



DESCRIPTION

The N₂ Nitrogen Generator is designed for use on tap changers, breakers, main tanks or any other electrical device requiring a gas blanketed enclosure. The unit produces nitrogen by separating oxygen from compressed air by means of hollow fiberglass separation membranes. The compressed air is supplied by an on-board compressor and generated nitrogen (N₂) is fed to internal storage vessels.

The output concentration of the air separator is factory pre-set. The system maintains transformer tank pressure between 0.2 and 5.5 psi. If the tank pressure reaches a min. 0.2 psi, nitrogen is sent from the storage vessels through the reducing valve assembly to the tank. Should tank pressure rise above 5.5 psi, a relief valve will open to bleed off excess pressure.

IMPORTANT: Changing the output concentration may only be performed by trained and authorized service technicians.

Refer to Figure 2 below.

1. The low pressure compressor stage (A) compresses the air to about 43.5 psi (3 Bar[g]).
2. Pressurized air is cooled as it travels from the low pressure compressor stage (A). The inlet of the low pressure air separator (B) is equipped with a 24V heater to prevent condensation.
3. Compressed air is fed through the low pressure air separator (B) where the bulk oxygen and the water vapor are removed and the oxygen level is reduced to about 3% (vol).
4. Flow is controlled by a low pressure flow control valve (C).
5. Nitrogen (N₂) is then fed to on-board storage vessels. The vessels enable peak demands to be fulfilled without the need for over-sizing of the nitrogen generator.

AIR SEPARATOR - PRINCIPLE OF OPERATION

See Figure 1. Compressed air flows into the hollow fiber membrane. The various air components, such as Oxygen, nitrogen, carbon dioxide and water vapor pass through the membrane wall, but the rate at which this occurs differs for the various gasses. Oxygen and water vapor have a high diffusion rate and diffuse rapidly through the membrane wall. Nitrogen has a low diffusion rate and penetrates the membrane wall slowly; mainly at the end of the of the hollow fibers. The purity of the nitrogen at the end of the fibers depends on the velocity of the gas flow. The nitrogen capacity of the membrane depends on the flow rate and operating pressure of the compressor.

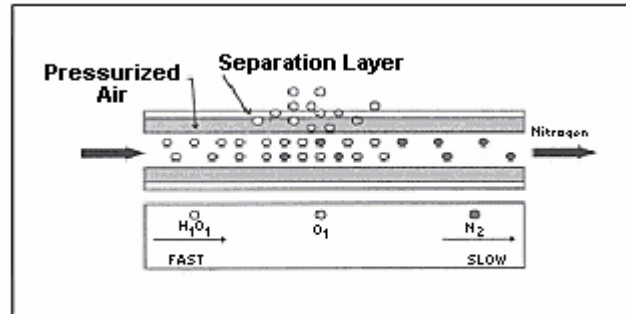


Figure 1. Air Separator

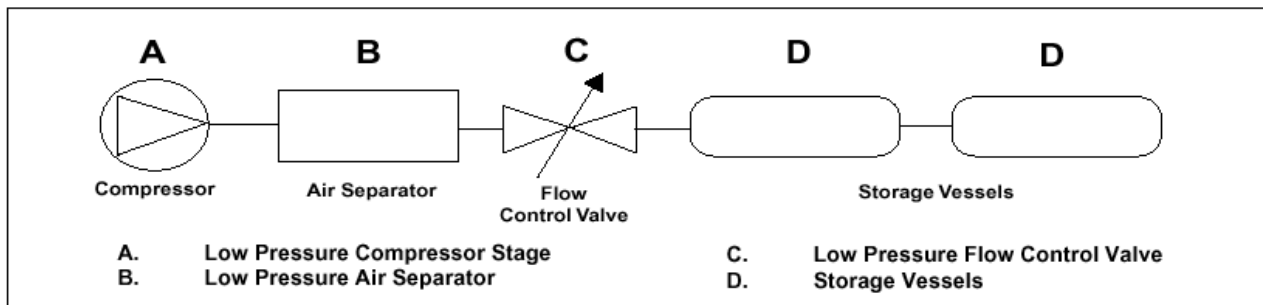


Figure 2. Process Description



SAFETY INFORMATION

Correct use of this equipment is important for your personal safety and for trouble-free functioning of the unit. Incorrect control or adjustments could cause damage or could lead to incorrect gas supply. Be sure to read and understand all instructions before attempting to operate the unit. The unit is designed to produce nitrogen. The nitrogen is supplied by an internal nitrogen generator that produces nitrogen from ambient air by separating oxygen from the ambient air. You must not use the unit for any other purpose than what is specified. Do not operate the unit beyond its limits (see *Specifications* page 3).

In addition to the warnings and cautions in this manual, use the following safety guidelines for safe operation of the unit.



WARNING

This unit is an electrical appliance. Make sure that the main power supply is disconnected before you perform installation, maintenance or repair work.



WARNING

If you must work on the equipment with the main power supply on, be aware of electrical hazards.



DANGER

When working on the equipment, do not wear loose clothes, jewelry or hair. They could become entangled in the fan blades.



WARNING

The compressors become very hot when operating. Be careful when you open the cabinet after the unit has been operating for any length of time. Do not touch the compressors. Allow them to cool down before you start to perform any service on the unit. If you must work on the unit while it is hot, be sure to wear protective gloves to protect yourself from the heat.



CAUTION

Do not block the ventilation inlets and outlets, this could cause overheating and damage to the unit.



WARNING

In order to prevent injury or damage caused by the sudden release of compressed air, make sure that the unit and connected systems are fully de-pressurized before you start uncoupling parts of the system. Make sure no one tampers with the pressure-relief valve.



DANGER

This unit produces nitrogen and oxygen-enriched air.

- Nitrogen can cause suffocation.
- Oxygen-enriched air can lead to increased risk of fire in the event of contact with flammable products.
- Ensure adequate ventilation at all times.

IMPORTANT: The following words and symbols appear throughout this manual and designate important safety instructions. Read all safety instructions to avoid personal injury or death, and to avoid damage to the unit or property.



DANGER

Indicates information important to the proper operation of the equipment. Failure to observe will result in damage to the equipment and/or severe bodily injury or death.



WARNING

Indicates information important to the proper operation of the equipment. Failure to observe may result in damage to the equipment and/or severe bodily injury or death.



CAUTION

Indicates information important to the proper operation of the equipment. Failure to observe may result in damage to the equipment.



SPECIFICATIONS

Nominal Performance

- Nitrogen (N₂) * 125psi (8.5 Bar[g])
- Purity of N₂ delivered * 99.5%
- Dew point of N₂ delivered * <-40°C
- Flow rate* ~3.0 SLPM

Average performance across temperature range from -40 to 50C

- Purity of N₂ delivered 98.8%
- Dew point of N₂ delivered -51.9°C
- Flow rate 2.3

Transformer Pressure Maintained between 0.2 and 5.5 psi

Electrical

- Voltage/Frequency 120Vac, 60 Hz
- Power consumption 7A
- Potential free alarm Normally open, 1A max.contact
- Plug Continental/European

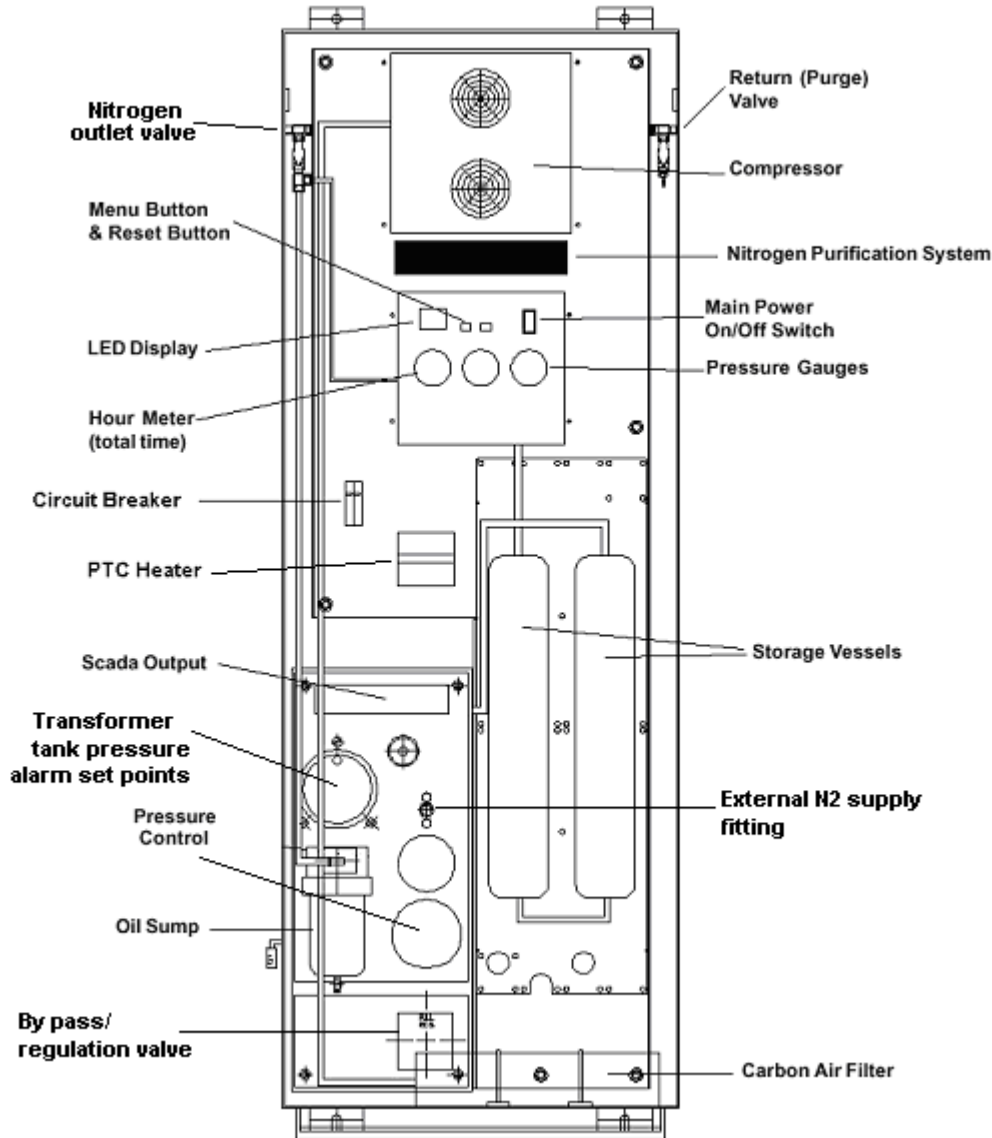
Ambient Conditions

- Temperature range -40° to 50°C
- Air quality Normally clean ambient air
- Relative humidity <90%

Environment

- Noise level Less than 65 db(A)
- Location Outdoors, wall-mounted
- Safety standards CE; applicable standards EN 50081-1, EN 50082-1, EN 50082-2, EN 60555-2, EN 60555-3, NEN EN 60204-1 protection degree IP 22

* Nitrogen Delivery properties at nominal temperature of 25°C





CONTROL PANEL
COMPONENT IDENTIFICATION (continued)

Figure 4. Control Panel

Display: All conditions and alarms are displayed in the LED window display as C!,C2,C3 & A1,A2,A3 . The corresponding messages are shown above the display.

Menu: Pressing this button displays the oxygen level and running hours.

Oxygen Level: Pressing the menu button once shows the oxygen level (range 0.0-9.9%) in the display.

Running Hours: Pressing the menu button twice displays H and the first digit of the running hours (). Hold the menu button in and press the reset button to display the next two digits of the running hours (). Continue to hold the menu button and press the reset button again to display the last two digits of the running hours (). Complete running time would be H00007 and would indicate seven running hours.

NOTE: Pressing the Menu button does not affect the operation of the unit. If the Menu button has not been pressed within two minutes, the display will show the current status of the unit.

Reset: The reset button is used to void an alarm condition once the source of the alarm has been corrected. It is also used with the menu button to display running hours.

Main Switch: This switch turns power on/off to the unit.

PI-4: This pressure gauge shows the pressure in the storage tanks.

PI-3: This pressure gauge shows the pressure in the transformer.

Hour Meter: The meter shows total running time.

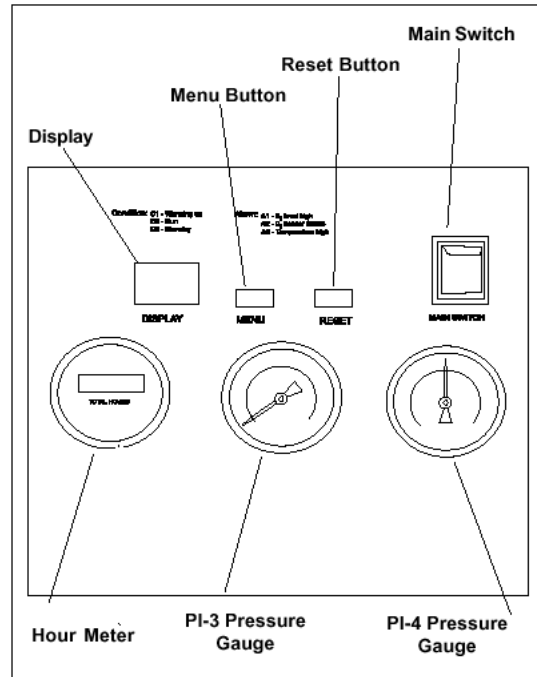


Figure 4. Control Panel



START-UP

IMPORTANT: Make sure the unit has been properly installed according to the Installation Instructions Supplied with the unit.

NOTE: It may take several hours for the storage vessels to fill completely.,

1. Open the Nitrogen outlet valve and close the return (purge) valve (figure 3).

2. Turn the main switch to ON (figure 5). The display will show C1 for approximately 15 minutes while the unit warms up.

NOTE: The pre-heat (warm-up) stage always occurs after switching on the unit, whether or not it was running recently.

3. After the warm-up period, the display will show C2 (figure 6) and the compressor will start to run.



CAUTION

When the compressor starts, cooling fans should rotate. If fans are not rotating, turn unit off or damage to the unit could occur.

4. The unit will continue to operate until the storage vessels reach the factory preset pressure setpoint of 125 psi (8.6 Bar[g]).

5. When the pressure setpoint is reached, the unit will shut down and C3 will be shown in the panel display (figure 7).

6. The unit will operate again when the storage vessels pressure reaches 90 psi (6 Bar[g]).

IMPORTANT: Check all pipes and connection for leaks using soap or leak-tracing spray. Any leakage will reduce capacity considerably.

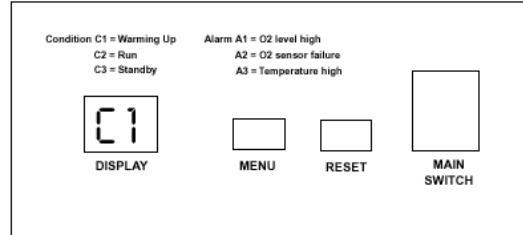


Figure 5. Control Panel Warm-Up Mode

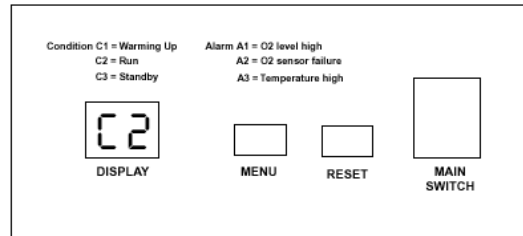


Figure 6. Control Panel Run Mode

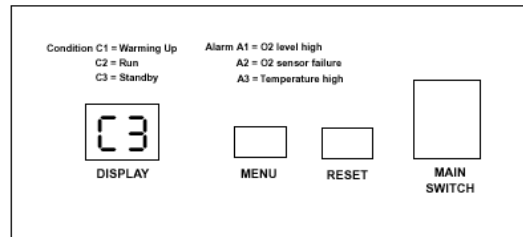


Figure 7. Control Panel Standby Mode

SHUT DOWN

Under normal operation, the unit can be left on. The compressor will switch on/off automatically according to the storage vessel pressure. The unit should only be switched off for maintenance work using the following Procedure:

1. Turn the main switch to the OFF position.,
2. Make sure the system is de-pressurized by opening the return (purge) valve (page 3).
3. Close the valve on the storage vessels



Problem	Cause	Solution
Compressor does not operate.	Main switch is off.	Turn main switch on.
	Unit is in "Warming up" status.	Wait 15 minutes for unit to warm up.
	One/several fuses are blown (on the electrical circuit board and near the main connection).	Find and replace fuse(s).
	Unit is in "Standby" status.	Wait until pressure in storage vessel is reduced.
	Poor nitrogen quality (alarm A1).	Readjust purity. Inlet filter contaminated and should be replaced. Check for, and seal any leaks in hoses or connections*.
	Oxygen sensor failed (alarm A2).	Replace sensor.
	Temperature is too high (alarm A3).	Ambient temperature is too high. In/Outlet gratings are clogged and should be cleaned. Cooling fans are not functioning properly and should be checked. Compressors are overloaded. Call WES.
Membrane pressure or delivery pressure too low.	Inlet filter is contaminated.	Replace the filter cartridge.
	Ambient temperature is too high (greater than 30°C).	Reduce ambient temperature.
	Leaks in the hoses or connections.	Seal any leaks.
	Excessive consumption.	Contact WES to confirm appropriate application.
	Pressure switch mis-adjusted.	Set pressure switch (see <i>Maintenance</i>).
	Fan outlets and/or inlets are contaminated.	Clean the fan outlets and/or inlets

* To check for leaks, use soap solution of leak-tracing spray.



Problem	Cause	Solution
Membrane pressure or delivery pressure too high.	Ambient temperature is too low	Increase ambient temperature.
Desired nitrogen flow not Achieved.	Inlet filter is contaminated.	Replace the inlet filter cartridge
	Leaks in hoses or connections	Seal any leaks; check V3.
Residual oxygen content too High.	Pressure in nitrogen storage vessel over 145 psi (10 bar[g]) due to erroneous pressure switch setting.	Readjust pressure switch
	Ambient temperature lower than normal.	Increase temperature or adjust purity
	Purity setting has changed over time.	Readjust purity.
No mix gas supply.	Air inlet, nitrogen inlet/outlet or unit outlet are closed.	Open ball valves.
	No/low pressure in the nitrogen storage vessel;read central pressure gauge (P13) on the instrument panel.	Stop mix delivery and wait until pressure in storage vessel has increased to over 101.5 psi (7 bar[g]).

Alarms

There are three possible alarm messages:

A.1 – POOR NITROGEN QUALITY

This alarm will be visible on the control panel display if the unit delivers poor quality nitrogen. See Troubleshooting Guide above.

A.3 – TEMPERATURE INSIDE THE UNIT IS TOO HIGH

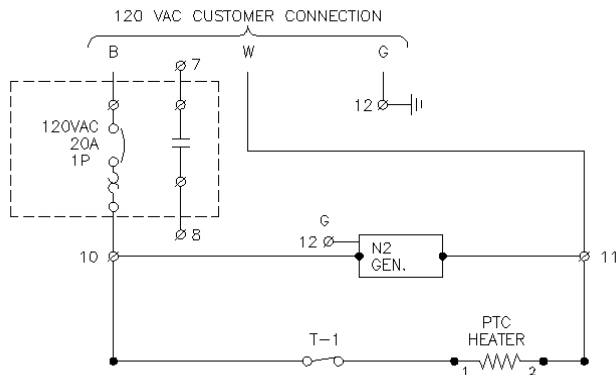
This alarm will be visible on the control panel display if the temperature inside the cabinet becomes too high. Open the cabinet door, allow the system to cool down, then press the reset button. If alarm is still on, see Troubleshooting Guide above.

A.2 – FAILURE OF RESIDUAL OXYGEN SENSOR

This alarm will be visible on the control panel display if there is a problem with the residual oxygen indicator. Press the reset button. If alarm does not reset, the O₂ sensor requires replacement. Contact your authorized service technician.

General Alarm

All alarms generated are available on “common alarm” for Customer remote monitoring. See wiring diagram





Alarm Summary Table

Alarm	Contacts	Open	Close
Low Transformer Tank Pressure	1 - 2	Above 0.2 psig	<i>Below 0.2 psig</i>
High Transformer Tank Pressure	2 - 3	Below 5.5 psig	<i>Above 5.5 psig</i>
Low N2 Storage Tank Pressure	4 - 5	<i>Below Acceptable Minimum Operating Pressure</i>	At or Above Acceptable Minimum Operating Pressure
	5 - 6	At or Above Acceptable Minimum Operating Pressure	<i>Below Acceptable Minimum Operating Pressure</i>
Nitrogen Generator Trouble (O2 Alarm)	7 - 8	When Operation is Normal	<i>In Troubled State</i>
Nitrogen Generator Trouble (Aux. Sw)	7 - 8	When Breaker CB1 is Closed	<i>When Breaker CB1 is Open</i>

NOTE: *Bold Italics indicates alarm condition*
Regular font indicates normal condition



MAINTENANCE

Carbon Filter

The carbon filter must be changed annually. Install a new carbon absorber/dust filter, part no. 2356.

1. Turn the main switch to the OFF position.
2. Make sure unit is de-pressurized by opening the return (purge) valve (page 3).
3. Disconnect the air line from the end of the filter (figure 8).
4. Slide the filter out of the rubber hold-down straps.
5. Slide a new filter into place and reconnect the air line. Make sure air line fitting is tight. Do not overtighten.
6. Turn main switch to the ON position.

Oil Sump

The oil sump must be checked and cleaned periodically.

1. Turn the main switch to the OFF position.
2. Make sure unit is de-pressurized by opening the return (purge) valve (page 3).
3. Open the valve located on the bottom of the oil sump (figure 9) and drain any excess oil.
4. If necessary, clean the oil sump with soap and warm water. The housing can be unscrewed from the mounting base for cleaning. Tighten housing securely but do not overtighten.
5. Turn main switch to the ON position.



CAUTION

Use only mild soap and water for cleaning. Do not use degreaser or incompatible chemicals.

Adjusting The Pressure Switch

The pressure switch (figure 10) factory preset default OFF setting is 125 psi (8.6 Bar[g]). The pressure switch Factory preset default ON setting is 100 psi (6.8 Bar[g]).

The pressure switch settings can be adjusted lower but should not be adjusted to higher settings. The pressure Switch adjusting screws are located on the left side of the Control panel (figure 10). Turn screws to obtain the desired setting. **Note:** When adjusting, note that the compressor is on a time delay and will not start again for at least 10 minutes after it has shut down.

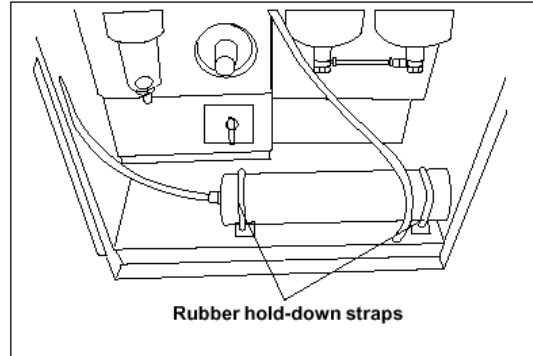


Figure 8. Air Carbon Filter

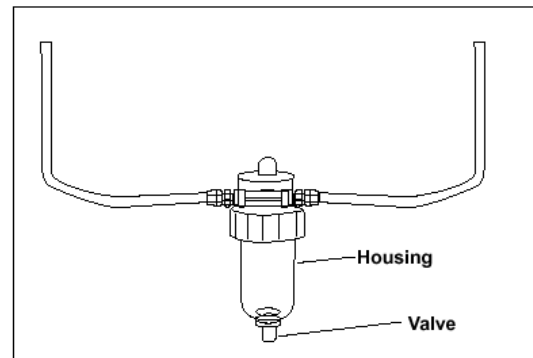


Figure 9. Oil Sump

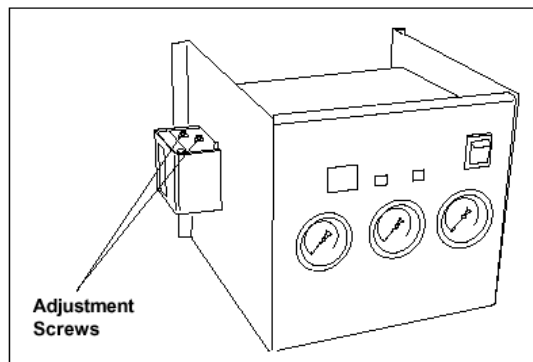


Figure 10. Pressure Switch



CAUTION

Do not set the pressure switch higher than 145 psi (10 Bar[g]) or exceed maximum temperature of 125°F. or damage to the unit could occur.



ADJUSTING THE PURITY

The purity of the nitrogen is factory preset. The purity of the nitrogen gas can be set between 97-99.9%.

IMPORTANT: *Adjusting the purity is a procedure that requires a skillful technician with a knowledge of the process. If this procedure is to be done, we recommend training by Waukesha Electric System to prevent voiding warranty.*

Refer to figure 12.

1. Completely open needle valves FCV1 and FCV2.
2. Adjust pressure valve PCV1 until pressure gauge PI1 indicates 110 psi (7.6 Bar[g]).
3. Adjust needle valve FCV1 until pressure gauge PI2 indicates 43.5 psi (3 Bar[g]).
4. Adjust needle valve FCV2 until pressure gauge PI2 indicates 145 psi (10 Bar[g]).
5. Readjust needle valve FCV1 until pressure gauge PI1 indicates 43.5 psi (3 Bar[g]).
6. Press the menu button on the control panel to read the oxygen level (figure 11).
7. To *decrease* the oxygen level:
 - Open FCV2 until PI2 indicates 116 psi (8 Bar[g]).
 - Close FCV1 gently until PI1 indicates 43.5 psi (3 Bar[g]).
 - Repeat until the desired purity has been achieved.
8. To *increase* the oxygen level:
 - Open FCV1 until PI1 indicates 36 psi (2.5 Bar[g]).
 - Close FCV2 gently until PI2 indicates 145 psi (10 Bar[g]).
 - Repeat until the desired purity has been achieved.



CAUTION

PI1 must not exceed 58 psi (4.0 Bar[g]).

PI2 must not exceed 159.5 psi (11.0 Bar[g]).

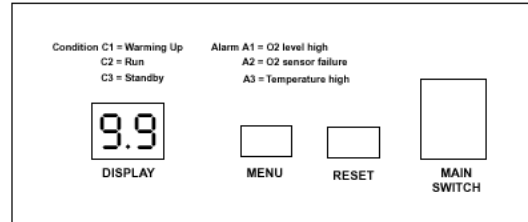


Figure 11. Checking Oxygen Level

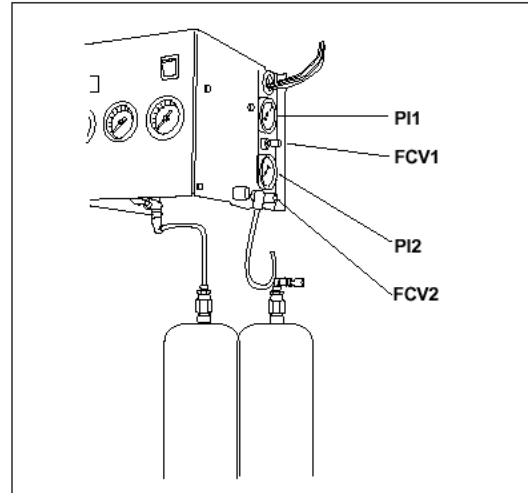


Figure 12. Adjusting Purity

