

CAIRE® LIBERATOR

# *Liberator*



S E R V I C E  
M A N U A L

LIBERATOR	20
	30
	37
	45
	60

# I Preface

SERVICE MANUAL

## LIBERATOR 20 LIBERATOR 30 LIBERATOR 37 LIBERATOR 45 LIBERATOR 60

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This manual covers use and maintenance of the Liberator 20, Liberator 30, Liberator 37, Liberator 45, and Liberator 60 units (see below). It is intended for use by experienced personnel only.

Model (0-6 LPM)	Side Fill	Top Fill	Dual Fill	Model (0-10 LPM)	Side Fill	Top Fill	Dual Fill	Model (0-15 LPM)	Side Fill	Top Fill	Dual Fill
L20	10562007	10564150	10660379	L20	10879389	10879434	10879477	L45	11177805	11018951	TBD
L30	10561995	10564133	10564176	L30	10879400	10879442	10879493	L60	11075948	11075972	11374876
L37	10562023	10564168	10660328	L37	10879418	10879451	10879514				
L45	10562015	10564141	10564184	L45	10879426	10879469	10879522				
L60	11068983	11069020	11208641	L60	11075905	11075921	11374892				

No attempt should be made to fill or maintain this equipment until both this manual and Patient Operating Instruction booklet have been read and fully understood.

The following abbreviations are used throughout this manual:

FCV — Flow Control Valve	PRV — Primary Relief Valve
LED — Light Emitting Diode	QDV — Quick Disconnect Valve
LO2 — Liquid Oxygen	RA — Return Authorization
LPM — Liters Per Minute	RP — Repair Procedure
NER — Normal Evaporation Rate	R/R — Removal and Replacement
POI — Patient Operating Instructions	SRV — Secondary Relief Valve

Definition of Terms

**WARNING** Description of a condition that can result in personal injury or death.

**CAUTION** Description of a condition that can result in equipment or component damage.

**NOTE** A statement containing information important enough to emphasize or repeat.

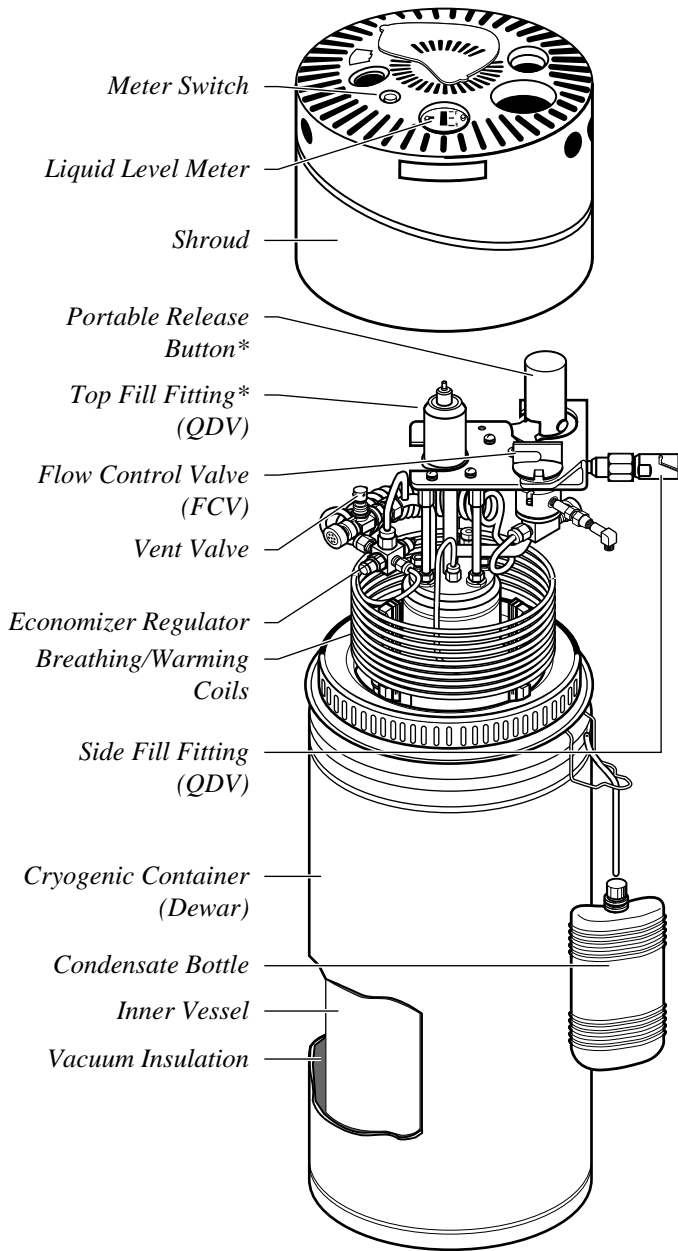
**(ITEM)** Item numbers used throughout this manual are shown on the illustrations beginning on page 35.

# Table of Contents II

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I. Preface	2
II. Table of Contents	3
III. Equipment Description	4
IV. Specifications	5
V. Safety	6
VI. Theory of Operation	7-9
VII. Unpacking/Setup Instructions	10
VIII. Operation	11-12
IX. Routine Maintenance	13-14
X. Troubleshooting/Repair	15
Troubleshooting Chart	16-17
Repair Procedures	18-31
Service Tools/Equipment/Supplies	32
XI. Parts Illustration (Top Fill G3.0 Units)	35
Parts Illustration (Side Fill G3.0 Units)	38
Parts Illustration (Dual Fill G3.0 Units)	42
Parts Illustration (Dual Fill G3.1 Units)	45
Parts Listing (Top Fill G3.0 Units)	33-34
Parts Listing (Side Fill G3.0 Units)	36-37
Parts Listing (Dual Fill G3.0 Units)	39-41
Parts Listing (Dual Fill G3.1 Units)	43-44
XII. Ordering Information/Return Policy	46-47

# III Equipment Description



The CAIRE™ Liberator is the stationary component of the Liberator/Stroller supplementary oxygen system. The Liberator incorporates a stainless steel cryogenic container with the valves, plumbing, and associated hardware required to deliver gaseous oxygen to the patient at near ambient temperature.

The Liberator is comprised of four major assemblies. Grouped according to function, they are:

1. Cryogenic Container – This assembly is a double walled, vacuum insulated dewar for storing liquid oxygen at approximately -300 degrees Fahrenheit. The inner pressure vessel is designed to safely hold liquid oxygen and is protected from over pressurization with the primary relief valve. The vacuum insulation between the inner and outer vessel keeps the outside heat from evaporating the cold liquid
2. Breathing Circuit – This circuit consists of the manifold assembly, fixed orifice rotary flow control valve (FCV), a breathing coil, and a warming coil. It withdraws liquid oxygen from the cryogenic container, warms it to near ambient temperature, and meters the oxygen gas to the patient. The water that is formed when the cold liquid is converted to gas is collected in the condensate bottle. An economizer regulator is used to reduce any excessive head pressure while oxygen is being provided to the patient.
3. Shroud Assembly – The shroud assembly houses and protects the breathing circuit and liquid level meter. Labels listing safety information and patient operating instructions are affixed to the side of the shroud.
4. Meter – This system uses a capacitance probe and an electronic level meter (LED) readout to measure and display the product contents at the touch of the meter switch.

An optional roller base can be provided to help move the Liberator.

\* For Top Fill or Dual Models Only

# Specifications (Nominal Values) IV

	LIBERATOR 20	LIBERATOR 30	LIBERATOR 37	LIBERATOR 45	LIBERATOR 60
<b>Capacity</b>					
Pounds (LO <sub>2</sub> ):	52	75	92	112	144
Liquid Liters:	21.6	31.2	38.3	46.6	60
Gaseous Liters:	17,780	25,650	31,460	38,300	49,200
<b>Selectable Flow Rates</b>					
Liters per minute (0-6 LPM):	Off, .25, .5, .75, 1, 1.5, 2, 2.5, 3, 4, 5, 6				
Liters per minute (0-10 LPM):	Off, .5, .75, 1, 1.5, 2, 3, 4, 5, 6, 8, 10				
Liters per minute (0-15 LPM):	Off, .5, 1, 2, 3, 4, 5, 6, 8, 10, 12, 15				
<b>Flow Rate Accuracy</b> ± .1 liter per minute or ±10% of flow setting, whichever is greater					
<b>Hours of Operation</b>					
@ 2 liters/minute:	148	213	262	319	410
<b>Standard Fill Connections</b>					
	Side Top	Side Top	Side Top	Side Top	Side Top
<b>Operating Pressure</b>					
(Economizer Regulator) PSIG:	20	20	20	20	20
<b>Primary Relief Valve Setting</b>					
PSIG:	23	23	23	23	23
<b>Secondary Relief Valve Setting</b>					
PSIG:	30	30	30	30	30
<b>Normal Evaporation Rate</b>					
Pounds per day:	1.5	1.5	1.5	1.5	1.6
<b>Filling Time (Fast Fill Technique)</b>					
Minutes: Warm	2.5	3.0	3.5	4.0	5.5
Cold	1.5	2.0	2.5	3.0	4.0
<b>Height</b>					
Inches:	24.5	29.5	32.75	37	39
<b>Diameter</b>					
Inches:	14	14	14	14	16
<b>Weight, Empty</b>					
Empty (Lbs.):	39	45	50	55	66
Full (Lbs.):	91	120	142	167	210
<b>Fill Connector Type</b>					
	Side Mounted Rotary Coupling (Standard)				
	Top Mounted Push Coupling (Optional)				

# V Safety

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Oxygen, as it exists at standard atmospheric pressure and temperature, is a colorless, odorless, and tasteless gas. Oxygen constitutes 21% of the atmosphere, by volume. Aside from its well-documented ability to sustain life, oxygen also supports combustion, even though it is nonflammable. Many substances which will burn in air, burn at a faster rate and at a higher temperature in an oxygen enriched atmosphere. A few materials that do not burn in air will burn as the oxygen concentration increases. Some greases and many liquid solvents become extremely hazardous materials when placed in an oxygen-enriched environment. In its liquid form, oxygen is still odorless and tasteless, but is now pale blue in color. At an operating pressure of 20 psig, the temperature of liquid oxygen is about -280° Fahrenheit. Skin exposed to such a low temperature can become severely frostbitten.

These hazards require that certain safety precautions be taken when working with or around gaseous and/or liquid oxygen:

1. Never permit combustible substances such as greases, oils, solvents, or other compounds not oxygen compatible to contact any component of the unit exposed to higher-than-atmospheric concentrations of gaseous or liquid oxygen. This especially applies to tubing, fittings, and valves.
2. Keep the oxygen equipment away from open flames or electrical appliances such as heaters, stoves, toasters, and other devices with heating elements.
3. Never permit smoking in an area where oxygen equipment is repaired, filled, or used.
4. Always wear goggles, a face shield, and insulated gloves when working with or around liquid oxygen.

While CAIRE equipment is designed and built to the most rigid standards, no piece of mechanical equipment can ever be made 100% foolproof. Strict compliance with proper safety practices is necessary when using a Liberator or Stroller. We recommend that our distributors emphasize safety and safe handling practices to their employees and customers. While safety features have been designed into the unit and safe operations are anticipated, it is necessary that all distributor personnel carefully read and fully understand **WARNINGS**, **CAUTIONS**, and **NOTES** throughout the manual. Periodic review of this information is recommended.

**WARNING:** Excess accumulation of oxygen creates an oxygen-enriched atmosphere (defined by the Compressed Gas Association as an oxygen concentration above 23%). In an oxygen-enriched atmosphere, flammable items may burn vigorously and may explode. Certain items considered non-combustible in air may burn rapidly in such an environment. Keep all organic materials and other flammable substances away from possible contact with oxygen; particularly oil, grease, kerosene, cloth, wood, paint, tar, coal dust, and dirt which may contain oil or grease. **DO NOT** permit smoking or open flame in any area where oxygen is stored, handled, or used. Failure to comply with this warning may result in serious personal injury.

**WARNING:** In the event a unit is dropped, tipped over, or unreasonably abused, immediately, but cautiously, raise the container to its normal vertical position. If substantial container damage has occurred, remove the liquid oxygen from the vessel in a safe manner (RP 24). Purge the unit with an inert gas (nitrogen) and promptly return it to CAIRE for inspection. The container should be prominently marked "CONTAINER DROPPED, INSPECT FOR DAMAGE." Failure to comply with these procedures may result in personal injury and can seriously damage the container.

**WARNING:** Personnel must remove liquid oxygen and depressurize the Liberator or Stroller before removing parts or loosening fittings from a unit. Failure to do so may result in personal injury because of the extreme cold of the liquid oxygen and the pressure in the vessel. External valves and fittings can become extremely cold during liquid transfer.

**WARNING:** During transfer of liquid oxygen, components will become extremely cold. Care should be used to avoid any contact with these components, as serious burns may result.

**WARNING:** Keep filled unit upright at all times. Tip over of filled unit may result in liquid oxygen leakage and/or oxygen enriched atmosphere.

**WARNING:** Only use replacement equipment which is compatible with liquid oxygen and has been cleaned for oxygen use. Do not use regulators, fittings, hoses, etc. which have been previously used in a non-oxygen service.

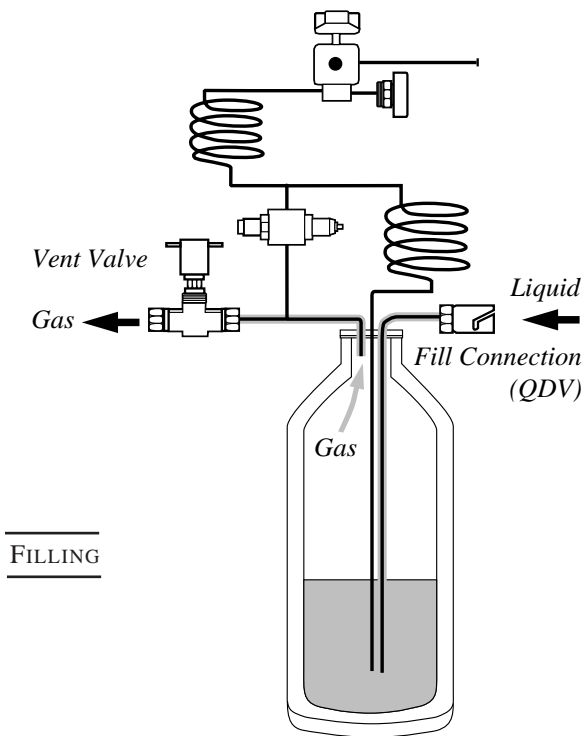
*CAUTION: The Liberator should be moved by utilizing the roller base or hand truck. The Liberator must be used, stored, and transported in a vertical position. Do not lay, store, or ship on its side.*

# Theory of Operation IV

## Filling

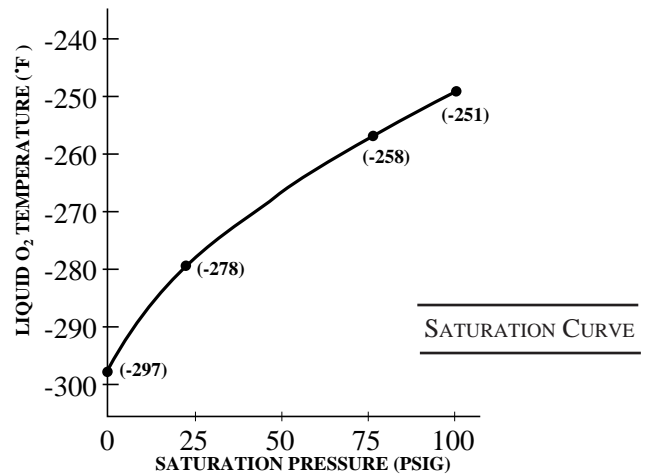
The Liberator is filled by connecting a pre-purged transfer line with a fill adapter from a larger liquid oxygen source to the Liberator female (side fill) or male (top fill) quick disconnect valve. The Liberator vent valve is opened. The pressure of the oxygen gas above the liquid in the source container forces liquid oxygen through the transfer line and into the Liberator inner vessel.

There will be some oxygen vaporized during filling. This gas is discharged through the vent valve. When the Liberator is full, liquid oxygen is expelled. Closing the Liberator vent valve and disconnecting the fill adapter from the Liberator QDV terminates the fill process.



## Saturation Pressure

The saturation point of a liquid is a steady-state condition where the liquid has absorbed the maximum amount of heat it can. Such a liquid is defined as being at its saturation pressure. For each saturation pressure, there is a corresponding temperature; the higher the saturation pressure, the higher the liquid temperature.



There are two conditions which can seriously affect the overall efficiency and operation of the system:

1. Saturation pressure of the liquid oxygen in the fill source is substantially higher than the Liberator operating pressure (oversaturated).
2. Saturation pressure of the liquid oxygen in the fill source is substantially lower than the Liberator operating pressure (undersaturated).

For example, when a Liberator is filled from a liquid source saturated at 100 psig, larger transfer losses will occur. This is because the Liberator is designed to operate at 20 psig, and the liquid it is filled with is saturated at a much higher pressure and at its correspondingly higher temperature. It is necessary for this liquid to desaturate to a lower pressure and temperature before the relief valve will close and the Liberator will operate properly.

In order to become saturated at 20 psig, the liquid oxygen must give up enough heat for its temperature to be lowered to that temperature corresponding to a pressure of 20 psig, as shown in the graph. It accomplishes this by a vigorous boiling action. All of the gas generated by this boiling is vented through the primary relief valve, and is lost.

If the saturation pressure of the liquid oxygen in the filling vessel is lower than the normal operating pressure of the Liberator, e.g., 10 psig, then the pressure building rod of the Liberator must function to raise the system pressure to the operating pressure of 20 psig. It may require as much as several hours for the undersaturated liquid to become saturated at 20 psig. The time required for saturation to 20 psig depends on the initial liquid saturation pressure.

# VI Theory of Operation

**WARNING: Low oxygen flow rates to the patient may result if the Liberator is filled with under-saturated liquid oxygen.**

To minimize the effect of undersaturated liquid on the Liberator, a fixed orifice has been installed in the outlet of the vent valve. This orifice regulates the back pressure in the unit during the fill process, resulting in more correct saturation pressures in the Liberator.

## Operation

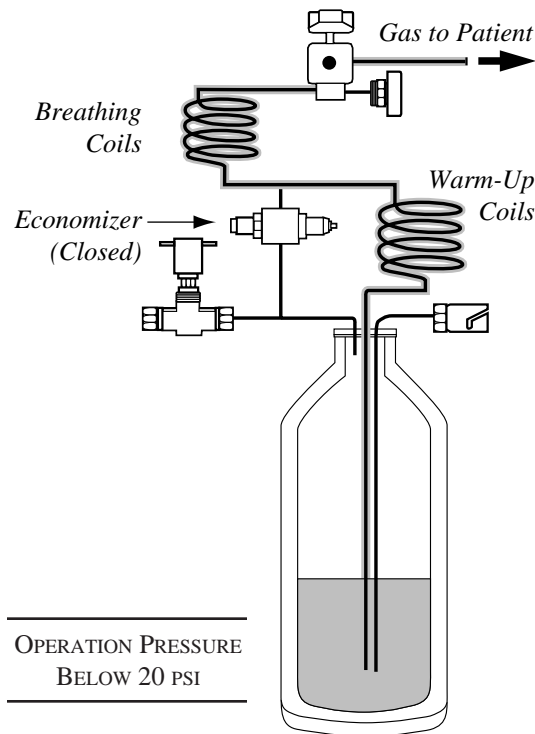
With liquid oxygen in the unit and the flow control valve and vent valve closed, the pressure in the inner vessel will remain near the primary relief valve setting of 23 psig.

In the Liberator, as in all vacuum-insulated cryogenic containers, some liquid (oxygen in this case) is always evaporating into a gas because no insulating system is perfect. The rate of generation of this gas, with the flow control valve closed, is called the normal evaporation rate (NER). This gas is lost through the primary relief valve.

When the flow control valve is at any setting other than off, and the economizer valve is open (pressure above 20 psig), gaseous oxygen is forced from the head space in the inner vessel, through the economizer valve, to the breathing coil.

This process conserves or “economizes” liquid oxygen by withdrawing the head gas first, instead of allowing it to escape through the relief valve.

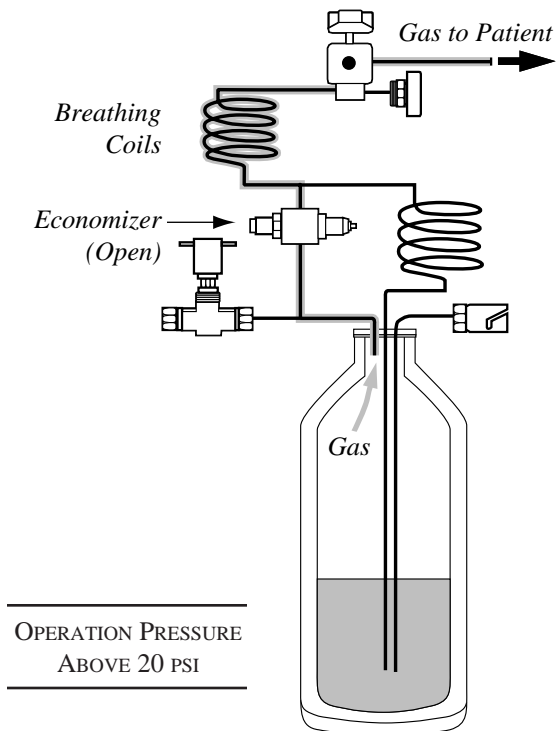
In the breathing coil, the cold gaseous oxygen is warmed to near-ambient temperature while flowing to the flow control valve, where it is metered and dispensed.



Whenever gas is removed from the space above the liquid oxygen, the inner vessel internal pressure begins to drop slightly. When the pressure drops to 20 psig, the economizer valve closes, forcing liquid oxygen up the withdrawal tube and through the warming coil where it becomes gas.

The gas then flows through the bypass tee to the breathing coil, the flow control valve, and then the patient.

As the pressure in the container increases over 20 psig, the economizer valve opens, and the cycle repeats, maintaining constant oxygen flow, at the set flow rate, to the patient.





# Theory of Operation VI

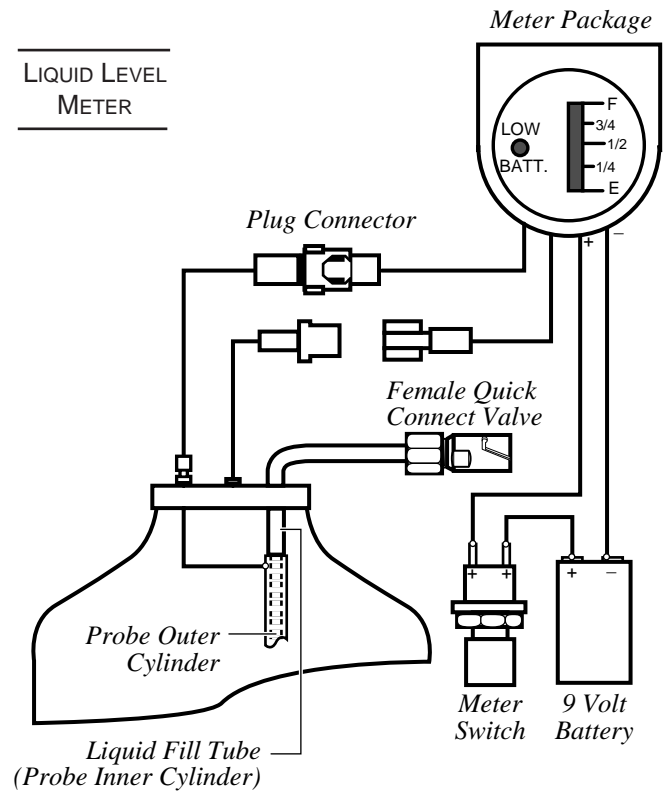
## Liquid Level Measurement

Liberators are equipped with a unique liquid level measurement system. This system measures the level of liquid oxygen inside the unit with a capacitance probe and displays that liquid level on an LED bar graph meter called "Sur-Cal 3™".

The liquid level probe consists of two concentric stainless steel cylinders, which are inside the inner vessel. As the liquid oxygen level rises, the capacitance of this assembly goes up. The meter measures this capacitance and displays it on the LED bar graph.

Electrical connection between the Sur-Cal 3™ meter and the probe is made via a single conductor plug connector. The male plug carries the coaxial cable from the meter. The female receptacle carries the same wire from the probe. A single ground wire is connected from the meter to a male spade terminal on the corresponding meter ground wire. The Sur-Cal 3™ is equipped with a short-circuit indicator which turns all LED's "off" when capacitance above approximately 375 pF is reached.

The meter is powered by a nine volt battery. The meter has a low battery (LOW BATT) indicator which signals the need for battery replacement.



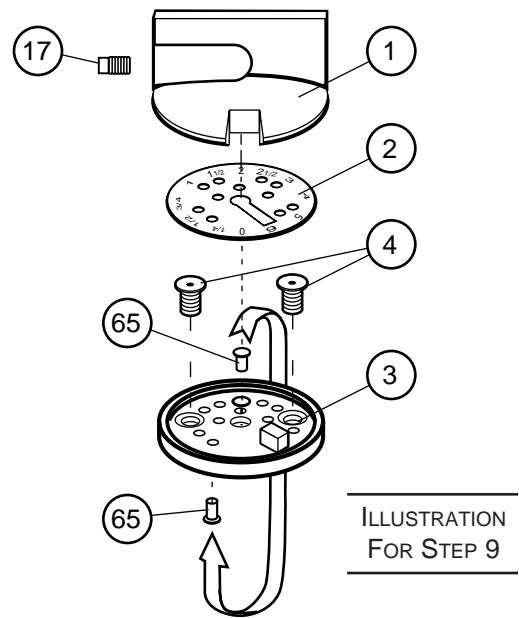
# VII Unpacking and Setup

## Unpacking

1. Always inspect carton for shipping damage. Report any damage to freight company before signing bill of lading.
2. Check description on carton against your order.
3. Unpack unit, including condensation bottle, POI, and humidifier elbow kit.
4. Set aside several sets of packing materials in case a unit must be returned to factory.

## Setup

1. Install condensation bottle on bracket located below shroud. Remove cap from bottle. Put condensation hose inside bottle.
2. Install humidifier elbow following instructions in carton.
3. Visually inspect the Liberator for damage from improper handling. Note any container dents, cracks in shroud, missing or loose screws or other hardware, bent quick disconnect valve or humidifier adapter.
4. Check for smooth operation of the flow control selector, making sure that a positive detent is felt at all settings. The flow control knob should be secure and properly aligned.
5. Check the vent valve (Item 41) for smooth operation.
6. If possible, connect a Stroller to the Liberator to check for smooth coupling, and to make sure the Stroller is in proper alignment with the Liberator when mated.
7. Verify operation of the Sur-Cal 3™ meter by depressing the push button. LED segments will light, displaying the level of liquid oxygen. If the unit is empty, only the bottom segment should light. If it does not, or if other erroneous indications are given, refer to the Troubleshooting/Repair Section.
8. Check all labels for damage and wipe away any dust on unit with a clean, dry, lint-free cloth.



9. If desired, flow control knob (Item 1) can be adjusted so it will not exceed maximum prescribed flow rate.
  - a. Using hex key wrench, loosen setscrew if used (Item 17) in flow control knob and remove knob (Item 1).
  - b. Remove flow rate decal number disc (Item 2).
  - c. Remove two hex head screws (Item 4) from flow lock plate (Item 3) and remove plate.
  - d. Remove locking pin (Item 65) from its storage position on flow lock plate (Item 3) and place in underside of hole corresponding to maximum allowable flow rate.
  - e. Replace flow lock plate (Item 3), number disc (Item 2) and knob. Tighten screws (Item 4) to 4-6 inch-pounds. Verify flow lock is at correct position.

# Operation VIII

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## Transport

*CAUTION: Always ship, store, or transport a Liberator, empty or full, in an upright position, properly secured to prevent damage.*

Specifically designed roller bases are available for moving the Liberators short distances on smooth surfaces. Hand trucks are also available for moving the Liberators.

The Liberator 20, 30, 37, 45 and 60 may be moved about or transported in a vehicle while full without damage. However, the equipment should not be dropped or handled roughly, or necktube damage may occur.

## Filling

### 1. Fill Source

- a. Fill source must contain a sufficient amount of liquid oxygen to completely fill the Liberator (approximately 120% of Liberator volume).
- b. The liquid oxygen in the fill source must be saturated at 35-60 psig (50 psig is optimal).
- c. The fill source must have correct fitting (5/8" \* 45° male flare) to connect to transfer line.

**WARNING: Fill source must be in a well ventilated area to prevent formation of oxygen enriched atmosphere.**

### 2. Fill Procedure

#### a. Required Equipment:

- ◆ Fill source as outlined above
- ◆ Liquid oxygen transfer line
- ◆ Male transfer line adapter for side fill Liberators
- ◆ Female transfer line adapter for top fill Liberators
- ◆ Liberator vent valve wrench
- ◆ Eye protection
- ◆ Insulated gloves

- b. If refilling partially filled Liberator, verify flow rates are within tolerance specifications before filling.
- c. Verify that liquid level meter is operating properly. The LED display should indicate approximate level in unit. The low battery LED should not be lit.

**NOTE:** If flow rates are out of specifications or liquid level meter operates improperly, refer to Troubleshooting/Repair section.

- d. Verify that fill source has enough properly saturated (35-60 psig) liquid oxygen to fill Liberator.
- e. Connect transfer line to fill source. Connect proper transfer line adapter to transfer line.
- f. Fully open liquid valve on fill source.

**WARNING: Wear insulated gloves and eye protection whenever working with liquid oxygen.**

# VIII Operation

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- g. For male fill adapter:

Purge transfer line by placing adapter poppet (remove protective cover) against side of unit and pressing in until poppet opens. Hold the poppet open for approximately five seconds, then release.

NOTE: Purge the transfer line any time fill source valve has been closed.

- h. Wipe reservoir fill connector with lint free rag if moist.
- i. Weigh unit as required by local and federal standards.
- j. Open reservoir vent valve.
- k. Connect transfer line (liquid hose) to reservoir to begin fill.
- l. Connect a pressure gauge to oxygen outlet and open the flow control valve to 2 lpm or greater.
- m. While filling throttle the vent valve as required to keep pressure at 20 psi nominal.

An alternate method to throttle the vent valve is to attach a flow meter to the oxygen outlet, set the flow control valve to 2 lpm, and then throttle the vent valve to maintain a flow of 2 lpm. This is equivalent to using a pressure gauge.

- n. When liquid spurts from vent outlet, disconnect transfer line.
- o. Close reservoir vent valve immediately after removing transfer line.
- p. Disconnect pressure gauge (or flow meter) from oxygen outlet.

*CAUTION: Do not allow excessive venting of liquid oxygen through the vent valve. Prolonged exposure may freeze the valve in the open position.*

- q. Replace protective cover on adapter QDV and hang adapter and transfer line using hook provided.
- r. Verify that all flow rates are within tolerance specifications. Verify that liquid level meter indicates full.

NOTE: The liquid level indicating system is accurate only after the vent valve is closed, and the oxygen has been stabilized for five minutes.

# Routine Maintenance/Schedule A, Annual IX

There are two schedules for routine maintenance which the home health care distributor may follow. These schedules allow the distributor maximum flexibility while assuring that equipment is operating properly.

## Schedule A – Annual

### A. Introduction

Routine maintenance is a series of steps used to assure that equipment is functioning properly.

1. If a unit fails to pass a given test, one of two things may be done.
  - a. Refer to Troubleshooting/Repair (Section X) of this manual.
  - b. Return to CAIRE for repair.
2. Schedule – Maximum of one year between routine maintenance testing. Unit should be tested when a problem is suspected.

### B. Procedure

Follow the steps in order listed. If the unit fails any step, refer to Troubleshooting/Repair (Section X) of this manual.

1. Visual Inspection:
  - a. Remove any LO<sub>2</sub> prior to maintenance (RP24).
  - b. Look for damaged or missing parts.
  - c. Verify that meter reads empty (one LED) and that the low battery LED is not lit.
2. Component Test:
  - a. Remove shroud (RP2).
  - b. Pressurize to 25 psig (RP12) and check that PRV is open.
  - c. Pressurize to 34 psig (RP12) and check that SRV is open.
  - d. Recalibrate meter (RP5).
  - e. Test pressure retention (RP15).
  - f. Replace shroud (RP2).
3. Flow Test:
  - a. Fill with approximately 15 lbs. (2 LEDs) of properly saturated LO<sub>2</sub>.
  - b. Set FCV to maximum setting and run for one hour minimum.
  - c. Check all flow settings to the following chart and check pressure to be at least 18 psi.

Reservoir Flow Test	
FCV Setting	LPM
OFF	-0-
0.25	0.15 to 0.35
0.50	0.40 to 0.60
0.75	0.65 to 0.85
1.00	0.90 to 1.10
1.50	1.35 to 1.65
2.00	1.80 to 2.20
2.50	2.25 to 2.75
3.00	2.70 to 3.30
4.00	3.60 to 4.40
5.00	4.50 to 5.50
6.00	5.40 to 6.60
8.00	7.20 to 8.80
10.00	9.00 to 11.00
12.00	10.80 to 13.20
15.00	13.50 to 16.50

### 4. Check Efficiency of Unit:

- a. Set FCV to zero and allow bottle to warm up (10-15 minutes).
- b. Inspect bottle for cold or sweaty condition and for excessive venting from relief valve (some venting is normal).
- c. If either condition is observed, conduct NER test (RP32).

### 5. Prepare for Use:

- a. Empty contents (RP24).
- b. Allow unit to sit until warm (2-4 hours).
- c. Clean outside of unit with household glass cleaner and lint free cloth (do not get in any valves).

# IX Routine Maintenance/Schedule B, Continuous

## Schedule B – Continuous

### A. Introduction

Continuous maintenance is a set of test or inspections done consistently to assure equipment is functioning properly. It can be done with equipment in service, by drivers or other personnel.

1. If a unit fails to pass a given test, it should be taken out of service and sent to the Repair Center/Department for further inspection.
2. Schedule – Checks are made when the driver sees patient and when moving equipment between patients.

### B. Procedure

These inspections/tests are done by driver as part of the Standard Fill Procedure every time the reservoir is filled.

1. Visual Inspection:
  - a. Broken shroud.
  - b. Cold sweaty bottle (vacuum problem).
  - c. QDV not deformed.
2. Check prescription flow rate(s). Erie liter meter ( $\pm 0.25$  lpm) can be used.
3. Check meter. Push meter button before fill and verify that battery is not low and that meter is within one LED of table below. After filling, verify that meter reads full.

Contents vs. Meter Reading					
LED	Pounds of Oxygen				
	Lib 20	Lib 30	Lib 37	Lib 45	Lib 60
1	0.0-9.8	0.0-14.6	0.0-17.8	0.0-21.2	0.0-21.6
2	9.9-14.7	14.7-21.9	17.9-26.7	21.3-31.8	21.7-33.4
3	14.8-19.6	22.0-29.2	26.8-35.6	31.9-42.4	33.5-53.1
4	19.7-24.5	29.3-36.5	35.7-44.5	42.5-53.0	53.2-71.9
5	24.6-29.4	36.6-43.8	44.6-53.4	53.1-63.6	72.0-86.3
6	29.5-34.3	43.9-51.1	53.5-62.3	63.7-74.2	86.4-100.5
7	34.4-39.2	51.2-58.4	62.4-71.2	74.3-84.8	100.6-121.9
8	39.3-44.1	58.5-65.7	71.3-80.1	84.9-95.4	122.0-130.9
9	Above 44.1	Above 65.8	Above 80.2	Above 95.5	Above 131

These inspections/tests are done between patients.

1. Visual Inspection:
  - a. Broken shroud/flow control knob.
  - b. Cold sweaty bottle or excessive venting from relief valve (vacuum problem). Some venting from relief valve is normal.
  - c. QDV not deformed.
  - d. Inspect under shroud (without removal) for any visible dirt or contaminants.
  - e. Inspect drain tube for visible dirt. Clean with a 6" cotton swab to remove dirt.
2. Verify that meter battery is not low and meter is within one LED of table. If unit is empty, verify meter reads empty, then fill with approximately 15 pounds of liquid oxygen and verify with chart.
3. Set FCV to maximum flow rate for one hour. Check all flow settings to the following chart and check pressure to be at least 18 psi.

Reservoir Flow Test	
FCV Setting	LPM
OFF	-0-
0.25	0.15 to 0.35
0.50	0.40 to 0.60
0.75	0.65 to 0.85
1.00	0.90 to 1.10
1.50	1.35 to 1.65
2.00	1.80 to 2.20
2.50	2.25 to 2.75
3.00	2.70 to 3.30
4.00	3.60 to 4.40
5.00	4.50 to 5.50
6.00	5.40 to 6.60
8.00	7.20 to 8.80
10.00	9.00 to 11.00
12.00	10.80 to 13.20
15.00	13.50 to 16.50

4. If unit fails one of the above test, return to Repair Center/Department or CAIRE. if units passes all tests, clean outside of unit with household glass cleaner and lint free cloth (do not get in any valves).

# Troubleshooting (Table of Contents) X

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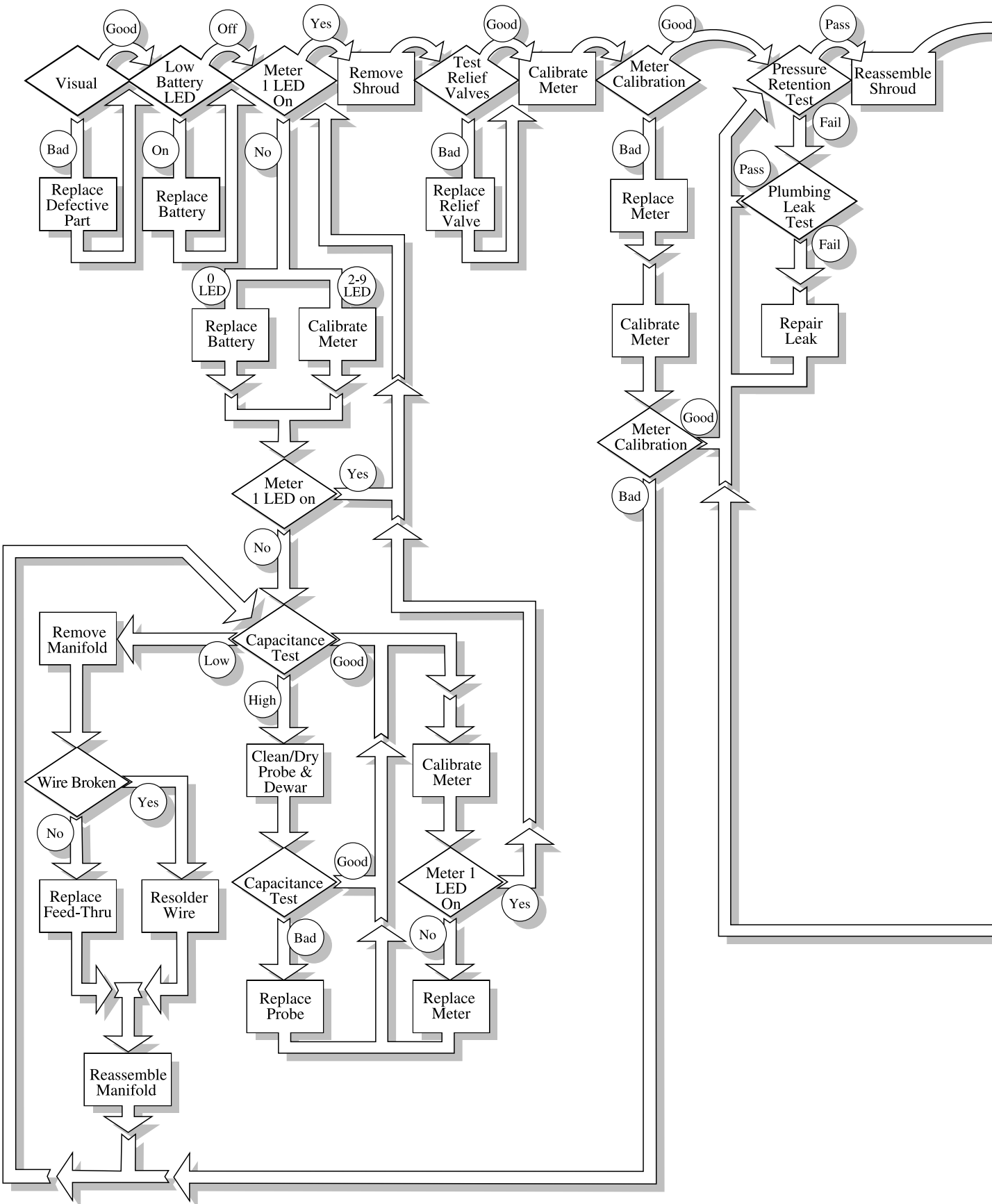
Introduction .....	15
Troubleshooting Charts .....	16-17
Procedures	
RP1    General .....	18
RP2    Shroud Assembly R/R .....	19
RP3    Condensation Bottle Bracket R/R .....	19
RP4    Battery R/R .....	19
RP5A   Sur-Cal 3™ Meter Calibration .....	19-21
RP5B   Sur-Cal 3.1™ Meter Calibration .....	21
RP6    Manifold Capacitance Test .....	22
RP7    Manifold Assembly R/R .....	22-23
RP8    Resolder Feed-thru Wire .....	23
RP9    Manifold Harness Assembly R/R .....	23
RP10   Clean/Dry Probe and Dewar .....	23
RP11   Sur-Cal 3™ Meter R/R .....	24
RP12   Relief Valve Test .....	24
RP13   Primary Relief Valve (PRV) R/R .....	24
RP14   Secondary Relief Valve (SRV) R/R .....	25
RP15   Pressure Retention Test .....	25
RP16   Plumbing Leak Test .....	25
RP17   Warming and Breathing Coil Assembly R/R .....	26
RP18   Vent Valve R/R .....	26
RP19   Fill .....	26
RP20   QDV Lip Seal R/R (Side Fill Only) .....	26-27
RP21   QDV Poppet Assembly R/R (Side Fill Only) .....	27
RP22   QDV Assembly R/R (Top Fill and Dual Only) .....	27
RP23   Stroller Pop-Off Assembly (Top Fill and Dual Only) .....	27
RP24   Empty Unit .....	28
RP25   Warm Unit .....	28-29
RP26   Flow Rate Test .....	29
RP27   Operating Pressure Test .....	29
RP28   Flow Meter Verification .....	29
RP29   Economizer Regulator R/R .....	30
RP30   Flow Control Valve (FCV) R/R .....	30
RP31   Dewar R/R .....	30-31
RP32   Normal Evaporation Rate (NER) Test .....	31
RP33   Cleaning Unit .....	31
Tools .....	32
Fixtures/Equipment .....	32
Supplies .....	32

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## Introduction

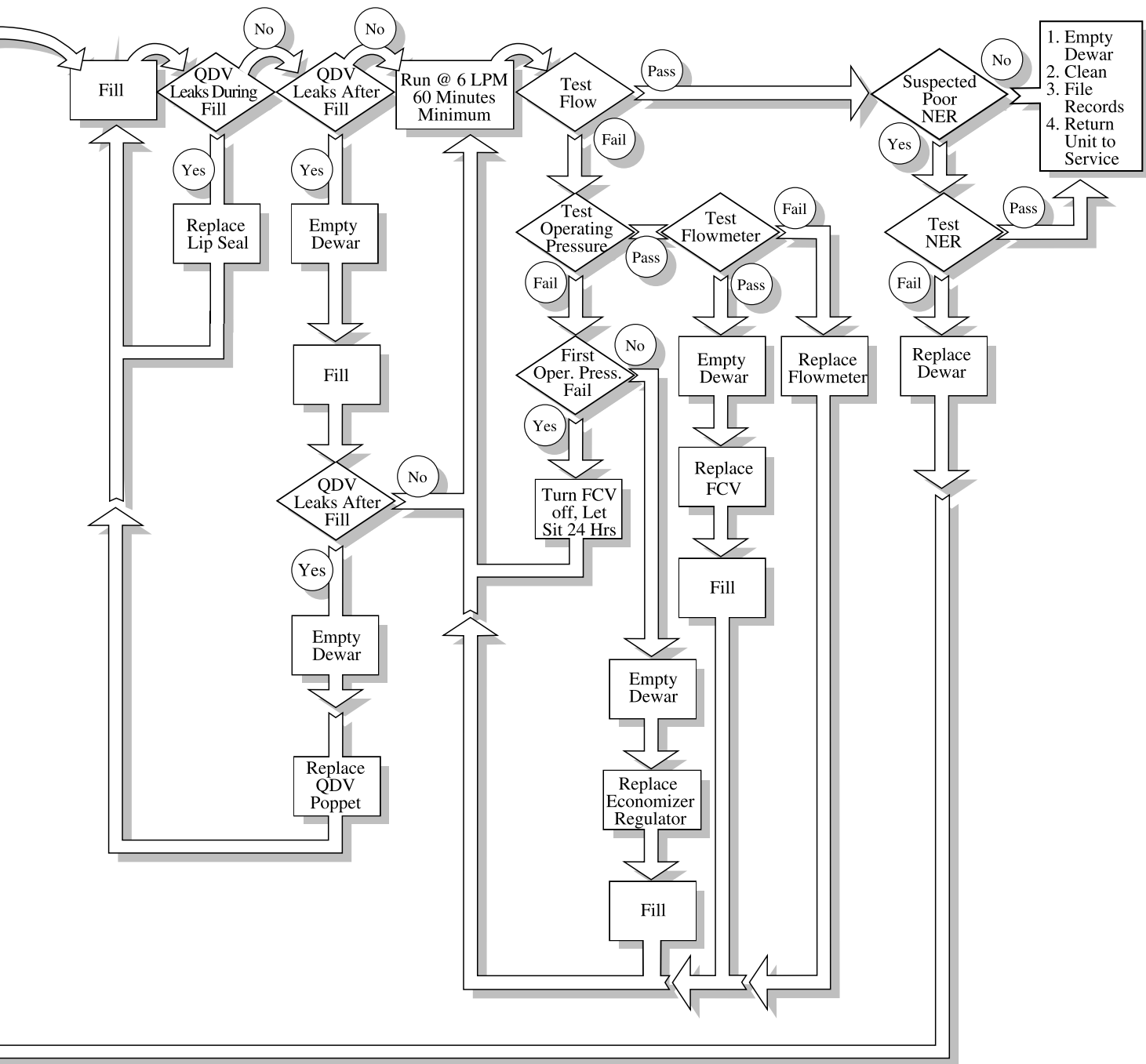
1. These procedures are designed to be performed only by qualified personnel with proper equipment.
2. Any failure during routine maintenance checks will refer you to this section. See troubleshooting chart for appropriate procedure.

# X Troubleshooting Chart





# Troubleshooting Chart X



To use the Troubleshooting Chart:

- ◆ Start at the upper left corner.
- ◆ The top line shows the steps of routine maintenance.
- ◆ Unless otherwise noted by the arrows, the flow through the chart is down or to the right.

# X Repair Procedures

---

## RP1 – General

The following procedures have been carefully prepared to allow proper removal and replacement of defective components and should be used in conjunction with the Troubleshooting Chart and the tests in this section.

**WARNING:** Make sure the unit is empty and vent valve is open before replacing any component, except shroud assembly components or Lip Seals.

**WARNING:** The worker's hands, tools, and clothing should be free of all oils and greases.

**WARNING:** Parts that are welded in place must not be replaced in the field. Should these parts fail, return complete assembly or sub-assembly to factory for repair. DO NOT use solder or silver solder to repair broken welds.

**WARNING:** The manufacturer of Krytox warns users not to allow Krytox fluorolubricant to contaminate tobacco products. Wash Krytox from hands before smoking.

**WARNING:** Do not use glues, thread locking compounds or unapproved sealants on any repairs.

*CAUTION:* When replacing components, make sure that new part is oriented exactly the same as original part prior to installation.

*CAUTION:* Some components require a specific amount of torque when assembling. Follow torque requirements where specified.

**NOTE:** All replacement parts must be factory approved, cleaned for oxygen service, and stored in sealed plastic bags. The repair area must be clean and separate from other areas. Room air should be filtered, and as free from dust, soot, and other contaminants as possible.

**NOTE:** When replacing components with pipe threads, use TEFLON tape thread sealant. Apply two rounds of TEFLON tape to threads near end of component, avoiding first thread.

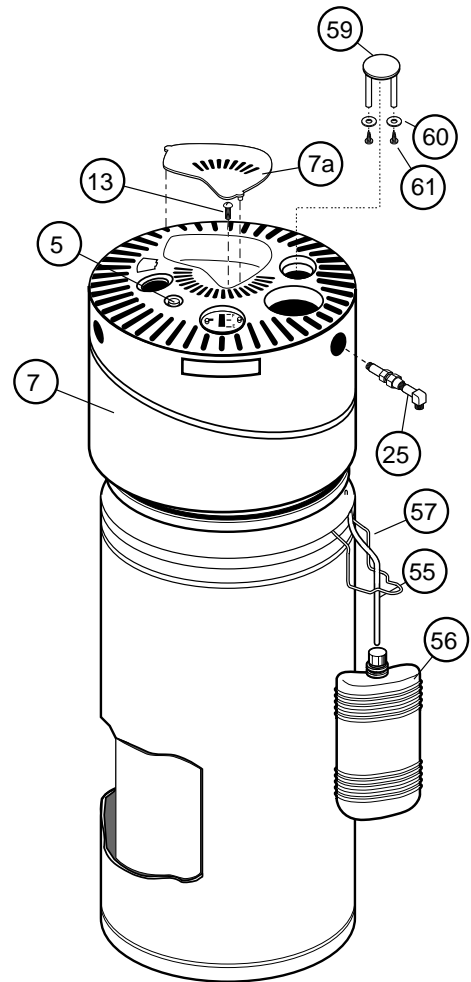
**NOTE:** When assembling new compression fittings, tighten 1/8", 1/4" and 1/2" nuts eight flats after finger tight and 3/16" nuts five flats after finger tight. When reassembling previously used compression fittings, tighten nuts one to two flats after finger tight.

# Repair Procedures X

## RP2 – Shroud Assembly R/R

ILLUSTRATION FOR RP 2 & 3

- a. Remove humidifier adapter (Item 25) from FCV (Item 24).
- b. Remove top fill shroud cover (Item 7a) if applicable.
- c. Remove the one shroud mounting screw (Item 13).
- d. Remove shroud (Item 7) by lifting up and moving side-ways to clear the QDV (Item 15) or lifting straight up and off for the top fill model.
- e. Disconnect manifold harness assembly (Item) located under shroud (Item 7).
- f. To replace shroud assembly, reverse above procedure. Torque humidifier adapter (Item 25) to 30-50 inch-lbs. on aluminum FCV (Item 24).



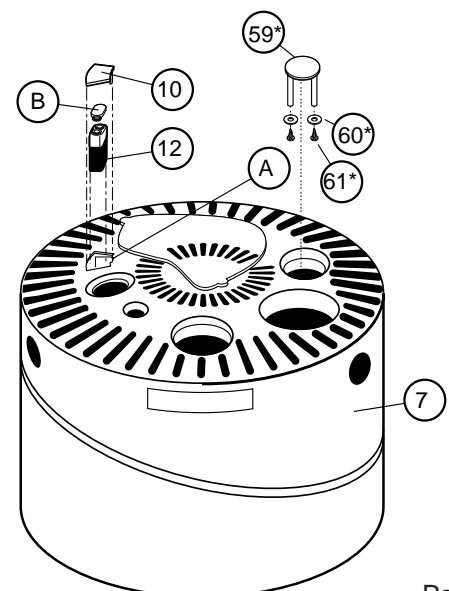
## RP3 – Condensation Bottle Bracket R/R

- a. Remove condensate drain tube from bottle (Item 55) and remove bottle from bracket (Item 56).
- b. Remove condensate bottle bracket (Item 57) squeezing legs together and pulling straight down.
- c. To replace bracket, reverse above procedure.

## RP4 – Battery R/R

- a. Insert screwdriver blade into slot (Item A) in battery cover (Item 10), located in top of shroud (Item 7), and pry up lightly. Battery cover (Item 10) will pop up.
- b. Remove battery covers (not shown).
- c. Remove battery (Item 12) from cover (Item 10).
- d. Remove terminal clip (Item B) from battery (Item 12).
- e. To replace battery (Item 12), reverse above procedure.

ILLUSTRATION FOR RP 4



## RP5A – Sur-Cal 3™ Meter Calibration

- a. Simulator Box Calibration Procedure:
  1. Connect adapter (Item A) to capacitance meter (Item B).
  2. Turn on capacitance meter (Item B) and select 200 pF range.
  3. Move zero adjustment on front of meter (Item B) until display reads zero.
  4. Connect simulator (Item C) to adapter (Item A).

# X Repair Procedures

ILLUSTRATION FOR RP 5A (section a)

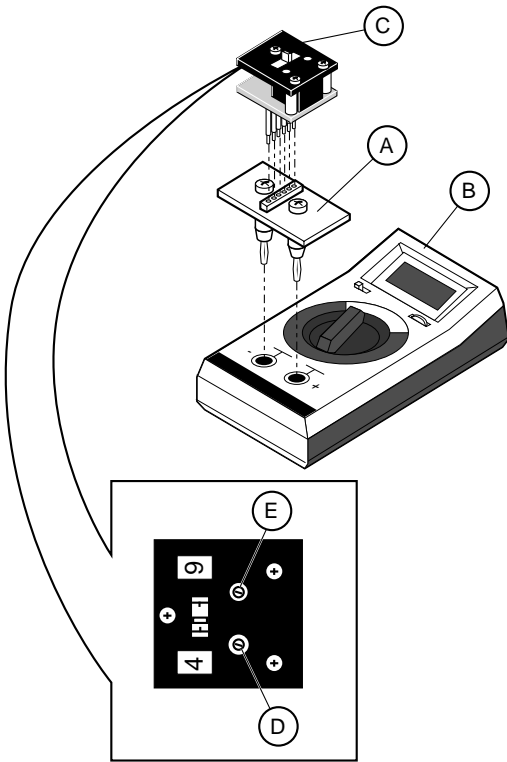
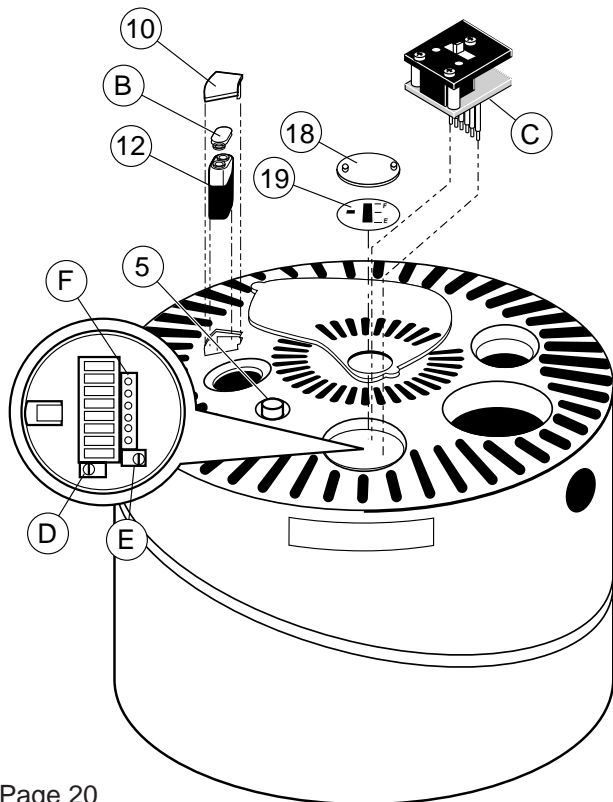


ILLUSTRATION FOR RP 5A (section b)



5. Set the capacitance for the 4th LED. The capacitance meter (Item B) should read value listed below (switch set to “4th LED”):

Res 20/30/37	17.3 pF ± 0.2 pF
Res 45	20.6 pF ± 0.2 pF

6. If meter (Item B) does not display correct reading, turn proper adjustment screw (Item D) through hole in top of simulator box (Item C).

7. Set the capacitance for the 9th LED. The capacitance meter (Item B) should read value listed below (switch set to “9th LED”):

Res 20/30/37	47.0 pF ± 0.2 pF
Res 45	55.0 pF ± 0.2 pF

8. If meter (Item B) does not display correct reading, turn proper adjustment screw (Item E) through hole in top of simulator box (Item C).

9. Disconnect simulator box (Item C) from female adapter.

10. Simulator box (Item C) is now properly calibrated.

b. Meter Calibration Procedure:

NOTE: Make sure that Liberator is empty and at room temperature before attempting calibration.

Recalibrate simulator box (Item C) each day before using.

1. Remove twist-lock meter lens (Item 18) by rotating it counterclockwise. Lift out decal (Item 19).

2. Attach simulator box (Item C) to the meter connector (Item F), LED display must be visible.

3. Switch simulator box to “4th LED”.

4. Verify that good battery (Item 12) is connected to battery terminal (Item B) on meter wiring.

5. Locate two adjustment screws (Item D & E) in meter case.

6. Holding meter switch (Item 5) down, turn screw (Item D) clockwise until 4th LED comes on. Turn it in opposite direction until 4th LED just goes off. Release meter switch (Item 5).

7. Switch simulator box to “9th LED”.

8. Depress meter switch (Item 5) in top cover. Turn 9th LED adjustment screw (Item E) until 9th LED just comes on. Release meter switch (Item 5).

9. Repeat Step 3, then depress meter switch (Item 5) to verify that three LED’s are on.

# Repair Procedures X

10. Remove the simulator box (Item C) from the meter connector (Item F). Press meter switch (Item 5). One LED should come on.
11. Reapply a thin film of KRYTOX over the 6-pin connector to completely surround and cover the sockets to make it waterproof.
12. Replace meter decal (Item 19) and lens (Item 18).

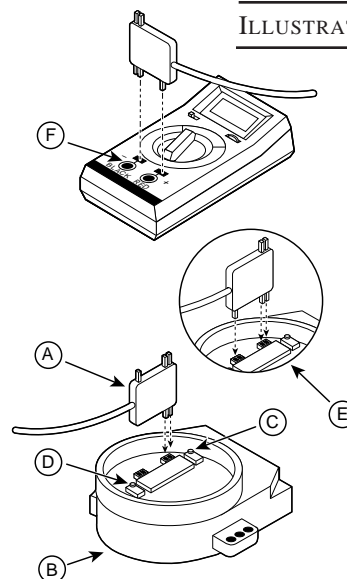
## RP5B – Sur-Cal™ 3.1 Meter Calibration

Requires Calibration kit PN 10856013, Digital voltmeter with high input impedance, display 1mV, and accuracy of  $\pm 0.5\%$ , and capacitance meter Ref 97403015 available from CAIRE.

1. Test the capacitance of the calibrator at least once daily. The reading should be between 62.0 pF and 63.8 pF. When testing the calibrator make sure a good contact is made between the meter and calibrator, and that the calibrator is inserted into the meter exactly as illustrated in RB5B (Item F).
2. Remove the clear twist lens and the decal such that the meter face is exposed. The meter should be connected to the empty warm unit.
3. Connect the banana plug ends of the calibrator to a voltmeter.
4. Plug the calibrator (Item A) into the meter (Item B) as shown in RP5B. The two male pins of the calibrator should be inserted into the two female pins, near Pot Screw (Item C) (cable from the calibrator is facing the same direction as the cables of the meter).
5. Turn the meter on by depressing the meter switch. At the same time, adjust the other Pot Screw (Item D) until a voltage of  $0.000 \pm 0.010$  volts is obtained.
6. Remove the calibrator (Item A), flip it over (Item E), and plug into the meter as shown. Once again the cable from the calibrator is facing the same direction as the cables of the meter.
7. Turn the meter on by depressing the meter switch. At the same time, adjust Pot Screw (Item C) until the proper voltage for the model size is obtained (see Voltage Table for this value).
8. Repeat steps 4 through 7 as necessary. (Most likely will not need to be repeated.)

If the meter does not seem to calibrate easily, turn Pot Screw (Item C) 12 turns one direction, then 6 turns in the other and attempt again.

ILLUSTRATION FOR RP5B



BROWN/TAN SHROUD	VOLTAGE
Sprint	$3.555 \pm .020$ volts
Stroller	$2.657 \pm .020$ volts
Liberator 20	$2.972 \pm .020$ volts
Liberator 30	$2.736 \pm .020$ volts
Liberator 45	$2.736 \pm .020$ volts

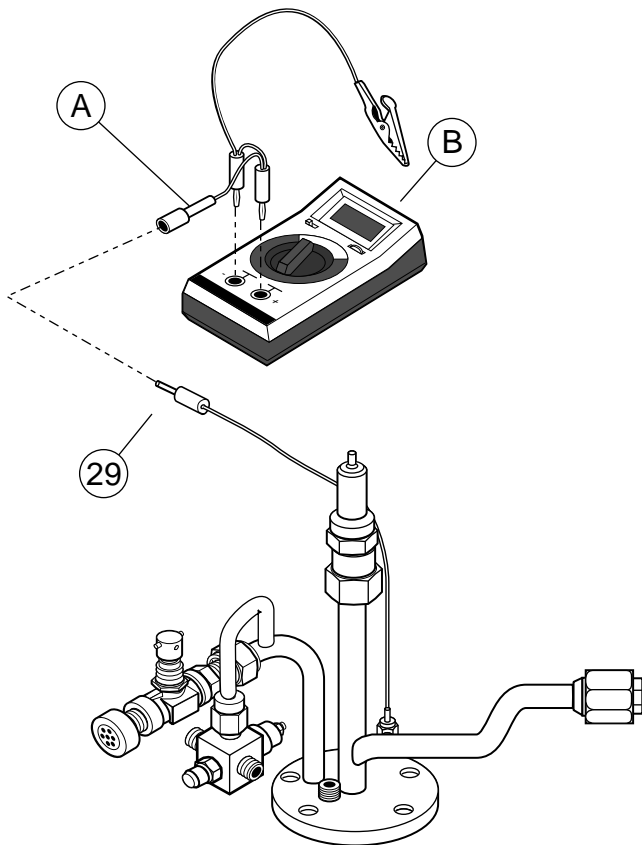
GENERATION 3	VOLTAGE
Sprint	$3.240 \pm .020$ volts
Stroller	$2.657 \pm .020$ volts
Liberator 10	$3.400 \pm .020$ volts
Liberator 20	$3.200 \pm .020$ volts
Liberator 30	$3.100 \pm .020$ volts
Liberator 37	$3.035 \pm .020$ volts
Liberator 41	$3.077 \pm .020$ volts
Liberator 45 & 60	$2.736 \pm .020$ volts
Low Loss 32 & 41	$3.035 \pm .020$ volts

### Alternate Method for Generation 3.1 Liquid Level Meter Calibration Recommended for Units Using Messenger Option for Highest Accuracy

1. Follow steps 2-5 as described above on an empty unit.
2. Fill Reservoir with liquid oxygen per normal manufacturer recommendations.
3. Attach the calibrator per step 4 above.
4. Turn the meter on by depressing the meter switch. At the same time, adjust Pot Screw (Item C) until  $2.900 \pm 0.020$  volts is obtained. (All units, regardless of model type, should read  $2.900 \pm 0.020$  volts when filled with liquid oxygen.)

# X Repair Procedures

ILLUSTRATION FOR RP 6



NOTE: Make sure unit is empty and at room temperature before testing.

**WARNING:** Before removing manifold assembly, Liberator must be empty, warm and vent valve open.

## RP6 – Manifold Capacitance Test

- a. Capacitance Meter Set-Up:
  1. Connect plug adapter to capacitance meter (Item B), following color code.
  2. Turn on capacitance meter (Item B) and select 200 pF range.
  3. Move zero adjustment on front of meter (Item B) until display reads zero.
- b. Capacitance Test:
  1. Remove shroud assembly (See RP 2).
  2. Connect plug adapter (with jumper wire) to manifold harness assembly (Item 29).
  3. Connect alligator clip to ground.
  4. Read manifold capacitance. May require changing meter range.
  5. Manifold capacitance specs:

Lib 20	175-210 pF
Lib 30	175-225 pF
Lib 37	175-225 pF
Lib 45	175-240 pF
Lib 60	175-220 pF

## RP7 – Manifold Assembly R/R

- a. Remove shroud assembly (See RP 2).
  - b1. If removing with coils:
    1. Remove three rivets (Item 47) retaining breathing and warming coils.
- OR
- b2. If removing manifold without coils:
    1. Disconnect compression fitting (Item 34) from economizer valve (Item 35).
    2. Disconnect compression fitting from liquid withdrawal port (Item D). When disconnecting tube, be careful not to kink vaporizer tube or internal TEFLON tube.
    3. Disconnect compression fitting from FCV.
  - c. Remove the three screws (Item 37) from the FCV bracket (Item 39).
  - d. Remove two manifold mounting screws (Item 31) and the three stand off bolts (Item 32).
  - e. Lift manifold assembly straight up to remove.

# Repair Procedures X

- f. Place cover on top of dewar.
- g. To replace manifold assembly, reverse above procedure. Apply small amount of Krytox to O-ring (Item 50) before assembly. Torque manifold mounting screws (Item 31) to 90-100 inch-lbs. using cross-tightening method.

## RP8 – Resolder Feed-thru Wire

- a. Remove manifold assembly (See RP 7).
- b. Strip approximately 1/8” of insulation from feed-thru wire (Item A) if necessary.
- c. Apply small amount of Stay-Clean flux to tinned area of probe (Item B) using a cotton swab.
- d. Resolder feed-thru wire (Item A) to tinned area of probe (Item B). Add small amount of 60/40 solid wire solder if necessary.
- e. Clean flux residue with distilled water and cotton swab. Dry thoroughly.
- f. Replace manifold following listed procedure (RP 7).

## RP9 – Manifold Harness Assembly R/R

- a. Remove manifold assembly (See RP 7).
- b. Unsolder feed-thru wire (Item A) from probe (Item B).
- c. Loosen feed-thru nut (Item C) and remove harness.
- d. To replace manifold harness, reverse above procedure. Tighten feed-thru nut (Item C) 1 to 2 flats after finger tight.
- e. Solder feed-thru wire (Item A) following resolder procedure (See RP 8). Replace manifold assembly (See RP 7).

## RP10 – Clean/Dry Probe and Dewar

### Procedure 1:

- a. Empty dewar per RP 24.
- b. Warm dewar per RP 25.
- c. If all moisture is not removed, go to procedure #2.

### Procedure 2:

- a. Remove manifold assembly (See RP 7).
- b. Blow off probe assembly with clean, dry nitrogen gas.
- c. Blow out inside of dewar with clean, dry nitrogen gas until inside is clean and dry.
- d. Replace manifold assembly (See RP 7).

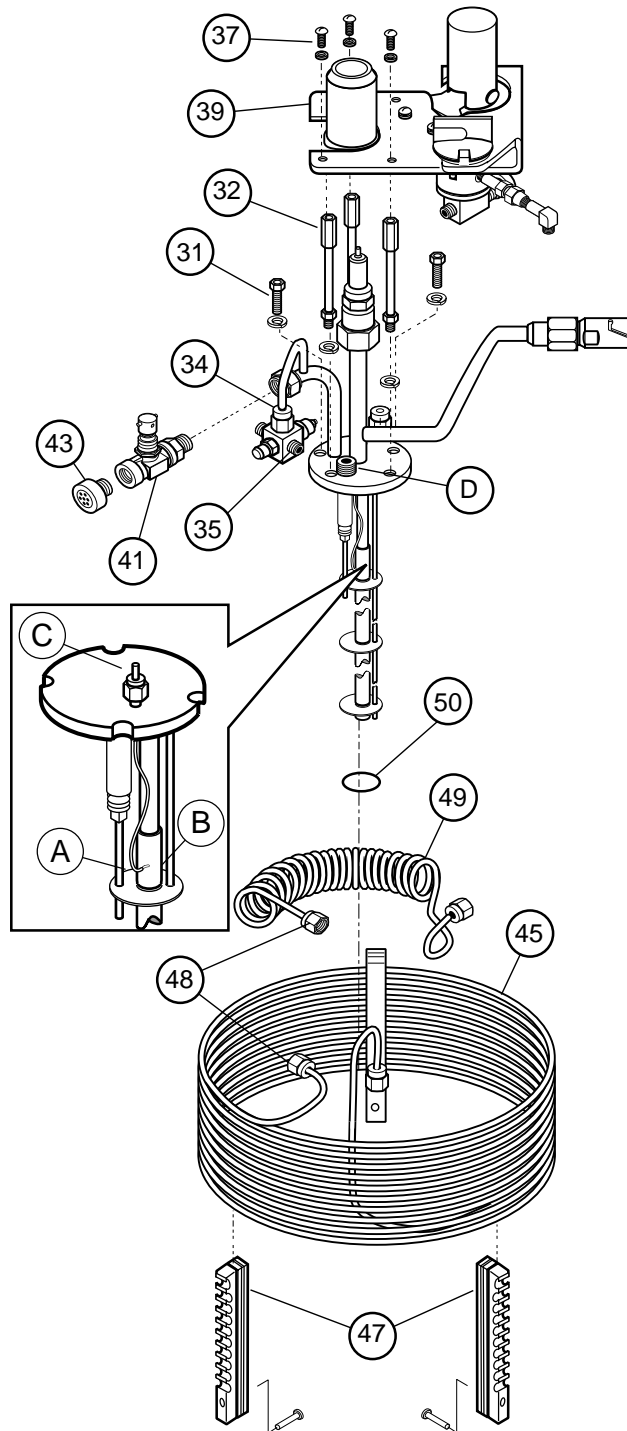
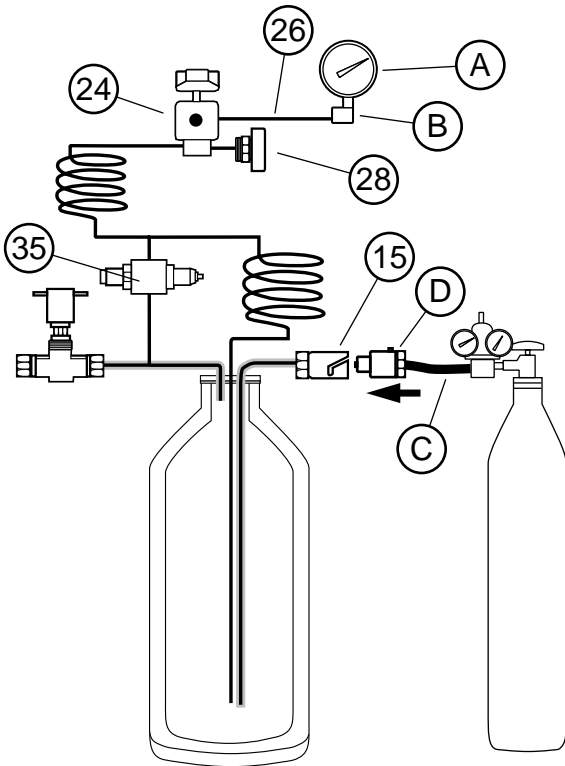


ILLUSTRATION FOR RP 7, 8 & 9

**CAUTION:** Be careful not to bend or damage manifold assembly or dewar neck tube.

# X Repair Procedures

ILLUSTRATION FOR RP 12



## RP11 – Sur-Cal 3™ Meter R/R

- Remove shroud (See RP 2).
- Remove push button cap from meter switch (Item 5).
- Remove switch retaining nut and lockwasher. Push meter switch through hole.
- Remove two screws and washers (Items 9 & 20) holding meter. Remove meter assembly from shroud.
- Remove nut from messenger connector (3.1 meter).
- To replace Sur-Cal 3™ meter, reverse above procedure. Tighten screws to 3-4 inch/lbs. only.

**CAUTION:** Be careful not to pinch wires!

## RP12 – Relief Valve Test

NOTE: Liberator should be empty and warm before testing.

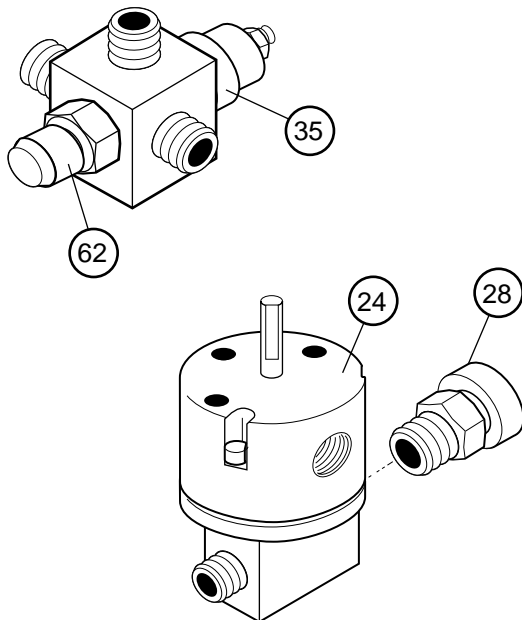
- Remove shroud (See RP 2).
- Assemble pressure gauge (Item A) and adapter (Item B) (use TEFLON tape).
- Connect gauge assembly to humidifier adapter (Item 26) on FCV outlet. Open FCV (Item 24) to 6 lpm setting.
- Assemble oxygen regulator and pneumatic hose (Item C) with DISS fittings and male pneumatic test adapter (Item D). Connect assembly to oxygen gas source.
- Connect male pneumatic test adapter (Item D) to Liberator QDV (Item 15).
- Increase pressure to 25 psig. PRV (Item 62) must be open (audible venting and/or bubbling of leak test solution).
- Hold PRV (Item 62) closed and increase pressure to 34 psig. SRV (Item 28) must be open (audible venting and/or bubbling of leak test solution).
- Decrease pressure to 19 psig. Test relief valve with leak test solution. A minimal amount of leakage (bubbling) is acceptable. If leakage is questionable, run pressure retention test before changing relief valve.

## RP13 – Primary Relief Valve R/R

**WARNING:** Liberator must be empty and vented before starting procedure.

- Remove shroud (See RP 2).
- Remove PRV (Item 62) from economizer valve.
- To replace PRV (Item 62), reverse above procedure. Snug the PRV approximately 10 to 20 degrees clockwise after the PRV body contacts the economizer regulator (minimum of 20-30 inch-pounds).

ILLUSTRATION FOR RP 13 & 14





# Repair Procedures X

## RP14 – Secondary Relief Valve R/R

**WARNING: Liberator must be empty and vented before starting procedure.**

- Remove shroud (See RP 2).
- Remove SRV (Item 28) from FCV (Item 24).
- To replace SRV (Item 28), reverse above procedure. Use TEFLON tape on threads.

## RP15 – Pressure Retention Test

**WARNING: Liberator must be empty and vented before starting procedure.**

- Assemble pressure gauge (Item A) and adapter assembly (Item B) (use TEFLON tape).
- Connect gauge assembly to humidifier adapter (Item 26) on FCV outlet. Open FCV (Item 24) to 6 lpm setting.
- Assemble oxygen regulator, pneumatic hose with DISS fittings (Item C) and male pneumatic test adapter (Item D). Connect assembly to oxygen gas source.
- Connect male pneumatic test adapter (Item D) to Liberator QDV (Item 15).
- Increase pressure to 20 psig.
- Disconnect male pneumatic test adapter (Item D) from QDV (Item 15).
- Turn FCV valve (Item 24) to Off setting.
- Allow unit to sit undisturbed for 60 minutes.
- Turn FCV valve (Item 24) to 6 lpm setting.
- If pressure gauge (Item A) indicates less than 19.0 psig, unit fails test.

## RP16 – Plumbing Leak Test

NOTE: Liberator should be empty and warm before testing.

- Remove shroud (See RP 2).
- Assemble pressure gauge (Item A) and adapter assembly (Item B) (use TEFLON tape).
- Connect gauge assembly to humidifier adapter (Item 26) on FCV outlet. Open FCV (Item 24) to 6 lpm setting.
- Assemble oxygen regulator, pneumatic hose (Item C) with DISS fittings and male pneumatic test adapter (Item D). Connect assembly to oxygen gas source.

- Connect male pneumatic test adapter (Item D) to Liberator QDV (Item 15).
  - Increase pressure to 19 psig.
  - Leak test all connections, joints, and valves with leak test solution.
- NOTE: PRV and SRV may leak slowly. Repair all other leaks first and retest for pressure retention before changing relief valves.
- Close FCV (Item 24) by turning to Off position. Remove pressure gauge assembly from humidifier adapter (Item 26).
  - Disconnect pneumatic adapter (Item D) from QDV (Item 15).
  - Leak test QDV poppet and FCV outlet.
  - Repair all leaks by following appropriate repair procedures.

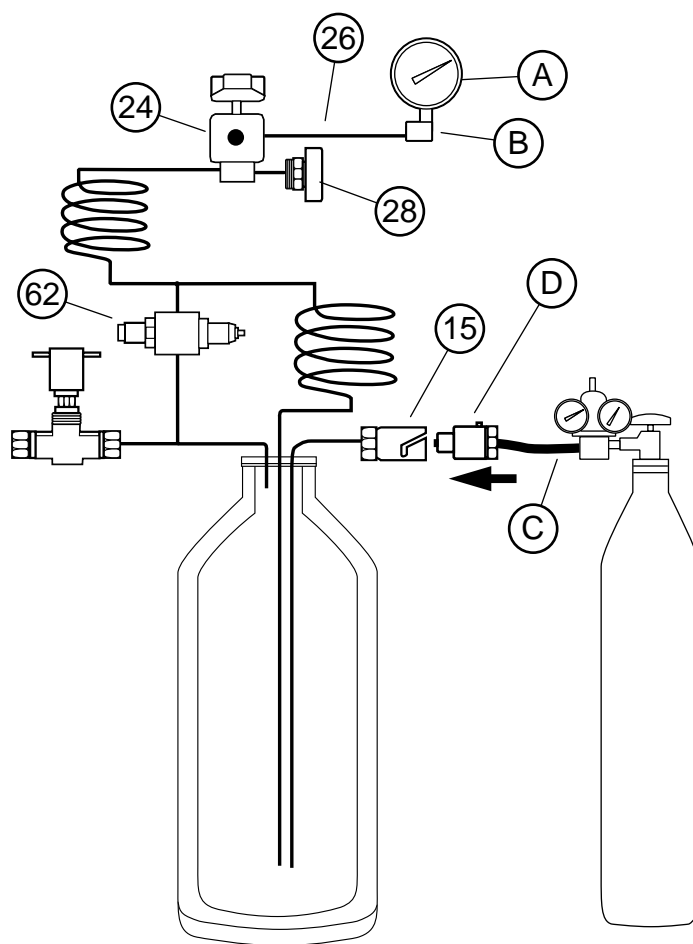
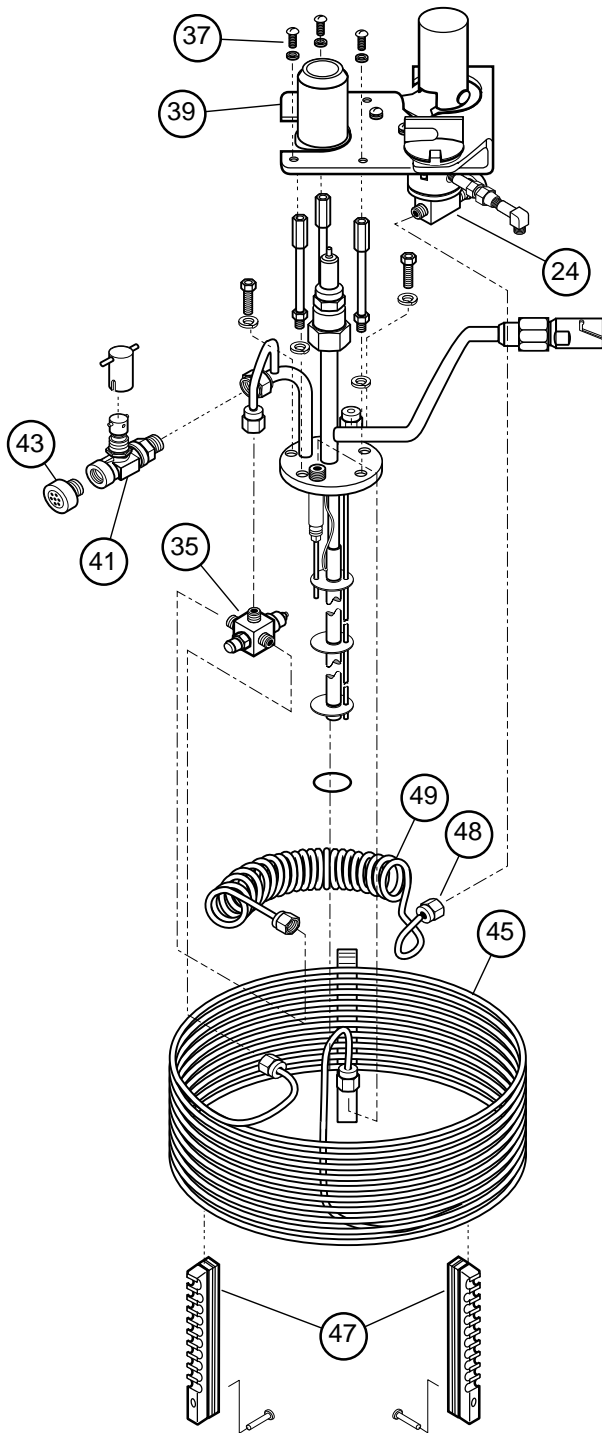


ILLUSTRATION FOR RP 15 & 16

# X Repair Procedures

ILLUSTRATION FOR RP 17 & 18



**WARNING:** Liberator must be empty and vented before starting procedure.

## RP17 – Warming and Breathing Coil Assembly R/R

- Remove shroud (See RP 2).
- Disconnect breathing coil (Item 49) at the FCV (Item 24) by unscrewing the tube nut (Item 48).
- Remove FCV bracket by removing the three screws (Item 37).
- Disconnect the two coils from the economizer (Item 35) and the manifold by unscrewing the three connectors (Item 48).
- Remove three rivets (Item 47) holding coil brackets.
- Remove warming and breathing coil assembly.
- To replace coil assembly, reverse above procedure.

## RP18 – Vent Valve R/R

- Remove shroud (See RP 2).
  - Remove muffer (Item 43).
  - Remove vent valve (Item 41) by unthreading valve nut while supporting the valve to prevent it from turning.
  - Replace vent valve (Item 41). Support the valve to prevent it from turning when tightening valve.
- NOTE: Valve must be properly aligned to allow access to handle through hole in shroud.
- Replace muffer (Item 43).
  - Replace shroud.

## RP19 – Fill

NOTE: For QDV leak test, Liberator needs only to be 1/4 to 1/2 full.

- Fill Liberator following filling procedures in Operation section of this manual.

## RP20 – Quick Disconnect Valve Lip Seal R/R (Side Fill only)

NOTE: Lip Seal may be changed on a full Liberator (side fill version only).

- Insert lip seal tool into Liberator female QDV (Item 15). Engage tabs on tool with slots in retaining ring (Item 87).
- Use wrench on hex end of tool. Push in on tool while turning to engage tabs on tool with slots in retaining ring (Item 87). Turn tool clockwise to loosen retaining ring (Item 87). Remove the ring.
- Remove lip seal (Item 88) from QDV (Item 15). Jeweler’s screwdriver may be used if necessary, but seating surfaces must not be damaged.
- Apply thin film of Krytox to lip seal O-Ring (Item 88).

# Repair Procedures X

- e. Place retaining ring (Item 87) on tool. Place new lip seal on tool.
- f. Install in QDV body (Item 15) by turning tool counter-clockwise while pushing in on tool. Torque retaining ring (Item 15b) to 20-25 inch-lbs.

## RP21 – Quick Disconnect Valve Poppet Assembly R/R (Side Fill only)

**WARNING: Liberator must be empty and vented before starting procedure.**

- a. Remove shroud (See RP 2).
- b. Turn nut (Item C) holding QDV body (Item 15) to fill tube clockwise to loosen. Hold QDV body (Item 15) with wrench to prevent it from turning.
- c. Disassemble QDV (Item 15).
- d. Apply thin film of Krytox to O-ring (Item 16) located between valve body (Item 15) and fill tube. Replace entire poppet assembly (Item 14).
- e. Reassemble QDV (Item 15), matching alignment marks on valve body and fill tube.
- f. Torque nut (Item C) to 45-50 ft.-lbs. while holding valve body (Item 15).
- g. Replace shroud (See RP 2).

## RP22 – Quick Disconnect Valve Assembly R/R (Top Fill and Dual only)

**Warning: Liberator must be empty and vented before starting this procedure.**

- a. Remove shroud (See RP 2).
- b. Remove two screws (Item 37) and washers (Item 38) from pop-off assembly (Item 27) and remove pop-off assembly.
- c. Remove pop-off sleeve (Item 21) from QDV (Item 11).
- d. Remove the top fill (QDV) by turning the QDV nut (Item D) clockwise while holding the valve (Item 11) with a wrench.
- e. Remove the retaining ring holding poppet in place.
- f. Replace poppet, fully seating retaining ring into the QDV body groove.
- g. Reassemble QDV to fill tube, torquing nut to 45-50 ft./lbs. while holding valve body.
- h. Reassemble pop-off sleeve over QDV.
- i. Reassemble pop-off assembly to unit, ensuring spring-to-pin engagement into pop-off sleeve groove.
- j. Replace shroud. (See RP2).

## RP23 – Stroller Pop-Off Assembly (Top Fill and Dual only)

- a. Remove shroud (See RP 2).
- b. Remove two screws (Item 37) and washers (Item 38) from pop-off assembly (Item 27) and remove pop-off assembly.
- c. Remove pop-off sleeve (Item 21) from QDV (Item 11).
- d. Replace necessary parts.
- e. Reassemble pop-off sleeve over QDV.
- f. Reassemble pop-off assembly to unit, ensuring spring-to-pin engagement into pop-off sleeve groove.

ILLUSTRATION FOR RP 20 & 21

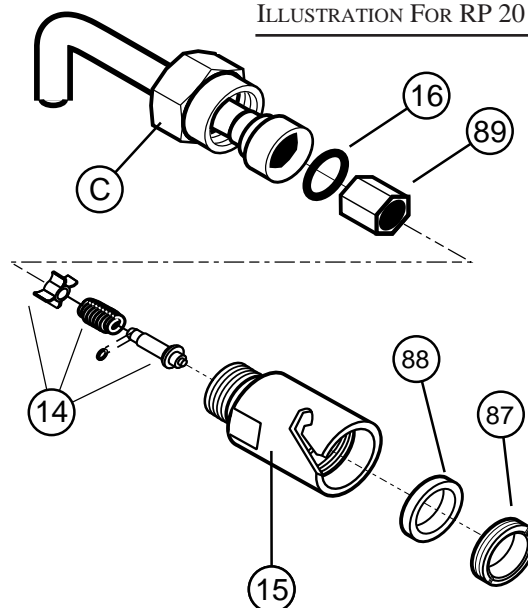
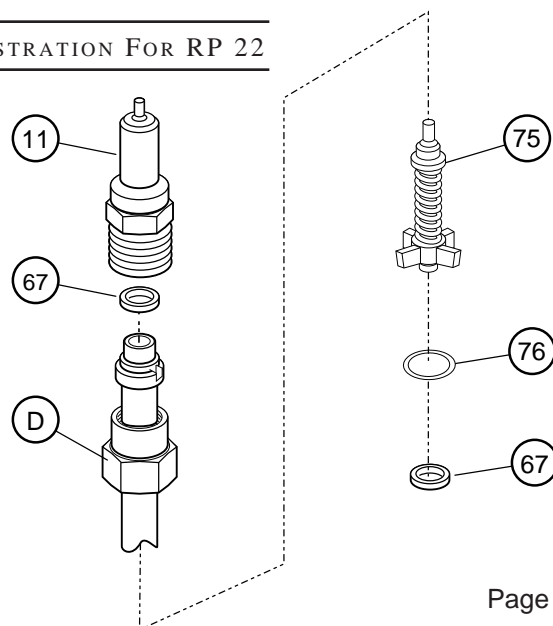


ILLUSTRATION FOR RP 22



# X Repair Procedures

ILLUSTRATIONS FOR RP 24

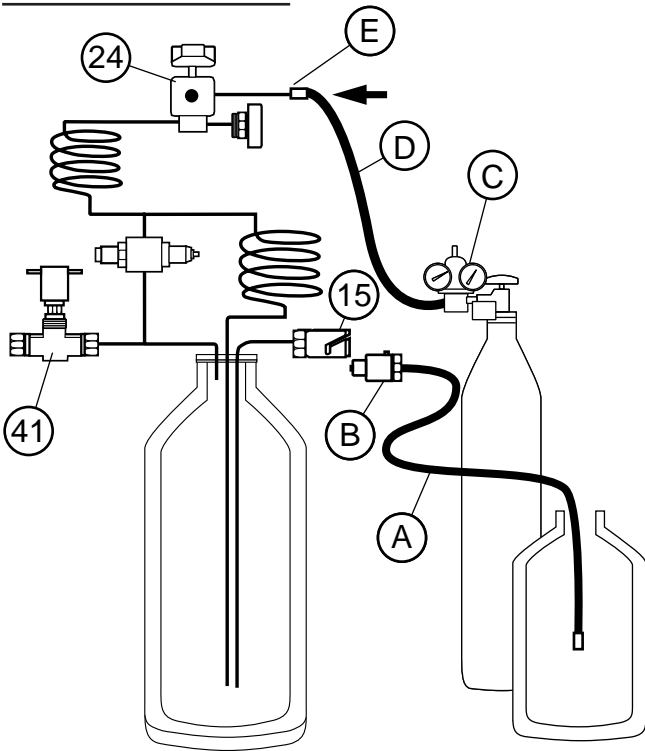
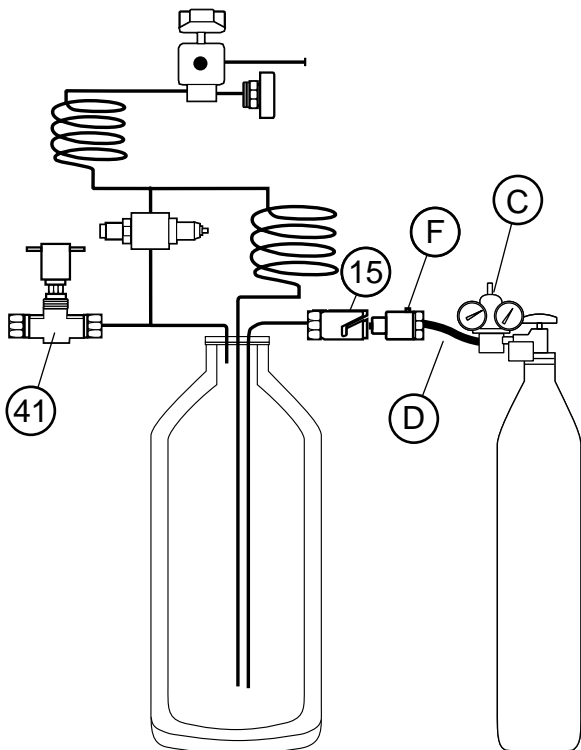


ILLUSTRATION FOR RP 25



## RP24 – Empty Unit

**WARNING:** Make sure open end of transfer line remains inside cryogenic container. Wear insulated gloves and eye protection when using this procedure. DO NOT reuse liquid oxygen.

- a. Place one end of the transfer line (Item A) into a suitable cryogenic container such as an empty, clean Liberator dewar. Connect a male transfer line adapter (Item B) to the other end of the line.

NOTE: Female transfer line adapter should be substituted for item B in top fill version.

- b. Connect the adapter to the Liberator QDV (Item 15), keeping the vent valve (Item 41) closed.
- c. Liquid oxygen will be discharged from the open end of the transfer line into the empty container. Continue process until Liberator is empty.
- d. If Liberator has no pressure, pressurize with the following procedure.

1. Connect regulator (Item C) to oxygen gas source.
2. Connect pneumatic hose (Item D) to regulator and Liberator DISS Fitting (Item E).
3. Adjust regulator (Item C) to supply 20 psig.
4. Set Liberator FCV (Item 24) to 6 lpm setting.
5. Continue until Liberator is empty.

## RP25 – Warm Unit

- a. Liberator may be allowed to sit (FCV off, vent closed) a minimum of 48 hours after emptying.

- b. To warm a Liberator in less time:

1. Connect regulator (Item C) to oxygen or nitrogen gas source.
2. Connect pneumatic hose (Item D) to regulator (Item C) and male pneumatic adapter (Item F).

NOTE: Female pneumatic adapter should be substituted for (Item F) in top fill version.

# Repair Procedures X

- Adjust regulator to 20 psig. Open vent valve (Item 41) to allow slow venting.
- Allow Liberator to vent until 1-1/2 hours minimum after vent valve (Item 41) defrosts.

ILLUSTRATION FOR RP 26 & 27

## RP26 – Flow Rate Test

NOTE: For flow rate test Liberator needs only to be 1/4 to 1/2 full.

- Connect FCV outlet to flow meter inlet with respiratory tubing. Make sure flow meter outlet is open and unobstructed and flow meter (Item G) is properly positioned.
- Unit should operate for 1-1/2 hours minimum (overnight is optimum). Test flow rate at each FCV (Item 24) position. Record all flow rates.
- Flow rates must be nominal values within tolerances listed in Specification section of this manual or unit fails flow rate test.

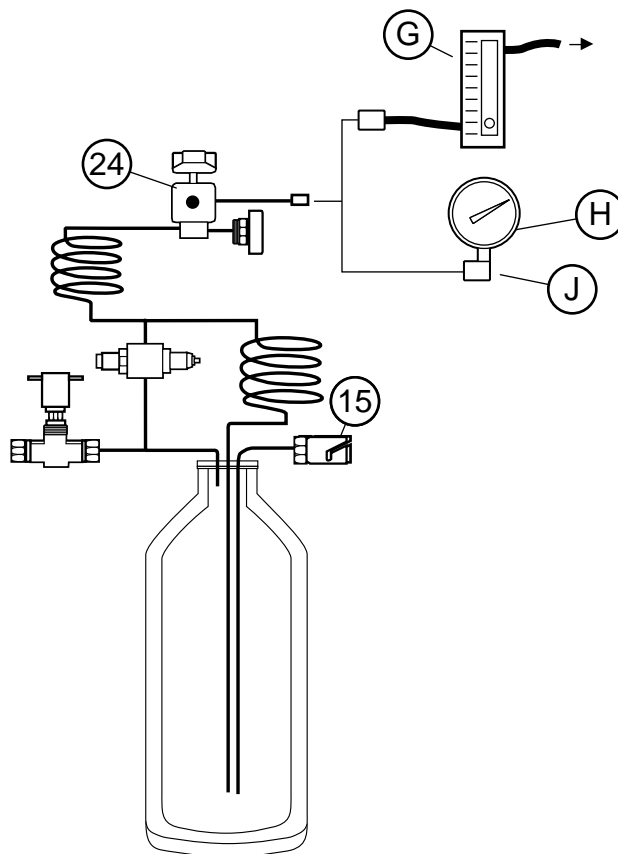
NOTE: Be careful to allow for accuracy tolerances of flow meter.

## RP27 – Operating Pressure Test

- Assemble pressure gauge (Item H) and adapter (Item J) (use TEFLON tape).
- Connect gauge assembly to DISS fitting on FCV outlet. Open FCV (Item 24) to 6 lpm setting.
- Read operating pressure on pressure gauge (Item H).
- Operating pressure must be 18-22 psig or unit fails test.

## RP28 – Flow Meter Verification

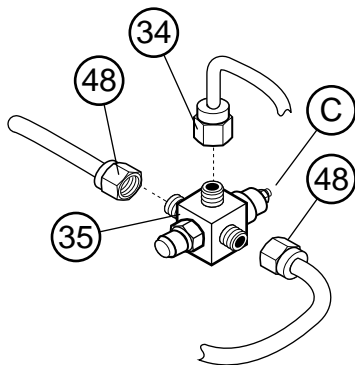
- Flow meter accuracy is best verified by calibration laboratory. Equipment should indicate liter per minute oxygen gas at 14.7 psia (0 psig) and 70° F.
- Flow meter accuracy may also be tested by comparison to one or more new, unused flow meters. This method will increase confidence in accuracy of readings, but not necessarily verify accuracy.



NOTE: If testing operating pressure because of improper flow rates, test immediately after flow rate test.

# X Repair Procedures

ILLUSTRATION FOR RP 29



**WARNING:** Liberator must be empty and vented before starting procedure.

## RP29 – Economizer Regulator R/R

- a. Remove shroud (See RP2)
- b. Loosen the two compression fitting nuts (Item 48) at the economizer regulator (Item 35). Move coil away from the regulator.
- c. Remove the economizer regulator (Item 35) from the vent tube (Item 34) by unscrewing the fitting.
- d. Connect the inlet of the economizer regulator (Item 35) to an oxygen pressure source as shown in the illustration.
- e. Open the pressure source valve. Adjust the pressure source regulator to 23 psi. The economizer regulator should be set to open at 21.5 psig and close at 20.5 psig.
- f. Slowly open valve (Item B) just enough to allow some gas to escape.
- g. Pressure gauge (Item A) will indicate the setting of the economizer regulator. The setting is increased by turning in the adjusting screw (Item C) or lowered by backing the screw out.
- h. Adjust valve (Item B) while watching the pressure on gauge (Item A). Gas will flow through the regulator when the set pressure is reached. The economizer regulator should be set to open at 21.5 psig and close at 20.5 psig.

## RP30 – Flow Control Valve R/R (See Illustration on Pg. 29)

- a. Remove shroud (See RP 2).
- b. Loosen compression fitting nut (Item 48) at connection of coil and FCV assembly. Disconnect FCV assembly (Item 24) from coil.
- c. Remove the FCV knob (Item 1) and flow rate decal (Item 2).
- d. Unscrew (Item 4) to remove the FCV.
- e. Remove the SRV (Item 28) from FCV (Item 24).
- f. To replace FCV (Item 24), reverse above procedure.

NOTE: FCV must be assembled properly to align with shroud.

## RP31 – Dewar R/R

- a. Remove shroud (See RP 2).
- b. Remove manifold assembly with coils (See RP 7).
- c. Remove condensate bottle (Item 56), drain tube (Item 55) and bracket (Item 54).
- d. Remove dewar cap from new dewar. Put cap on old dewar.
- e. Clean/dry probe and dewar following procedure in this section.

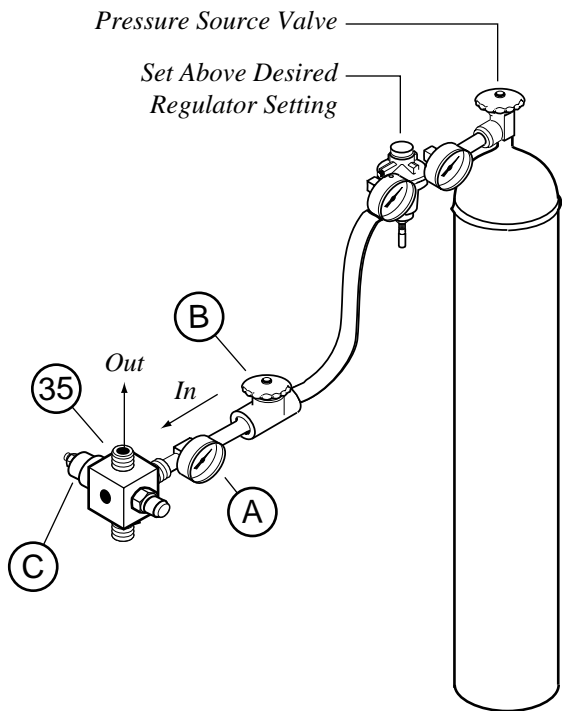


ILLUSTRATION FOR RP 29

# Repair Procedures X

- f. Assemble manifold assembly with coils to new dewar following manifold assembly replacement procedure (See RP 7). (Do not replace shroud.)

NOTE: QDV location is nearest the dewar vacuum pump out port.

- g. Replace condensate bottle (Item 56), bracket (Item 54) and drain tube (Item 55).
- h. Scribe part number and serial number on new dewar handle similar to old dewar. Use vibrating engraver to make part number and serial number on old dewar illegible.
- i. Calibrate meter following procedure (See RP 5). (Do not replace shroud.)

## RP32 – Normal Evaporation Rate Test

- a. Fill unit with correct amount of properly saturated liquid oxygen following procedure:

Lib 20	25-30 pounds	Lib 45	55-60 pounds
Lib 37	45-50 pounds	Lib 60	65-70 pounds
Lib 30	35-40 pounds		

- b. Allow unit to sit undisturbed a minimum of 12 hours with FCV in Off position and vent closed.
- c. Weigh unit. Record weight and time.  
NOTE: Weight must be within  $\pm 0.05$  pound.
- d. Allow unit to sit undisturbed for a minimum of 24 hours.
- e. Weigh unit. Record weight and time.
- f. Calculate liquid loss rate (NER) in pounds  $L_{O_2}$ /day using the following formula

$$NER = \frac{\text{Weight lost in lbs.}}{\text{Elapsed time in hrs.}} \times 24 \text{ hours/day}$$

Example

$$NER = \frac{1.65 \text{ lbs.}}{25.5 \text{ hrs.}} \times 24 \text{ hours/day}$$

NER = 1.55 lbs. loss per day

- g. If NER is more than 2 pounds per day for a Liberator, the dealer may want to send the unit to CAIRE for re-evacuation. Any unit over 5 pounds per day should be removed from service and re-evacuated.

## RP33 – Cleaning Unit

NOTE: Clean only after unit is empty and vented.

- a. Clean using household glass cleaner and lint free cloth. Do not get glass cleaner inside shroud or onto any valves.
- b. Allow unit to dry thoroughly before using.

NOTE: Dewar may be repairable. Refer to Return Policy section.

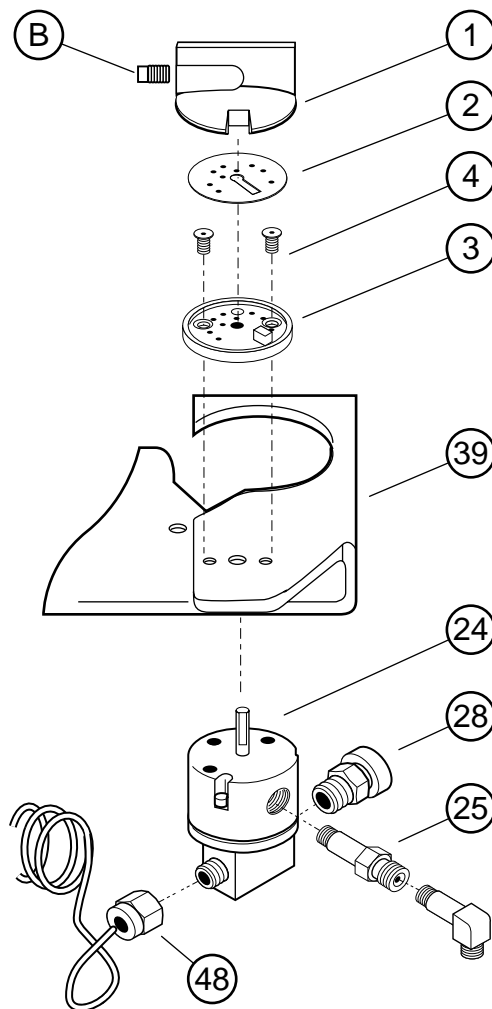


ILLUSTRATION FOR RP 30

# X Service Tools/Equipment/Supplies

## Required Tools

Hex Wrenches (various sizes)  
 Flat Blade Screwdriver  
 5/16" Nut Driver  
 Open End Wrenches (1/2" to 1-1/8")  
 Side Cutters  
 Pliers  
 Torque Driver/Wrench (10-15 inch-lbs., 20-25 inch-lbs.,  
 60-80 inch-lbs., 90-100 inch-lbs., 45-50 ft.-lbs.)  
 Jeweler's Screwdriver  
 Vibrating Engraver

## Required Fixtures/Equipment

Capacitance Meter  
 Sur-Cal 3™ Simulator Box with Adapter  
 Soldering Pencil  
 Oxygen Regulator  
 Pressure Gauge  
 Pressure Gauge Adapter  
 Flowmeter  
 O2 Gas Source (HP bottle)  
 O2 Liquid Source  
 N2 Gas or Clean Dry Compressed Air Source  
 Tubing (O2 compatible)  
 Lip Seal Service Tool  
 Male Pneumatic Test Adapter  
 LO2 Transfer Line  
 Transfer Line Adapter with Filter  
 Dewar Cap  
 Vent Valve Wrench  
 Scale 0-150# with 0.05# increments  
 Voltmeter (x.xxx ± 5%)

## Required Supplies

Stay-Clean Flux  
 Cotton Swabs  
 60-40 Solid Wire Solder  
 Distilled Water  
 Household Glass Cleaner  
 Lint-Free Cloth  
 TEFLON Tape  
 Krytox  
 SNOOP Leak Detection Fluid

## Service Tools and Accessories available from CAIRE

Part No	Description
10679862	Female Top Fill Pneumatic Test Adapter
10678157	Female Top Fill Transfer Line Adapter
CA200071	Krytox 240 AC Lubricant
CA200072	"Snoop" Leak Detection Fluid (gallon)
97200076	Erie "Liter Meter"
97212021	Male Side Fill Pneumatic Test Adapter
97212023	Male Side Fill Transfer Line Adapter w/Filter
CA005571	Transfer Line Adapter Cover
97217007	Pressure Gauge Adapter
CA400004	Replacement Filter/Male Transfer Line Adapter
97403016	Jeweler's Screwdriver
97403015	Capacitance Meter
97403574	Dewar Cap
97403577	0-60 psig Pressure Gauge
97404539	Stroller Cart
97404564	Transfer Line Swivel Connector
97405147	0-45 psig Oxygen Regulator
97405275	Wheelchair Bracket
97405277	Hand Truck w/o Stair Climber
97405278	Hand Truck w/Stair Climber
97405279	Pneumatic Hose with DISS Fittings
97405431	Liquid Oxygen Transfer Line – 6'
97405590	Lip Seal Service Tool
10597921	Sur-Cal 3™ Simulator Box w/Adapter (G 3.0)
10597912	Sur-Cal 3™ Probe/Capacitance Meter Adapter (G 3.0)
10856013	Sur-Cal 3.1™ Calibrator
10855491	External Messenger
CA406308	150 psi Relief Valve Assembly
CA406310	TEFLON Tape
CA406398	150 psi Relief Valve only
97406471	Tandem Tee Kit
97406555	Super Flex Liquid Oxygen Transfer Line – 6'
97406630	Dual Fill Head Tee
10662649	Service Manual
10661515	Conversion Kit TF to SF
10660361	Conversion Kit SF to Dual
10660344	Conversion Kit TF to Dual
10661523	Conversion Kit SF to TF



# Top Fill G3.0 Units Parts List XI

This section of the service manual contains lists and drawings useful in selecting Liberator replacement parts and service equipment. The Parts Diagram on page 35 is an exploded view of a Liberator top fill unit applicable to either the Liberator 20, 30, 37 or 45. The numbers encircled in The Parts Diagram on

page 35 refer to specific replacement parts which are described on pages 33 and 34, Section XI. Page 32 lists special tools and equipment required to service the Liberator, several of which are only available from CAIRE, Inc. All parts and equipment listed in this section can be purchased from CAIRE, Inc.

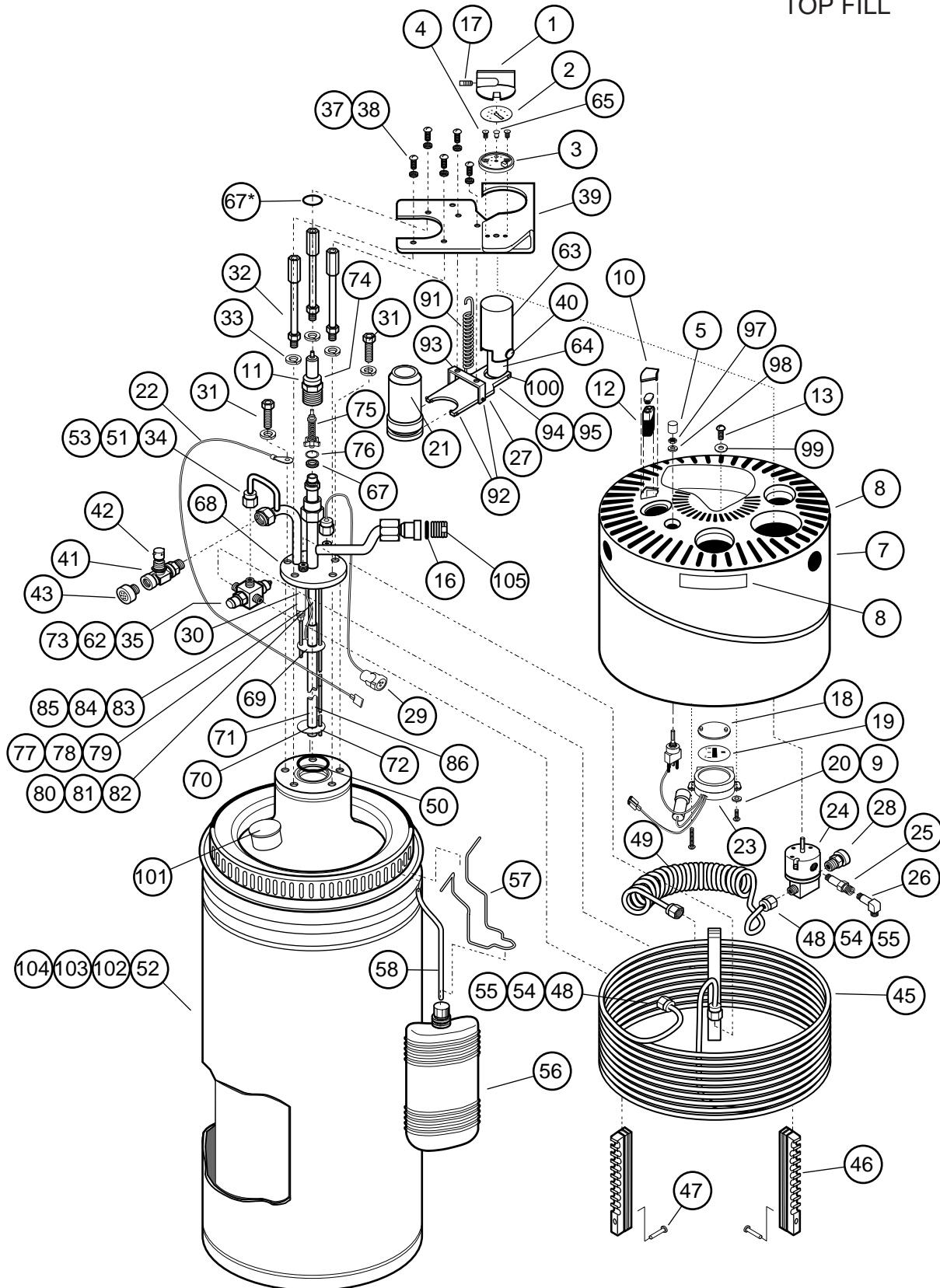
Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
-	10564150	10564133	10564168	10564141	Liberator TF (Complete) 0-6 LPM.....	A/R
-	10879434	10879442	10879451	10879469	Liberator TF (Complete) 0-10 LPM.....	A/R
1	10567941	10567941	10567941	10567941	Knob, Flow Control.....	1
2	10567967	10567967	10567967	10567967	Decal Flow Rate 0-6 LPM.....	1
2	10816071	10816071	10816071	10816071	Decal Flow Rate 0-10 LPM.....	1
3	CA406438	CA406438	CA406438	CA406438	Lock Plate.....	1
4	CA002876	CA002876	CA002876	CA002876	Screw, Lock Plate to FCV.....	2
5	10484432	10484432	10484432	10484432	Cap, Push Button.....	1
7	10562138	10562138	10562138	10562138	Shroud.....	1
8	10564192	10564192	10564192	10564192	Label Set.....	1
9	CA403690	CA403690	CA403690	CA403690	Meter Mount Washer.....	2
10	10562154	10562154	10562154	10562154	Battery Cover.....	1
11	10542031	10542031	10542031	10542031	Top Fill QDV Assembly.....	1
12	CA110060	CA110060	CA110060	CA110060	Battery.....	1
13	2910391	2910391	2910391	2910391	Screw, Shroud Mount.....	1
16	CA404838	CA404838	CA404838	CA404838	Side Fill QDV O-Ring.....	1
17	CA405232	CA405232	CA405232	CA405232	Screw, FCV Knob.....	1
18	CA403406	CA403406	CA403406	CA403406	Lens, Twist Lock.....	1
19	10578076	10578076	10578076	10578076	Decal, Meter.....	1
20	10577891	10577891	10577891	10577891	Meter Mount Screw.....	2
21	10576441	10576441	10576441	10576441	Sleeve, Pop-Off.....	1
22	10657831	10657831	10657831	10657831	Wire Assembly, Ground.....	1
23	10855985	10855985	10855985	10855985	Meter Assembly w/Messenger.....	1
23	11510882	11510882	11510882	11510882	Meter Assembly w/o Messenger.....	1
24	10480511	10480511	10480511	10480511	Flow Control Valve 0-6 LPM.....	1
24	10523403	10523403	10523403	10523403	Flow Control Valve 0-10 LPM.....	1
25	CA405938	CA405938	CA405938	CA405938	Humidifier Adapter.....	1
26	CA405451	CA405451	CA405451	CA405451	Elbow Male Humidifier.....	1
27	10576513	10576513	10576513	10576513	Pop-Off Assembly.....	1
28	10495289	10495289	10495289	10495289	Secondary RV 30 psi.....	1
29	10657823	10657823	10657823	10657823	Harness Assembly.....	1
30	10494841	10494841	10494841	10494841	PB Rod.....	1
31	CA406432	CA406432	CA406432	CA406432	Manifold Mount Screws.....	2
32	10620107	10620107	10620107	10620107	Stand Off Bolts.....	3
33	CA200038	CA200038	CA200038	CA200038	Washers, Manifold Mount.....	5
34	10760273	10760273	10760273	10760273	Nut, 1/4 ODT BRS.....	1
35	10531833	10531833	10531833	10531833	Economizer Regulator 20 psi.....	1
37	CA405164	CA405164	CA405164	CA405164	Screw, #8 -32 MS.....	5
38	CA405145	CA405145	CA405145	CA405145	Washer, #8 Lock.....	5
39	N/A	N/A	N/A	N/A	(Replaced by 10905583)	
40	10576450	10576450	10576450	10576450	Pin, Pop-Off Knob.....	1
41	10570517	10570517	10570517	10570517	Vent Valve.....	1
42	10509960	10509960	10509960	10509960	Handle, Vent Valve.....	1
43	10571069	10571069	10571069	10571069	Muffler, Vent.....	1
45	10657760	10657760	10657760	10657760	Warning Coil.....	1
46	CA005676	CA005676	CA005676	CA005676	Brackets, Vaporizer.....	3
47	CA004412	CA004412	CA004412	CA004412	Rivets, Vaporizer Brackets.....	3
48	10760273	10760273	10760273	10760273	Nut, 1/4 ODT BRS.....	4
49	10657778	10657778	10657778	10657778	Breathing Coil.....	1

# XI Top Fill G3.0 Units Parts List

Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
50	CA405086	CA405086	CA405086	CA405086	O-Ring, Viton . . . . .	1
51	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Back . . . . .	1
52	11034003	11034097	11033959	11034142	Dewar Assembly . . . . .	1
53	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front . . . . .	1
54	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front . . . . .	4
55	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Back . . . . .	4
56	CA404899	CA404899	CA404899	CA404899	Condensate Bottle . . . . .	1
57	10584513	10584513	10584513	10584513	Condensate Bottle Bracket . . . . .	1
58	10657807	10657807	10657807	10657807	Drain Tube Assembly . . . . .	1
62	10585882	10585882	10585882	10585882	Primary RV 23 psi . . . . .	1
63	10645478	10645478	10645478	10645478	Knob w/Hole, Pop-Off . . . . .	1
64	10643755	10643755	10643755	10643755	Shaft, Pop-Off . . . . .	1
65	CA110071	CA110071	CA110071	CA110071	Stop Rivet, FCV . . . . .	1
67	CA406506	CA406506	CA406506	CA406506	Static Seal, Top Fill QDV . . . . .	1
68	N/A	N/A	N/A	N/A	(See G3.1 List)	
69	10494868	10494868	10494868	10494868	TEFLON Insulator . . . . .	2
70	10494850	10494850	10494850	10494850	Retaining Ring . . . . .	4
71	10657997	10657989	10657971	10657962	Probe Assembly . . . . .	1
72	10658017	10658033	10658025	10658009	Withdrawal Tube . . . . .	1
73	CA003830	CA003830	CA003830	CA003830	O-Ring Primary RV . . . . .	1
74	10665719	10665719	10665719	10665719	Body, QDV Top Fill . . . . .	1
75	10665292	10665292	10665292	10665292	Poppet, QDV Top Fill . . . . .	1
76	10656054	10656054	10656054	10656054	Retainer Ring, QDV Top Fill . . . . .	1
77	10494884	10494884	10494884	10494884	Nut 1/8 ODT Tube BRS . . . . .	1
78	10494892	10494892	10494892	10494892	Ferrule 1/8 ODT BRS Front . . . . .	1
79	10494905	10494905	10494905	10494905	Ferrule 1/8 ODT BRS Rear . . . . .	1
80	10871053	10871053	10871053	10871053	Nut 1/2 ODT Tube BRS . . . . .	1
81	10871061	10871061	10871061	10871061	Ferrule 1/2 ODT BRS Front . . . . .	1
82	10871037	10871037	10871037	10871037	Ferrule 1/2 ODT BRS Rear . . . . .	1
83	CA006292	CA006292	CA006292	CA006292	Nut 3/16 ODT BRS . . . . .	1
84	CA006191	CA006191	CA006191	CA006191	Ferrule 3/16 ODT BRS Front . . . . .	1
85	CA006192	CA006192	CA006192	CA006192	Ferrule 3/16 ODT BRS Rear . . . . .	1
86	10657946	10657946	10657946	10657946	Tube Shrink .142 x 20-1/4 LG . . . . .	1
91	10931351	10931351	10931351	10931351	Spring, Pop-Off Assembly . . . . .	1
92	10500033	10500033	10500033	10500033	Spring Pins 1/8 x 7/16 LG . . . . .	6
93	10576505	10576505	10576505	10576505	Hanger Bracket, Pop-Off Assembly . . . . .	1
94	CA003937	CA003937	CA003937	CA003937	Screw #10-24 x 1" LG SS . . . . .	1
95	2911061	2911061	2911061	2911061	Jam Nut #10-24 SS . . . . .	1
97	CA406301	CA406301	CA406301	CA406301	Switch Jam Nut . . . . .	1
98	10490381	10490381	10490381	10490381	Switch Lock Washer . . . . .	1
99	2910991	2910991	2910991	2910991	Washer, Shroud Mount . . . . .	1
100	10576468	10576468	10576468	10576468	Lever Plate, Pop-Off Assembly . . . . .	1
101	3910986	3910986	3910986	3910986	Pumpout Cap . . . . .	1
102	—	—	—	—	Shipping Carton Components . . . . .	
—	CA210025	CA210025	CA210025	CA210025	—Bag, Clear Poly . . . . .	1
—	10792401	10792401	10545207	10545207	—Carton, Shipping . . . . .	1
—	10926587	10926587	10545240	10545240	—Corner Post . . . . .	4
—	10793323	10793323	10793323	10793323	—Top Support . . . . .	1
—	10792435	N/A	N/A	N/A	—Top Support . . . . .	4/2
104	10564387	10564387	10564387	10564387	POI Top Fill . . . . .	1
—	10585866	10585866	10585866	10585866	Roller Base (Complete) . . . . .	1
—	10585840	10585840	10585840	10585840	—Vinyl Caps Black (Roller Base) . . . . .	5
—	11192765	11192765	11192765	11192765	—Castor Dual Wheels (Roller Base) . . . . .	5
—	10647449	10647449	10647449	10647449	Handtruck Stairclimber Replacement . . . . .	1 Set
105	10566446	10566446	10566446	10566446	Plug, Side Fill QDV . . . . .	1

# Parts Illustration XI

LIBERATOR GEN 3.0  
TOP FILL



# XI Side Fill G3.0 Units Parts List

This section of the service manual contains lists and drawings useful in selecting Liberator replacement parts and service equipment. The Parts Diagram on page 38 is an exploded view of a Liberator side fill unit applicable to either the Liberator 20, 30, 37 or 45. The numbers encircled in The Parts Diagram

on page 38 refer to specific replacement parts which are described on pages 36 and 37, Section XI. Page 32 lists special tools and equipment required to service the Liberator, several of which are only available from CAIRE, Inc. All parts and equipment listed in this section can be purchased from CAIRE, Inc.

Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
-	10562007	10561995	10562023	10562015	Liberator SF (Complete) 0-6 LPM.....	A/R
-	10879389	10879400	10879418	10879426	Liberator SF (Complete) 0-10 LPM.....	A/R
1	10567941	10567941	10567941	10567941	Knob, Flow Control .....	1
2	10567967	10567967	10567967	10567967	Decal Flow Rate 0-6 LPM .....	1
2	10816071	10816071	10816071	10816071	Decal Flow Rate 0-10 LPM .....	1
3	CA406438	CA406438	CA406438	CA406438	Lock Plate .....	1
4	CA002876	CA002876	CA002876	CA002876	Screw, Lock Plate to FCV .....	2
5	10484432	10484432	10484432	10484432	Cap, Push Button .....	1
7	10562138	10562138	10562138	10562138	Shroud .....	1
8	10564192	10564192	10564192	10564192	Label Set .....	1
9	CA403690	CA403690	CA403690	CA403690	Meter Mount Washer .....	2
10	10562154	10562154	10562154	10562154	Battery Cover .....	1
12	CA110060	CA110060	CA110060	CA110060	Battery .....	1
13	2910391	2910391	2910391	2910391	Screw, Shroud Mount .....	1
14	10665372	10665372	10665372	10665372	Poppet Assembly .....	1
15	10577858	10577858	10577858	10577858	Side Fill QDV Assembly .....	1
16	CA404838	CA404838	CA404838	CA404838	Side Fill QDV O-Ring .....	1
17	CA405232	CA405232	CA405232	CA405232	Screw, FCV Knob .....	1
18	CA403406	CA403406	CA403406	CA403406	Lens, Twist Lock .....	1
19	10578076	10578076	10578076	10578076	Decal, Meter .....	1
20	10577891	10577891	10577891	10577891	Meter Mount Screw .....	2
22	10657831	10657831	10657831	10657831	Wire Assembly, Ground .....	1
23	10855985	10855985	10855985	10855985	Meter Assembly w/Messenger .....	1
23	11510882	11510882	11510882	11510882	Meter Assembly w/o Messenger.....	1
24	10480511	10480511	10480511	10480511	Flow Control Valve 0-6 LPM.....	1
24	10523403	10523403	10523403	10523403	Flow Control Valve 0-10 LPM.....	1
25	CA405938	CA405938	CA405938	CA405938	Humidifier Adapter .....	1
26	CA405451	CA405451	CA405451	CA405451	Elbow Male Humidifier .....	1
28	10495289	10495289	10495289	10495289	Secondary RV 30 psi .....	1
29	10657823	10657823	10657823	10657823	Harness Assembly .....	1
30	10494841	10494841	10494841	10494841	PB Rod .....	1
31	CA406432	CA406432	CA406432	CA406432	Manifold Mount Screws .....	2
32	10620107	10620107	10620107	10620107	Stand Off Bolts .....	3
33	CA200038	CA200038	CA200038	CA200038	Washers, Manifold Mount .....	5
34	10760273	10760273	10760273	10760273	Nut, 1/4 ODT BRS .....	1
35	10531833	10531833	10531833	10531833	Economizer Regulator 20 psi .....	1
37	CA405164	CA405164	CA405164	CA405164	Screw, #8 -32 MS .....	5
38	CA405145	CA405145	CA405145	CA405145	Washer, #8 Lock .....	5
39	N/A	N/A	N/A	N/A	(Replaced by 10905583)	
41	10570517	10570517	10570517	10570517	Vent Valve .....	1
42	10509960	10509960	10509960	10509960	Handle, Vent Valve .....	1
43	10571069	10571069	10571069	10571069	Muffler, Vent .....	1
45	10657760	10657760	10657760	10657760	Warming Coil .....	1
46	CA005676	CA005676	CA005676	CA005676	Brackets, Vaporizer .....	3
47	CA004412	CA004412	CA004412	CA004412	Rivets, Vaporizer Brackets .....	3
48	10760243	10760243	10760243	10760243	Nut, 1/4 ODT BRS .....	4
49	10657778	10657778	10657778	10657778	Breathing Coil .....	1
50	CA405086	CA405086	CA405086	CA405086	O-Ring, Viton .....	1

# Side Fill G3.0 Units Parts List XI

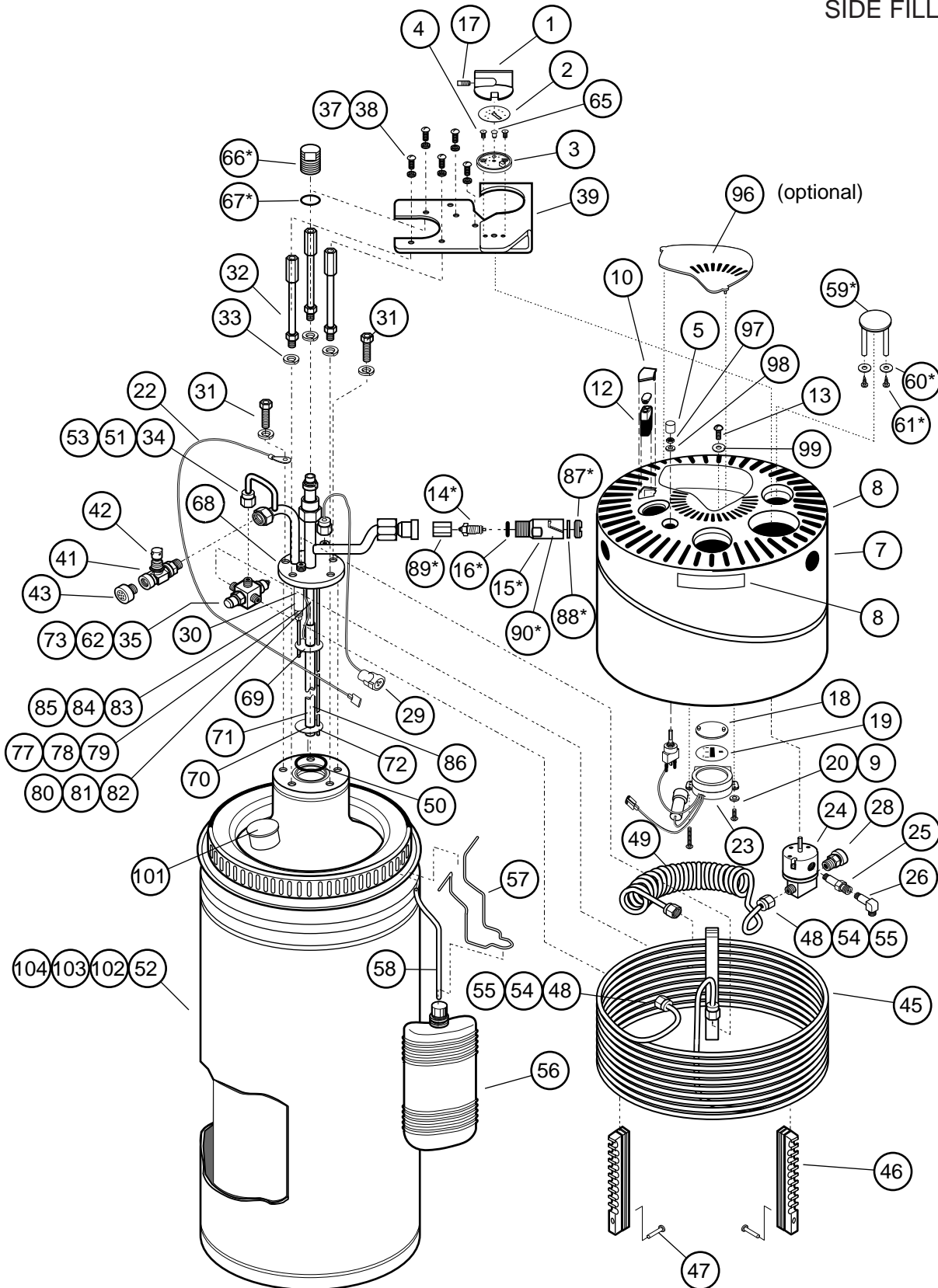
Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
51	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Back . . . . .	1
52	11034003	11034097	11033959	11034142	Dewar Assembly . . . . .	1
53	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front . . . . .	1
54	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front . . . . .	4
55	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Back . . . . .	4
56	CA404899	CA404899	CA404899	CA404899	Condensate Bottle . . . . .	1
57	10584513	10584513	10584513	10584513	Condensate Bottle Bracket . . . . .	1
58	10657807	10657807	10657807	10657807	Drain Tube Assembly . . . . .	1
59	10569006	10569006	10569006	10569006	Insert, Pop-Off (optional) . . . . .	1
60	10616458	10616458	10616458	10616458	Screw, Pop-Off Insert (optional) . . . . .	2
61	2910991	2910991	2910991	2910991	Washer, Pop-Off Insert (optional) . . . . .	2
62	10585882	10585882	10585882	10585882	Primary RV 23 psi . . . . .	1
65	CA110071	CA110071	CA110071	CA110071	Stop Rivet, FCV . . . . .	1
66	10566454	10566454	10566454	10566454	Plug, Top Fill QDV . . . . .	1
67	CA406506	CA406506	CA406506	CA406506	Static Seal, Top Fill QDV . . . . .	1
68	N/A	N/A	N/A	N/A	(See G3.1 List)	
69	10494868	10494868	10494868	10494868	TEFLON Insulator . . . . .	2
70	10494850	10494850	10494850	10494850	Retaining Ring . . . . .	4
71	10657997	10657989	10657971	10657962	Probe Assembly . . . . .	1
72	10658017	10658033	10658025	10658009	Withdrawal Tube . . . . .	1
73	CA003830	CA003830	CA003830	CA003830	O-Ring Primary RV . . . . .	1
77	10494884	10494884	10494884	10494884	Nut 1/8 ODT Tube BRS . . . . .	1
78	10494892	10494892	10494892	10494892	Ferrule 1/8 ODT BRS Front . . . . .	1
79	10494905	10494905	10494905	10494905	Ferrule 1/8 ODT BRS Rear . . . . .	1
80	10871053	10871053	10871053	10871053	Nut 1/2 ODT Tube BRS . . . . .	1
81	10871061	10871061	10871061	10871061	Ferrule 1/2 ODT BRS Front . . . . .	1
82	10871037	10871037	10871037	10871037	Ferrule 1/2 ODT BRS Rear . . . . .	1
83	CA006292	CA006292	CA006292	CA006292	Nut 3/16 ODT BRS . . . . .	1
84	CA006191	CA006191	CA006191	CA006191	Ferrule 3/16 ODT BRS Front . . . . .	1
85	CA006192	CA006192	CA006192	CA006192	Ferrule 3/16 ODT BRS Rear . . . . .	1
86	10657946	10657946	10657946	10657946	Tube Shrink .142 x 20-1/4 LG . . . . .	1
87	CA405319	CA405319	CA405319	CA405319	Retainer Ring, Side Fill QDV . . . . .	1
88	CA110104	CA110104	CA110104	CA110104	Lip Seal, Side Fill QDV . . . . .	1
89	CA405606	CA405606	CA405606	CA405606	Coupler, Hex Side Fill QDV . . . . .	1
90	10666439	10666439	10666439	10666439	Body, Side Fill QDV . . . . .	1
96	10562146	10562146	10562146	10562146	Portable Insert (optional) . . . . .	1
97	CA406301	CA406301	CA406301	CA406301	Switch Jam Nut . . . . .	1
98	10490381	10490381	10490381	10490381	Switch Lock Washer . . . . .	1
99	2910991	2910991	2910991	2910991	Washer, Shroud Mount . . . . .	1
101	3910986	3910986	3910986	3910986	Pumpout Cap . . . . .	1
102	—	—	—	—	Shipping Carton Components . . . . .	
—	CA210025	CA210025	CA210025	CA210025	—Bag, Clear Poly . . . . .	1
—	10792401	10792401	10545207	10545207	—Carton, Shipping . . . . .	1
—	10926587	10926587	10545240	10545240	—Corner Post . . . . .	4
—	10793323	10793323	10793323	10793323	—Top Support . . . . .	1
—	10792435	N/A	N/A	N/A	—Top Support . . . . .	4/2
103	10564379	10564379	10564379	10564379	POI Side Fill . . . . .	1
—	10585866	10585866	10585866	10585866	Roller Base (Complete) . . . . .	1
—	10585840	10585840	10585840	10585840	—Vinyl Caps Black (Roller Base) . . . . .	5
—*	CA405944	CA405944	CA405944	CA405944	—Caster, Dual Wheels 60mm (Roller Base) . . . . .	5
—*	10539261	10539261	10539261	10539261	—Caster, Dual Wheels 60mm w/Brake (Roller Base) . . . . .	5
—*	11192765	11192765	11192765	11192765	—Caster, Dual Wheels 50mm (Roller Base) . . . . .	5
—*	11192757	11192757	11192757	11192757	—Caster, Dual Wheels 50mm w/Brake (Roller Base) . . . . .	5
—	10647449	10647449	10647449	10647449	Handtruck Stairclimber Replacement . . . . .	1 Set

\* CA405944/10539261 (60mm) used on roller bases through 4/30/00.

\* 11192765/11192757 (50mm) used on roller bases shipped after 5/1/00.

# XI Parts Illustration

LIBERATOR GEN 3.0  
SIDE FILL



# Dual Fill 3.0 Units Parts List XI

This section of the service manual contains lists and drawings useful in selecting Liberator replacement parts and service equipment. The Parts Diagram on page 42 is an exploded view of a Liberator dual fill unit applicable to either the Liberator 20, 30, 37 or 45. The numbers encircled in The Parts Diagram on

page 42 refer to specific replacement parts which are described on page 39, 40 and 41, Section XI. Page 32 lists special tools and equipment required to service the Liberator, several of which are only available from CAIRE, Inc. All parts and equipment listed in this section can be purchased from CAIRE, Inc.

Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
–	10660379	10564176	10660328	10564184	Liberator Dual (Complete) 0-6 LPM. . . . .	A/R
–	10879477	10879493	10879514	10879522	Liberator Dual (Complete) 0-10 LPM. . . . .	A/R
1	10567941	10567941	10567941	10567941	Knob, Flow Control 0-6 LPM . . . . .	1
2	10567967	10567967	10567967	10567967	Decal Flow Rate 0-6 LPM . . . . .	1
2	10816071	10816071	10816071	10816071	Decal Flow Rate 0-10 LPM . . . . .	1
3	CA406438	CA406438	CA406438	CA406438	Lock Plate . . . . .	1
4	CA002876	CA002876	CA002876	CA002876	Screw, Lock Plate to FCV . . . . .	2
5	10484432	10484432	10484432	10484432	Cap, Push Button . . . . .	1
7	10562138	10562138	10562138	10562138	Shroud. . . . .	1
8	10564192	10564192	10564192	10564192	Label Set. . . . .	1
9	CA403690	CA403690	CA403690	CA403690	Meter Mount Washer . . . . .	2
10	10562154	10562154	10562154	10562154	Battery Cover . . . . .	1
11	10542031	10542031	10542031	10542031	Top Fill QDV Assembly . . . . .	1
12	CA110060	CA110060	CA110060	CA110060	Battery . . . . .	1
13	2910391	2910391	2910391	2910391	Screw, Shroud Mount. . . . .	1
14	10665372	10665372	10665372	10665372	Poppet Assembly . . . . .	1
15	10577858	10577858	10577858	10577858	Side Fill QDV Assembly . . . . .	1
16	CA404838	CA404838	CA404838	CA404838	Side Fill QDV O-Ring . . . . .	1
17	CA405232	CA405232	CA405232	CA405232	Screw, FCV Knob . . . . .	1
18	CA403406	CA403406	CA403406	CA403406	Lens, Twist Lock . . . . .	1
19	10578076	10578076	10578076	10578076	Decal, Meter. . . . .	1
20	10577891	10577891	10577891	10577891	Meter Mount Screw . . . . .	2
21	10576441	10576441	10576441	10576441	Sleeve, Pop-Off . . . . .	1
22	10657831	10657831	10657831	10657831	Wire Assembly, Ground. . . . .	1
23	10855985	10855985	10855985	10855985	Meter Assembly w/Messenger. . . . .	1
23	11510882	11510882	11510882	11510882	Meter Assembly w/o Messenger . . . . .	1
24	10480511	10480511	10480511	10480511	Flow Control Valve 0-6 LPM. . . . .	1
24	10523403	10523403	10523403	10523403	Flow Control Valve 0-10 LPM. . . . .	1
25	CA405938	CA405938	CA405938	CA405938	Humidifier Adapter . . . . .	1
26	CA405451	CA405451	CA405451	CA405451	Elbow Male Humidifier . . . . .	1
27	10576513	10576513	10576513	10576513	Pop-Off Assembly . . . . .	1
28	10495289	10495289	10495289	10495289	Secondary RV 30 psi . . . . .	1
29	10657823	10657823	10657823	10657823	Harness Assembly . . . . .	1
30	10494841	10494841	10494841	10494841	PB Rod . . . . .	1
31	CA406432	CA406432	CA406432	CA406432	Manifold Mount Screws. . . . .	2
32	10620107	10620107	10620107	10620107	Stand Off Bolts. . . . .	3
33	CA200038	CA200038	CA200038	CA200038	Washers, Manifold Mount . . . . .	5
34	10760273	10760273	10760273	10760273	Nut, 1/4 ODT BRS . . . . .	1
35	10531833	10531833	10531833	10531833	Economizer Regulator 20 psi . . . . .	1
37	CA405164	CA405164	CA405164	CA405164	Screw, #8 -32 MS. . . . .	5
38	CA405145	CA405145	CA405145	CA405145	Washer, #8 Lock. . . . .	5
39	N/A	N/A	N/A	N/A	(Replaced by 10905583)	
40	10576450	10576450	10576450	10576450	Pin, Pop-Off Knob . . . . .	1

# XI Dual Fill 3.0 Units Parts List

Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
41	10570517	10570517	10570517	10570517	Vent Valve . . . . .	1
42	10509960	10509960	10509960	10509960	Handle, Vent Valve . . . . .	1
43	10571069	10571069	10571069	10571069	Muffler, Vent . . . . .	1
45	10657760	10657760	10657760	10657760	Warming Coil . . . . .	1
46	CA005676	CA005676	CA005676	CA005676	Brackets, Vaporizer . . . . .	3
47	CA004412	CA004412	CA004412	CA004412	Rivets, Vaporizer Brackets. . . . .	3
48	10760243	10760243	10760243	10760243	Nut, 1/4 ODT BRS . . . . .	4
49	10657778	10657778	10657778	10657778	Breathing Coil . . . . .	1
50	CA405086	CA405086	CA405086	CA405086	O-Ring, Viton . . . . .	1
51	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Back . . . . .	1
52	11034003	11034097	11033959	11034142	Dewar Assembly . . . . .	1
53	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front. . . . .	1
54	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front. . . . .	4
55	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Back . . . . .	4
56	CA404899	CA404899	CA404899	CA404899	Condensate Bottle. . . . .	1
57	10584513	10584513	10584513	10584513	Condensate Bottle Bracket . . . . .	1
58	10657807	10657807	10657807	10657807	Drain Tube Assembly. . . . .	1
62	10585882	10585882	10585882	10585882	Primary RV 23 psi . . . . .	1
63	10645478	10645478	10645478	10645478	Knob w/Hole, Pop-Off . . . . .	1
64	10643755	10643755	10643755	10643755	Shaft, Pop-Off. . . . .	1
65	CA110071	CA110071	CA110071	CA110071	Stop Rivet, FCV . . . . .	1
67	CA406506	CA406506	CA406506	CA406506	Static Seal, Top Fill QDV . . . . .	1
68	N/A	N/A	N/A	N/A	(See G3.1 List)	
69	10494868	10494868	10494868	10494868	TEFLON Insulator . . . . .	2
70	10494850	10494850	10494850	10494850	Retaining Ring . . . . .	4
71	10657997	10657989	10657971	10657962	Probe Assembly . . . . .	1
72	10658017	10658033	10658025	10658009	Withdrawal Tube . . . . .	1
73	CA003830	CA003830	CA003830	CA003830	O-Ring Primary RV . . . . .	1
74	10665719	10665719	10665719	10665719	Body, QDV Top Fill. . . . .	1
75	10665292	10665292	10665292	10665292	Poppet, QDV Top Fill . . . . .	1
76	10656054	10656054	10656054	10656054	Retaining Ring, QDV Top Fill. . . . .	1
77	10494884	10494884	10494884	10494884	Nut 1/8 ODT Tube BRS . . . . .	1
78	10494892	10494892	10494892	10494892	Ferrule 1/8 ODT BRS Front. . . . .	1
79	10494905	10494905	10494905	10494905	Ferrule 1/8 ODT BRS Rear . . . . .	1
80	10871053	10871053	10871053	10871053	Nut 1/2 ODT Tube BRS . . . . .	1
81	10871061	10871061	10871061	10871061	Ferrule 1/2 ODT BRS Front. . . . .	1
82	10871037	10871037	10871037	10871037	Ferrule 1/2 ODT BRS Rear . . . . .	1
83	CA006292	CA006292	CA006292	CA006292	Nut 3/16 ODT BRS . . . . .	1
84	CA006191	CA006191	CA006191	CA006191	Ferrule 3/16 ODT BRS Front. . . . .	1
85	CA006192	CA006192	CA006192	CA006192	Ferrule 3/16 ODT BRS Rear . . . . .	1
86	10657946	10657946	10657946	10657946	Tube Shrink .142 x 20-1/4 LG . . . . .	1
87	CA405319	CA405319	CA405319	CA405319	Retainer Ring, Side Fill QDV . . . . .	1
88	CA110104	CA110104	CA110104	CA110104	Lip Seal, Side Fill QDV . . . . .	1
89	CA405606	CA405606	CA405606	CA405606	Coupler, Hex Side Fill QDV . . . . .	1
90	10666439	10666439	10666439	10666439	Body, Side Fill QDV . . . . .	1
91	10931351	10931351	10931351	10931351	Spring, Pop-Off Assembly . . . . .	1
92	10500033	10500033	10500033	10500033	Spring Pins 1/8 x 7/16 LG . . . . .	6



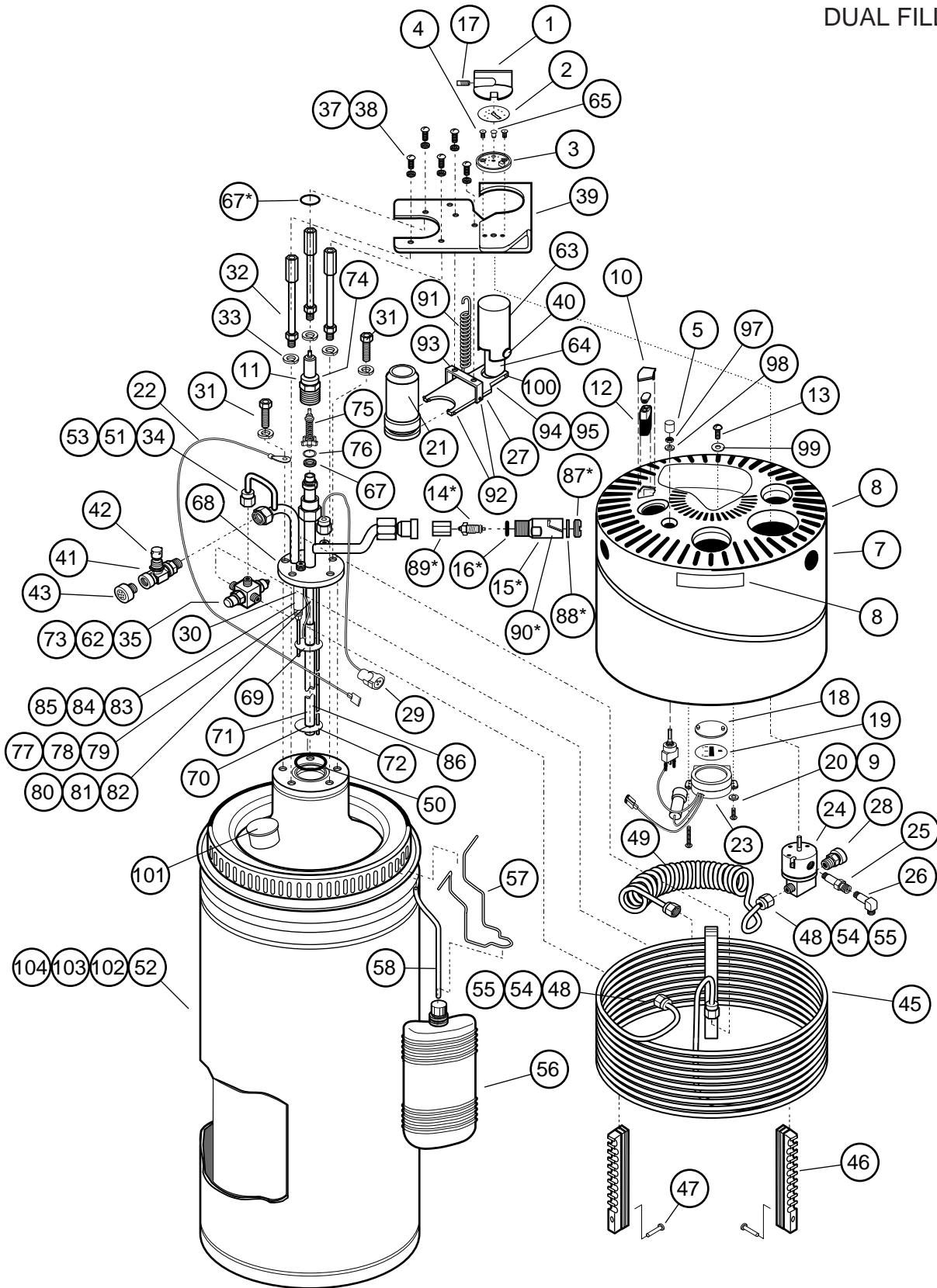
# Dual Fill G3.0 Units Parts List XI

Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Description	Quantity
93	10576505	10576505	10576505	10576505	Hanger Bracket, Pop-Off Assembly . . . . .	1
94	CA003937	CA003937	CA003937	CA003937	Screw #10-24 x 1" LG SS . . . . .	1
95	2911061	2911061	2911061	2911061	Jam Nut #10-24 SS . . . . .	1
97	CA406301	CA406301	CA406301	CA406301	Switch Jam Nut . . . . .	1
98	10490381	10490381	10490381	10490381	Switch Lock Washer . . . . .	1
99	2910991	2910991	2910991	2910991	Washer, Shroud Mount . . . . .	1
100	10576468	10576468	10576468	10576468	Lever Plate, Pop-Off Assembly . . . . .	1
101	3910986	3910986	3910986	3910986	Pumpout Cap . . . . .	1
102	—	—	—	—	Shipping Carton Components . . . . .	
—	CA210025	CA210025	CA210025	CA210025	–Bag, Clear Poly . . . . .	1
—	10792401	10792401	10545207	10545207	–Carton, Shipping . . . . .	1
—	10926587	10926587	10545240	10545240	–Corner Post . . . . .	4
—	10793323	10793323	10793323	10793323	–Top Support . . . . .	1
—	10792435	N/A	N/A	N/A	–Top Support . . . . .	4/2
103	10564379	10564379	10564379	10564379	POI Side Fill . . . . .	1
104	10564387	10564387	10564387	10564387	POI Top Fill . . . . .	1
—	10585866	10585866	10585866	10585866	Roller Base (Complete) . . . . .	1
—	10585840	10585840	10585840	10585840	–Vinyl Caps Black (Roller Base) . . . . .	5
—*	CA405944	CA405944	CA405944	CA405944	–Caster, Dual Wheels 60mm (Roller Base) . . . . .	5
—*	10539261	10539261	10539261	10539261	–Caster, Dual Wheels 60mm w/Brake (Roller Base) . . . . .	5
—*	11192765	11192765	11192765	11192765	–Caster, Dual Wheels 50mm (Roller Base) . . . . .	5
—*	11192757	11192757	11192757	11192757	–Caster, Dual Wheels 50mm w/Brake (Roller Base) . . . . .	5
—	10647449	10647449	10647449	10647449	Handtruck Stairclimber Replacement . . . . .	1 Set

\* CA405944/10539261 (60mm) used on roller bases through 4/30/00.  
 \* 11192765/11192757 (50mm) used on roller bases shipped after 5/1/00.

# XI Parts Illustration

LIBERATOR GEN 3.0  
DUAL FILL



# Dual Fill G3.1 Unit Parts List XI

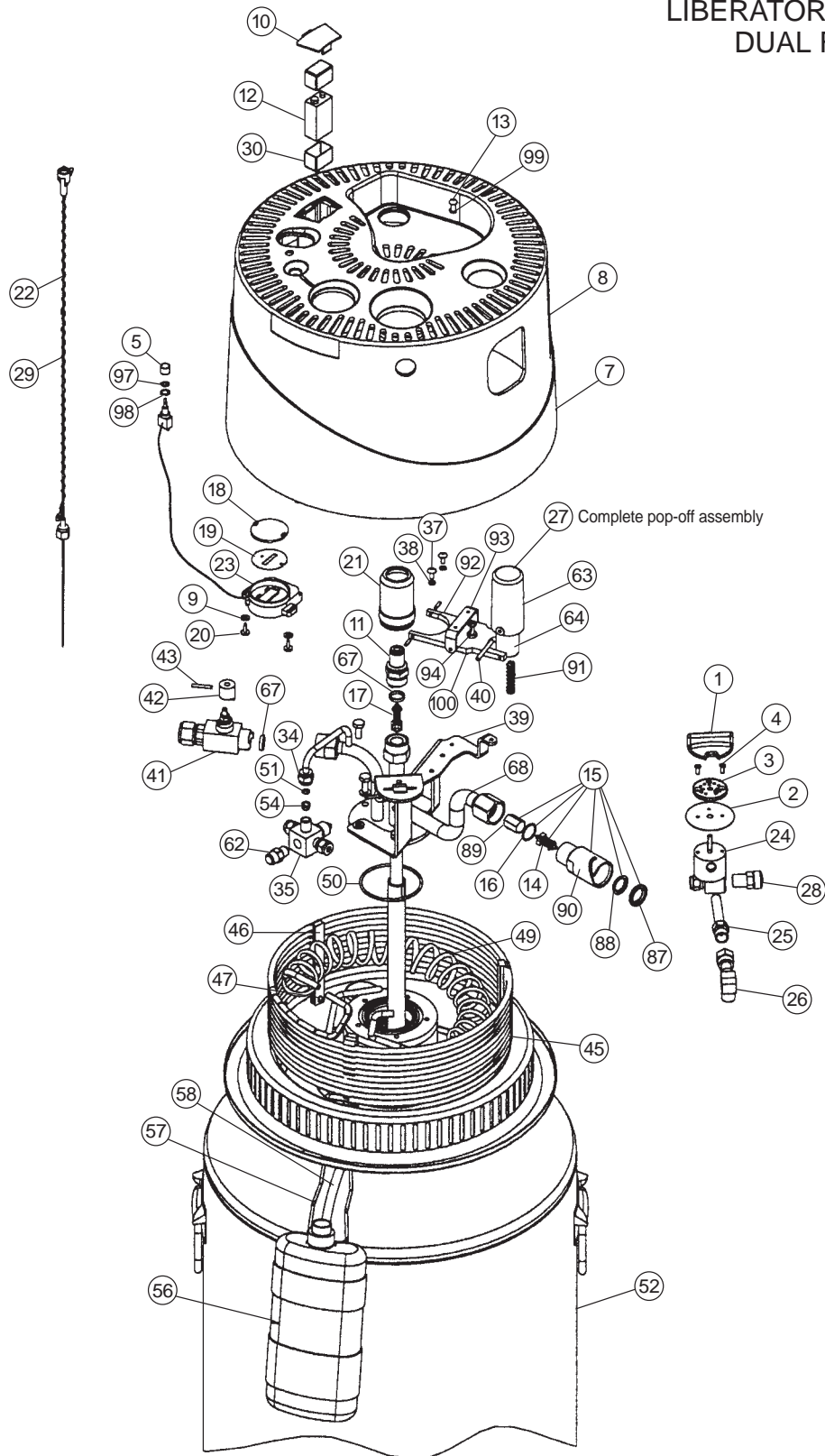
Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Part Number Lib 60	Description	Quantity
1	10567941	10567941	10567941	10567941	10567941	Knob Flow Control Red	.1
2	10567967	10567967	10567967	10567967	10567967	Decal Flow Rate 0-6 LPM	.1
2	10816071	10816071	10816071	10816071	10816071	Decal Flow Rate 0-10 LPM	.1
2	N/A	N/A	N/A	11019006	11019006	Decal Flow Rate 0-15 LPM	.1
3	CA406438	CA406438	CA406438	CA406438	CA406438	Lock Plate	.1
—	CA110071	CA110071	CA110071	CA110071	CA110071	Stop Rivet, FCV	.1
4	CA002876	CA002876	CA002876	CA002876	CA002876	Screw, Lock Plate to FCV	.2
5	10484432	10484432	10484432	10484432	10484432	Cap, Push Button Green	.1
7	10562138	10562138	10562138	10562138	10562138	Shroud Blue	.1
8	10564192	10564192	10564192	10564192	10564192	Label Set	.1
9	CA403690	CA403690	CA403690	CA403690	CA403690	Meter Mount Washer	.2
10	10562154	10562154	10562154	10562154	10562154	Battery Cover Blue	.1
11	10542031	10542031	10542031	10542031	10542031	Top Fill QDV Assembly (PB)	.1
—	10754084	10754084	10754084	10754084	10754084	Top Fill QDV Assembly (Cryo 2)	.1
—	10768540	10768540	10768540	10768540	10768540	QDV Extension (Cryo 2)	.1
—	10531876	10531876	10531876	10531876	10531876	QDV Dust Cap (Cryo 2)	.1
—	10754105	10754105	10754105	10754105	10754105	Top Fill QDV Assembly (Penox)	.1
—	10768558	10768558	10768558	10768558	10768558	QDV Extension (Penox)	.1
—	CA005571	CA005571	CA005571	CA005571	CA005571	QDV Dust Cap (Penox & PB)	.1
12	CA110060	CA110060	CA110060	CA110060	CA110060	Battery	.1
13	2910391	2910391	2910391	2910391	2910391	Screw, Shroud Mount	.1
14	10665372	10665372	10665372	10665372	10665372	Poppet Assembly Side-Fill	.1
15	10577858	10577858	10577858	10577858	10577858	Side Fill QDV Assembly (CA)	.1
16	CA404838	CA404838	CA404838	CA404838	CA404838	O-Ring Seal SF QDV	.1
17	10665292	10665292	10665292	10665292	10665292	Poppet Assembly Top-Fill	.1
18	CA403406	CA403406	CA403406	CA403406	CA403406	Lens, Twist Lock	.1
19	10578076	10578076	10578076	10578076	10578076	Decal, Meter	.1
20	10577891	10577891	10577891	10577891	10577891	Meter Mount Screw	.2
21	10576441	10576441	10576441	10576441	10576441	Sleeve, Pop-Off	.1
22	10657831	10657831	10657831	10657831	10657831	Ground Wire Assembly	.1
23	10855985	10855985	10855985	10855985	10855985	Meter Assembly w/Messenger	.1
23	11510882	11510882	11510882	11510882	11510882	Meter Assembly w/o Messenger	.1
24	10480511	10480511	10480511	10480511	10480511	Flow Control Valve 0-6 LPM	.1
24	10523403	10523403	10523403	10523403	10523403	Flow Control Valve 0-10 LPM	.1
24	N/A	N/A	N/A	11018986	11018986	Flow Control Valve 0-15 LPM	.1
25	CA405938	CA405938	CA405938	CA405938	CA405938	Humidifier Adapter	.1
26	CA405451	CA405451	CA405451	CA405451	CA405451	Elbow Male Humidifier	.1
27	10576513	10576513	10576513	10576513	10576513	Pop-Off Assembly	.1
28	10495289	10495289	10495289	10495289	10495289	Secondary RV 30 psi	.1
29	10657823	10657823	10657823	10657823	10657823	Harness Assembly	.1
30	11040690	11040690	11040690	11040690	11040690	Battery Isolator Vinyl	.2
31	2910501	2910501	2910501	2910501	2910501	Manifold Mount Screws	.2
33	CA200038	CA200038	CA200038	CA200038	CA200038	Washers, Manifold Mount	.5
34	10760273	10760273	10760273	10760273	10760273	Nut, 1/4" ODT BRS	.4
35	10531833	10531833	10531833	10531833	10531833	Economizer Regulator 20 psi	.1
37	CA405164	CA405164	CA405164	CA405164	CA405164	Screw, Mount Pop-Off Assembly	.2
38	CA 405145	CA 405145	CA 405145	CA 405145	CA 405145	Washer, Mount Pop-Off Assembly	.2
39	10905583	10905583	10905583	10905583	10905583	Bracket, Shroud Mount	.1

# XI Dual Fill G3.1 Unit Parts List

Ref. No.	Part Number Lib 20	Part Number Lib 30	Part Number Lib 37	Part Number Lib 45	Part Number Lib 60	Description	Quantity
40	10576450	10576450	10576450	10576450	10576450	Pin, Pop-Off Knob	1
41	10858588	10858588	10858588	10858588	10858588	Vent Valve	1
42	10509960	10509960	10509960	10509960	10509960	Handle, Vent Valve	1
43	10963628	10963628	10963628	10963628	10963628	Spring Pin Handle	1
45	10657760	10657760	10657760	10657760	10657760	Warming Coil	1
45	N/A	N/A	N/A	11018994	11018994	Warming Coil 15 LPM	1
—	N/A	N/A	N/A	10735983	10735983	Cable Tie (used for 15 LPM Warming Coil)	5
46	CA005676	CA005676	CA005676	CA005676	CA005676	Bracket, Vaporizer	3
47	CA004412	CA004412	CA004412	CA004412	CA004412	Rivets, Vaporizer Brackets	3
49	10657778	10657778	10657778	10657778	10657778	Breathing Coil	1
50	CA405086	CA405086	CA405086	CA405086	CA405086	O-Ring, Viton	1
51	CA405074	CA405074	CA405074	CA405074	CA405074	Ferrule BRS 1/4 ODT Front	4
52	11034003	11034094	11033959	11034142	11389031	Dewar Assembly (Domestic)	1
54	CA405072	CA405072	CA405072	CA405072	CA405072	Ferrule BRS 1/4 ODT Front	4
56	CA404899	CA404899	CA404899	CA404899	CA404899	Condensate Bottle	1
57	10584513	10584513	10584513	10584513	11892892	Condensate Bottle Bracket	1
58	10657807	10657807	10657807	10657807	10657807	Drain Tube Assemble	1
62	10585882	10585882	10585882	10585882	10585882	Primary RV 23 psi	1
—	CA003830	CA003830	CA003830	CA003830	CA003830	O-Ring Primary RV	1
63	10645478	10645478	10645478	10645478	10645478	Knob w/Hole, Pop-Off	1
64	10643755	10643755	10643755	10643755	10643755	Shaft, Pop-Off	1
67	CA406506	CA406506	CA406506	CA406506	CA406506	Static Seal Posi-Lok	1
68	10929358	10870430	10929366	10870421	10870421	Manifold / Probe Assembly DF	1
—	10566454	10566454	10566454	10566454	10566454	Plug QDV TF Tube	1
—	CA406506	CA406506	CA406506	CA406506	CA406506	Static Seal Posi-Lok	1
—	10566446	10566446	10566446	10566446	10566446	Plug QDV SF Tube	1
87	CA405319	CA405319	CA405319	CA405319	CA405319	Retaining Ring Side Fill QDV	1
88	CA110104	CA110104	CA110104	CA110104	CA110104	Lip Seal Side Fill QDV	1
89	CA405606	CA405606	CA405606	CA405606	CA405606	Hex Coupler Side Fill QDV	1
90	10666439	10666439	10666439	10666439	10666439	Body Female QDV	1
91	10931351	10931351	10931351	10931351	10931351	Spring, Pop-Off Assembly	1
92	10500033	10500033	10500033	10500033	10500033	Spring Pins 1/8 x 7/16 LG	6
93	10576505	10576505	10576505	10576505	10576505	Hanger Bracket, Pop-Off Assembly	1
94	CA003937	CA003937	CA003937	CA003937	CA003937	Screw #10-24 x 1" LG SS	1
97	CA406301	CA406301	CA406301	CA406301	CA406301	Switch Jam Nut	1
98	10490381	10490381	10490381	10490381	10490381	Switch Lock Washer	1
99	2910991	2910991	2910991	2910991	2910991	Washer, Shroud Mount	1
100	10576468	10576468	10576468	10576468	10576468	Lever Plate, Pop-Off Assembly	1
102	—	—	—	—	—	Shipping Carton Components	1
—	CA210025	CA210025	CA210025	CA210025	CA210025	– Bag, Clear Poly	1
—	10792401	10792401	10545207	10545207	11069011	– Carton, Shipping	1
—	10926587	10926587	10545240	10545240	10545240	– Corner Post	4
—	10793323	10793323	10793323	10793323	10793323	– Tip Support	1
—	10564379	10564379	10564379	10564379	10564379	POI SF English	1
—	10564387	10564387	10564387	10564387	10564387	POI TF English	1
—	10585866	10585866	10585866	10585866	11194074	Roller Base (Complete)	1
—	10585840	10585840	10585840	10585840	10585840	– Vinyl Caps Black (Roller Base)	5
—	CA405944	CA405944	CA405944	CA405944	CA405944	– Caster Dual Wheels (Roller Base) 60mm	5
—	11192765	11192765	11192765	11192765	11192765	– Caster Dual Wheels (Roller Base) 50mm	5

# Parts Illustration XI

## LIBERATOR GEN 3.1 DUAL FILL



# XII Ordering Information

## Ordering Information

The following steps should be used when ordering a new Liberator or replacement parts for an existing unit:

- 1. Compile a list of all equipment and replacement parts to be ordered. An exploded view drawing for easy parts identification, along with parts lists can be found in this section of the manual.**

NOTE: Use the following numbers to order a complete unit:

Model (0-6 LPM)	Side Fill	Top Fill	Dual Fill
L20	10562007	10564150	10660379
L30	10561995	10564133	10564176
L37	10562023	10564168	10660328
L45	10562015	10564141	10564184
L60	11068983	11069020	11208641

Model (0-10 LPM)	Side Fill	Top Fill	Dual Fill
L20	10879389	10879434	10879477
L30	10879400	10879442	10879493
L37	10879418	10879451	10879514
L45	10879426	10879469	10879522
L60	11075905	11075921	11374892

Model (0-15 LPM)	Side Fill	Top Fill	Dual Fill
L45	11177805	11018951	TBD
L60	11075948	11075972	11374876

Please specify also if roller bases are required.

- 2. Fill out a purchase order containing the following information:**

- Purchase order number.
- Name and address of billing location.
- Name and address of shipping location.
- Quantity, part number, description, and unit cost for each item ordered.

- 3. Telephone or Fax CAIRE at one of the numbers listed below to begin immediate processing of the order:**

Toll Free Phone (U.S.A.): 1-800-48 CAIRE  
(1-800-482-2473)

Toll Free Fax (U.S.A.) 1-888-WE CAIRE  
(To place an order): (1-888-932-2473)

Phone: 1-952-882-5000

Fax: 1-952-882-5178

- 4. Mail or fax the completed purchase order for confirmation to:**

**CAIRE, Inc.**  
**3505 County Road 42 West**  
**Burnsville, MN 55306-3803, USA**

# Return Policy XII

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When a Liberator is received, it should be inspected immediately, as outlined in Section VII, Unpacking and Setup Instructions.

If a problem with the unit should be encountered, reference should be made to the Troubleshooting Chart in Section X, page 16-17. If these procedures do not provide a solution for the problem, the following steps should be taken:

1. Call CAIRE, using one of the toll-free numbers, and request a Medical Technical Service Representative. State the problem with the unit. If it is determined that the problem cannot be solved by the distributor, a "Return Authorization Number" will be assigned to the unit or part(s). If a Purchase Order Number is to be referenced, please give this number to the Customer Service Representative at that time.
2. Carefully package the parts, or repack the unit in its original shipping container, precisely as shipped.
3. Write the Return Authorization Number on the top of the shipping container.
4. Return the unit or parts by professional carrier to:

**CAIRE, Inc.**  
**3505 County Road 42 West**  
**Burnsville, MN 55306-3803, USA**

All equipment returned to CAIRE must be shipped "prepaid."

When the defective item(s) is received at CAIRE, it will be serviced and returned to the distributor as soon as possible. A copy of the "Repair Cost Sheet" will be enclosed giving a detailed listing of any maintenance performed.

## Restocking Policy

If it becomes necessary to cancel an order with CAIRE after the shipment has been received, use the following "Restock Policy" procedure:

1. Notify the Customer Service Department at CAIRE using one of the toll-free numbers. When contacting customer service personnel, it will be necessary to relay the following information:
  - a. State the quantity and description of equipment to be returned.
  - b. Give the Serial Number of each unit to be returned.
  - c. State the equipment purchase date.
2. A Return Authorization Number will be issued in the name of the distributor by CAIRE for the equipment to be returned. When the equipment is shipped to the factory, the Return Authorization Number must appear on the packing slip.
3. All equipment must be returned "prepaid" to:

**CAIRE, Inc.**  
**3505 County Road 42 West**  
**Burnsville, MN 55306-3803, USA**

4. Finally, a "Credit Memo" will be issued to the distributor when all equipment has been received, inspected, and restocked by CAIRE.









CAIRE<sup>®</sup> INC

3505 County Road 42 West  
Burnsville, MN 55306-3803, USA

Ref 10662649 Rev K 4/04

