



# BRC FuelMaker

Models FMQ-2,  
FMQ-2.5 & FMQ-2-36

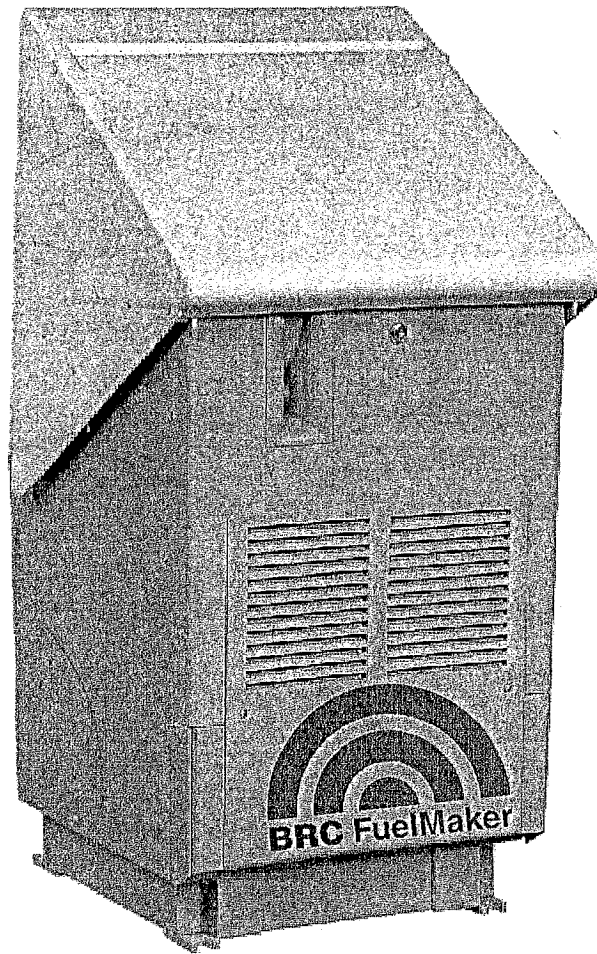
## Vehicle Refueling Appliance



Argentina  
Gas Association



German Gas  
Association



## Installation and Service Instructions

**BRC FuelMaker VRAs Shall Only be Installed and Serviced by an Authorized  
Installation and Service Technician**

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**NATURAL GAS VEHICLE REFUELING  
APPLIANCES**

Natural Gas is currently utilized for home, industrial and electricity generation use. In addition, it has been utilized as a Vehicle Fuel since the 1930s. Early vehicles used low pressure Natural Gas and carried it in balloons on trailers or the roof of the vehicle. Modern personal and fleet vehicles use compressed Natural Gas stored in cylinders.

Currently, Natural Gas powers over one million vehicles worldwide and 1/3 of all new transit buses ordered are Natural Gas powered. Natural Gas is currently utilized in passenger vehicles, fleet vehicles, taxis, buses, lift trucks and ice resurfacers. Natural Gas is a safe viable alternative to gasoline. Natural Gas has a higher octane rating and burns cleaner with less emissions. Natural Gas powered vehicles require less maintenance and have longer engine life. It is lighter than air, and if Natural Gas escapes, it dissipates very rapidly.

BRC FuelMaker Vehicle Refueling Appliances can be found in residences to fuel personal vehicles, in hockey rinks to fuel ice resurfacers, in warehouse operations to fuel lift truck fleets and in many businesses to fuel company vehicles.



## **SAFETY INSTRUCTIONS PLEASE READ CAREFULLY**

### **1. NO USER-SERVICEABLE COMPONENTS**

The FuelMaker FMQ-2/FMQ-2.5/FMQ-2-36 Modules (Control Module, Compression Module, and Electronics Module) must be installed and serviced by personnel specifically trained and authorized by BRC FuelMaker.

Modules must not be dismantled in the field. To do so will void all warranties and could result in serious injury.

### **2. READ INSTRUCTIONS CAREFULLY**

Please read this manual carefully and those of any other FuelMaker Equipment supplied prior to installation and operation. If you are unsure about any feature or are experiencing any difficulties, please contact FuelMaker's Technical Support Group at:

**1-714-656-5905 (North America)**

**+39.0172.486.628 (Europe and Asia)**

### **3. LOCATION OF THE FUELMAKER**

The VRA is to be installed outdoors in non-hazardous locations as defined by the C22.1 Canadian Electrical Code (Canada), and the NEC National Electrical Code (USA). Do not install the VRA under or near a window or directly under potential gas accumulating overhangs. Leaves, snow and other debris should be kept clear of the air inlet and outlet of the VRA. The VRA and the vehicle cylinders must be located so they are both exposed to the same ambient temperature during refueling.

### **4. FOR REFUELING NATURAL GAS VEHICLES ONLY**

Attempts to use the VRA for any other purpose could result in serious injury or death. Vehicle cylinders must be certified for Natural Gas storage at 3000 psig (207 bar) or higher for the FMQ-2 / FMQ-2.5 and 3600 psig (248 bar) or higher for the FMQ-2-36. The BRC FuelMaker VRA may be used for residential and commercial applications in accordance with the requirements of the authorities having jurisdiction.

### **5. REFUELING PRECAUTIONS**

Do not run vehicle engine while refueling and ensure all ignition sources are OFF (including pilot lights in recreational vehicles). Do not smoke or bring an open flame within 3 metres (10 ft.) of the vehicle being refueled.

### **6. IF YOU SMELL GAS**

Shut off the manually-operated valve in the gas supply to the VRA. If possible, close the manual gas valve in the vehicle. Extinguish any open flames. Contact an authorized service representative.

### **7. REFUELING HOSE**

The fill hose must be protected from physical damage, abrasion or from being driven over. When a sign of wear, deterioration, or other damage is apparent in the hose or hose connector, the hose or hose connector must be inspected or replaced immediately by an authorized service representative.

#### **CAUTION**

**NEVER USE ACETONE, THINNER, OR OTHER STRONG  
CHEMICAL AGENTS ON THE PLASTIC HOUSING. TO  
CLEAN THE OUTER SURFACES USE ONLY MILD SOAPS  
AND HOUSEHOLD CLEANERS.**



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## 1 INTRODUCTION

The BRC FuelMaker model FMQ-2, FMQ-2.5, and FMQ-2-36 *Vehicle Refueling Appliances (VRAs)* are self-contained oil-free outdoor appliances used for Natural Gas refueling of vehicles and storage cylinders. The BRC FuelMaker *VRA* can be used in direct fill applications where one or two hoses are connected to the vehicle to be filled or configured for remote time-fill applications by connecting to a *Remote Fueling Panel (RFP)* or for manifolded time-fill applications by connecting to one or more *Auxiliary Fueling Panels (AFP)*. The BRC FuelMaker *VRA* can also be connected to a *Fast-Fill Storage System* for use with fast-fill applications.

Clean burning Natural Gas is less volatile than traditional fuels and decreases required maintenance on your vehicle or equipment. The BRC FuelMaker *VRA* complements the existing network of Natural Gas Fueling Stations.

The model FMQ-2 is designed to fill 20.7 MPa (3000 psi) fuel systems at a nominal flow rate of 3.4 m<sup>3</sup>/hr (2 scfm). The model FMQ-2.5 is designed to fill 20.7 MPa (3000 psi) fuel systems at a nominal flow rate of 4.25 m<sup>3</sup>/hr (2.5 scfm). The model FMQ-2-36 is designed to fill 24.8 MPa (3600 psi) fuel systems at a nominal flow rate of 3.1 m<sup>3</sup>/hr (1.8 scfm).

The BRC FuelMaker *VRA* contains *Ambient Temperature Sensors* which allow the *Electronics Module* to determine the

maximum temperature compensated fill pressure the BRC FuelMaker *VRA* will deliver to the storage cylinder. This prevents over-pressurization of the fuel cylinder should it warm up after being filled.

The BRC FuelMaker *VRA* is air-cooled and is rated for an operating ambient temperature range of -40°C to +45°C (-40° F to +113°F). Air is drawn into the BRC FuelMaker *VRA* through a set of louvers in the rear of the housing and is exhausted through another set of louvers in the front of the housing (See Figure 1). The BRC FuelMaker *VRA* has a *User Panel* located at the front of the unit where the current operating status and error messages are displayed.

**Important: FMQ-2 and FMQ-2.5 are CGA and AGA certified for Canada and the United States. FMQ-2-36 is AGA certified only for the United States. VRAs equipped with Pressure Start System are AGA certified for commercial and industrial applications only for the United States of America. If a model FMQ-2-36 VRA is used to fill a system designed to deliver fuel to a vehicle with a lower pressure rating, a pressure compensating system must be installed to ensure the vehicle cylinder is not over-pressurized. Serious injury or damage to the equipment may result if these precautions are not taken.**

## 2 TECHNICAL SPECIFICATIONS

GAS	FMQ-2	FMQ-2.5	FMQ-2-36
Maximum Discharge Pressure:	20.7 MPa @ 21°C (3000 psig @ 70°F)	20.7 MPa @ 21°C (3000 psig @ 70°F)	24.8 MPa @ 15°C (3600 psig @ 59°F)
Minimum Inlet Pressure:	1.7 kPa (7" w.c.) at rated flow	1.7 kPa (7" w.c.) at rated flow	1.7 kPa (7" w.c.) at rated flow
Maximum Inlet Pressure:	14 kPa (2 psig) at rated flow	3.5 kPa (14" w.c.) at rated flow	3.5 kPa (14" w.c.) at rated flow
Nominal Flow Rate (60 Hz):	3.4 m <sup>3</sup> /hr @ 21°C and 1.7 kPa inlet (2.0 SCFM @ 70°F and 7" w.c. inlet)	4.25 m <sup>3</sup> /hr @ 21°C and 1.7 kPa inlet (2.5 SCFM @ 70°F and 7" w.c. inlet)	3.1 m <sup>3</sup> /hr @ 15°C and 1.7 kPa inlet (1.8 SCFM @ 59°F and 7" w.c. inlet)
<b>ELECTRICAL</b>			
Electrical Supply:	240 Volt AC Single Phase 60 Hz 220 Volt AC Single Phase 50 Hz	240 Volt AC Single Phase 60 Hz 220 Volt AC Single Phase 50 Hz	240 Volt AC Single Phase 60 Hz 220 Volt AC Single Phase 50 Hz
Circuit Ampacity:	15 Amps	15 Amps	15 Amps
Full Load Amperage (60/50Hz):	7.0 / 6.5 Amps	8.0 / 7.25 Amps	7.0 / 6.5 Amps
Average Power Consumption:	0.9 to 1.2 kWh	1.1 to 1.5 kWh	0.9 to 1.2 kWh
<b>MECHANICAL</b>			
Dimensions (L x W x H):	540 mm x 500 mm x 990 mm (21" x 20" x 39")		
Unit Weight / Shipping Weight:	66 kg (145 lbs)		
Noise Level:	49 dBA @ 5 m (16.5 ft), hemispherical field		
Ambient Temperature Rating:	-40°C to +45°C (-40°F to +113°F)		

Table 1 - Technical Specifications

### 3 INSTALLATION INSTRUCTIONS

#### 3.1 GENERAL

Inspect the unit for shipping damage; report any to your distributor immediately. **Do not return product to the manufacturer without prior authorization.**

Verify that the nameplate ratings of the BRC FuelMaker VRA are compatible with the electrical and gas supplies available. In Canada, the BRC FuelMaker VRA must be installed in accordance with CAN/CGA-B149.1 Natural Gas Installation Code, CSA-B108 Natural Gas Fuelling Stations Installation Code, CSA-C22.1 Canadian Electrical Code-Part 1 and with the requirements of the authorities having jurisdiction. In the United States, the VRA shall be installed in accordance with NFPA 52 CNG Vehicular Fuel Systems, NFPA 54 National Fuel Gas Code, NFPA 70 National Electrical Code and the requirements of the authorities having jurisdiction.

Do not install the BRC FuelMaker VRA under or near a window or directly under potential gas accumulating overhangs. Local codes and regulations take precedence over any recommendations contained in these instructions.

Particular attention should be paid to codes dealing with fuel storage, vehicle refueling, and permissible sound levels at the property line.

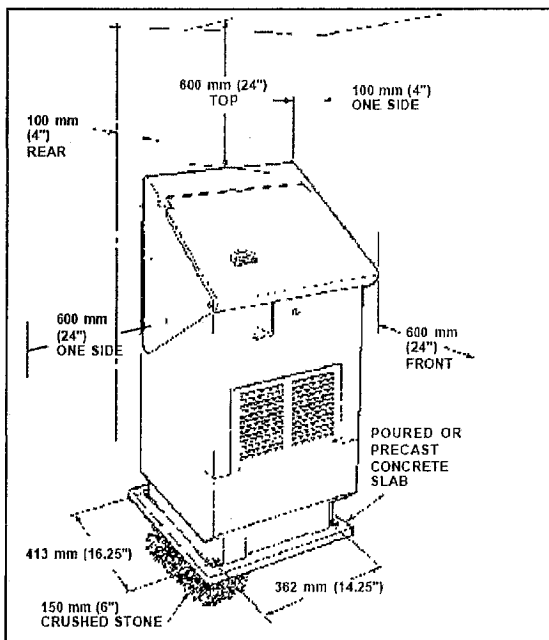


Figure 1 Service Clearances and Mounting Dimensions

The Installer shall instruct the User in the proper operation of the BRC FuelMaker VRA and any approved ancillary devices. Before leaving the site, the Installer shall complete Table 7 on Page 13 in the Operating Instructions manual and shall leave the Operating Instructions manual, and any ancillary device manuals, with the User.

#### 3.2 LOCATION OF THE FUELMAKER

##### Positioning of Base

The BRC FuelMaker VRA must be installed outdoors in accordance with the requirements of the authorities having jurisdiction.

The BRC FuelMaker VRA must be mounted on a firm, level, noncombustible base. Where ground is not level a poured or precast concrete slab placed on a suitably prepared base (e.g. crushed stone, 150 mm (6") deep) is acceptable. Ensure that the servicing clearances stated on the nameplate are maintained, (See Figure 1). Avoid areas where damage from excessive ice build-up may occur such as building overhangs or where vegetation, snow or debris may clog the cooling air inlet/outlet.

##### Vehicle Refueling Point

The VRA is supplied with a coiled high pressure hose to deliver fuel to the vehicle. Single hose lengths from 2 m (7 ft.) to 7.5 m (25 ft.) are available. Dual hoses are restricted to a combined length of 9 m (30 ft) for FMQ-2/ FMQ-2.5 VRAs and 6 m (20 ft) for FMQ-2-36 VRAs. The VRA contains a temperature sensor to determine the allowable fill pressure for any ambient temperature. The VRA must be installed in the vicinity of the cylinders to be refueled. The VRA should not be situated where the vehicle fill hose or outlet tubing must cross a walkway or access route.

##### Electrical and Gas Supply

BRC FuelMaker FMQ-2, FMQ-2.5 and FMQ-2-36 VRAs require a dedicated 240 Volt, 15Amp, Single Phase, 60 Hertz electrical supply.

**Lower input voltage to the FuelMaker can cause the unit to overheat and shut off during warm weather - see Field Wiring section in this manual.**

BRC FuelMaker VRAs should only be installed in distribution areas of relatively dry gas, typically not more than 110 mg/m<sup>3</sup> (7 lbs per million cubic feet) of water vapor. The pressure supplied to the VRA must not exceed the rated supply pressure. Higher pressure will cause damage to the VRA.

#### **Pressure Start System (Optional)**

All BRC FuelMaker VRAs equipped with the Pressure Start option will automatically restart and fill the storage or manifold line. All VRAs are equipped with automatic temperature compensation and will shut down at a maximum pressure determined by the ambient temperature sensed at the VRA (see Table 3). When connected to a storage system or manifold line the Pressure Start System continuously monitors the line pressure and turns the VRAs on when the line pressure drops below a pre-determined level. The *Electronics Module* must have software version 64Q22B for proper operation.

#### **Sound Levels**

The BRC FuelMaker VRA is designed to ensure a sound pressure level of less than 49 dBA (hemispherical field) at a distance of 5 m (16.5 ft). Some local codes restrict the sound level at a property line. Units should not be located where direct or reflected noise is aimed at neighboring windows or other building opening. Avoid locating the unit near a sound reflecting surface or between buildings which are close together.

A noise reduction package is available (model FMQ-2 only) as a factory option which ensures a sound pressure level of less than 45 dBA hemispherical field. Contact BRC FuelMaker for details.

#### **Protection from Vehicle Impact**

Position the BRC FuelMaker VRA in a location where it will not become damaged from possible vehicle impact. If the BRC FuelMaker VRA must be located close to a driveway, provision must be made to protect the unit from damage.

Typically, 4" diameter steel posts embedded at least 1 m (3 ft.) in the ground, with at least 1 m (3 ft.) extending aboveground, and filled with concrete are suitable. Heavy squared timbers or wheel stops may also be used. In any case, the local gas distribution utility should be consulted to determine what practice is locally accepted by the authority having jurisdiction.

### **3.3 INSTALLATION OF THE BRC FUELMAKER VRA**

#### **Mounting to Base**

Prepare the base as explained in Section 3.2. Lag Bolts (3/8 inch) and anchors must be used to secure the FuelMaker feet to the base; the locations of the mounting bolt holes in the FuelMaker base are indicated in Figure 1.

**It is very important to bolt the BRC FuelMaker VRA to the base as the unit must resist the force applied to it in the event of a break-away (e.g. vehicle driven away with the fill hose still attached).**

#### **Gas Piping - Inlet side**

The gas supply is connected to the BRC FuelMaker VRA via a 1/2" NPT nipple provided (See Figure 2). A coupling and transition fittings need to be field-supplied in order to adapt to the supply piping system. Where the supply piping is fixed to a wall, a flex connector may be required to prevent noise transmission into the building.

It is important to clean any contaminants such as cutting oil, rust, and metal shavings out of the interior of the gas inlet piping. Pipe dope and other sealing compounds must not enter the piping.

On low-pressure gas systems in the range of 1.7 kPa (7" w.c.), the VRA must be connected using 1" (minimum) pipe unless the pipe run is less than 3 m (10 ft.); in that case, 3/4" piping can be used. In order to prevent operation with excessively low pressures at the gas inlet to the BRC FuelMaker VRA (e.g. as a result of a partially closed shut-off valve), the BRC FuelMaker VRA has been equipped with a low-pressure switch factory-set to 1.3 kPa (5.2" w.c.).

The BRC FuelMaker VRA may shut down due to low inlet pressure when other gas loads (e.g. furnace, water heater, etc.) draw from the gas supply system. The utility regulator set provided by the local gas utility must have an orifice/spring/setting appropriate for the maximum gas load that the system will experience. In Canada, the installer shall ensure that the compressor and integral low-pressure cut-off switch operates so as to prevent a piping system pressure loss in excess of that specified in CAN/CGA-B149.1 Natural Gas Installation Code.

It is strongly recommended that the VRA be started while simultaneously operating all major gas appliances on the User's system in order to verify the regulator setting. If the BRC FuelMaker VRA shuts down from low inlet pressure, the gas regulator should be reset or resized.

**Gas Piping - Outlet**

The VRA is available with one or two fibre-reinforced high pressure fill hose(s). The fill hose is connected to the VRA via a break-away fitting which allows the hose to be pulled free from the VRA without damage should the user drive the vehicle away without disconnecting. The break-away force is approximately 150 N (34 lbs.) and is independent of the pressure contained in the fill hose.

The VRA can be connected to a Remote Fueling Panel, Auxiliary Fueling Panel or Storage System. The VRA can also be manifolded to other VRAs via manifold adaptor assemblies and tubing.

For slow fill applications the BRC FuelMaker VRA must be used with a refueling nozzle that is AGA/CGA

NGVI Type 3 approved. The nozzle must seal reliably throughout the temperature range and conditions anticipated for the location. An integral normally-closed poppet valve in the nozzle is absolutely essential as it must maintain a positive pressure in the FuelMaker's Blow-down System at all times; air must not migrate up the fill hose and into the *Blow-Down Vessel* during standby.

The use of the Canadian Gas Association (CGA) Certification Seal is contingent upon the use of a refueling nozzle that is CGA NGVI Type 3 approved for use with a Vehicle Refueling Appliance. Therefore, installations requiring the CGA certification to be in force must be equipped with a CGA NGVI Type 3 approved nozzle.

BRC FuelMaker has done, and continues to perform, extensive testing on fueling nozzles. Please contact BRC FuelMaker Technical Support for recommendations.

The fill hose incorporates a fitting and a seal to connect the refueling nozzle. Various adapters are available from BRC FuelMaker to facilitate the attachment of various

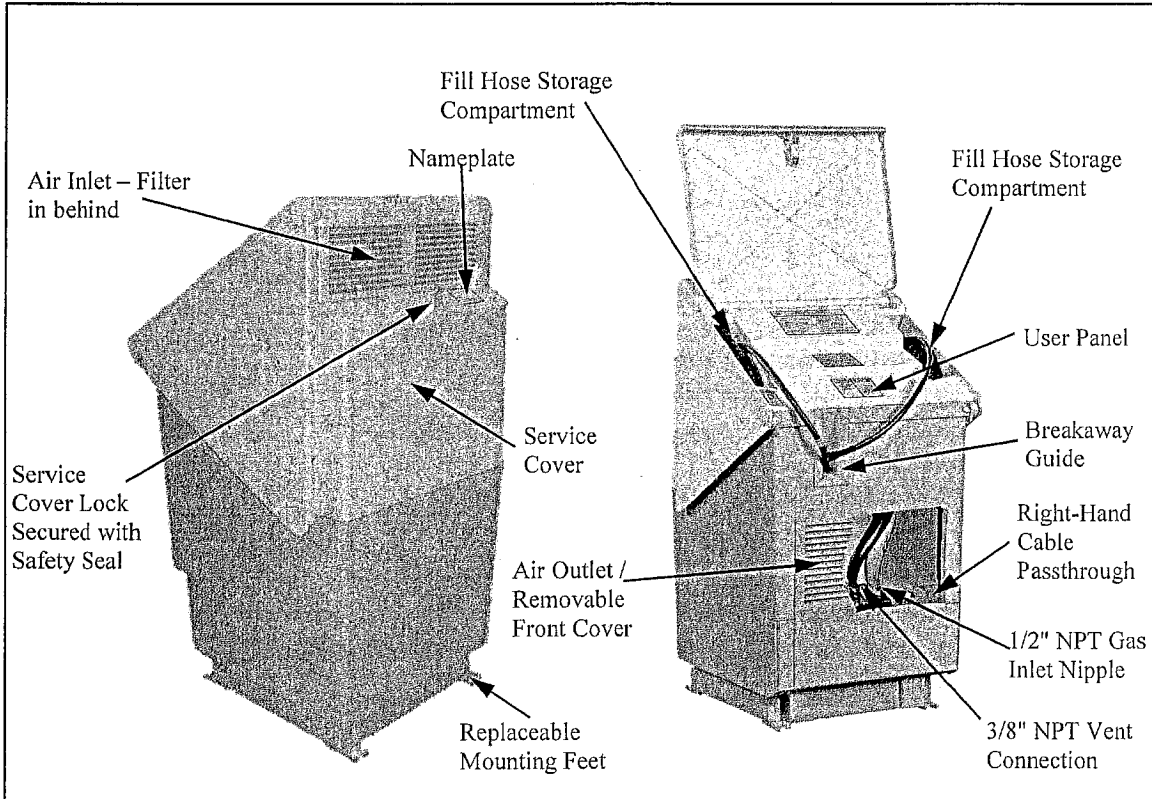


Figure 2 BRC FuelMaker VRA - Main Components

**Gas Piping - Outlet (cont'd)**

nozzles, including 90° or straight take-offs. The fill hose is coiled to allow storage within one of the side pockets of the VRA.

and 9 m (30 ft) for FMQ-2 and FMQ-2.5. Refueling nozzles used with the VRA shall not have an internal volume exceeding 5 cc (0.3 in<sup>3</sup>) per nozzle. When connecting a VRA to a Remote Panel or Auxiliary Fueling Panel, refer to the Installation and Operating instructions for that product regarding maximum allowable tubing and hose lengths. When connecting the VRA to a Storage System, a check valve must be installed between the VRA and the Fast Fill Storage System. When using 1/8" tubing, the check valve must be no more than 27m (85 ft.) from the VRA. When using 1/4" tubing, the check valve must be no more than 6m (20 ft.) from VRA.

**IMPORTANT**

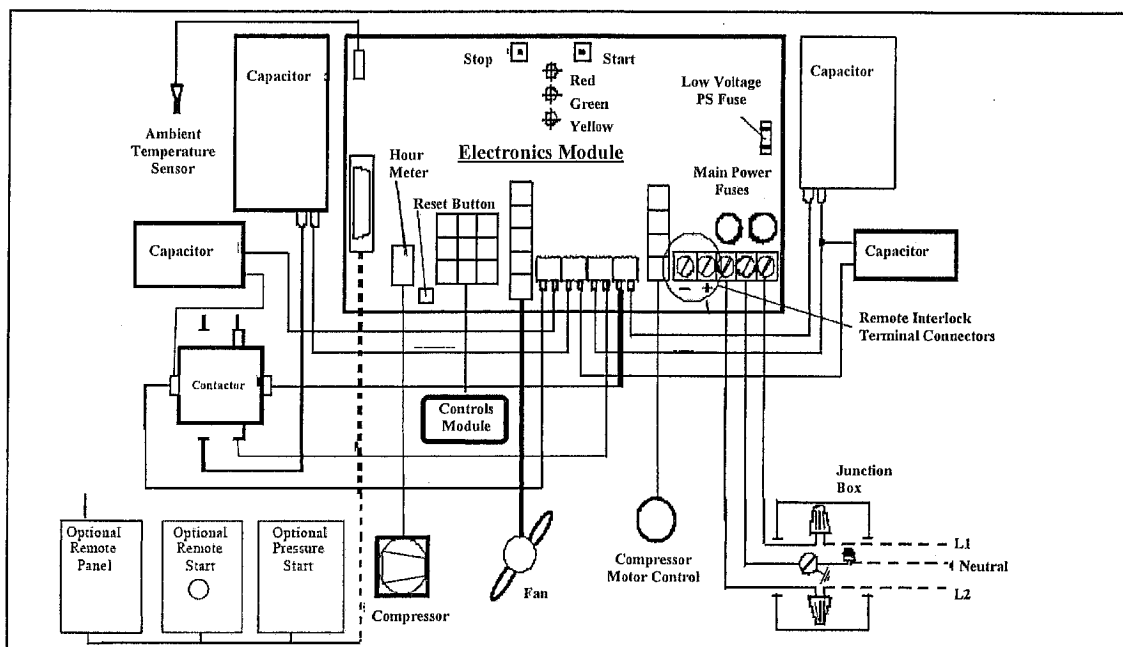
The break-away in the FMQ-2-36 will not engage the hose designed for the FMQ-2/ FMQ-2.5 or vice versa. Please ensure proper hose is used on the VRA. Attempt to use an incorrect hose on the VRA may result in serious injury.

At the completion of each refueling cycle, the high pressure gas contained downstream of the compressor is returned to a *Blow-Down Vessel* (See Figure 4) thus reducing the pressure in the fill hose to approximately 2 bar g (29 psig). "Blow-down" allows the nozzle to be disconnected from the vehicle.

When manifolding VRAs, a check valve must be installed in the branch line to each VRA. Contact BRC FuelMaker Technical Support for information regarding accessories available to connect VRAs to the above noted products.

The BRC FuelMaker Blow-down System has been designed to accommodate the volume of gas contained by the fill hose, refueling nozzle, and the space between the vehicle receptacle and check valve only. Therefore, the allowable maximum length of fill hose has been limited to a combined length of 6 m (20 ft.) for FMQ-2-36 and

Do not connect additional devices or hose lengths to the delivery side of the VRA. To do so will over-pressurize the Blow-down System and cause the pressure relief valve to open, venting Natural Gas to the atmosphere. Contact the local authority having jurisdiction for requirements pertaining to manifolding VRAs or connecting VRAs to ground Storage.



*Figure 3 Schematic Diagram of Electronics Module*

### Vent Connection

The 3/8" NPT vent connection (See Figure 2) is protected from blockage by ice or insects by the supplied screen fitting. The Vent discharges any gas released by the pressure relief valve in order to protect the Blow-down System from over pressurization. If the VRA must be installed near building openings, a 10 mm (3/8") minimum inside diameter steel vent line should be connected to the 3/8" NPT Vent Connection and routed to a safe place of discharge as required by the local codes. The maximum allowable vent line length is limited to 5 m (17 ft.) when using 3/8" vent to protect the low pressure switch from over-pressurization. Refer to the applicable gas code for appropriate pipe size if vent line must extend beyond 5m (17 ft.). Be sure to transfer the screen fitting to the end of the remote vent line (if applicable) to protect it from blockage.

**It is extremely important to terminate the remote vent line in such a way that water cannot enter the vent line and freeze. Do not allow ice to build up at the open vent connection or the remote vent line termination. The vent line must remain clear if it is to be able to vent gas and protect the Blow-down System from over pressurization.**

### Field Wiring

The VRA has been wired at the factory and is ready for connection to the electrical service. The junction box can be accessed by opening the *service cover* of the VRA (See Figure 4). Three No. 16 gauge wires have been provided; Line 1, Line 2, and a grounding conductor. The connections can be made with any approved wire splicing devices such as wire nuts. The junction box incorporates 7/8" knock-outs to accept various wiring methods (e.g. armoured liquid-flex, BX, portable cable with strain relief, etc.). The cable/conduit is passed through one of the two cable passthrough openings located on either side of the piping bulkhead (the left-hand passthrough opening is most convenient) and then routed up to the junction box.

The electrical wiring must comply with the latest revision of the Canadian Electrical Code Part I in Canada, or the National Electrical Code NEC in the United States and the requirements of the authority having jurisdiction. Each branch circuit feeding the VRA should be protected from overcurrent by a separate 2-pole circuit breaker, or time delay fuse disconnect. In addition to the overcurrent protection device, an emergency disconnect

should be located within sight and within 30 feet of the VRA. If allowed by local codes, a manually operated general purpose AC switch rated at 15A 240 VAC housed in a suitable enclosure, may be used as the emergency disconnect.

Low-voltage wiring is required when connecting an interlocking (remote shutdown) device such as a *natural gas detector*. The low-voltage wiring can be routed into the VRA adjacent to electrical supply cable or conduit, and connected to the terminal strip on the electronics board as shown in Figure 3 (do not run low-voltage wiring and electrical supply wiring within the same conduit). The interlocking device should be selected to provide a 12 VDC Normally-On signal. Once the interlocking device has been installed, the VRA, must be programmed to acknowledge the presence of the device.

### Field Programming

A programming device is available from BRC FuelMaker to allow the installer or service personnel to change the following parameters in the field:

- recognition of remote panel connected;
- maximum tank volume, 140 or 280 litres (37 or 74 US gal.);
- recognition of remote shutdown device (eg. Natural Gas Detector) connected;
- pressure rise monitoring ON/OFF.

Upon receipt of a new BRC FuelMaker VRA, the parameters have been factory-set to: *Remote Panel* not connected (OFF), 280 litres, and pressure rise monitoring ON. The programming device is connected to the *Electronics Module* via the programming device connection located underneath the *Electronics Module* (See Figure 4). Follow the instructions included with the programming device.

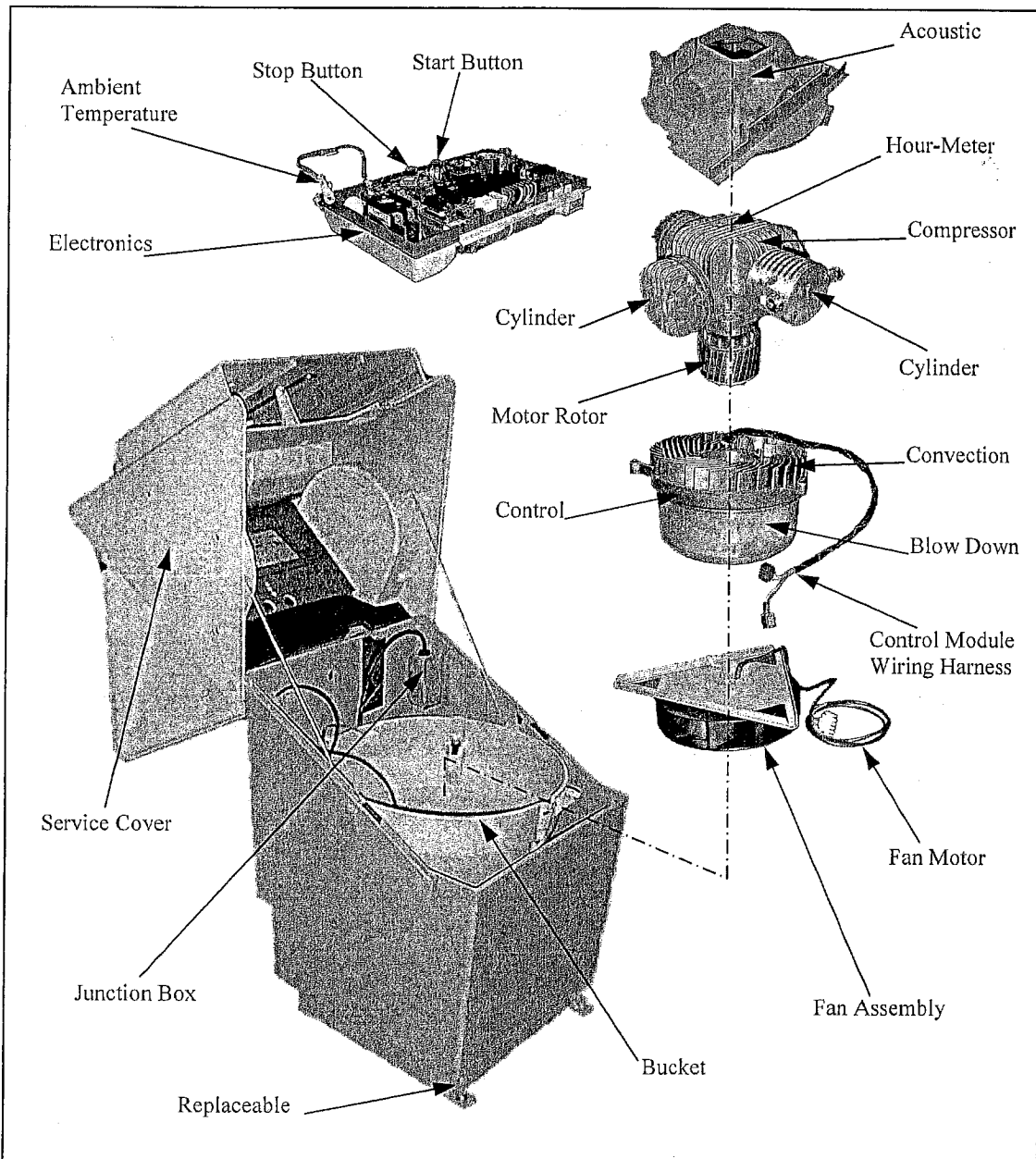
### IMPORTANT

**After the changing of any of the settings, the unit must be powered down at the main electrical switch (NOT the STOP button only) for 1 minute and turned on again. If this procedure is not followed, the settings may not change.**

The VRA monitors the pressure rise at the fill hose during refueling in order to check for possible leaks. A leak is presumed if the pressure does not rise at a sufficient rate. Since the rate of pressure rise depends on the volume of the vehicle cylinder(s), some adjustment must be

made to accommodate the slower pressure rise associated with the larger cylinder(s). The programming device provides such an adjustment. For the greatest leak detection sensitivity, the lowest cylinder setting should be used, when possible. In the rare case where the tank volume is in excess of 280 litres, or where the VRA is connected to ground storage or piping system exceeding 280 litre water capacity, the pressure rise monitoring

system must be programmed OFF. This setting should not be used unless absolutely necessary and the User must be made aware that fill hose leakage will not be monitored.



**Figure 4** *BRC FuelMaker - Module Components*



3.4 TESTING AND COMMISSIONING

To commission (and service) the VRA, an approved high pressure test cylinder is required. A *test kit* is available from BRC FuelMaker, complete with a CGA/AGA NGV 1 vehicle refueling receptacle, a hand-operated vent valve, and a calibrated pressure gauge.

Purge the Natural Gas supply piping of air as follows:

- Attach the fill hose to the *test kit* via the refueling nozzle, and then open the vent valve.
- Purge the VRA of air by running it on natural gas and venting the gas through the *test kit* vent valve for 30 seconds.
- Verify that the cooling fan is operating by checking for air flow out of the front grill.
- After purging, close the vent valve and allow the VRA to fill the test cylinder until the VRA shuts off with the "Vehicle Full" indication on the *user panel* (e.g. yellow lamp illuminated steadily). The *test kit* cylinder should be full within 13 minutes for models FMQ-2 and FMQ-2-36; 10 minutes for model FMQ-2.5, and the shut-off pressure should be within the allowable limits as indicated in Table 2 & Table 3.

- If the shutdown pressure is out of tolerance, refer to Section 6 "Service Instructions", in this manual.

Following installation, the fittings should be leak-tested using a suitable soap solution. The high pressure connections should be leak-checked while the VRA is in operation filling the *test kit* cylinder in the range of 238 to 248 bar (3450-3600 psig) for FMQ-2-36 and 190 to 200 bar (2760-2900 psig) for FMQ-2/FMQ-2.5. As a minimum, the following locations must be leak-tested:

- All inlet piping connections.
- All high-pressure piping connections including the break-away fitting(s) and refueling nozzle(s).
- The screen fitting at the end of the vent line (small leaks from the pressure relief valve may not be detected by the VRA's fault diagnostic system). Ensure that the leak detection fluid does not freeze and block the vent line.

Safety precautions require that the FuelMaker's internal components be inaccessible to the user and other unauthorized persons. Therefore, before leaving the site, authorized personnel **must** ensure that the service cover is locked with a safety seal. (See Figure 2).

207 ± 7.0 bar @ 21°C and above	3000 ± 100 psig @ 70°F and above
183 ± 7.5 bar @ 10°C	2660 ± 110 psig @ 50°F
166 ± 8.0 bar @ 0°C	2410 ± 115 psig @ 32°F
150 ± 8.5 bar @ -10°C	2180 ± 120 psig @ 14°F
133 ± 9.0 bar @ -20°C	1930 ± 130 psig @ -4°F
116 ± 9.5 bar @ -30°C	1690 ± 135 psig @ -22°F
100 ± 10 bar @ -40°C	1450 ± 145 psig @ -40°F

At temperatures below -45°C (-49°F) and +55°C (131°F) the micro-processor will not allow the FuelMaker to start, and indicate an "Incorrect" condition at the *user panel*.

Table 2 Shutdown Pressure vs Ambient Temperature for FMQ-2 & FMQ-2.5

248 ± 7.0 bar @ 15°C and above	3600 ± 100 psig @ 59°F and above
232 ± 7.5 bar @ 10°C	3370 ± 110 psig @ 50°F
210 ± 8.0 bar @ 0°C	3050 ± 115 psig @ 32°F
188 ± 8.5 bar @ -10°C	2730 ± 120 psig @ 14°F
165 ± 9.0 bar @ -20°C	2390 ± 130 psig @ -4°F
143 ± 9.5 bar @ -30°C	2073 ± 135 psig @ -22°F
121 ± 10 bar @ -40°C	1754 ± 145 psig @ -40°F

At temperatures below -45°C (-49°F) and +55°C (131°F) the micro-processor will not allow the FuelMaker to start, and indicate an "Incorrect" condition at the *user panel*.

Table 3 Shutdown Pressure vs Ambient Temperature for FMQ-2-36

### 4 USER PANEL OPERATION

Starting, stopping and monitoring of the VRA takes place at the *User Panel*. The *User Panel* has separate "START" and "STOP" buttons and three indicator lights, as shown in Figure 5.

After shut-down the pressure in the refueling hose will be automatically reduced to less than 2 bar (29 psig), making it possible to disconnect the refueling nozzle from the vehicle.

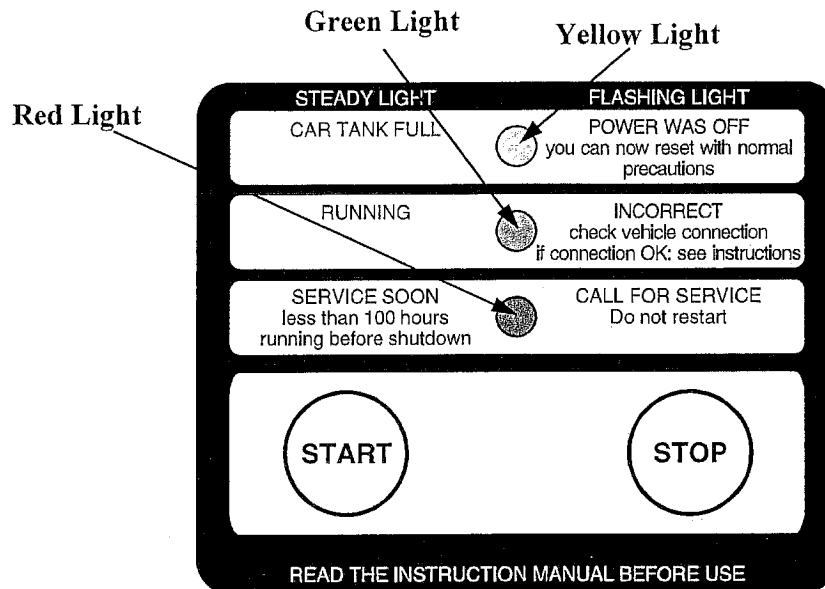


Figure 5 - User Panel

#### 4.1 USER PANEL INDICATIONS

The lights on the *user panel* indicate the following conditions:

INDICATION	DESCRIPTION
No Light Illuminated	<b>READY</b> to start, <b>or</b> electrical power is disconnected, <b>or</b> fuses require replacement. Note: if VRA is running and a power failure occurs and lasts less than 15 seconds, the VRA will start automatically 15 seconds after the return of power.
Yellow Light Steady	<b>VEHICLE CYLINDERS(S) FULL</b> The vehicle is full or the maximum pressure has been reached in a disconnected <i>Fill Hose</i> . The VRA can be restarted by pressing the <b>START</b> button.
Green Light Steady	<b>RUNNING</b> The VRA is running.
Red Light Steady	<b>SERVICE SOON</b> The VRA will run for less than 100 hours after which it will shut down if not serviced. Note: During the last 100 hours of operation, both the green light and red light will illuminate steadily while the VRA is in operation.



4.2 ABNORMAL USER PANEL INDICATIONS (FLASHING LIGHTS)

INDICATION	DESCRIPTION
Yellow Light Flashing	<p><b>POWER WAS OFF</b> for more than 15 seconds. Press <b>START</b> to operate the BRC FuelMaker VRA.</p> <p>Note: If the power failure lasts for less than 15 seconds, the BRC FuelMaker VRA will start automatically 15 seconds after the return of power (providing that the VRA was running before the power failure).</p>
Green Light Flashing	<p><b>INCORRECT</b> –The BRC FuelMaker VRA is shut down in an <b>INCORRECT</b> state but may be restarted by the User if the fault is corrected.</p> <p>The most common causes of an <b>"INCORRECT"</b> indication will be:</p> <ul style="list-style-type: none"> <li>• incorrect or damaged connection to the vehicle.</li> <li>• a closed gas supply shut-off valve.</li> <li>• a blockage of in the FuelMaker VRA air vents.</li> <li>• a faulty filling hose (e.g. leak)</li> <li>• excessive filling time (25 hours continuous running).</li> </ul> <p><b>Note:</b> Vehicles, with total tank capacities in excess of 140 litres (37 US gal), may take longer than 25 hours to fill from empty under certain conditions (e.g. high ambient temperature, <i>Compression Module</i> approaching service interval, etc.)</p> <p>In this case, a thorough check for gas leakage shall be conducted. The BRC FuelMaker VRA may be simply restarted after a positive check that there is no other cause of the <b>"INCORRECT"</b> indication. If the User is routinely filling vehicles with a cylinder capacity greater than 140 litres, the maximum tank volume can be set by your local authorized dealer with a programming device.</p> <p>Details on the above faults are given in the <b>"FAULT DIAGNOSTICS"</b> tables. When the above have been checked and any obvious faults corrected, the unit may be restarted after first pressing the <b>"STOP"</b> button.</p>
Red Light Flashing	<p><b>CALL FOR SERVICE</b> - The BRC FuelMaker VRA is shut down and a <b>CALL FOR SERVICE</b> is necessary.</p> <p>The automatic safety system will prevent a restart unless the fault is corrected by authorized personnel.</p>
Yellow, Green and Red lights flashing (simultaneously)	<p><b>HOURL-METER MISSING</b> - The BRC FuelMaker VRA is shut down and the automatic safety system will prevent a restart. <b>IMPORTANT:</b> Before plugging the <i>hour-meter</i> into the <i>Electronics Module</i> circuit board, the main electrical power <b>must</b> be disconnected. Hour-meter data will be destroyed if power is not disconnected and the BRC FuelMaker VRA will not restart unless the <i>Compression Module</i> is changed.</p>
Yellow, Green and Red lights flashing (sequentially)	<p><b>SYSTEM LOCKOUT FOR APPROXIMATELY 15 SECONDS</b> - The BRC FuelMaker VRA automatic safety system will prevent immediate restart due to internal requirements.</p>



**4.3 INDICATOR LIGHTS CHECK:  
(BRC FUELMAKER VRA NOT RUNNING)**

To check that the indicator lights are working correctly, press and hold the **STOP** button. All three indicator lights should light briefly (about one second) and then go out. If no indicator lights come on, there is probably no power to the *Electronics Module* or the fuses require replacement. (If one or more indicator lights fail to illuminate there is probably an error in the *User Panel*).

**4.4 SERVICE HOURS:**

Table 4 displays the operating hours until the VRA requires service (or hours since service up to the first 50 hours). To obtain the indications, the following button(s) have to be pressed:

When the VRA is **"RUNNING"**:  
Press and hold the **"START"** button.

When the VRA is not running:  
First press and hold the **"STOP"** button, then press the **"START"** button.

After the code is displayed, release the **"START"** button first, followed by the **"STOP"** button (the VRA will not start if this sequence is not followed).

At first, all lights are illuminated briefly as a light check. The light check is followed by the operating hours check.

CODE	YELLOW	GREEN	RED	HOURS REMAINING UNTIL SERVICE
0 0 1	○	○	●	1450 and Higher
0 1 0	○	●	○	650 — 1449
0 1 1	○	●	●	350 — 649
1 0 0	●	○	○	250 — 349
1 0 1	●	○	●	150 — 249
1 1 0	●	●	○	50 — 149
1 1 1	●	●	●	0 — 49

*Table 4 - Hours remaining before service*

**5 FAULT DIAGNOSTICS (Software Version 64):**

The VRA has diagnostic capabilities both in the "INCORRECT" (green light flashing) and the "CALL FOR SERVICE" (red light flashing) mode. To display the cause of an "INCORRECT" or a "CALL FOR SERVICE" mode, press and hold the "STOP" button. Tables 4 and 5 show the fault diagnostics and corrective actions.

The digits 0, 1 and 2 in Tables 4 and 5 correspond to the following light status.

<p>Top = Yellow light          Centre = Green light          Bottom = Red light</p> <p>0 =  light off      1 =  steady light      2 =  light flashing</p>
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**5.1 DIAGNOSTICS WHEN IN "INCORRECT" MODE (GREEN LIGHT FLASHING) :**

Pressing and holding the "STOP" button first acts as a light check by illuminating all 3 lights briefly. After this brief delay, error codes are displayed:

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
0 0 0	YEL off GRN off RED off	Error indication lost or error in display or <i>Electronics Module</i> , or in connecting cables.  <b>If OK:</b> try normal filling procedure. <b>If fault persists,</b> Check Power Supply and Fuses.
0 0 1	YEL off GRN off RED steady	Excessive motor temperature  Check if cooling path is clear.  <b>If OK:</b> Try normal filling procedure.  <b>If fault persists,</b> check voltages at the Power Supply and at the connection to the BRC FuelMaker VRA.
0 1 0	YEL off GRN steady RED off	Insufficient rise of filling pressure at beginning of fill cycle, and below 20 bar g (290 psig). [7 minutes for 280 liters (74 US gal.) setting].  Check that refueling nozzle is properly connected to vehicle.  <b>If OK:</b> check that total vehicle cylinder volume does not exceed the maximum volume of 140 litres (37 U.S. gal.) [may be reset to 280 litres (74 U.S. gal.) by authorized Dealer].  <b>If OK:</b> Check high pressure system for leaks.  <b>If leaks are found,</b> repair as required.  <b>If no leaks are found,</b> restart the BRCFuelMaker VRA.  <b>If fault persists,</b> check high pressure components in the BRC FuelMaker VRA.

Table 5 - Diagnostics for "INCORRECT" Mode.



ERROR CODE		DESCRIPTION	CORRECTIVE ACTION
0	YEL off	Sudden pressure drop in high pressure system to below 20 bar g (290 psig).*	Check high pressure system for leaks.
1	GRN steady		<b>If OK:</b> start VRA with refueling nozzle disconnected from vehicle (approved refueling nozzles will seal when disconnected from vehicle). Allow VRA to run until "FULL" is indicated.  <b>If VRA continues to run for longer than 1 minute with disconnected refueling nozzle,</b> check Controls Module for leakage.
1	RED steady		
<p><b>Note:</b> Error Code 011 can also result from:</p> <p>a) Filling two vehicles simultaneously if either of the vehicle check valves stick, or if a second vehicle is connected while the VRA is running. <b>To start filling procedure, always connect the refueling nozzle to the vehicle receptacle first, open the nozzle shut-off valve if provided, and subsequently start the FuelMaker.</b></p> <p>b) Hydrate (ice) blockages (snow-like) within the fill hose fittings that are suddenly blown clear. Low temperatures and wet gas contribute to hydrate formation.</p>			
0	YEL off	External Interlock (remote shut-down).*	Check condition which caused error (e.g. Remote Panel R410, gas sensor) if an external interlock has been installed.
2	GRN flashing		Restart the unit, if safe to do so.
1	RED steady		<b>If fault persists,</b> check voltages from external interlock to determine which device is at fault.
1	Yel steady	Temperature too low or too high or failure of temperature sensor.*	Restart the unit if cause was temperature below -45° C (-49° F) or above +45° C (+113° F).
0	GRN off		<b>If fault persists,</b> check temperature sensor in FuelMaker VRA for proper connection and ensure that the sensor is properly locked into place.
0	RED off		
1	Yel steady	Insufficient inlet pressure.*	Check that the main Natural Gas supply valve is open.
0	GRN off		<b>If OK:</b> restart the VRA.
1	RED steady		<b>If fault persists,</b> check inlet pressure with system running at full demand (i.e. all heaters and NG appliances running).
1	Yel steady	Excessive surface temperature or failure of temperature sensor while VRA is running.*	Check to see if the cooling air path is clear.
0	GRN off		<b>If OK:</b> restart the VRA.
2	RED flashing		<b>If fault persists,</b> check power supply voltage at mains and at the FuelMaker VRA.

Table 5 - Diagnostics for "INCORRECT" Mode (continued)



ERROR CODE		DESCRIPTION	CORRECTIVE ACTION
1	YEL steady	Stop button sequencing error.	Press "STOP" button then "START" button to restart the unit.  If fault persists, reset the FuelMaker VRA.
1	GRN steady		
0	RED off		
1	YEL steady	Electronics error.	Press "STOP" button then "START" button to restart the unit.  If fault persists, check Electronics Module.
1	GRN steady		
1	RED steady		
1	YEL steady	No storage of operating hours during last power failure.	Restart the unit.  If fault persists, reset the FuelMaker VRA.
1	GRN steady		
2	RED flashing		
1	YEL steady	Failure of motor controls	Restart the unit.  If fault persists, check controls module for proper operation.
2	GRN flashing		
0	RED steady		
1	YEL steady	Excessive Pressure Rise	Ensure that the refueling hose is properly connected to the vehicle.  If OK: Check for refueling hose blockage.  If OK: Restart the FuelMaker VRA.
2	GRN flashing		
1	RED steady		
1	YEL steady	Maximum running time exceeded (more than 25 hours).	Verify that the maximum vehicle cylinder volume does not exceed the maximum volume of 140 litres (37 U.S. gal.) [may be set to 280 litres (74 U.S. gal.) by Local Authorized Dealer].  If Cylinder volume is correct, check for leaks (smell).  If leaks detected, repair as required.  If no leaks detected, restart the FuelMaker VRA and complete the fill.  If fault persists, reset and restart FuelMaker VRA.
2	GRN flashing		
2	RED flashing		

Table 5 - Diagnostics for "INCORRECT" Mode (continued)



ERROR CODE		DESCRIPTION	CORRECTIVE ACTION
0	YEL off	Sudden pressure drop in high pressure system to below 20 bar g (290 psig). *	Check high pressure system for leaks.
1	GRN steady		<b>If OK:</b> start VRA with refueling nozzle disconnected from vehicle (approved refueling nozzles will seal when disconnected from vehicle). Allow VRA to run until "FULL" is indicated.  <b>If VRA continues to run for longer than 1 minute with disconnected refueling nozzle,</b> check Controls Module for leakage.
1	RED steady		
<p><b>Note:</b> Error Code 011 can also result from:</p> <p>a) Filling two vehicles simultaneously if either of the vehicle check valves stick, or if a second vehicle is connected while the VRA is running. <b>To start filling procedure, always connect the refueling nozzle to the vehicle receptacle first, open the nozzle shut-off valve if provided, and subsequently start the FuelMaker.</b></p> <p>b) Hydrate (ice) blockages (snow-like) within the fill hose fittings that are suddenly blown clear. Low temperatures and wet gas contribute to hydrate formation.</p>			
0	YEL off	External Interlock (remote shut-down). *	Check condition which caused error (e.g. Remote Panel R410, gas sensor) if an external interlock has been installed.
2	GRN flashing		Restart the unit, if safe to do so.
1	RED steady		<b>If fault persists,</b> check voltages from external interlock to determine which device is at fault.
1	Yel steady	Temperature too low <b>or</b> too high <b>or</b> failure of temperature sensor. *	Restart the unit if cause was temperature below -45° C (-49° F) or above +45° C (+113° F).
0	GRN off		<b>If fault persists,</b> check temperature sensor in FuelMaker VRA for proper connection and ensure that the sensor is properly locked into place.
0	RED off		
1	Yel steady	Insufficient inlet pressure. *	Check that the main Natural Gas supply valve is open.
0	GRN off		<b>If OK:</b> restart the VRA.
1	RED steady		<b>If fault persists,</b> check inlet pressure with system running at full demand (i.e. all heaters and NG appliances running).
1	Yel steady	Excessive surface temperature <b>or</b> failure of temperature sensor while VRA is running. *	Check to see if the cooling air path is clear.
0	GRN off		<b>If OK:</b> restart the VRA.
2	RED flashing		<b>If fault persists,</b> check power supply voltage at mains and at the FuelMaker VRA.

Table 5 - Diagnostics for "INCORRECT" Mode (continued)



ERROR CODE		DESCRIPTION	CORRECTIVE ACTION
1	YEL steady	Stop button sequencing error.	Press "STOP" button then "START" button to restart the unit.  <b>If fault persists</b> , reset the FuelMaker VRA.
1	GRN steady		
0	RED off		
1	YEL steady	Electronics error.	Press "STOP" button then "START" button to restart the unit.  <b>If fault persists</b> , check Electronics Module.
1	GRN steady		
1	RED steady		
1	YEL steady	No storage of operating hours during last power failure.	Restart the unit.  <b>If fault persists</b> , reset the FuelMaker VRA.
1	GRN steady		
2	RED flashing		
1	YEL steady	Failure of motor controls	Restart the unit.  <b>If fault persists</b> , check controls module for proper operation.
2	GRN flashing		
0	RED steady		
1	YEL steady	Excessive Pressure Rise	Ensure that the refueling hose is properly connected to the vehicle.  <b>If OK</b> : Check for refueling hose blockage.  <b>If OK</b> : Restart the FuelMaker VRA.
2	GRN flashing		
1	RED steady		
1	YEL steady	Maximum running time exceeded (more than 25 hours).	Verify that the maximum vehicle cylinder volume does not exceed the maximum volume of 140 litres (37 U.S. gal.) [may be set to 280 litres (74 U.S. gal.) by Local Authorized Dealer].  <b>If Cylinder volume is correct</b> , check for leaks (smell).  <b>If leaks detected</b> , repair as required.  <b>If no leaks detected</b> , restart the FuelMaker VRA and complete the fill.  <b>If fault persists</b> , reset and restart FuelMaker VRA.
2	GRN flashing		
2	RED flashing		

Table 5 - Diagnostics for "INCORRECT" (continued)



ERROR CODE		DESCRIPTION	CORRECTIVE ACTION
2	YEL flashing	Power was off.	Restart the FuelMaker VRA.
0	GRN off		
0	RED off		
2	YEL flashing	Failure of Blow-down System.	<p><b>If refueling nozzle is difficult to disconnect</b>, reduce pressure in the hose by closing the fuel supply valve between the vehicle cylinder(s) and engine, then start and run the engine until it quits.</p> <p>Open the fuel supply valve and restart the FuelMaker VRA.</p> <p><b>If fault persists</b>, check controls module for proper operation.</p>
0	GRN off		
1	RED steady		
2	YEL flashing	<p>Insufficient pressure rise with tank pressure exceeding 20 bar g (290 psig) or beyond 6 minutes after start up</p> <p>[with 280 litre (74 U.S. gal.) setting: 14 minutes]</p>	<p>Check high pressure system for leaks.</p> <p><b>If OK:</b> turn off gas supply and restart the FuelMaker VRA. It should shut down within 1 minute indicating "INCORRECT" 101.</p> <p><b>If fault persists</b>, check controls module for proper operation.</p>
1	GRN steady		
0	RED off		
2	YEL flashing	Faulty Hour-meter	<p>Restart the FuelMaker VRA.</p> <p><b>If fault persists</b>, check connection of hour meter to the electronics module with the unit powered OFF. Replace compression module if damage has occurred to hour meter.</p>
2	GRN flashing		
0	RED steady		

Table 5 - Diagnostics for "INCORRECT" (continued)



**5.2 DIAGNOSTICS WHEN IN "CALL FOR SERVICE" MODE (RED LIGHT FLASHING):**

Pressing and holding the "STOP" button first acts as a light check by illuminating all three lights briefly. After this brief delay, the error codes described in Table 5 are displayed by pressing and holding the "STOP" button. Up to five error conditions are stored and retrieved by respectively pressing the "START" button (while the "STOP" button remains pressed continuously) until the 222 indication (end of stored messages) is given. After the appropriate corrective action is taken, as indicated in Table 5, the reset button (shown in Figure 3) should be pushed to clear the error.

ERROR CODE		DESCRIPTION	CORRECTIVE ACTION
0	YEL off	Service Interval Overdue	Replace Compression Module.
0	GRN off		
2	RED flashing		
0	YEL off	Excessive Blow-down Pressure or vehicle check valve stuck	Check vehicle refueling receptacle for debris or damage.
1	GRN steady		
2	RED flashing		
0	YEL off	Failure of High Pressure Transducer.	Check Controls Module and replace if required..
2	GRN flashing		
0	RED off		
1	YEL steady	Failure of Motor Controls	Check Controls Module and replace if required.
2	GRN flashing		
0	RED off		
2	YEL flashing	Faulty <i>Hour-meter</i>	Check hour meter and replace Compression Module if required.
2	GRN flashing		
0	RED off		
2	YEL flashing	End of stored messages	
2	GRN flashing		
2	RED flashing		

Table 6 - Diagnostics for "CALL FOR SERVICE" Mode.



*Vehicle Refueling Appliance*

*Models FMQ-2, FMQ-2.5 and FMQ-2-36*

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## 6 SERVICE INSTRUCTIONS

### 6.1 SERVICE INTRODUCTION

Safety precautions require that the VRA's internal components be inaccessible to the user and other unauthorized personnel, and accordingly the *service cover* is sealed by authorized service personnel before they leave the site. Only authorized service representatives may service the VRA at the user's premises.

When carrying out a service call on a VRA, the service representative should:

1. Check the Fault Diagnostics System as described in Section 5.
2. Correct the faults indicated by changing modules or correcting installation errors.
3. Test to determine if the fault has been corrected.

- *Compression Module* (after 4,000 hours, or if a fault is indicated by the diagnostics)
- *Control Module* (if a fault is indicated by the diagnostics)
- *Electronics Module* (if a fault is indicated by the diagnostics)
- *Cooling Fan* (if noisy or vibrating excessively, or if a fault is indicated)

All normal safety precautions must be observed when undertaking on-site service and replacing BRC FuelMaker modules.

Any detailed service not described in this document must only be carried out by BRC FuelMaker service staff at a factory service facility. Service undertaken by unauthorized persons may cause the VRA to operate incorrectly, may result in damage or serious injury and will void the warranty.

#### Service Interval

At the time of publication, BRC FuelMaker requires that the *Compression Module* be serviced after every 4,000 hours of running time. Depending on the local gas quality or future technical advancements, the service interval may be increased beyond 4,000 hours in the future. A red lamp on the *User Panel* will begin to illuminate steadily indicating to the user that less than 100 hours of running time remaining on the VRA; if the *Compression Module* is not serviced during this period, the VRA will shut down and lock out after the final 100 hours have elapsed.

The following modules must be serviced or remanufactured at one of BRC FuelMaker factory service facilities only:

#### Regular Service Checks

Whenever service work is performed, the checks described in section 3.4 "Testing and Commissioning" on page 8, should be performed. The VRA's shut-down pressure should correspond with the values indicated in Table 2 or 3, within the allowable limits specified. If the fill pressure is outside the allowable limits, either the *Electronics Module* or the *Control Module* requires replacement. First replace the *Electronics Module*; if the shut-off pressure is still out of tolerance then replace the *Control Module* and re-install the original *Electronics Module*. Any abnormal deviation in shut-off pressure must be reported to BRC FuelMaker when the malfunctioning module is returned for service.

The fibre-reinforced high pressure *fill hose* connects to the *Compression Module* via a break-away fitting. The *hose* should be carefully inspected for evidence of abrasion, cuts, or kinks and should be replaced if such deterioration is found. The *break-away fitting* allows the *fill hose* to be pulled free from the VRA without damage should the User drive away without disconnecting. Pull on the *fill hose* using a force gauge and check that the break-away force does not exceed 150 N (34 lbs); if excessive, the *hose nipple* and *breakaway fitting* should be inspected for wear or damage and the faulty part replaced.

## 6.2 INTERCHANGABILITY OF MODULES BETWEEN FMQ-2 AND FMQ-2.5

### IMPORTANT

The *Compression Modules, Control Modules and Electronic Modules* in model FMQ-2-36 are designed for 248 bar (3,600psig) service. The *Compression Modules, Control Modules and Electronic Modules* in models FMQ-2 and FMQ-2.5 are designed for 207 bar (3,000) psig service. Modules designed for 248 bar (3,600 psig) are not compatible nor interchangeable with modules designed for 207 bar (3,000 psig).

Installing modules from model FMQ-2-36 into models FMQ-2 and FMQ-2.5 or vice versa could result in damage to equipment, electrical shock, fire or serious injury.

Please consult BRC FuelMaker Technical Support if you are experiencing any difficulty or are unsure about any feature.

### COMPRESSION MODULES BETWEEN FMQ-2 AND FMQ-2.5

The *Compression Modules* in models FMQ-2 and FMQ-2.5 are not interchangeable. *Compression Module* for model FMQ-2 must not be installed into model FMQ-2.5 or vice versa. Interchanging *Compression Modules* between FMQ-2 and FMQ-2.5 will result in overheating or loss of flow.

### ELECTRONIC AND CONTROL MODULES BETWEEN FMQ-2 AND FMQ-2.5

The *Electronic Modules and Control Modules* in models FMQ-2 and FMQ-2.5 are identical and therefore, are interchangeable. Please refer to Section 6.3 for module removal and replacement.

### 6.3 REPLACEMENT OF VRA COMPONENTS

**IMPORTANT:** Turn off the gas and electrical power supply before working inside the VRA. Under most circumstances the VRA can be repaired on site. In the rare case when it is necessary to remove the entire VRA, please refer to the section entitled "Removing the VRA".

#### Module Replacement Preparation

Shut off the electrical power to the VRA. Grasp the *Fill Hose* with both hands and pull out of the break-away fitting using a sharp horizontal pulling action (do not wrap the fill hose around the hands). **IMPORTANT:** Before breaking the safety seal and opening the *service cover*, ensure that the *lid* is unlocked and the key removed (if equipped), otherwise **serious damage to the plastic housing and the lock could result**. If the VRA is configured for remote or manifold filling, remove the manifold block assembly from cylinder No. 4 and transfer to replacement *Compression Module*.

If servicing cannot be completed in one visit, the following steps should be taken by the repair personnel before leaving the site: seal up all gas passage openings including the rotor hole in the *convection plate* (if the *Compression Module* has been removed, use the *service plate*), lift and lock the *Electronics Module* back into the operating position, replace the *Acoustic Shroud*, close the *Service Cover*, and then apply the *safety seal*.

#### Compression Module Removal

- The gas and electrical supply must be **OFF**.
- Release the latch from the *Electronics Module* and tilt module down into servicing position (See Figure 6).
- Remove the *hour-meter* from the *Electronics Module* circuit board (See Figure 7).
- Tilt the *Electronics Module* back up and pull latch into locked position.
- Remove the *Acoustic Shroud*.
- Store the *hour-meter* in the pocket provided in the top of the compressor housing and lay the cord in the cooling fins (See Figure 8).
- Loosen the Allen head *Compression Module* mounting bolts about 4 to 5 turns until residual pressure in the *blow-down vessel* is released, but **DO NOT REMOVE THEM**. This precaution is necessary since an abnormally high pressure may exist in the *Blow-Down Vessel* under certain conditions (e.g. remote vent line plugged)
- Completely remove the 4 *Compression Module* bolts and washers (See Figure 9).
- Lift the *Compression Module* straight out of the *convection plate* and set it down on a clean surface.

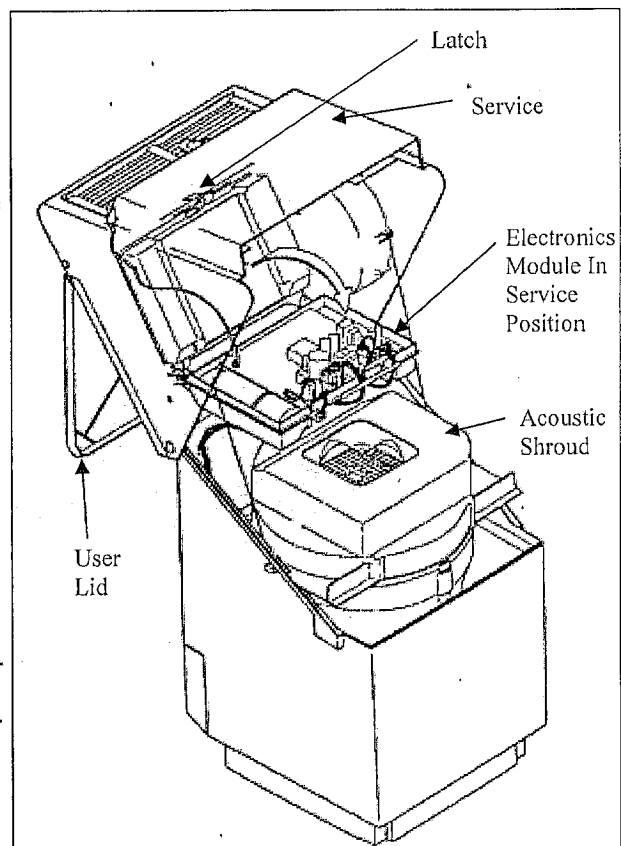
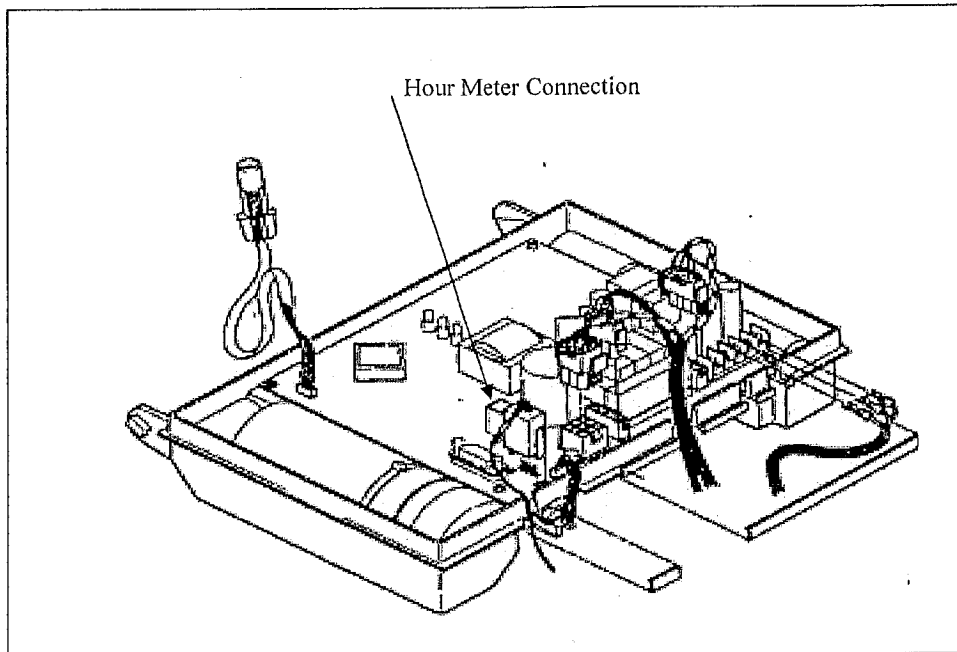
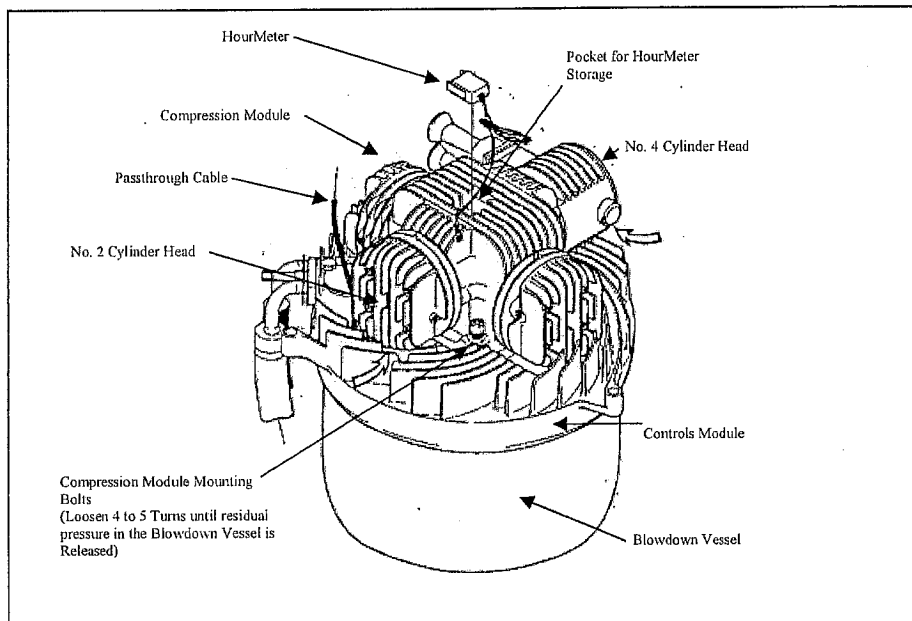


Figure 6 Electronics Module in Servicing Position



*Figure 7 Hour-meter Location*



*Figure 8 Hour-meter Storage Location and Blow-down Vessel Pressure Relief*

**CAUTION:** To avoid serious damage to the *Compression Module* internal parts, do not knock the bottom of the rotor when setting the *Compression Module* down.

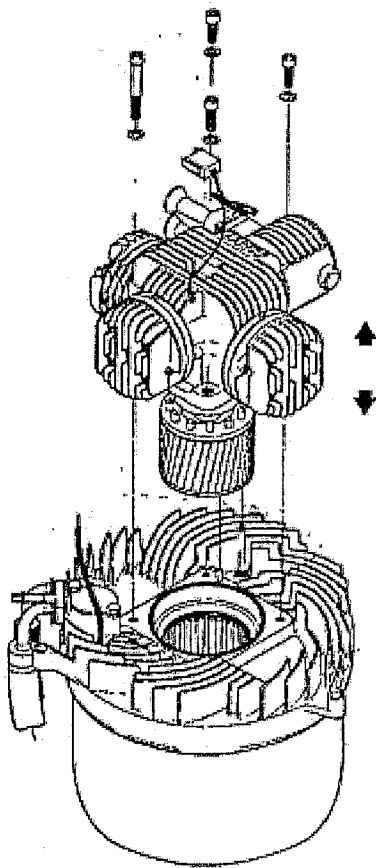


Figure 9 Compression Module Removal

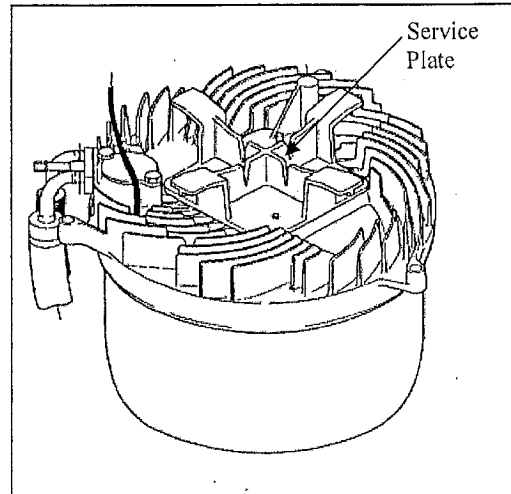


Figure 10 Service Plate Location

**IMPORTANT:** Be sure that the *high pressure connecting tube* located beneath cylinder No.4 remains in the *convection plate seat* and not in *Compression Module seat*.

If the *high pressure connecting tube* is accidentally pulled out of the *convection plate seat*, the seat and the gas passage must be completely cleared of dirt and debris before re-inserting the *high pressure connecting tube* back into the *convection plate seat*.

- Ensure that the large *O-ring* remains in its seat in the *convection plate*.
- If the *Compression Module* will not be replaced immediately, the rotor hole in the *convection plate* must be covered with the *service plate* available from BRC Fuel-Maker (See Figure 10).
- Cover all exposed gas passages on the *Compression Module* with tape.

**NOTE:** To prevent damage in transit - Before packaging the *Compression Module* for shipment to a maintenance/repair facility, remove and retain the *funnel* and secure the *hour-meter* in the pocket provided using tape (See Figure 9).

### Compression Module Replacement

- Transfer all transportation protection from the new *Compression Module* to the one removed from the VRA.
- Ensure that the mating surfaces of the *Compression Module* and *Control Module* are clean.
- Check for proper seating of *large O-ring* in the groove of the *convection plate*.
- Closely inspect the *O-ring* on top of the *high pressure connecting tube*; replace if damaged (See Figure 11).
- Grasp the *Compression Module* by cylinders No. 2 and 4 and then orientate it so that the guide pin in the *convection plate* lines up directly with its respective hole in the *Compression Module* as shown in Figure 11.
- Gently lower the *Compression Module* onto the guide pin until it seats; **DO NOT FORCE THE MODULE DOWNWARD.**
- Reinsert the Allen head bolts (3 short, 1 long) and washers; finger tighten with an appropriate tool then alternately (diagonally) tighten each bolt another 1/8 turn.
- Unlatch and tilt the *Electronics Module* down into servicing position.
- Remove the *hour-meter* from its pocket in the *Compression Module* and plug it into the *Electronics Module* circuit board; ensure positive engagement of the retaining clip (See Figure 12).

**CAUTION:** Never plug the *hour-meter* into the *Electronics Module* circuit board when the main electrical power is connected.

- Tilt the *Electronics Module* back up and pull latch into locked position.

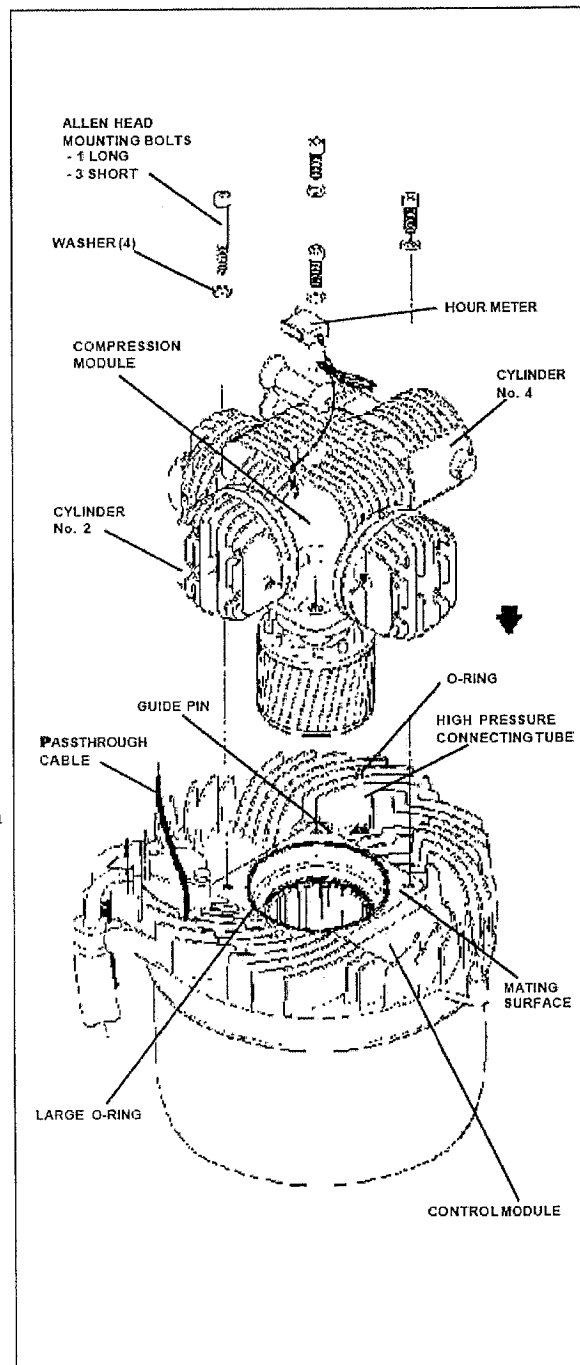


Figure 11 Compression Module Replacement

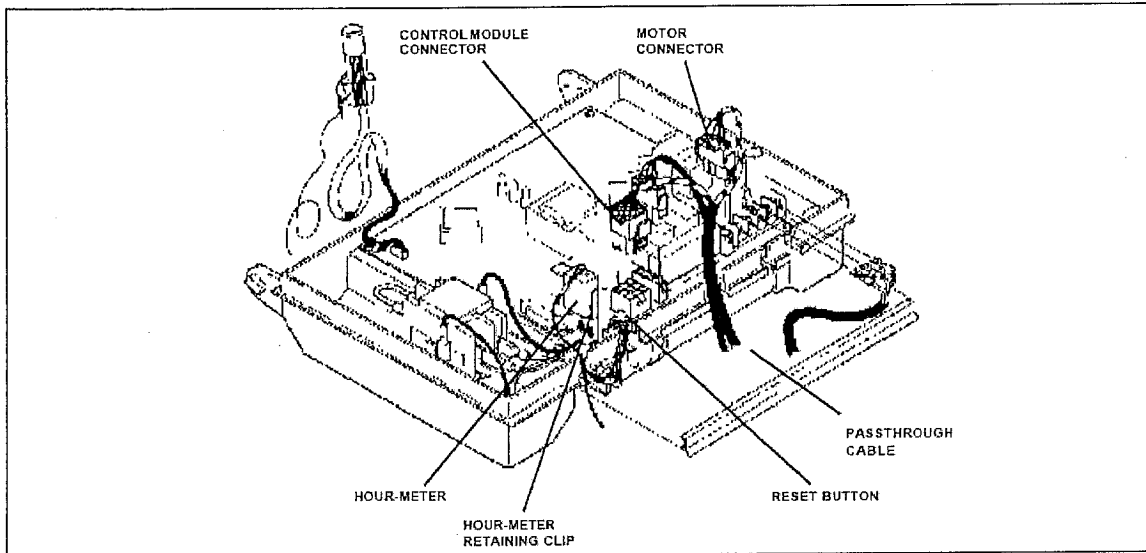


Figure 12 Compression Module Connections and Reset Button Location

**NOTE:** If a "Call for Service" (e.g. red light flashing) was evident before servicing the VRA, the electronics must be "reset" by pushing the blue reset button located on the lower left corner of the *Electronics Module* circuit board (See Figure 12).

**WARNING:** To reset the electronics, the power supply must be switched on while the *Electronics Module* is in its lowered position, thereby exposing service personnel to **HIGH VOLTAGE** contacts.

Use **EXTREME CAUTION** when inserting fingers into the **HIGH VOLTAGE** area to push the reset button.

**SWITCH OFF THE POWER SUPPLY IMMEDIATELY AFTER THE RESET-  
TING PROCEDURE HAS BEEN ACCOM-  
PLISHED.**

**Control Module Removal**

- Ensure that the power supply and gas supply have been turned off.
- Remove the *Compression Module* as detailed in "Compression Module Removal" on pages 21 to 23.
- Ensure that the *high pressure connecting tube* remains installed in the *convection plate* (See Figure 11).
- Unplug the two connectors on the end of the *pass through cable*, from the *Electronics Module* (See Figure 12).
- Undo/loosen the *low pressure connection flange* screw and pull the *inlet tube* and *vent tube* away from the manifold (See Figure 13).

Before removing the *low pressure connection flange*, **BE AWARE**, that an abnormally high pressure may exist in the *Blow-Down Vessel* under certain conditions (e.g. remote vent line plugged).

- Remove and inspect the *O-rings* on the *inlet* and *vent tubes*; replace if damaged or hard (See Figure 13).
- Re-install the *O-rings* on the *inlet* and *vent tubes*.

### Control Module Removal (Cont'd)

- Remove the three *convection plate* mounting bolts from the vibration mounts, and lift the *Control Module* out of the BRC FuelMaker VRA.
- Plug all openings with tape; the shipping plugs from the new *Controls Module* could be used for this purpose. Plug the *rotor hole* in the *convection plate* with the *service plate* available from BRC FuelMaker.
- Coil the *passthrough cable* around the outside of the *service plate* to protect the wiring.

### Control Module Replacement

- Align the new *Control Module* with the *vibration mounts* in the *bucket* and lower into position.
- Install and tighten the three *convection plate* mounting bolts.
- Install the *inlet* and *vent tubes* into the low pressure manifold in the *convection plate*.
- Install the *Compression Module* following all the steps outlined in the “*Compression Module Replacement*” instructions, found on page 24.

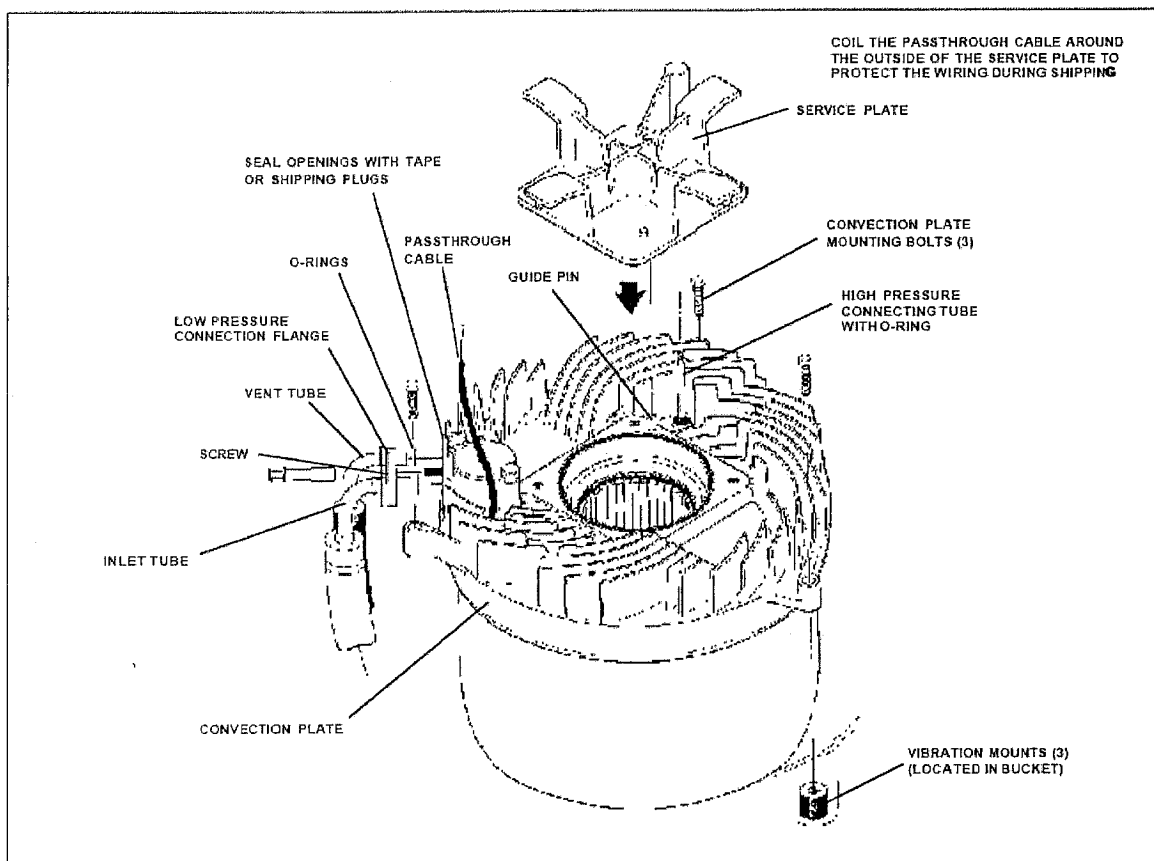


Figure 13 Control Module Removal and Replacement

### Fan Removal and Replacement

- Remove the *Compression Modules* and *Control Modules* as described in previous sections.

**NOTE:** The combined weight of the *Compression Module* and the *Controls Module* is approximately 90 lbs (41 kg.). If the combination can be lifted (e.g. by two people) then the removal of the *compression module* is an unnecessary step.

- Release the latch from the *Electronics Module* and tilt the module down into servicing position.
- Unplug the *fan motor cable* from the *Electronics Module* (See Figure 15).
- Remove the three tapping screws from the *Fan Assembly* in the bottom of the *bucket* (See Figure 14).
- Remove the *Fan Assembly* from its seat and install a new *Fan Assembly* using the previously removed screws.
- Tighten the three *Fan Assembly* screws, and plug the *fan motor cable* into the *Electronics Module* (See Figure 14).
- Tilt the *Electronics Module* back up and pull latch into locked position.
- Replace the *Compression Module* and *Controls Modules* as described in previous sections.

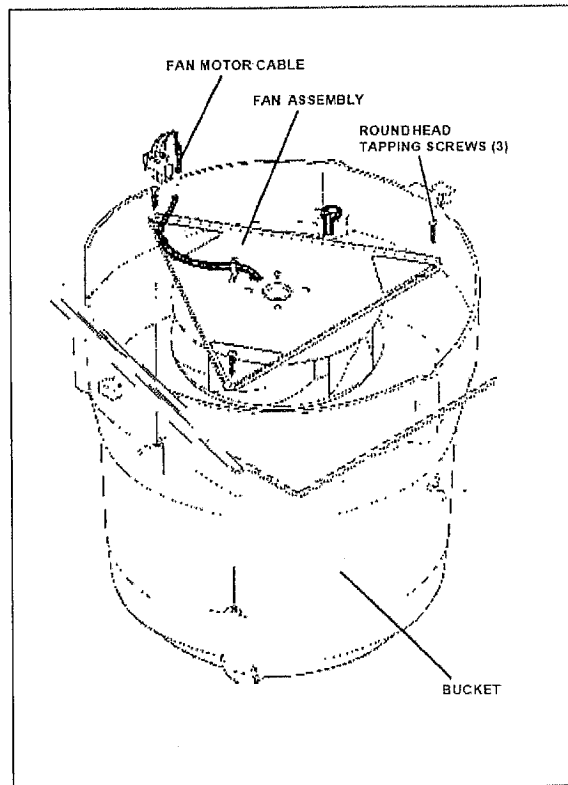


Figure 14 Fan Removal and Replacement

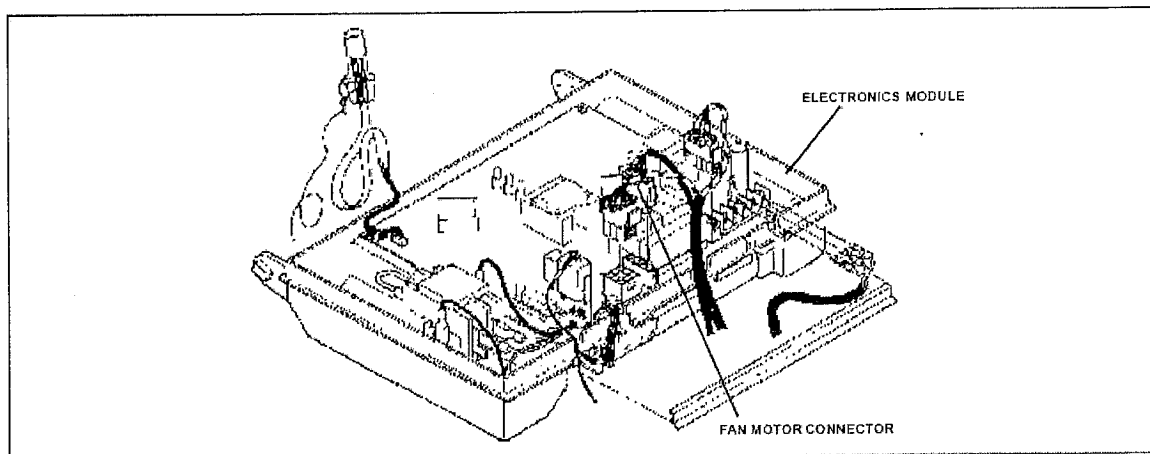


Figure 15 Location of Fan Motor Connector on Electronics Module

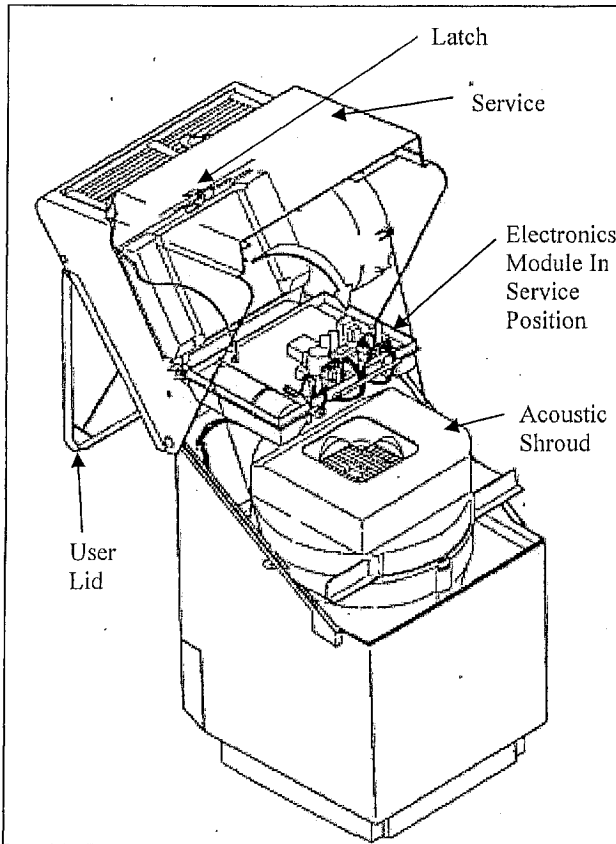


Figure 16 Electronics Module Removal

#### Electronics Module Removal

- Turn off the electrical power supply.
- Release the latch from the *Electronics Module* and tilt module down into servicing position (See Figure 16).
- Disconnect the *hour-meter* from the *Electronics Module* circuit board (See Figure 17).
- Unplug the two connectors on the end of the *passthrough cable*, from the *Electronics Module* (See Figure 17).
- Squeeze and pull the winged tabs on the *ambient temperature sensor* to remove it from the *service cover housing* - **DO NOT PULL ON THE FLEXIBLE CABLE** (See Figure 16 & 17).
- Disconnect the power supply wires at the terminal strip on the *Electronics Module* (See Figure 17).
- Disconnect the power supply wires from the terminal strip located on the *Electronics Module* circuit board (See Figure 17).
- Lift the *Electronics Module* slightly and pull to release it from the VRA hinges (See Figure 16).

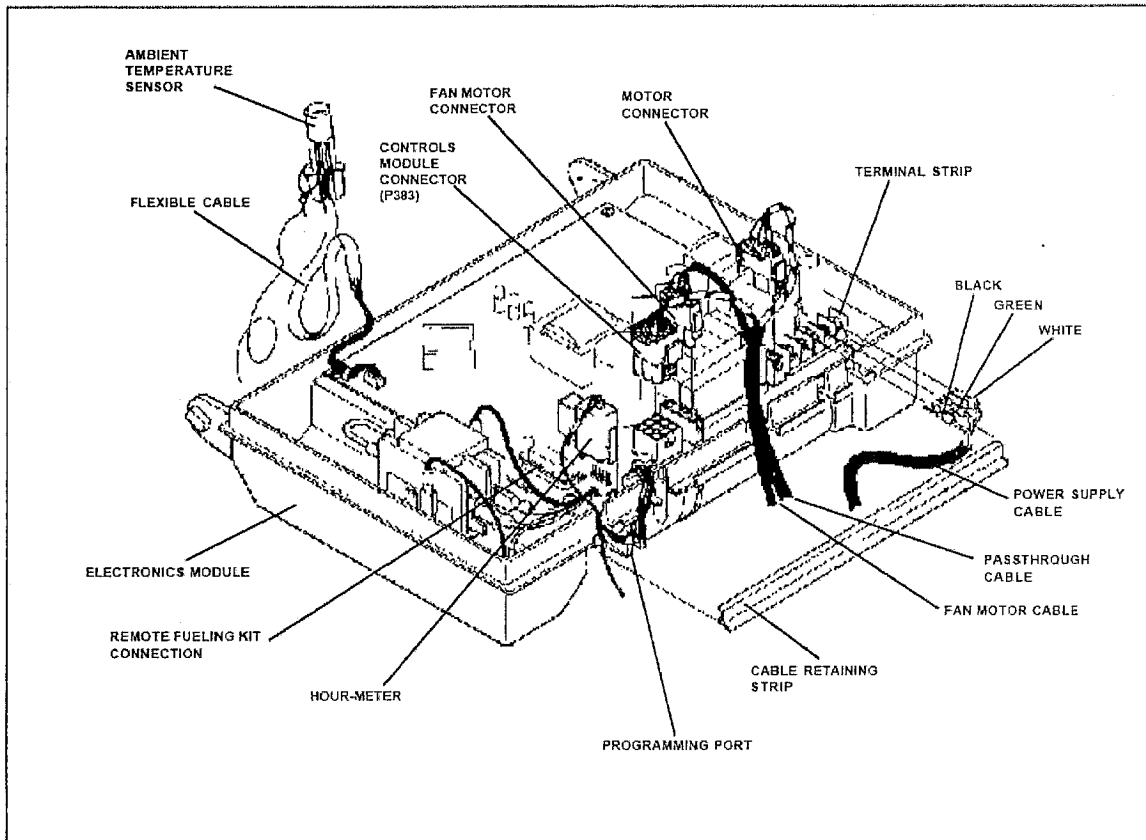


Figure 17 Electronics Module Connections

### Electronics Module Replacement

- Slide the *Electronics Module* into the hinges at the same angle required for removal, and then lower the module into the servicing position (See Figure 16).
- Re-establish all connections that were previously removed, according to the "*Electronics Module Removal*" instructions (See Figure 17).
- Insert the *ambient temperature sensor* into its socket; ensure that it is positively locked in position (See Figure 16 for Sensor location).
- Switch on the power supply to the VRA.
- Perform the pressure test as described in Section 3.4 "Testing and Commissioning", on page 8 of this manual.

### Electronics Module Settings

The Programming Port is located on the underside of the *Electronics Module* ( See Figure 17). To change settings, refer to the Section 3.3 "Field Programming" in this manual.

### Start / Stop Button Height Adjustment

- The height of the START and STOP buttons has been adjusted at the factory to fit the service cover that comes with the new VRA. However, during installation and during the course of connecting the 240 V electrical power supply, some shifting of components can take place. This may require a START/STOP BUTTON HEIGHT ADJUSTMENT.
- After replacing an existing *Electronics Module* with a spare *Electronics Module*, there is a possibility that the components of the spare will stack up differently than the components of the existing *Electronics Module*. This will require a START / STOP BUTTON HEIGHT ADJUSTMENT.
- If after completion of installation or servicing of the VRA, the unit does not function as described in the Installation and Field Service Manual, test if an adjustment of the START / STOP buttons is required.
- Power down the VRA. Lift the VRA's service cover open, and tilt the *Electronics Module* down to the service position. Try to operate the VRA by pressing the buttons directly on the board.
- If the VRA operates properly, a START / STOP-BUTTON HEIGHT ADJUSTMENT is required. Otherwise refer to the "Installation and Field Service Instructions" for troubleshooting procedures.
- Depending on the assembly, the Start and Stop buttons may protrude either **too much** or **not enough** into the bubble below the start / stop label.
- If the plastic buttons do **not protrude enough**, add rubber pads to the top surfaces of the buttons. The symptom of buttons not protruding enough is a VRA that shows the yellow LED blinking but is not responding to the buttons.
- If the plastic buttons protrude **too much**, remove the existing rubber pads. If the fault persists, check if the service cover properly engages with the housing when closed. The symptom of buttons protruding too much is a VRA that displays meaningless messages.
- Extra *plastic buttons* and extra *rubber pads* have been included with every spare *Electronics Module* and every new VRA.

**WARNING: Apply extreme caution when pressing the buttons. HIGH VOLTAGE is connected to some components of the *Electronics Module*. DO NOT TOUCH any other components of the *Electronics Module* to avoid serious injury or death.**

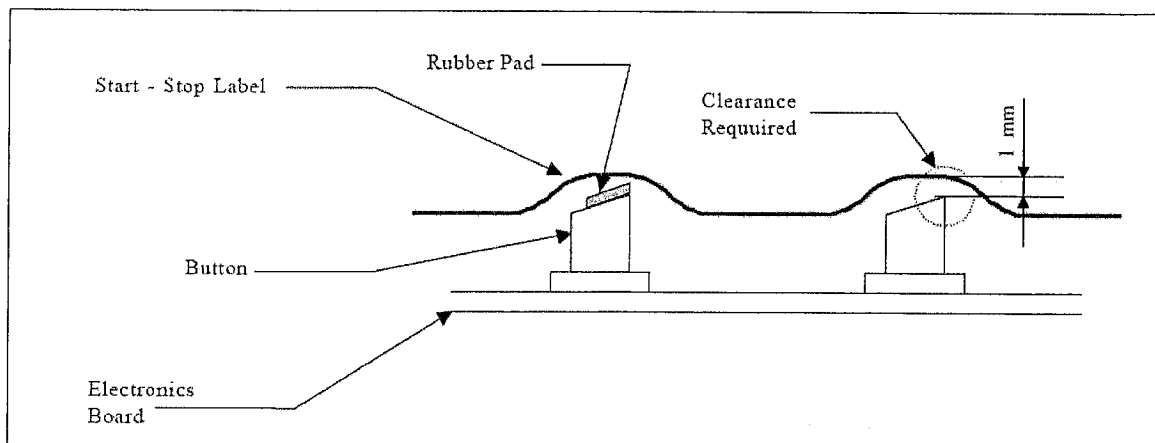


Figure 18 Start Stop Button Clearance

### Removing the VRA

If for any reason the entire VRA needs to be removed:

- All normal safety precautions must be observed when disconnecting the VRA.
- Turn off the electrical power supply to the VRA.
- Remove the fill hose(s) or tubing as described in the section "Module Replacement Preparation" on page 21.
- Disconnect the power supply wires inside the junction box and not at the terminal strip on the *Electronics Module* (See Figure 17).
- Turn off and disconnect the gas supply.
- Release the pressure inside the *blow-down system* by temporarily connecting an open dummy fill hose to the breakaway fitting.
- Plug the gas inlet and vent connections before transporting the VRA (See Figure 20).
- The *fill hose* should either be neatly stowed inside the VRA or removed for shipping.

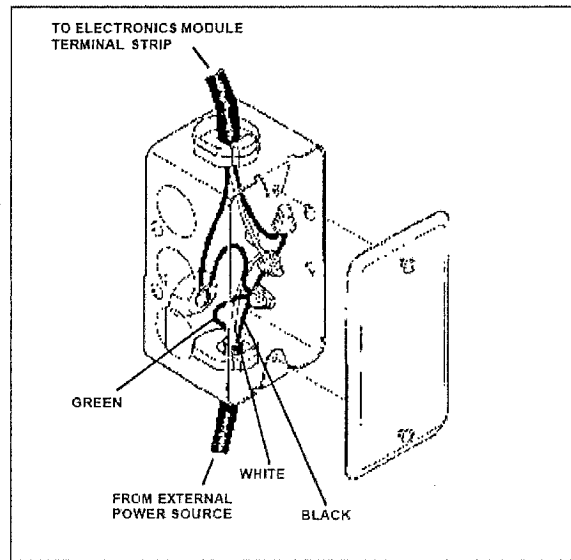


Figure 19 External Power Disconnect

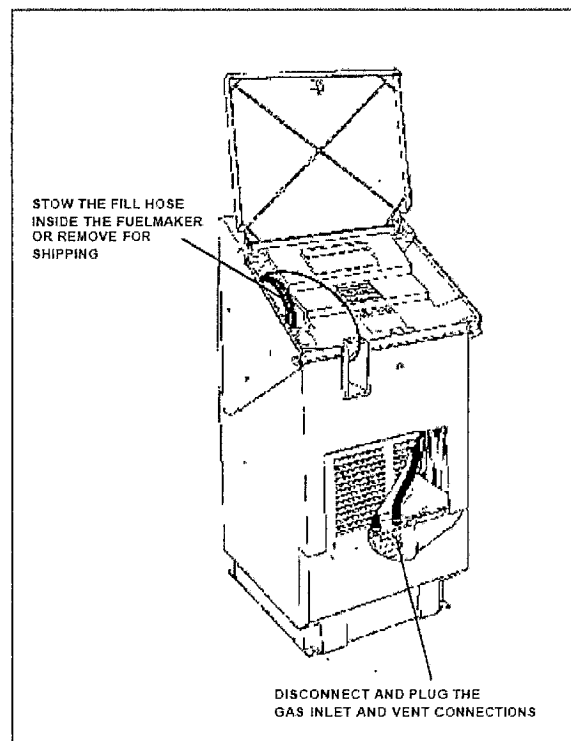


Figure 20 VRA Removal

