined Pumping Unit

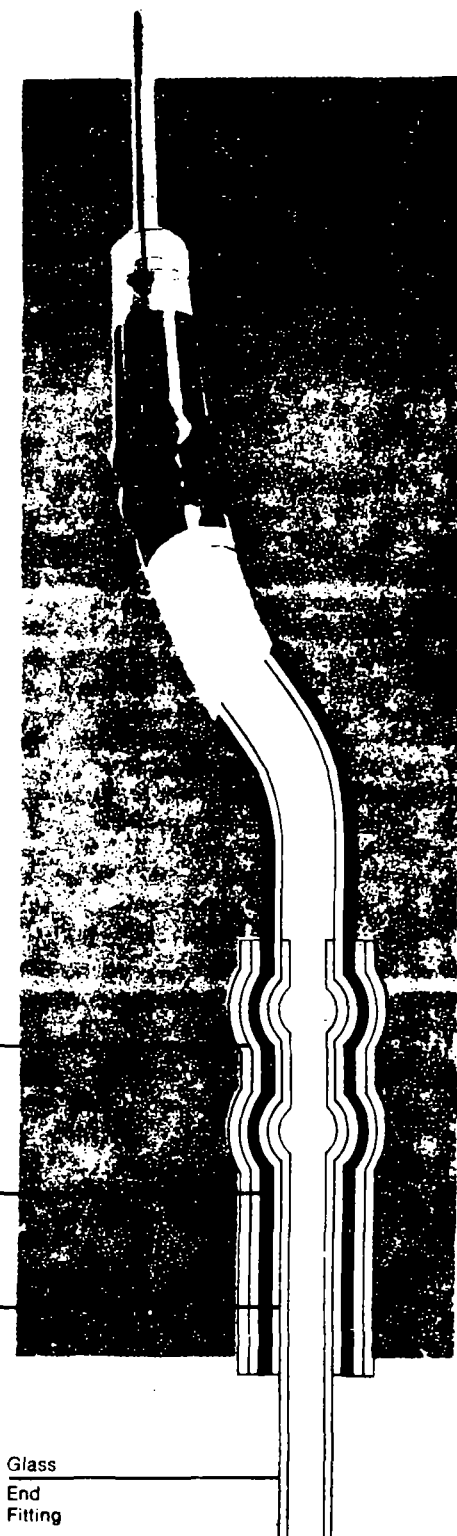
Versatube has been designed to allow Manostat's line of peristaltic pumps to be used with highly reactive reagents that ordinarily cannot be pumped because they attack the tubing. With Versatube™ the liquid comes in contact with Teflon® and glass only.

This unique design consists of a 12" to 36" long unit with a Teflon® lined silicone rubber section just long enough to fit into the pumping head of one of the Manostat pumps. Glass inlet and outlet connectors protrude from the two ends of the pumping head and can be connected to Teflon® or glass tubing directly or by means of Manostat Manolok® Teflon® connectors. Versatube™ is made in three models to fit the three sizes of pump heads in the Manostat pumps. Tube life well in excess of 400 hours can be achieved depending on the reagent, temperature, viscosity and speed of pumping.

Man-O-Lok®
Shrinkable
Teflon
Connector

Silicone
Sheathing

Teflon
Tubing



Glass
End
Fitting

Flow rates:

Varistaltic® Pumps

Advanced Model	50-550 ml/min
Solid State Model	20-600 ml/min
Junior Model	100-350 ml/min
Dispenser Pump	4-40 ml/cycle

Cassette® Pump

Standard Model	10-45 ml/hour
Junior Model	20-30 ml/hour

75-100-000 Standard Versatube, for use in Solid State or Advanced Vari-staltic® pumps. 16" overall length, .295" I.D. Teflon® tubing, 7mm O.D. glass fitting. (Use 75-405-200 Teflon tubing to connect to Versatube.) Each 24.00

75-100-010 Junior Versatube, for use in Junior Model Varistaltic® or modified Dispenser Pump. 12¾" overall length, .210" I.D. Teflon® tubing, 5mm O.D. glass fitting. (Use 75-405-150 Teflon tubing to connect to Versatube.) Each 24.00

75-100-020 Cassette Versatube, for use in Manostat Cassette Pumps 12" overall length, .150" I.D. Teflon® tubing, 3mm O.D. glass fitting. (Use 75-405-005 Teflon tubing to connect to Versatube.) Each 24.00

*U.S. Patent No. 3,875,970.

Flexible Tubings for Peristaltic Pumps

Any soft flexible tubing up to 70 Shore A hardness can be used for peristaltic pumps. Proper selection should be made on the basis of chemical resistance and operating conditions. The following are average characteristics of the tubing materials supplied by Manostat.

Tubing	Life Hours*	Operating Temp. 0°F	Auto-clave
Manogon™			
Tygon®	500	-20 to 165	No
Manosil™			
Silicone			
Rubber	1000	-50 to 450	Yes
Versatube™	400	0 to 250	Yes
Hypalon®	150	0 to 250	Yes
Viton®	200	-10 to 600	Yes

*Pumping water at 100 rpm, S.T.P.

Manosil™ Brand Silicone Rubber Tubing

Silicone rubber is the best general purpose tubing for laboratory use in peristaltic pumps. Its great flexibility gives maximum pump performance and excellent tubing life. Temperature range is -50°F to 450°F, and it may be auto-claved. It has good abrasion resistance and may be used with a wide range of reagents. (See chemical resistance chart.)

Cat. No.	I.D. x Wall	Per 50ft
75-300-015	.015" x 1/32"	50.00
75-300-050	.020" x 1/32"	23.50
75-300-150	1/32" x 1/32"	23.50
75-300-200	1/16" x 1/32"	23.50
75-300-250	3/32" x 1/32"	23.50
75-300-300	1/8" x 1/32"	25.50
75-300-350	5/32" x 1/32"	28.50
75-300-400	3/16" x 1/32"	31.00
		Per 10ft*
75-300-450	3/32" x 1/16"	10.00
75-300-500	1/8" x 1/16"	9.45
75-300-550	3/16" x 1/16"	11.25
75-300-600	1/4" x 1/16"	12.85
75-300-650	5/16" x 1/16"	15.00
75-300-700	3/8" x 1/16"	16.85

* Available in continuous 50ft lengths.

Manogon™ Brand Tygon® Vinyl Tubing

Manogon is a formulation of Tygon® tubing that has been specially selected for its hardness for use in peristaltic pumps. It is crystal clear, tasteless and odorless, non-toxic and can be easily sterilized by chemical or gas methods. The bore is glass smooth which prevents interior build up and allows maximum flow. The walls will retain their shape and will not collapse.

Cat. No.	I.D. x Wall	Per 100ft
75-310-050	.020" x 1/32"	16.00
		Per 50ft
75-310-150	1/32" x 1/32"	6.95
75-310-200	1/16" x 1/32"	6.95
75-310-250	3/32" x 1/32"	14.40
75-310-300	1/8" x 1/32"	10.95
75-310-350	5/32" x 1/32"	10.95
75-310-400	3/16" x 1/32"	12.00
75-310-450	3/32" x 1/16"	20.00
75-310-500	1/8" x 1/16"	20.60
75-310-525	5/32" x 1/16"	29.00
75-310-550	3/16" x 1/16"	28.80
75-310-600	1/4" x 1/16"	35.20
75-310-650	5/16" x 1/16"	42.20
75-310-700	3/8" x 1/16"	49.20

Hypalon® Tubing

Hypalon is a synthetic rubber with outstanding resistance to weather, oil, flame, and strong oxidizing chemicals such as concentrated sulfuric acid and hypochlorite solutions. It has sufficient flexibility to make a very efficient tubing for use in peristaltic pumps.

Cat. No.	I.D. x Wall	Per 10ft*
75-410-150	3/16" x 1/16"	21.60
75-410-200	1/4" x 1/16"	23.50
75-410-300	3/8" x 1/16"	25.00

* Other sizes and 50ft lengths of listed sizes available on special order.

Viton® Tubing

Viton® Fluoroelastomer compound is a synthetic rubber with exceptional resistance to oils, fuels, lubricants, most mineral acids, many aliphatic and aromatic hydrocarbons like carbon tetrachloride, xylene or toluene.

Cat. No.	I.D. x Wall	Per 10ft
75-420-050	.020" x 1/32"	17.50
75-420-200	1/16" x 1/32"	21.50
75-420-300	1/8" x 1/32"	27.50
75-420-400	3/16" x 1/32"	32.00

* Other sizes and 50ft lengths of listed sizes available on special order.

Teflon Semi-Flex Tubing

This tubing, in which the medium comes in contact only with Teflon®, may not be used in peristaltic pumps, as it is too stiff. The flexible tubings on the previous page, and Manostat's Versatube™ are sufficiently flexible for this purpose; however, this non flexible Teflon® tubing may be attached to the inlet and/or outlet of any pump.

For use in our Varistaltic® Pumps, Manostat offers our Versatube™, a flexible teflon

lined silicone tubing with glass connectors on each end. (See p. 1)

Teflon offers complete chemical inertness and good mechanical strength. When used in conjunction with Versatube™ and Manolok® connectors (see p. 4) it is possible to construct a liquid handling system for any reagents. Teflon® TFE has a continuous service temperature limit of 500°F and tensile strength of 6000 p.s.i. It can be used at extremely low temperatures, down to -268°C.

Teflon® TFE, 0.030" Wall Thickness*

Cat. No.	I.D.	Length	Price
75-405-005	.095"	50ft	28.50
75-405-050	1/16"	10ft	9.90
74-405-055	1/16"	50ft	45.00
74-405-100	1/8"	10ft	13.20
75-405-105	1/8"	50ft	59.40
75-405-150	3/16"	10ft	18.60
75-405-155	3/16"	50ft	83.60

75-405-200	1/4"	10ft	24.20
75-405-205	1/4"	50ft	109.00
75-405-250	5/16"	10ft	27.00
75-405-255	5/16"	50ft	121.50
75-405-300	3/8"	10ft	32.00
75-405-305	3/8"	50ft	144.00

* .095 ID has .012 wall thickness

Other wall thicknesses and diameters available on special order.

Manostat™ Stat-O-Lok®

Quick tubing
connectors
with automatic
shut off feature
on dis-connect

Stat-O-Lok™ is the ideal quick coupling disconnect connector for the most popular sizes of tubing in general laboratory use.

The couplings' compact size, attractive appearance, and dependable operation meet most instrument requirements.

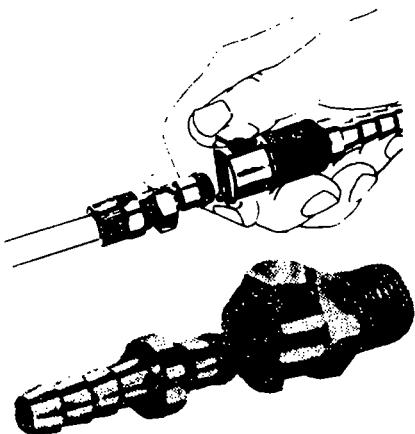
Stat-O-Lok™ is available for 1/8" and 1/4" I.D. tubing in two styles for maximum flexibility: Hose end connectors for flexible tubing such

as PVC (tygon), rubber and silicone tubing. The tube fitting connector ends are ideal for stiffer non-flexible tubing such as the popular polyethylene and nylon materials.

Maximum flexibility: combine shut off on female and male end or shut off on female end only. Eight styles or combinations to choose from. Stat-O-Lok™ connectors feature one hand easy operation slide locks.

Catalog Number	Coupling Type	Shut Off Or		Fitting Type	Size (in.)	Price (\$)
		Straight Through	Through			
STAT-O-LOK, METAL						
75-661-002	Female	Shut off		Male Pipe Thread	1/8	8.30
75-661-004	Female	Shut off		Male Pipe Thread	1/4	9.50
75-661-204	Female	Shut off, Panel		Rigid	1/4	12.40
75-661-602	Female	Shut off, Panel		Hose	1/8	11.90
75-661-604	Female	Shut off, Panel		Hose	1/4	12.20
75-661-802	Female	Shut off, In Line		Hose	1/8	11.70
75-661-804	Female	Shut off, In Line		Hose	1/4	12.00
75-662-004	Male	Shut off		Rigid	1/4	9.70
75-662-202	Male	Shut off		Hose	1/8	8.50
75-662-204	Male	Shut off		Hose	1/4	8.60
75-672-004	Male	Straight Through		Rigid	1/4	5.30
75-672-202	Male	Straight Through		Hose	1/8	4.20
75-672-204	Male	Straight Through		Hose	1/4	4.40

Catalog Number	Coupling Type	Shut Off Or		Fitting Type	Size (in.)	Price (\$)
		Straight Through	Through			
STAT-O-LOK, PLASTIC						
75-681-002	Female	Shut off		Pipe Thread	1/8	6.20
75-681-004	Female	Shut off		Pipe Thread	1/4	6.60
75-681-204	Female	Shut off, Panel		Rigid	1/4	9.20
75-681-602	Female	Shut off, Panel		Hose	1/8	8.50
75-681-604	Female	Shut off, Panel		Hose	1/4	8.60
75-681-802	Female	Shut off, In Line		Hose	1/8	8.30
75-681-804	Female	Shut off, In Line		Hose	1/4	8.60
75-692-004	Male	Straight Through		Rigid	1/4	3.30
75-692-202	Male	Straight Through		Hose	1/8	2.30
75-692-204	Male	Straight Through		Hose	1/4	2.50



Man-O-Lok® Shrinkable Teflon® Connectors

Man-O-Lok® provides a Teflon® connector that joins glass to glass with a seal that can be used in any system, including vacuum. The two ends are joined in seconds and provide a transparent, corrosive resistant joint, which while permanent can be removed by simply cutting away the Teflon sleeve with a razor blade. With Man-O-Lok it is possible to build glass systems in minutes that otherwise would take hours and the skills of a glass blower. It is also possible to use Man-O-Lok to repair broken apparatus that might previously have been discarded.

The exclusive Man-O-Lok "O" ring provides the grip in sealing the Teflon® shrink tube to the glass that makes the connection tight.

We provide an electrical heater to heat the Teflon® shrink tubing to sufficient temperature for it to shrink, however, a laboratory bunsen burner or even a pocket match can do the job.

The Flexconnector and CT Flex listed on the next page provide tremendous versatility in flow system construction.

(Continued)

Prices Subject
to Change

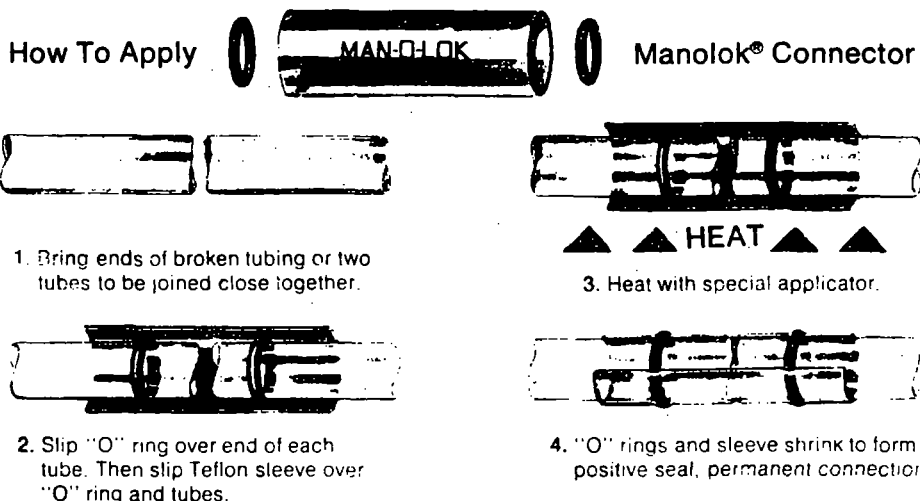
(Continued From p. 3) **Man-O-Lok®**

- 75-460-512 Man-O-Lok Kit, consisting of 54 assorted connectors (8 each, 5, 6, and 7mm; 6 each 8, 9, and 10mm; 12 each 11 to 12mm) with the necessary "O" rings and the electrical applicator in a fitted plastic box. ea. 65.00
- 91-023-910 Manostat Electrically Heated Applicator, 115 V AC ea. 19.00

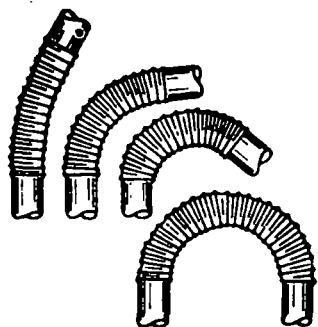
Parts

Cat. No.	For Glass O.D.	Per Pk of 12
75-460-005	5mm	8.50
75-460-006	6mm	8.50
75-460-007	7mm	8.50
75-460-008	8mm	8.50
75-460-009	9mm	8.50
75-460-010	10mm	11.00
75-460-012	11-12mm	12.00
75-460-014	12.5-14mm	13.00

Other sizes available on special order.



Flexconnector™



This flexible corrugated Teflon® tubing has heat shrinkable ends for connecting to glass tubing, and it provides the same vacuum and pressure tight connection as the Man-O-Lok. Made of translucent Teflon® it allows construction of very complex systems because of its extreme flexibility. Flexconnectors will withstand continuous flexing to practically zero bend radius within a service temperature

of -80°C to +130°C. All diameters have a 6" extended length and are supplied with Man-O-Lok "O" Rings.

Cat. No.	For Glass O.D.	Each
75-515-007	7mm	16.00
75-515-010	10mm	20.00
75-515-012	13mm	25.00

Other sizes available on special order.

CT-Flex Penntube

This flexible corrugated Teflon® tubing is similar to Flexconnector except that it has a push-on end fitting instead of a heat shrinkable one. It can also be heat sealed or clamped on tubing. Can be bent to one half of tubing I.D. Withstands continuous flexing within a temperature range of -80°C to 130°C. Approved by FDA.

All connectors listed below have 22"

extended corrugated length. Other diameters and lengths as well as braided tubing for higher pressures are available on special order.

Cat. No.	I.D.	Max. Pressure	Each
75-515-002	1/4"	100 psi	16.00
75-515-003	3/8"	80 psi	20.00
75-515-004	1/2"	65 psi	25.00

Available from Your
Laboratory Supply Dealer



519 Eighth Avenue, New York, N.Y. 10018 Tel: (212) 594-6262

TB/2M+3M/SP/1-82

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Chemical Resistance

To assist customers in selecting the appropriate elastomer for the particular environment, the accompanying tabulation has been prepared based on laboratory tests as well as data supplied by individual producers.

This should be used as a guide only, since variables as temperature, velocity of flow, duration of exposure, stability of fluid, etc., may affect some chemicals. All ratings in this chart are based on room temperature.

CHEMICALS	Buna N	Hypalon	Natural Rubber	Neoprene	Polyethylene	Polypropylene	Manosil Silicone	Stainless	Teflon, Versatube	Manogon Tygon	Viton A	Ministatic Pump
Acetaldehyde	A	B	B	C	B	B	A	A	A	C	A	B
Acetates							C	A	C	A		
Acetic Acid	B	B	C	B	B	B	B	A	A	A	C	B
Acetic Anhydride	A	A		A	B	B	B	A	A	C	C	B
Acetone	C	B	B	B	B	A	A	A	A	C	C	B
Acetyl Bromide								A	A	C		
Acetyl Chloride					C			A	A	C		
Air	A	A	A	A	A	A	A	A	A	A	A	A
Alcohols		A	A	A	A	A	A	A	A	A	A	A
Alum	A	A	A	A	A	A		C	A	A	A	A
Aluminum Salts	A	A	A	A	A	A	B	B	A	A	B	A
Ammonia		B	A	A	A	A	A		A	B	C	B
Ammonium Acetate	A	A	C	A	A	A		A	A	A	A	A
Ammonium Chloride		A	A	A	A	A	A	B	A	A	A	A
Ammonium Hydroxide	C	A	C	A	A	A	A	A	A	A	A	A
Ammonium Phosphate	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Sulfate		A		A	A	A	A	B	A	A	A	A
Amyl Acetate	C	C	B	C	A	A	B	A	A	C	C	C
Animals Oils		C	C	A	B	B	B		A	A	A	C
Aniline	C	B	C	C	C	B	B	A	A	C	A	C
Aromatic Hydrocarbons			C		C	B	B		A	B		
Arsenic Salts			A	A	B	A			A	A	A	
Barium Salts		A	A	A	A	A	A		A	A	B	A
Benzene	C	C	C	C	C	B	B	A	A	B	B	C
Benzyl Alcohol			A						A	A	A	
Bleaching Liquors									A	A		
Boric Acid (Solution)	A	A	A	A	A	A	B	A	A	A	B	A
Bromine	C	C	C	C	C	C	C	C	A	A	A	C
Butane		A	C	A	B	A	C		A	B	A	B
Butanol		B	B	B	B	A			A	A	A	B
Butyl Acetate	B	C	C	C	C	B	C	A	A	C	C	C
Calcium Salts		B	B	B	A	A	B		A	A	B	B
Carbon Dioxide	A	A	A	A	A	A	B	A	A	A	B	A
Carbon Sulfide		B	C	A	B	B			A	C	C	B
Carbon Tetrachloride	C	C	C	C	C	C	B	A	A	B	A	C
Caustic Potash	A	A	A	A	A	A	A	A	A	C	A	A
Caustic Soda	A	A	A	A	A	A	B	A	A	C	A	A
Chloroacetic Acid	C	A	C	A	C	C	A	C	A	C	B	C
Chlorine (Wet)	C	B		C	C	B	B	C	A	A	B	C
Chlorine (Dry)		B		B	B	B			A	A	A	B
Chlorobenzene	C		C		C	C	C	A	A	C	A	A
Chloroform	C	C	C	C	C	C	B	A	A	B	A	C
Chromic Acid	C	A	C	C	A	A	B	A	A	A	B	A
Copper Salts		A	A	B	A	A	B		A	A	A	A
Cresol			C	C	C	A	A	A	A	C	B	
Cyclohexanone	C		C	C	C	A	A	A	A	C	B	
Ethers		C	C	B	B	A	C		A	B	A	C
Ethyl Acetate		C	C	C	B	A	B	A	A	C	C	C
Ethyl Alcohol	A	A	A	A	A	A	A	A	A	B	A	A
Ethyl Bromide		C	A	B		B	B	A	A	C	A	
Ethyl Chloride		C	B	B		B	B	A	A	C	B	
Fatty Acids	A	B	B	B	B	B	B	A	A	A	A	B
Ferric Salts		A	A	A	A	A	B		A	A	A	A
Formaldehyde	A	A	A	A	A	A	A	A	A	A	A	A
Formic Acid	C	A	C	A	A	A	B	A	A	A	C	A

RATING KEY — A - Fluid has little or no effect B - Fluid has minor to moderate effect. C - Not suitable. Blank indicates no evaluation has been attempted.

CHEMICALS	Buna N	Hypalon	Natural Rubber	Neoprene	Polyethylene	Polypropylene	Manosil Silicone	Stainless	Teflon, Versatube	Manogon Tygon	Viton A	Ministatic Pump	
Freon	A	B	C	B	B	B	B	A	A	C	A	B	
Gasoline	A	B		B	C	B	B	A	A	C	A	C	
Glucose	A	A	A	A	A	A	A	A	A	A	A	A	
Glycerine		A	A	A	A	A	A		A	A	A	A	
Hydroic Acid					C	C		C	A	A	A		
Hydrochloric Acid (Med. Conc.)		A	A	A	A	A	A	C	A	A	A	A	
Hydrochloric Acid (Conc.)		A		A	B	A	B		A	A	A	B	
Hydrofluoric Acid		A	C	C	A	A	C	C	A	C	A	A	
Hydrogen Peroxide (Dil.)	C	B	C	B	B	B	A	A	A	A	A	B	
Hydrogen Peroxide (Conc.)	C	B	C	C	B	B	A	A	A	B	A	B	
Hydrogen Sulfide	C	A	C	A	A	A	A	A	A	A	B	A	
Kerosene	A	C	C	C	C	B	C	A	A	C	A	C	
Ketones		B	B	B	B	B	A		A	C	A	B	
Lacquer Solvent		C	C	C	B	B	C	A	A	C	C	C	
Lactic Acid		A	A	A	A	A		A	A	A	B	A	
Lead Acetate		C	A	C	B	A	A	A	A	A	A	C	
Linseed Oil	A	A	C	A	C	A	C	A	A	A	A	A	
Magnesium Salts		A	A	A	A	A			A	A	B	A	
Naphtha	B	C	C	C	C	B	B	C	A	B	A	C	
Natural Gas		A	B	A	B	B	B		A	A	A	B	
Nickel Salts		A	A	A	A	A			A	A	A	A	
Nitric Acid (Dil.)	C	A	B	B	C	B		C	A	A	A	C	
Nitric Acid (Conc.)	C	B	C	C	C	C	B	C	A	B	A	C	
Nitrobenzene	C	C	C	C	C	B	B	A	A	C	B	C	
Nitrogen Oxides									A	A	A		
Nitrous Acid									A	A			
Oils (Animal & Mineral)		B	B	B	B	B	C		A	C	A	B	
Oils (Vegetable)	A	B		A	B	B	B		A	B	A	B	
Oxygen		A	B	A	A	A	A		A	A	A	A	
Perchloric Acid	C		C	B	C	B	C	C	A	C	A		
Phenol	C	B	B	B	B	B	A		A	A	B	A	
Potassium (All)	A	A	A	A	A	A	B	A	A	A	B	A	
Pyridine		C	C	C	B	B	A		A	C	C	C	
Silver Nitrate	A	A	A	A	A	A			A	A	A	A	
Soap Solutions	A	A	A	A	A	A	A		A	A	A	A	
Sodium (All)		A	A	A	A	A	B		A	A	A	A	
Stearic Acid	C	B	C	B	B	B	B	A	A	A	B	B	
Sulfur Chloride		A	C	B	B	B	A		A	B	A	B	
Sulfuric Acid (Dil.)	C	A	C	B	B	A	B	C	A	A	A	B	
Sulfuric Acid (Conc.)	C	A	C	C	C	B	C	A	B	A	B	C	
Sulfurous Acid	C	A	B	B	C	B	B	C	A	A	B	C	
Tannic Acid	C	A	A	B	A	A	B		A	A	A	A	
Tanning Extracts	C								A	A	A		
Tartaric Acid	C	A	A	A	A	A			A	A	A	A	
Tin Salts									A	A			
Titanium Salts									A	A			
Toluene	C	C	C	C	C	C	C	A	A	C	B	C	
Trichloroacetic Acid	C	C	C	C	C	A			C	A	B	A	C
Trichlorethylene	C	C	C	C	C	B	C	A	A	C	A	C	
Turpentine	C	C	C	C	C	B	B	A	A	A	A	C	
Urea	C	A	C	A	A	A	A		A	A	A	C	
Uric Acid									A	A			
Water	A	A	A	A	A	A	A		A	A	A	A	
Xylol		C	C	C	C	B	C		A	C	A	C	
Zinc Chloride	A	A	A	A	A	A	A	C	A	A	A	A	

Chemical Resistance

To assist customers in selecting the appropriate material for the particular environment, the accompanying tabulation has been prepared based on laboratory tests as well as data supplied by individual producers.

This should be used as a guide only, since variables as temperature, velocity of flow, duration of exposure, stability of fluid, etc. may affect some chemicals. All ratings in this chart are based on room temperature.

CHEMICALS

CHEMICALS	Minipet Aqueous	Minipet Solvent	Minipet Acid	Econopet & Porto-Pet	Varipet, Metal Luer Lock	(All Carry "A" Rating For All Chemicals Except HF)	Manogon Tygon	Manosil Silicone	Autoclavable Pistolpet
Acetaldehyde	C	C	C	B			C	A	B
Acetates	C	C	C				C	C	
Acetic Acid	C	C	A	B	C		C	B	B
Acetic Anhydride	C	C	B	C	B		C	B	B
Acetone	C	C	A	C	B	A	C	A	B
Acetyl Bromide	C	C	C		B		C		C
Acetyl Chloride	C	C	C	C	C		C		C
Air	A	A	A	A	A		A	A	A
Alcohols	B	B	B	A	B		A	A	C
Alum	C	C	B	A	C		A		
Aluminum Salts		B	B	A			A	B	
Ammonia	C	C	B	A	C		B	A	A
Ammonium Acetate	B	B	B	A	B		A		
Ammonium Chloride	C	C	A	A	C		A		A
Ammonium Hydroxide	C	C	A	A	C		A	A	A
Ammonium Phosphate	C	C	A	A	C		A	A	A
Ammonium Sulfate	B	B	A	A	B		A	A	A
Amyl Acetate	C	B	C	C	B		C	B	B
Animal Oils			C	B	A		A	B	C
Aniline	C	B	C	C	B		C	B	C
Aromatic Hydrocarbons			C				B	B	C
Arsenic Salts				A			A		
Barium Salts			A	A			A		
Benzene	C	B	C	C	A		B	B	C
Benzyl Alcohol							A		
Bleaching Liquors							A		
Boric Acid (Solution)	B	B	A	A	B		A	B	
Bromine	C	C	C	C	C		A	C	C
Butane			B	A			B	C	C
Butanol	B	A	B	B	A		A		
Butyl Acetate	C	B	C	C	A		C	C	C
Calcium Salts			A	B			A	B	
Carbon Dioxide	B	B	A	A	B		A	B	B
Carbon Sulfide	C	B	C	B	B		C		
Carbon Tetrachloride	C	B	C	C	B		B	B	C
Caustic Potash			C	A			C	A	B
Caustic Soda			C	A			C	B	B
Chloracetic Acid	C	C	C	C	C		C	A	C
Chlorine (Wet)	C	C	C	C	C		A	B	C
Chlorine (Dry)	B	A	B	B	A		A		
Chlorobenzene		B	C		B		C		C
Chloroform	C	A	C	C	A		B	B	C
Chromic Acid	C	C	A	C	C		A	B	
Copper Salts			A	B			A	B	
Cresol	C	B	C	C	B		C	A	C
Cyclohexanone	C		C	C			C		C
Ethers	B	A	C	B	A		B	C	B
Ethyl Acetate	C	A	C	C	A		C	B	B
Ethyl Alcohol	B	B	B	A	B		B	A	A
Ethyl Bromide	C		C	B			C	B	
Ethyl Chloride	C		C	B			C	B	B
Fatty Acids	C	C	B	B	B		A	B	
Ferric Salts			A	A			A	B	
Formaldehyde	B	B	A	A	A		A	A	A
Formic Acid	C	C	A	A	C		A	B	B
Freon	C	B	C	B	B		C	B	B
Gasoline	C	A	C	B	A		C	B	C

CHEMICALS

CHEMICALS	Minipet Aqueous	Minipet Solvent	Minipet Acid	Econopet & Porto-Pet	Varipet, Metal Luer Lock	(All Carry "A" Rating For All Chemicals Except HF)	Manogon Tygon	Manosil Silicone	Autoclavable Pistolpet
Glucose	B	B	A	A	B		A	A	C
Glycerine		B	B	A	B		A	A	A
Hydriodic Acid	C	C	C		C		A		C
Hydrochloric Acid (Med. Conc.)	C	C	A	A	C		A	A	A
Hydrochloric Acid (Conc.)	C	C	B	A	C		A	B	B
Hydrofluoric Acid	C	C	B	C	C		C	C	C
Hydrogen Peroxide (Dil.)		B	B	B	B		A	A	B
Hydrogen Peroxide (Conc.)	C	C	B	C	C		B	A	B
Hydrogen Sulfide	C	C	A	C	A		A		A
Kerosene	C	A	C	C	A		C	C	C
Ketones	C		C	B			C	A	
Lacquer Solvent	C	B	C	C	B		C	C	C
Lactic Acid	B	B	A	A	B		A		C
Lead Acetate	C	C	C	C	B		A		B
Linseed Oil	B	B	C	A			A	C	C
Magnesium Salts	B		A	A			A		
Naphtha	C	A	C	C	A		B	B	C
Natural Gas			B	B			A	B	B
Nickel Salts			A	A			A		
Nitric Acid (Dil.)	C	C	B	B	C		A		C
Nitric Acid (Conc.)	C	C	C	C	C		B	A	C
Nitrobenzene	C	B	C	C	B		C	B	C
Nitrogen Oxides							A		
Nitrous Acid	C	C			A		A		
Oils (Animal & Mineral)	C		C	B			C	C	C
Oils (Vegetable)				B			B	B	B
Oxygen			A	A			A	A	A
Perchloric Acid	C	C		B	C		C	C	C
Phenol	C	C	B	B	C		B		C
Potassium (All)	B	B	A	A	B		A		B
Pyridine	C		C	C			C		B
Silver Nitrate	C	C	A	A	C		A		B
Soap Solutions	A	A	A	A	A		A	A	A
Sodium (All)	B	B	A	A	B		A	B	B
Stearic Acid	B	B	B	B	B		A	B	B
Sulfur Chloride	C	C	B	B	C		B		C
Sulfuric Acid (Dil.)	C	C	B	B	C		A	B	B
Sulfuric Acid (Conc.)	C	C	C	C	C		B	B	C
Sulfurous Acid	C	C	C	B	C		A	B	C
Tannic Acid	B	B	A	B	B		A	B	B
Tanning Extracts							A		
Tartaric Acid	B	B	A	A	B		A		C
Tin Salts							A		
Titanium Salts							A		
Toluene	C	A	C	C	A		C	C	C
Trichloroacetic Acid	C	C	C	C	C		B		C
Trichlorethylene	C	B	C	C	B		C	C	C
Turpentine	C	B	C	C	B		A	B	C
Urea	B	B	A	A	B		A		C
Uric Acid							A		C
Water	A	A	A	A	A		A	A	C
Xylo	C		C	C			C	C	A
Zinc Chloride	C	C	A	A	C		A	A	A



Manostat

519 Eighth Avenue, New York, N. Y. 10018

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