

waukesha®

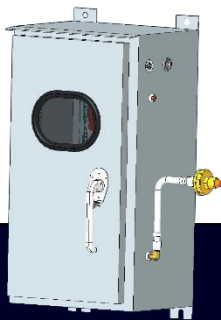


2ND GENERATION

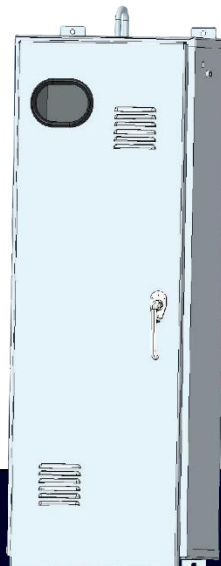
Inert Air (N2) Systems Manual

Inert Air-MANUAL – 2.18

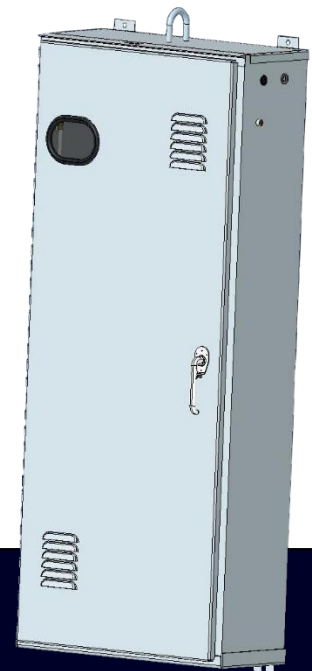
Read and understand this manual prior to operating or servicing the products.



N2-0 Series



N2-1 Series



N2-2 Series



CONTENTS

General Information	3
Description	3
Installation	3
System Settings	4
Panel Major Components	5
System Configurations	6–8
N2-0 & N2-1 Series	6
N2-2 Series	7
MN2 Series	8
Customer Terminal Block Connections	9
Tank Pressure Alarm Settings	10
Heater Power Connections	10
Transducer Wiring (if equipped)	11
General System Operations	12–13
Transformer Tank Purging	12
Third Stage Pressure Setting	12
Maintenance	13
System Checks	13
N2 Bottle Replacement	13
Contact Information	14

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, page 5) 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 that 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, transformer tank pressure will maintain 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 are 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 recommended to be 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 6 and 7.

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 equipped with 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.

SETTINGS SUMMARY

N2 SYSTEM SETTINGS SUMMARY	
BYPASS REGULATOR PRESSURE	+ 7.0 PSI
STANDARD TANK REGULATION PRESS.	+ 0.5 PSI
PRESSURE RELIEF SET POINT	+ 5.0 PSI
VACUUM RELIEF SET POINT	- 3.0 PSI
HIGH PRESSURE ALARM	+ 5.5 PSI
LOW PRESSURE ALARM	+ 0.2 PSI
EMPTY CYLINDER ALARM	+200.0 PSI

MAJOR PANEL COMPONENTS:

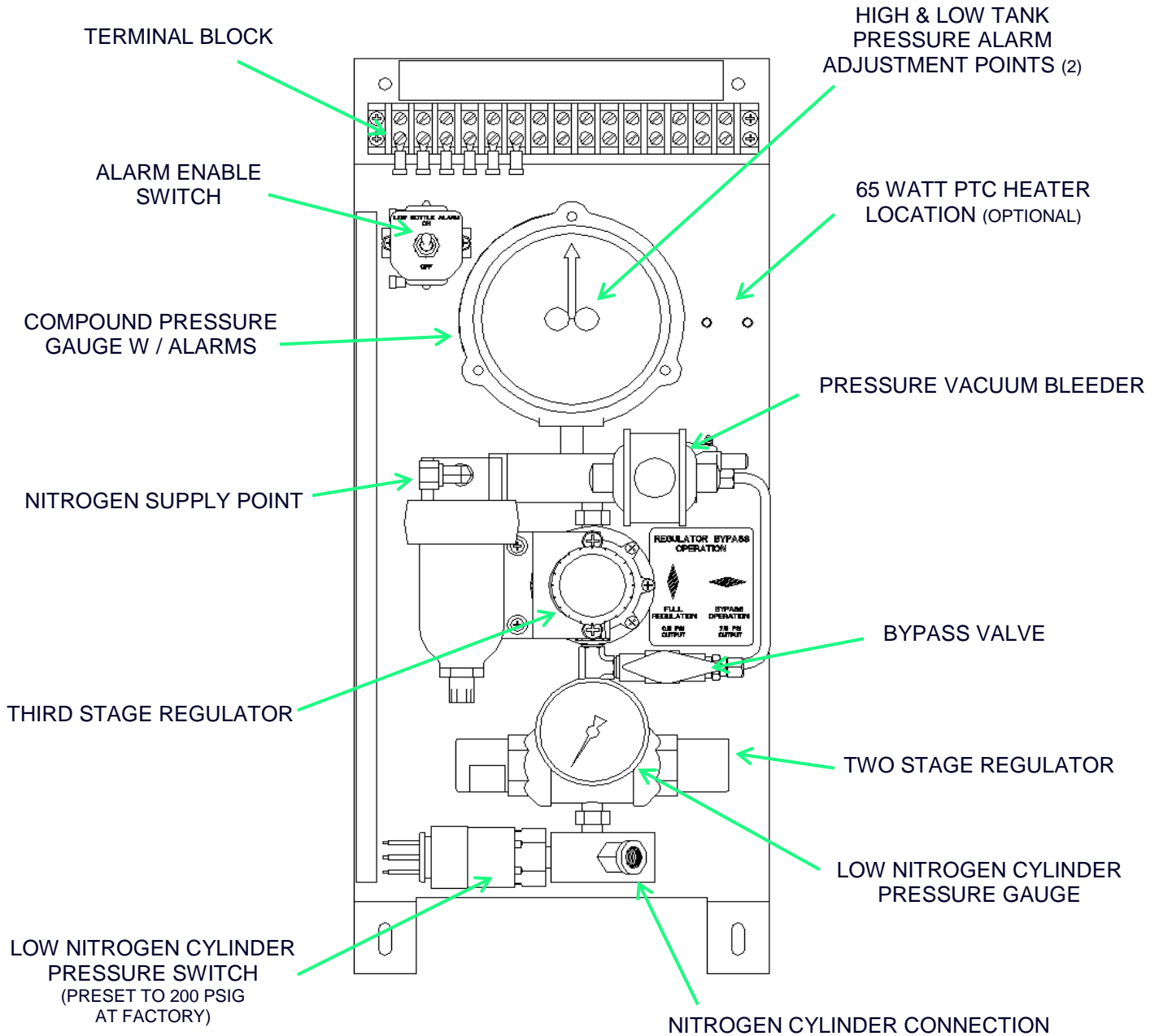


Figure 1 – Regulator Panel Assembly

SYSTEM CONFIGURATIONS:

Dimensions in inches [mm]

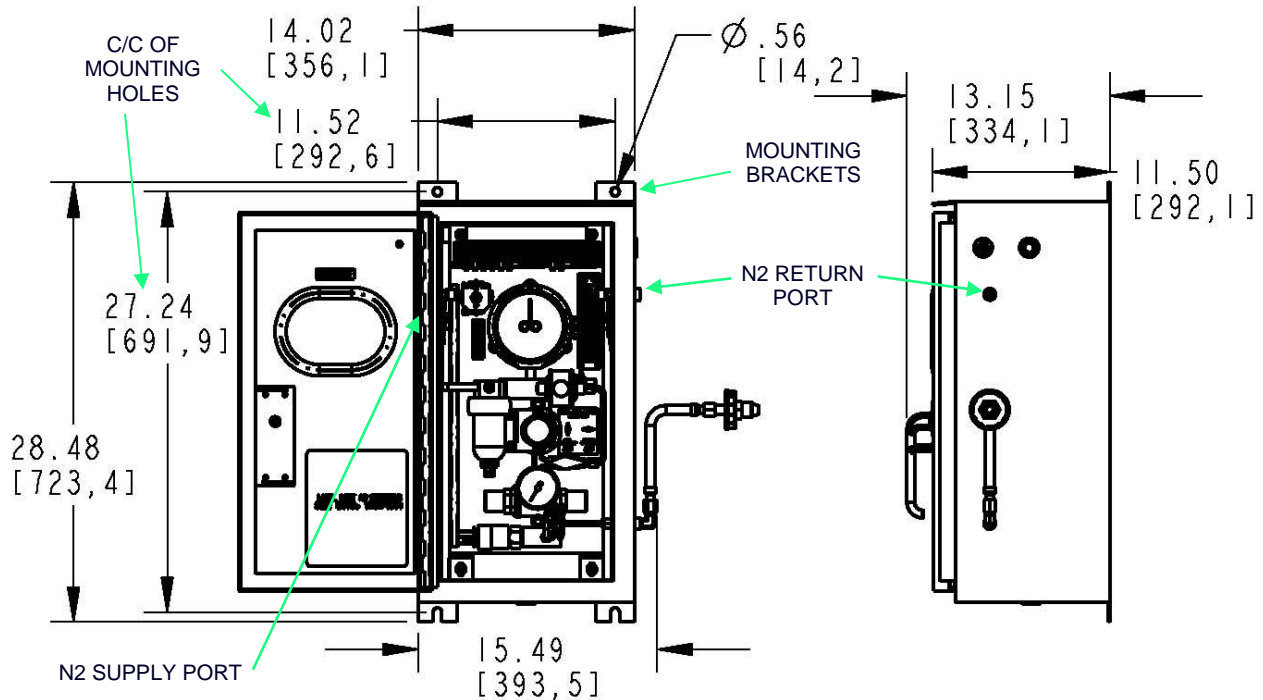


Figure 2 – N2-0 System (External Bottle)

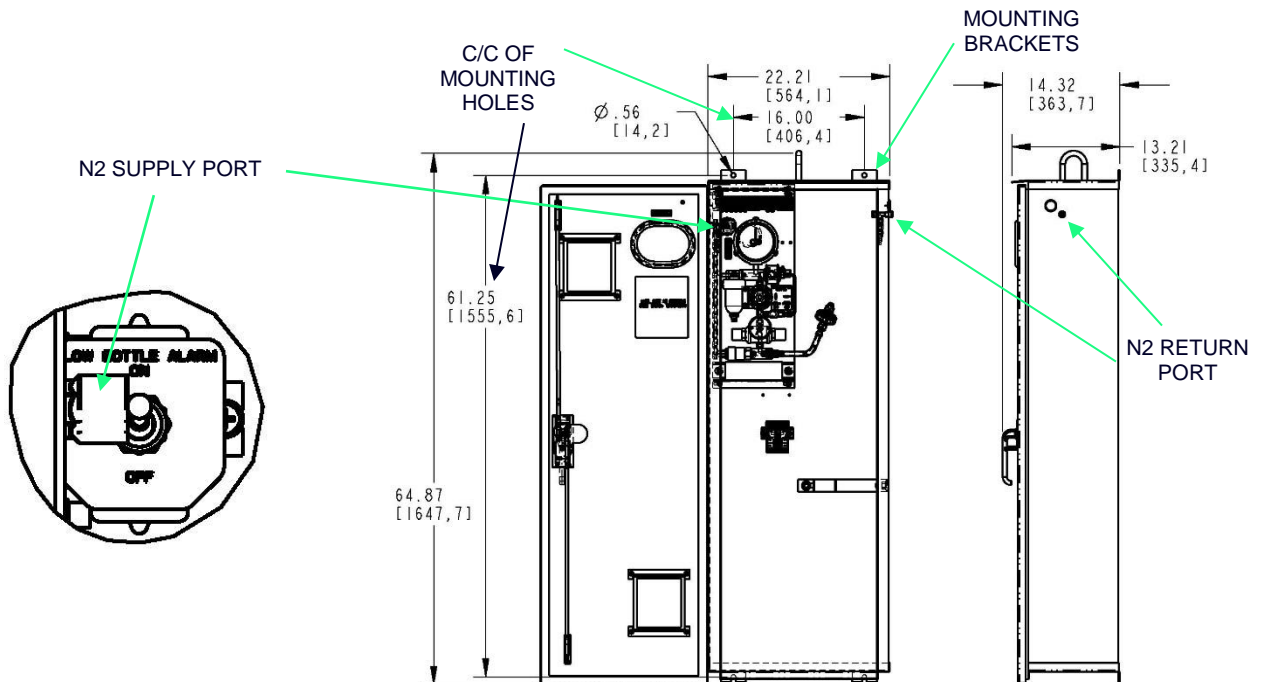


Figure 3 – N2-1 System (One Internal Bottle)

SYSTEM CONFIGURATIONS (continued):

Dimensions in inches [mm]

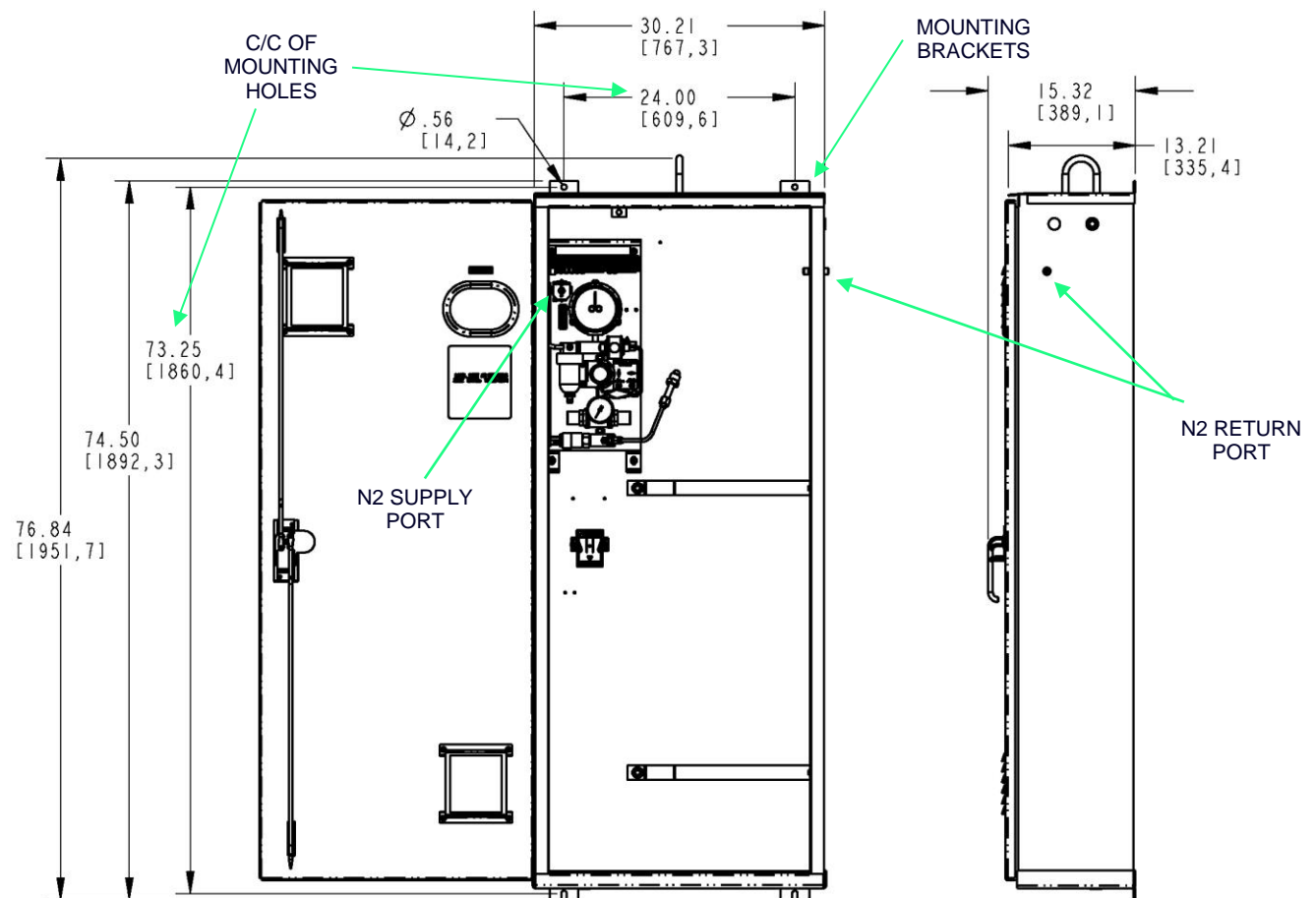
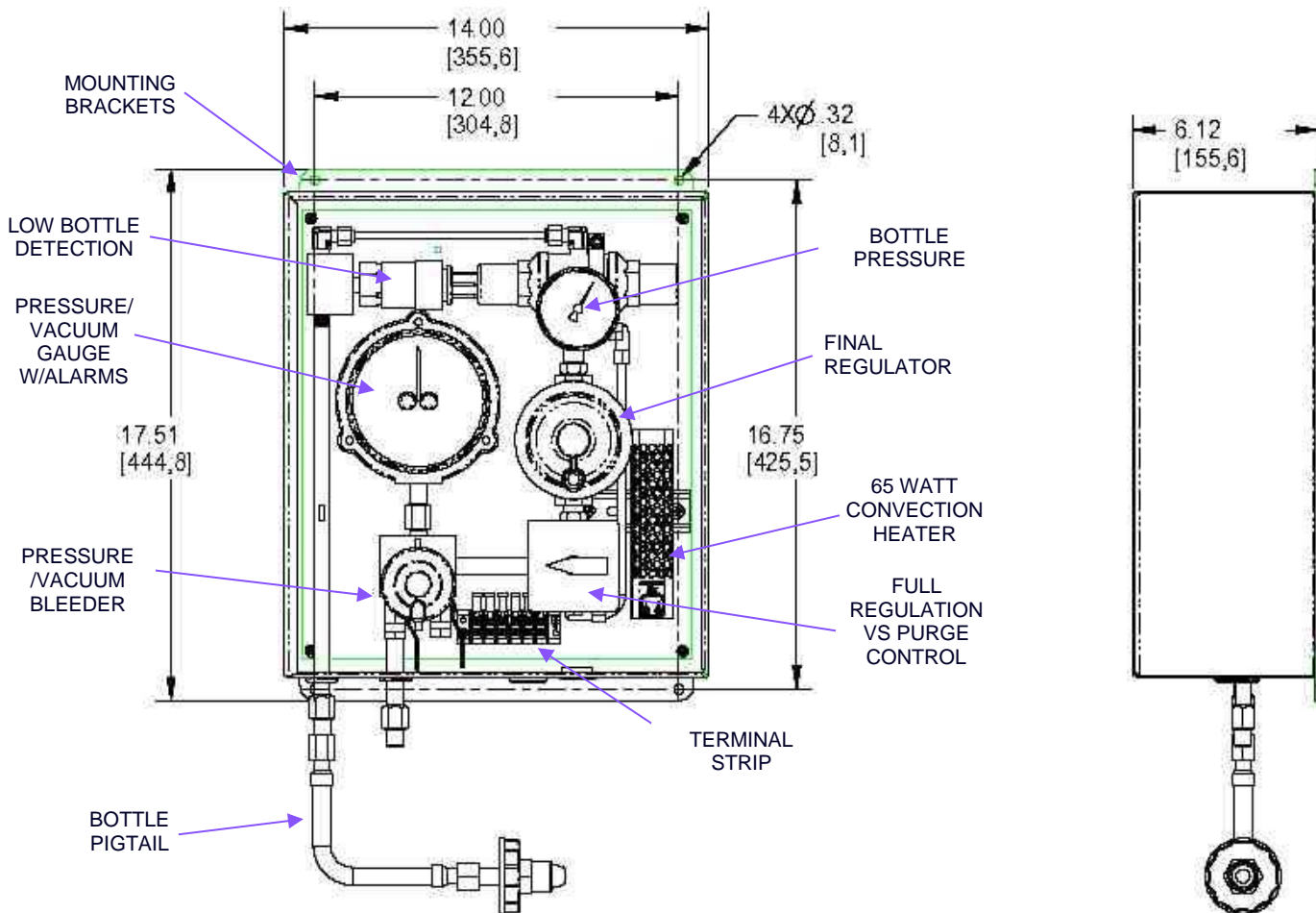


Figure 4 – N2-2 System (Two Internal Bottles)

CAUTION For ALL system configurations (Figures 2, 3, 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 10 under “Tank Purging”).

SYSTEM CONFIGURATIONS (continued):

Dimensions in inches [mm]



OPTIONAL ITEMS ARE SHOWN,
REFERENCE CONFIGURATOR FOR
SPECIFIC CONFIGURATIONS

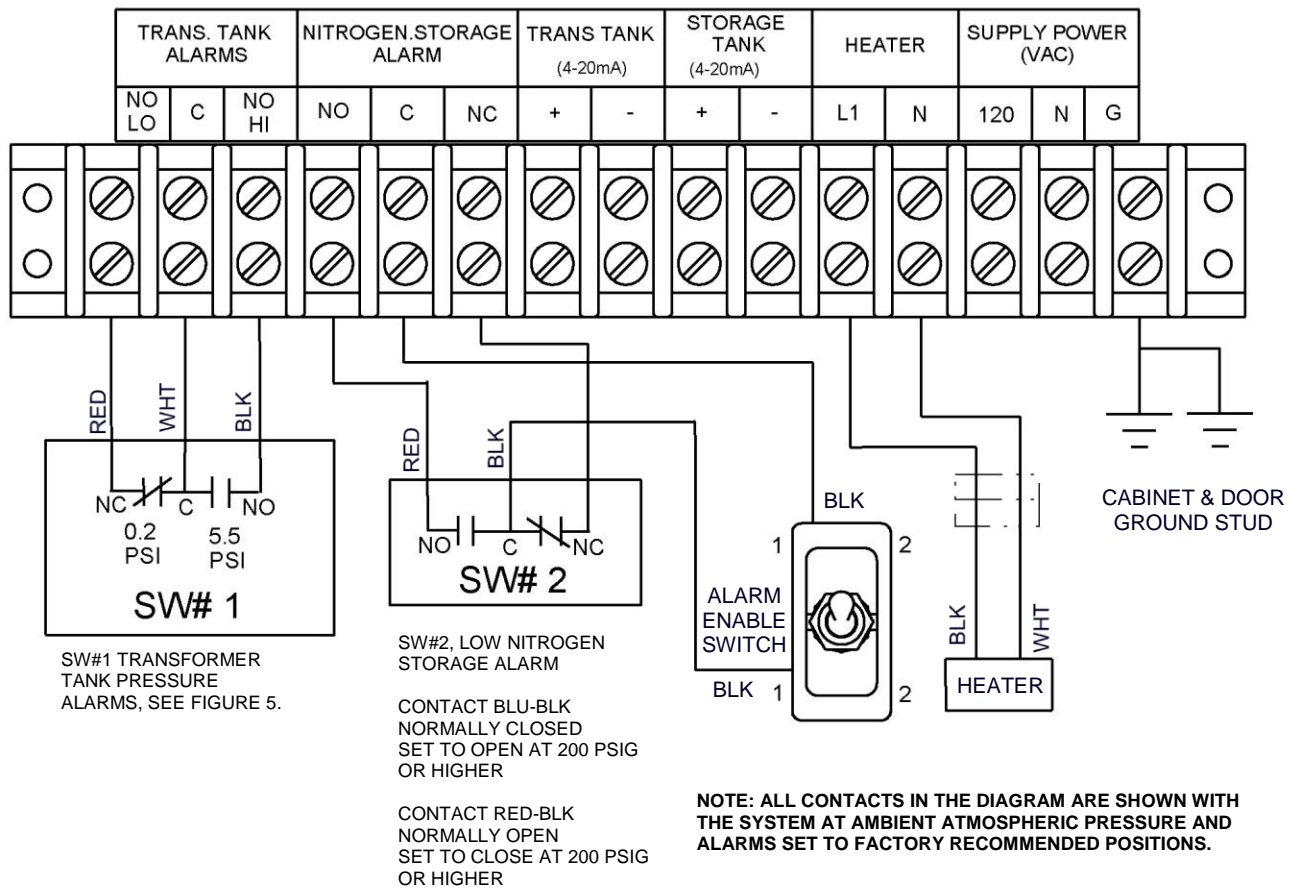
Figure 5 – MN2 System

CUSTOMER CONNECTION TERMINAL STRIP WIRING:

The compound pressure gauge monitors the gas pressure in the transformer tank (see Figure 1, page 5 for location of this gauge). The gauge has a range from negative 15.0 psi to positive 15.0 psi (-15.0 psi to +15.0 psi) and is equipped with two adjustable alarm contacts. The gauge is shipped with both moveable alarms adjusted to zero to prevent shipping damage due to shipping vibration. Before placing the unit in service, these alarm points must be adjusted to be outside of the normal regulation band.

Factory recommended settings would be 0.2 psi and 5.5 psi.

ELECTRICAL CONTACTS



During normal operations, the pressure on the transformer tank is expected to fluctuate between 0.5 psi and 5.0 psi, following the temperature variations in the transformer, at which both SW#1 contacts will stay open. In the event the pressure drops to 0.2 psi or below (the low pressure alarm setting), the SW#1 low pressure contact (Red-White) will close, sending an alarm, if monitored. On the other hand, if the pressure on the transformer tank increases to 5.5 psi or above (the high-pressure alarm setting), the SW#1 high pressure contact (Black-White) will close, sending an alarm, if monitored. See Figure 6 for clarity. The *Alarm Enable Switch* is used to disable alarm signals during a nitrogen bottle change.

TANK PRESSURE ALARM SETTINGS:

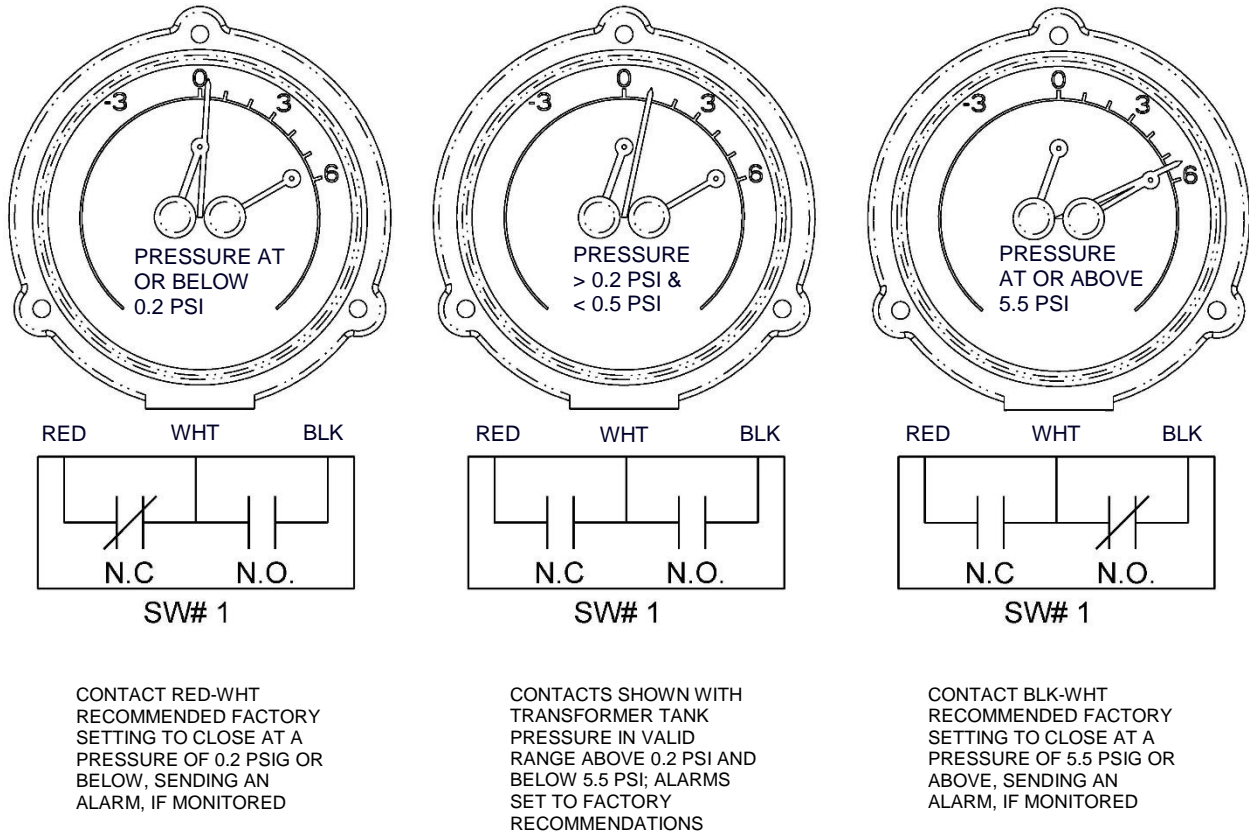


Figure 6 – Typical SW#1 Contact Operation

HEATER POWER CONNECTIONS

Heaters for N2 systems are the positive temperature coefficient 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 65-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:

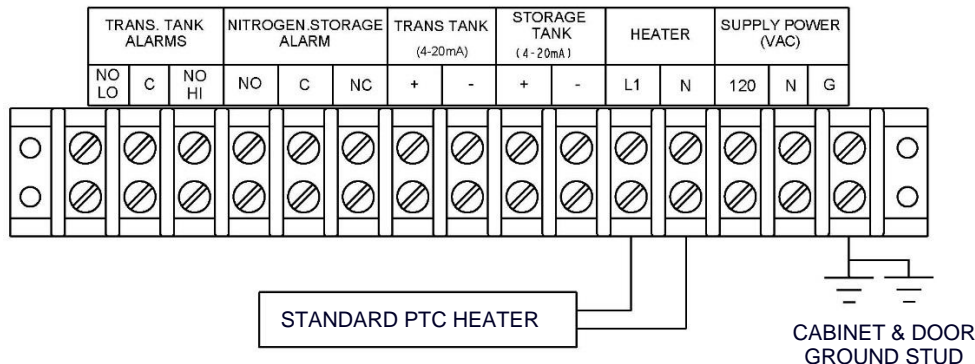


Figure 7 – Typical Power Connections for N2 System Heaters

TRANSDUCER POWER WIRING

If the system is equipped with transducers, the transducers will need to be wired to an exciting voltage & applicable meter for operation (Figure 8a). Terminal strip landing positions (Figure 8b).

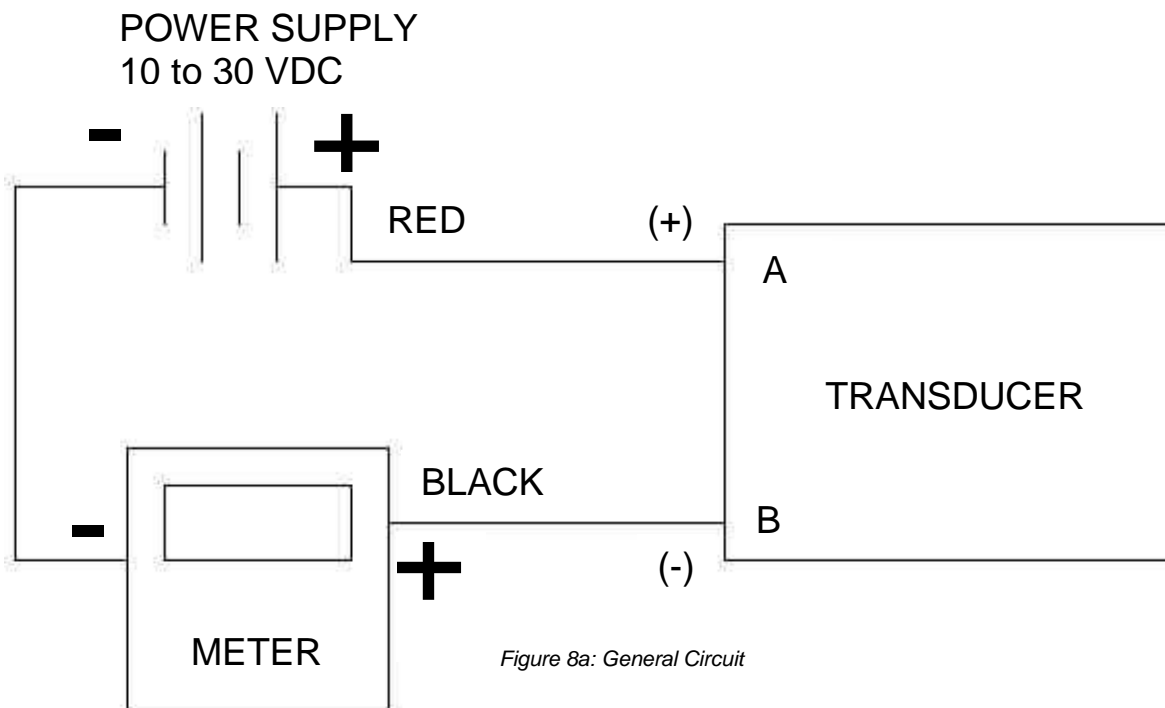


Figure 8a: General Circuit

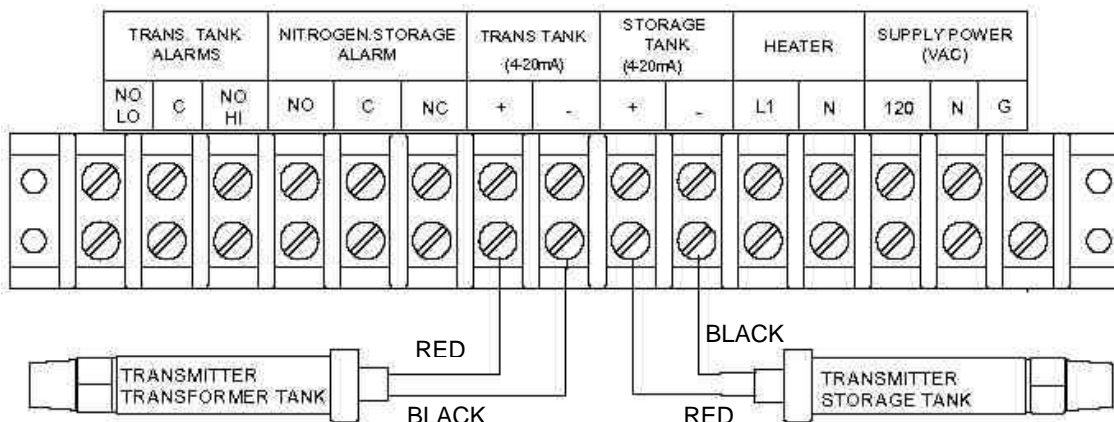


Figure 8b: Terminal Strip Landing Positions

OPERATION

Transformer 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 while feeding nitrogen to the transformer tank if the static tank pressure exceeds 5 psi.

To Purge the Tank

1. Open the transformer outlet purge valve.
2. Turn the “Bypass-Reg.” to “Bypass” position for purging. This increases pressure going into the transformer from 0.5 to 7 psi (Figure 9a).

When Purging Is Complete

1. Return the “Bypass-Reg.” valve to “Reg.” position (Figure 9b).
2. Close the transformer outlet purge valve.

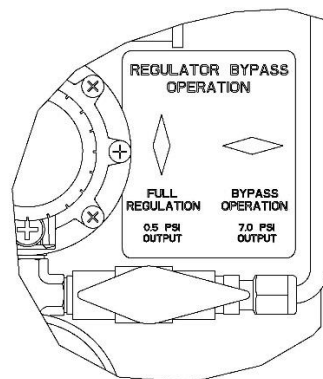


Figure 9a – By-Pass Regulation Valve
(Shown in bypass position)

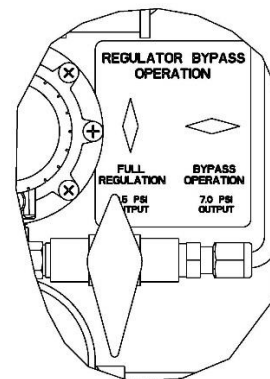


Figure 9b – By-Pass Regulation Valve
(Shown in full regulation position)

THIRD 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, page 5).

The third stage reduces the pressure of the gas flowing from 7 to **0.5 psi (adjustable 0-2 psi)** 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.**

MAINTENANCE

Inert air systems are shipped with the system tested and 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. *The factory set point for the low bottle alarm is 200 PSIG.*

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, and 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.

REPLACEMENT PARTS AND SERVICE

Please contact your local sales representative or authorized distributor for replacement parts and/or service, or visit us online at www.waukeshacomponents.com.

For technical support, call us at **800-338-5526**.