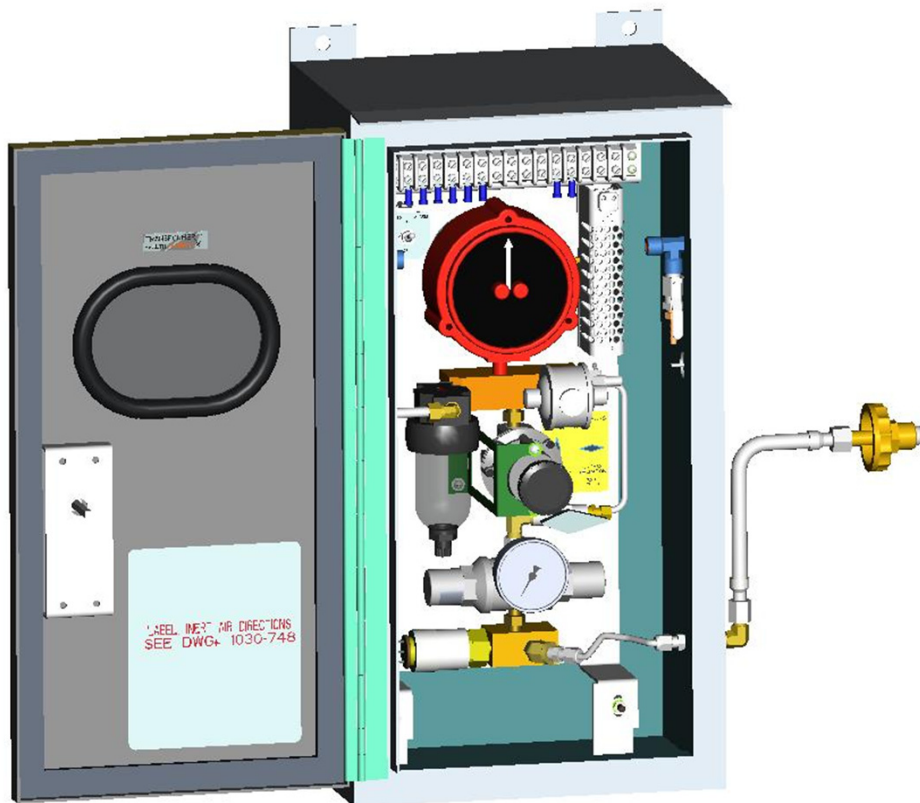




AN SPX BRAND



Inert Air (N2) Systems Manual



Inert Air (N2) Systems are manufactured and distributed by Waukesha Service & Components, a division of Waukesha Electric Systems, Inc.



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GENERAL INFORMATION

Positive pressure nitrogen gas pressurizing systems protect transformer oil in the main tank from exposure to both oxidation and moisture, thereby maintaining the highest quality insulating oil.

DESCRIPTION

The nitrogen regulation system (see Figure 1 on page 4) consists of a nitrogen gas supply cylinder with its own control valve, a supply pressure gauge, a three stage pressure reducing assembly and the piping and valves which control the flow of gas to and from the tank. The system includes electrical connection points for low gas supply, high tank pressure and low tank pressure alarms. Provisions for pressure transmitters for bottle supply and tank pressures are included as well.

When the nitrogen regulation system is correctly set-up and operating, it will maintain transformer tank pressure at 0.5 psi minimum and 5.0 psi maximum. During periods of transformer cooling, the overall tank pressure will decrease. If the tank pressure drops below 0.5 psi, nitrogen gas flows from the bottle supply cylinder through the reducing valve assembly and into the tank until the 0.5 psi pressure is restored. During periods of transformer heating, tank pressure will increase. If tank pressure exceeds 5.0 psi, the regulator assembly will vent the excess nitrogen to atmosphere to prevent tank damage or PRD operation.

The 3rd stage regulator supplying nitrogen to the transformer tank has an adjustable range of 0–2 psi and is set to a slight positive pressure (0.5 psi standard) at the factory. A 0.5 psi nitrogen supply pressure and a relief valve breaking pressure of 5.0 psi is chosen in order to provide a 4.5 psi tank regulation band. *Increasing the nitrogen supply pressure will decrease the regulation band for the transformer tank and may increase nitrogen use during periods of heavy thermal cycling.*

Adjustable alarm contacts are provided to indicate max/min tank pressures selected by user. Typical alarm points would be set just outside of the selected regulation band. For example, user alarms are normally set for 0.2 psi and 5.5 psi for a 0.5 to 5.0 regulation band. Nitrogen regulation systems are available in several configurations , as shown in Figures 2, 3 and 4 on pages 5 and 6.

INSTALLATION

The N2 system is easy to install and maintain. The following should be noted during installation:

- Mount the cabinet so that the bottom is at least 4" above grade.
- Use 3/8" diameter mounting hardware to mount the cabinet securely to the side of the transformer.
- Use sealed fittings for the electrical connections to avoid water accumulation inside the enclosure. Electrical connection points are provided on either side of the box and are sized for standard 1/2" conduit fittings.
- Ensure piping to the transformer is clean and free from corrosion or rust. The N2 system is designed to accept 1/4" NPT female connections for both the transformer tank inlet (left side of cabinet) and outlet (right side of cabinet) points. Valves located inside the cabinet walls allow the user to control the inlet and outlet flow for the tank piping.

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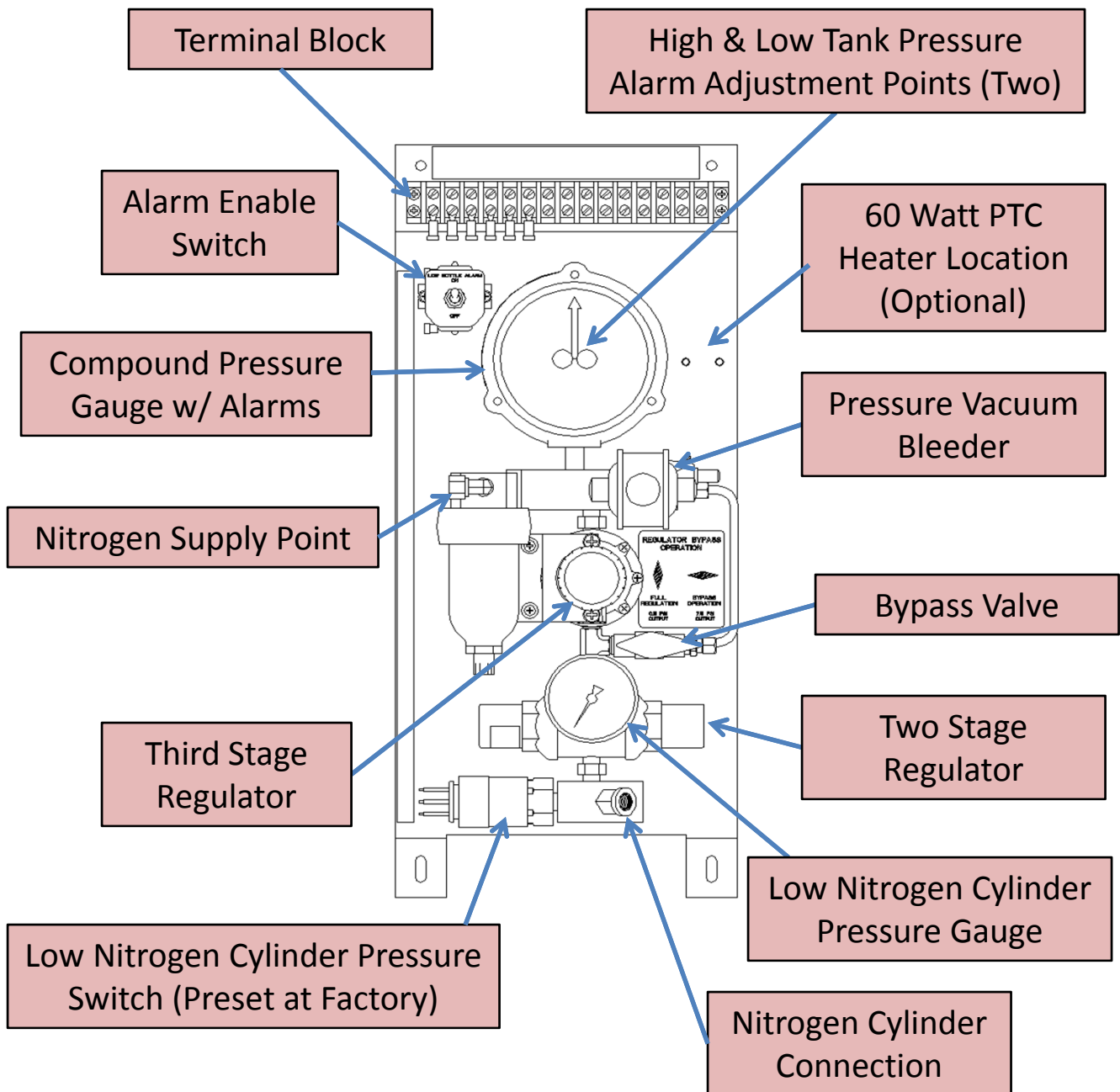


Figure 1 – Regulator Panel Assembly

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SYSTEM CONFIGURATIONS

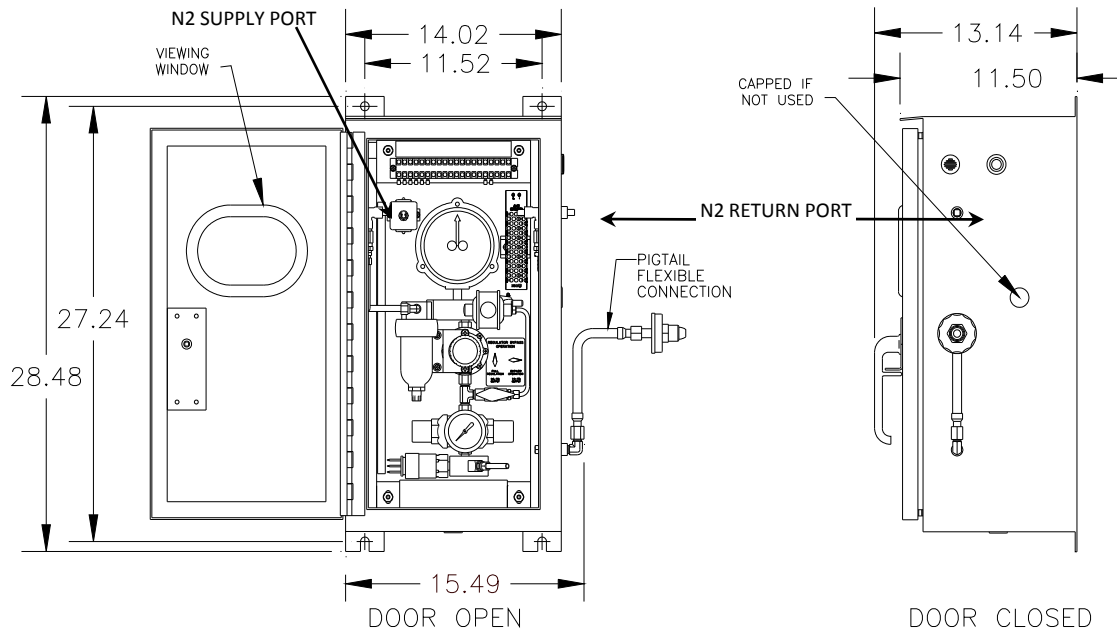


Figure 2 – N2-0 System (External Bottle)

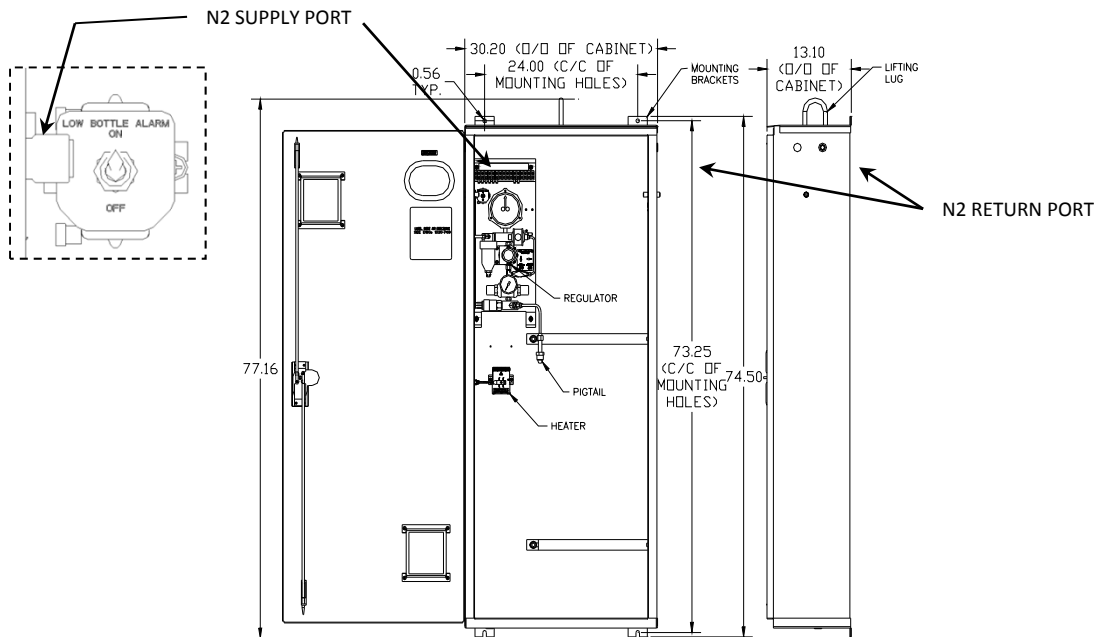


Figure 3 – N2-1 System (One Internal Bottle)

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SYSTEM CONFIGURATIONS (continued)

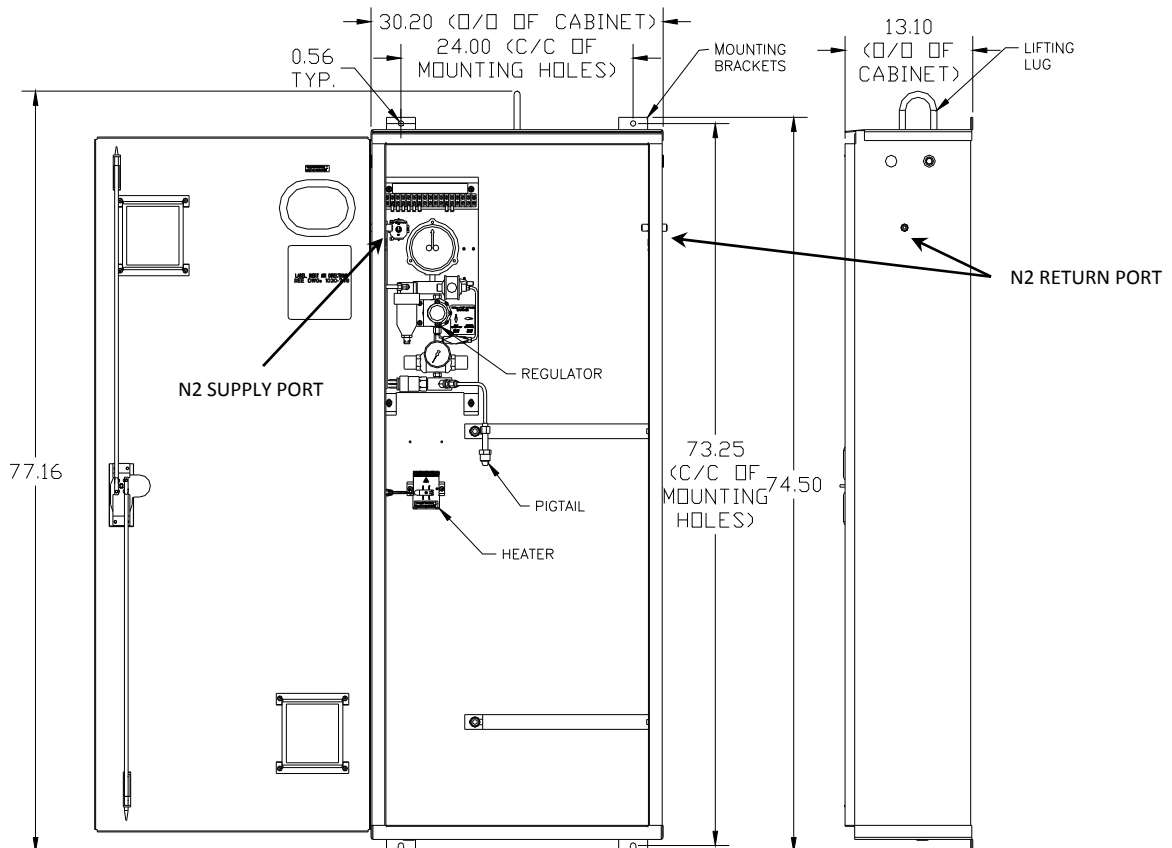


Figure 4 – N₂-2 System (Two Internal Bottles)



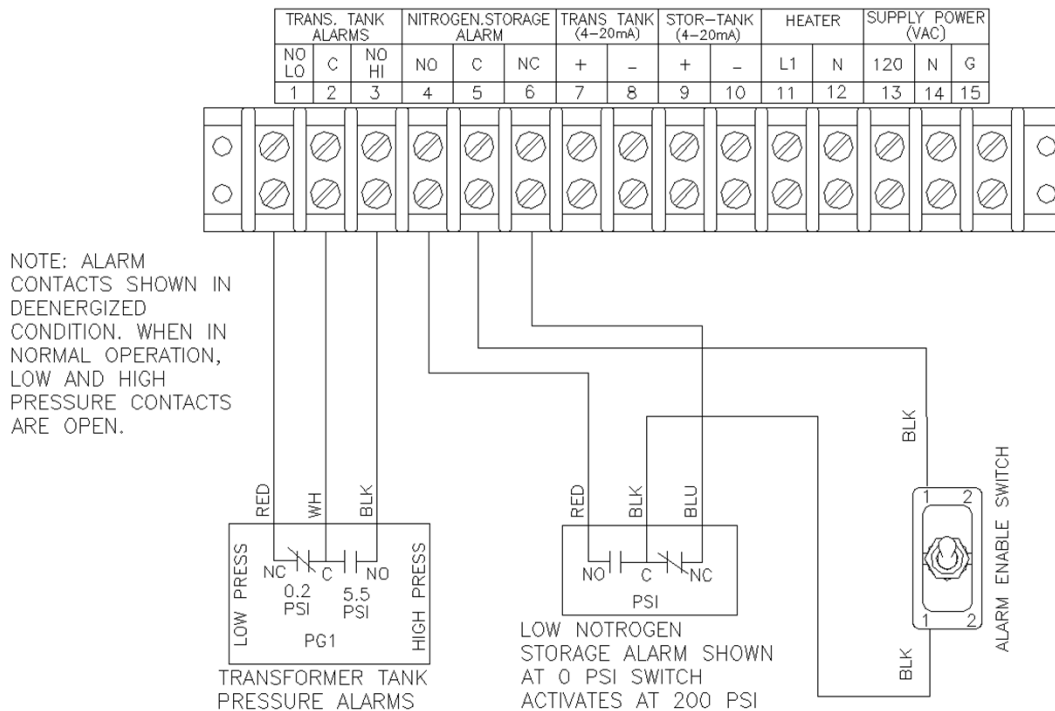
CAUTION – For ALL system configurations (Figures 2, 3 and 4), verify weekly during first 4 weeks and every 90 days thereafter that the oxygen content remains below one percent (1%). An increase in oxygen content indicates that purging of the tank is required (see page 9 under “Tank Purging”).

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TANK PRESSURE ALARM SETTINGS

The compound pressure gauge monitors the gas pressure in the tank (see Figure 1 on page 4 for location of this gauge). The gauge is graduated from a negative 15.0 psi to a positive 15.0 psi (-15.0 psi to +15.0 psi) and is equipped with two sets of adjustable alarm contacts. Alarm contacts are shipped with these alarms at 0. Upon receipt of the unit, these alarm points must be adjusted outside of the normal regulation band. **Typical settings would be 0.2 psi and 5.5 psi.**

ELECTRICAL CONTACTS



NOTE: PG1 switch contacts shown are in deactivated state. Contacts are open when tank pressure is between 0.2 and 5.5 psi. PS1 contacts are shown in deactivated state (zero bottle pressure). COMPOUND PRESSURE GAUGE IS RATED 1A, 120V AC; 2A, 30V AC/DC. The Low Bottle Alarm Enable Switch is used during bottle changes. See N2 bottle change procedure on page 10.

Figure 5 – Typical Alarm Connections for Pressure Gauge (PG1) and Bottle Switch (PS1)



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HEATER POWER CONNECTIONS

Heaters for the N2 systems are the Positive Temperature Coefficient (PTC) self-regulating type. Heater power requirements are 120V AC (50–60 Hz) and should be powered with a standard 20A feed.

N2-0 systems use a standard 60 watt radiant heater type while the N2-1 and N2-2 systems use a 200 watt forced convection type heater.

A terminal block is provided for easy customer power termination (see Figure 6 below).

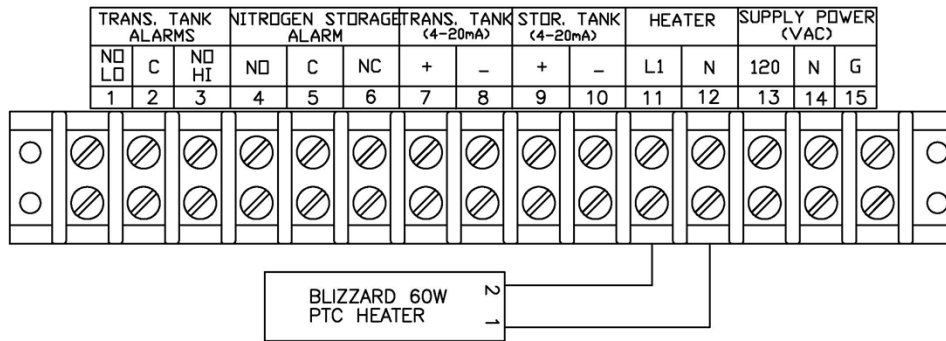


Figure 6 – Typical Power Connections for N2 System Heaters

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OPERATION

TANK PURGING

The nitrogen gas pressurizing system may be used to purge transformer tanks of contaminated gas or air. During purging, gas does not flow through the 3rd stage pressure regulator. Instead, the gas flows from the 2nd stage regulator through a bypass line directly to the tank inlet pipe.

NOTE: During bypass operation, the pressure-vacuum bleeder device may operate when feed nitrogen to static pressure is in excess of 5 psi.

To Purge The Tank

1. Open the transformer outlet purge valve.
2. Turn the “By-Pass-Reg.” to “By-Pass” position for purging. This increases pressure going into the transformer from 0.5 to 7 psi.

When Purging Is Completed

1. Return the “By-Pass-Reg.” valve to “Reg.” position.
2. Close the transformer outlet purge valve.

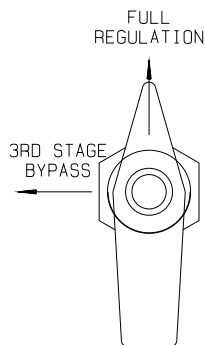


Figure 7 – By-Pass Regulation Valve

THREE STAGE PRESSURE REDUCER ADJUSTMENTS

The three-stage pressure reducer assembly regulates the flow of gas from the supply cylinder to the transformer tank. Stage one reduces the pressure of the gas flowing from the supply cylinder from 2200 to 100 psi. The regulator at stage two reduces the pressure of the gas flowing from 100 to 7 psi (see Figure 1 on page 4).

The third stage reduces the pressure of the gas flowing from 7 to 0.5 psi (adjustable) and controls the flow of gas to the tank, admitting gas into the tank whenever the tank pressure drops below 0.5 psi. The third stage also includes a pressure vacuum device, which opens if tank pressure rises beyond 5.0 psi or a vacuum below 3.0 psi. P-V adjustable range is 3–12 psig. **The three stages are factory set.**



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MAINTENANCE

Inert air systems are shipped with the system tested and fully operational. To make certain that all components are functioning properly, the system should be checked according to the following schedule:

- First Week — Check daily (minimum)
- Second through Fourth Week — Check once per week (minimum)
- After Fourth Week — Check as required by utility maintenance program and record with dates and times noted. Readings showing consistency indicate the equipment is operating properly.

PARAMETERS TO BE CHECKED INCLUDE SUPPLY CYLINDER PRESSURE, TRANSFORMER TANK PRESSURE, TRANSFORMER OIL TEMPERATURE AND AMBIENT TEMPERATURE.

NITROGEN GAS CYLINDER REPLACEMENT

The cylinder that should be used is a standard, commercially available, 244 cu. ft. nitrogen gas cylinder pressurized to 2000 psi. Replacement cylinders should meet all required pressure vessel specifications and be filled with oil pumped nitrogen or nitrogen with a certified moisture content of less than 0.03 percent by weight. The impurity content must be less than 7.5 parts per million.

Nitrogen consumption is dependent on transformer load variations and on the condition of the gas pressurizing equipment. Cylinder must be replaced when the supply pressure gauge reads 200 psi or below.

To Replace the Cylinder

1. Close transformer inlet valve.
2. Turn the Low Bottle Alarm Enable Switch to the OFF position.
3. Close the supply cylinder shutoff valve.
4. Release the union connection and remove the empty cylinder.
5. Position the replacement cylinder and make the connection. *Do not tighten more than finger tight.*
6. Open the shut-off valve on the replacement cylinder very slightly. Allow escaping gas to leak past the loose union connection and blow away any loose dirt, then tighten the connection with a wrench until leakage stops.
7. Open transformer inlet valve.
8. Turn the Low Bottle Alarm Enable Switch to the ON Position.

CONTACT US AT 800-338-5526 FOR REPLACEMENT PARTS AND/OR SERVICE.



REPLACEMENT PARTS AND SERVICE

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Or visit us online at **www.WaukeshaElectric.com**.

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