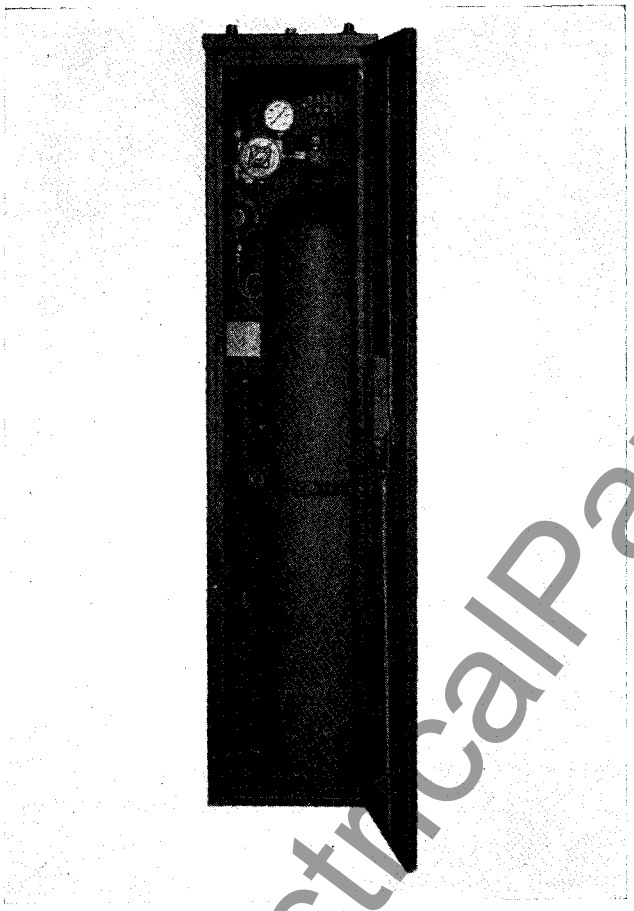
DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

INERTAIRE® EQUIPMENT
Types RB and RV



INERTAIRE is the name originally given by Westinghouse to a system for removing oxygen and moisture from the air being drawn into a transformer tank when decreasing temperature would create a partial vacuum within the tank. With the oxygen and moisture removed, the remaining inert gases are almost wholly nitrogen. Subsequent development has evolved means for feeding dry nitrogen at low pressure into the transformer tank from high pressure nitrogen cylinders, instead of depending on removing oxygen and moisture from the air drawn in during breathing.

Westinghouse Type RB and RV Inertaire equipment maintains a cushion of inert dry gas above the oil of transformers or similar oil-filled equipment.

The nitrogen is supplied from a steel cylinder which is initially filled to a pressure of 2,000 pounds per square inch. A pressure reducing valve automatically feeds nitrogen into the transformer whenever the transformer pressure falls below ½ pound per square inch.

A relief valve assembly incorporated in the final stage of the reducing valve conserves the nitrogen in the gas space by permitting it to escape to the atmosphere only when the pressure in the transformer, due to the expansion of the oil with temperature, exceeds the predetermined value of 8 pounds per square inch (5 psi if RV). A sampling valve connected to the gas space provides means for taking a sample of the gas to determine its oxygen content.

DESCRIPTION

Reducing Valve and High Pressure Gauge. A three-stage reducing valve, Fig. 1, is used to reduce nitrogen cylinder pressure of 2000 psi to ½ psi minimum operating pressure. The first stage is compensated to give constant pressure and flow to the second stage regardless of drop in cylinder pressure. In passing through the first stage the pressure is reduced from 2000 psi to approximately 100 psi.

The second stage further reduces the pressure to approximately 6 to 10 psi before the gas enters the third and final stage reducer where the pressure is reduced to ½ psi. The nitrogen is fed into the transformer gas space at this final pressure when the pressure in the gas space falls below ½ psi.

A high pressure relief is provided in the event of excessive heat near the cylinder causing the cylinder pressure to increase to a dangerous value.

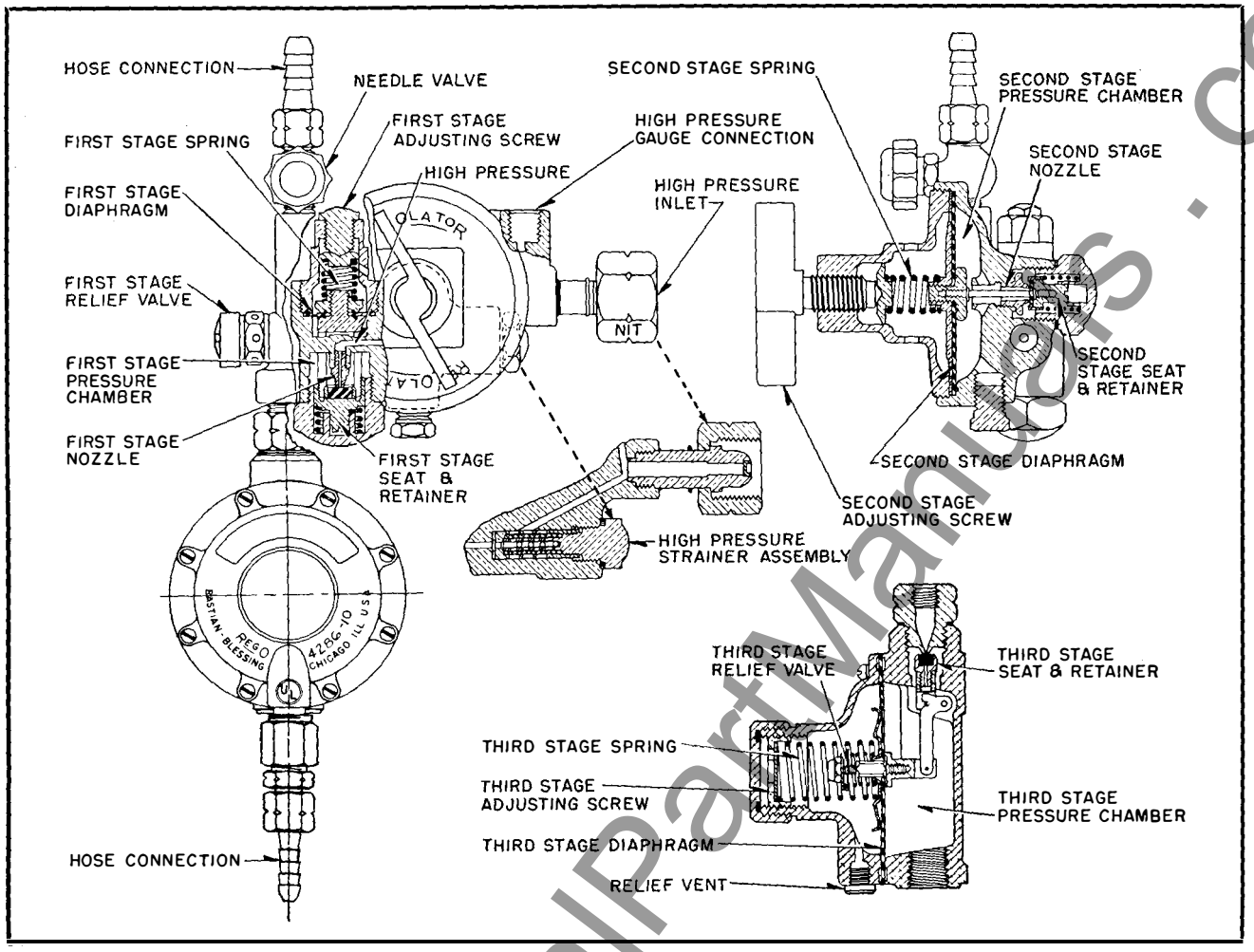


FIG. 1. Reducing and Relief Valve Assembly.

The high pressure relief consists of a diaphragm backed by rose metal. When excessive heat occurs, the rose metal backing the diaphragm melts, leaving the diaphragm unsupported. The diaphragm then ruptures, permitting the gas to escape to the atmosphere through several holes arranged to distribute the thrust in all directions.

The test needle valve with a hose connection is located at the outlet of the second stage. This connection provides a relatively low pressure source (3 to 10 psi) for checking the relief pressure of a relief valve incorporated as part of the third stage. This connection may also be used for purging the gas space if desired.

The pressure at this connection can be adjusted by turning the adjusting screw (or T-handle) clockwise to raise the pressure or counterclockwise to lower the pressure.

Note: After using this connection, the adjustment should be reset to provide approximately 6 pounds per square inch pressure, (but never less than 3 pounds per square inch), since 6 pounds per square inch pressure gives the best performance in the following stage.

The third stage of the valve is the lower portion of the device. It is adjusted at the factory to feed nitrogen into the gas space when the pressure in the transformer falls below ½ pound per square inch, and to seal off the gas space from the nitrogen supply when this pressure rises above ½ pound per square inch. This setting should not be disturbed under any circumstances. Incorporated within the third stage is a relief valve which acts to prevent the transformer pressure from exceeding 8 pounds per square inch. It is a spring loaded diaphragm valve. When the gas pressure on the transformer side exceeds 8 pounds per square inch, the valve opens slightly, permitting the gas to escape to the atmosphere through a relief vent in the body of the valve thus relieving the excess pressure. As soon as the pressure falls below 8

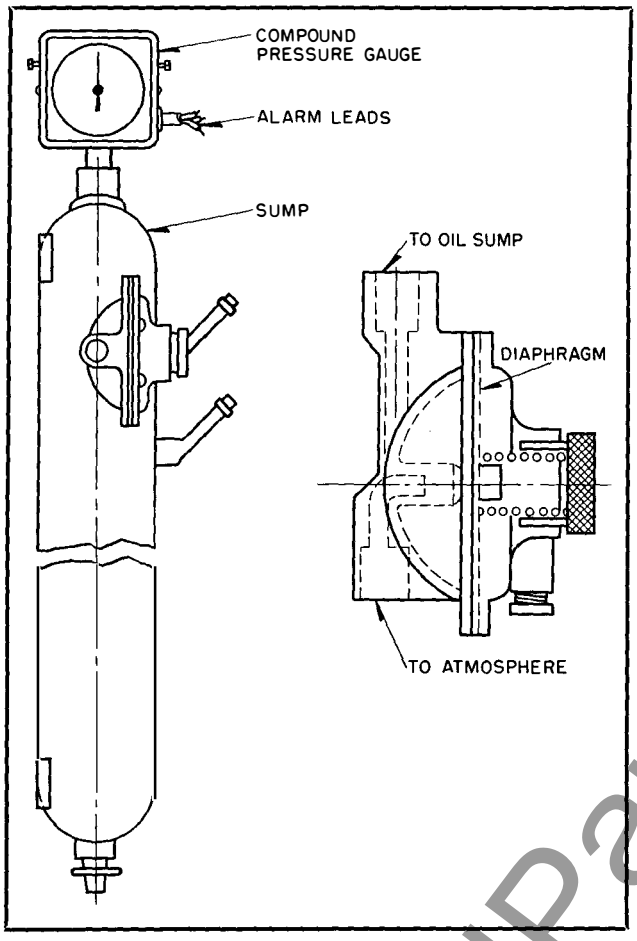


FIG. 2. Sump, Compound Pressure Gauge, and Diaphragm Type Breathing Regulator. (Regulator on Type RV Only.)

pounds per square inch the valve closes, preventing further loss of gas. In case of RV equipment excess pressure (over 5 psi) is relieved by a separate relief valve installed on the sump.

Important: The reducing valve is a precision instrument and adjustment other than the one mentioned in the previous Note should not be attempted. If the valve does not operate correctly, notify the nearest Westinghouse Office and send the valve to the Westinghouse Electric Corporation, Sharon, Pa., for repair. Repair of reducing valves and high pressure gauges should not be attempted in the field.

A 3000 pound per square inch pressure gauge is connected to the high pressure chamber of the reducing valve, and indicates the nitrogen pressure in the cylinder. The gauge is equipped with electrical contacts which close when the cylinder pressure falls to 200 pounds per square inch, plus or minus 10 percent and thus warns the operator that only 10 percent of a full cylinder of nitrogen is left. (See Fig. 4). The switch ratings are given in Table No. 1. The reducing valve will continue to function, however, until the cylinder is empty.

No vacuum relief is provided as the reducing valve feeds nitrogen into the transformer tank before a vacuum is reached. The slight amount of vacuum which might occur when the cylinder has been shipped away to be refilled will not be detrimental to the transformer or the Inertaire Equipment.

Compound Pressure Gauge. A compound pressure gauge, Fig. 2, mounted on top of the sump, is used to indicate pressure in the transformer gas space. It is of the diaphragm type, with increments of one-tenth psi and major divisions every 1 psi from −10 to +10 psi. The gauge is equipped with two alarm micro-switches, one to operate at abnormal high pressure and the other to operate at vacuum should it occur. Refer to Fig. 4. The standard compound pressure gauge is supplied with normally open contacts (Fig. 4b), but a special compound pressure gauge with normally closed contacts (Fig. 4a) may be supplied on request. The switches are set 8½ psi on the pressure side and —3 psi on the vacuum side (RB Inertaire). The switch ratings are given in Table No. 1.

These values are recommended but if other than the above is required, setscrews on the side of the gauge are provided for adjustment of the switches.

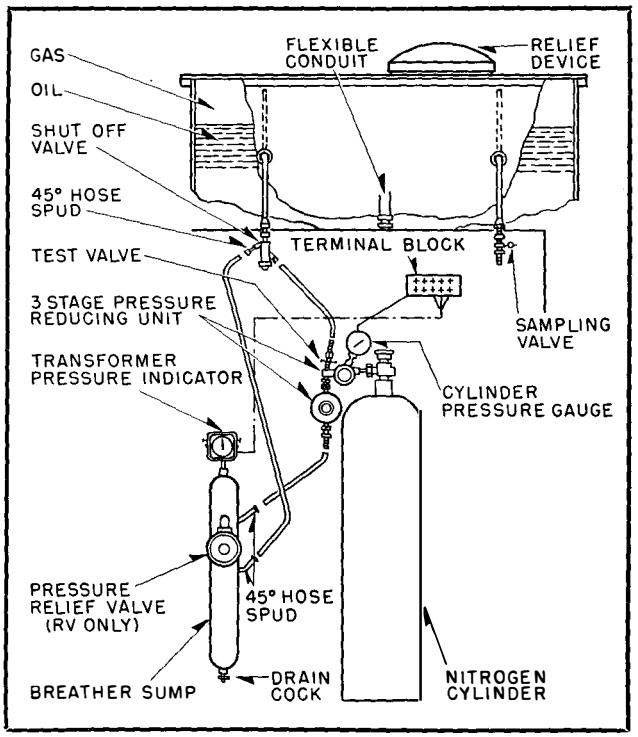


FIG. 3. Schematic Diagram of Equipment.

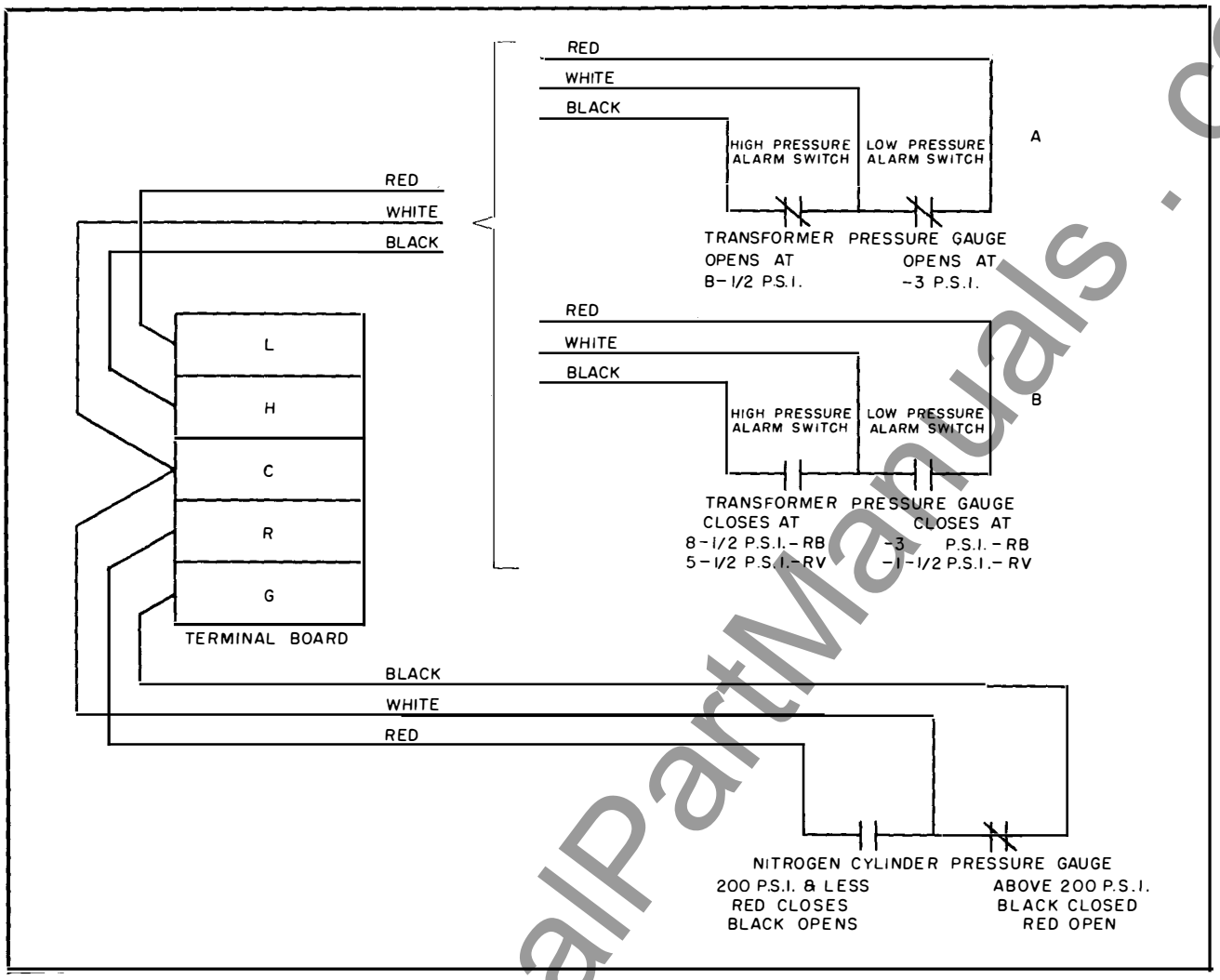


FIG. 4. Connection Diagram of Pressure Gauge Alarm Switches, Showing Alternate Arrangement.

These setscrews are hex-head screws and can be turned with a small open-end or box-end wrench.

The differential of the switches is approximately 1/4 psi. That is, if the high alarm operates, the pressure must fall only 1/4 psi before the switch is reset; if the low alarm operates, the pressure must increase 1/4 psi for the switch to reset.

It should be noted that the vacuum switch will never operate except in case the nitrogen cylinder is allowed to become empty. The pressure switch will not operate unless the relief valve should fail to perform its function, or the pressure builds up faster than it can be relieved by the relief valve due to a fault in the transformer.

Shut-off Valve. A three-way shut-off valve with two 45-degree hose spuds, located above the reducing valve, connects the gas space above the transformer oil level to the sump assembly or the test valve on the outlet of the first stage of the reducing valve. The three positions of the valve are as follows:

1. ***Shut-off*** (clockwise to limit). This shuts off the gas space and connects the relief valve through the hose to the test valve. This position is used to seal the gas space, and also for testing the operating pressure of the relief valve.

2. ***Mid-position*** (approximately 3 turns from either limit). In this position of the valve, the gas space, the relief valve, and the test valve are connected together. This position is used when it is desired to purge the oxygen from the gas space initially with dry nitrogen.

3. ***Operating*** (counter-clockwise the limit). in this position, the gas space is connected to the relief valve through the oil sump, and the connection to the test valve closed.

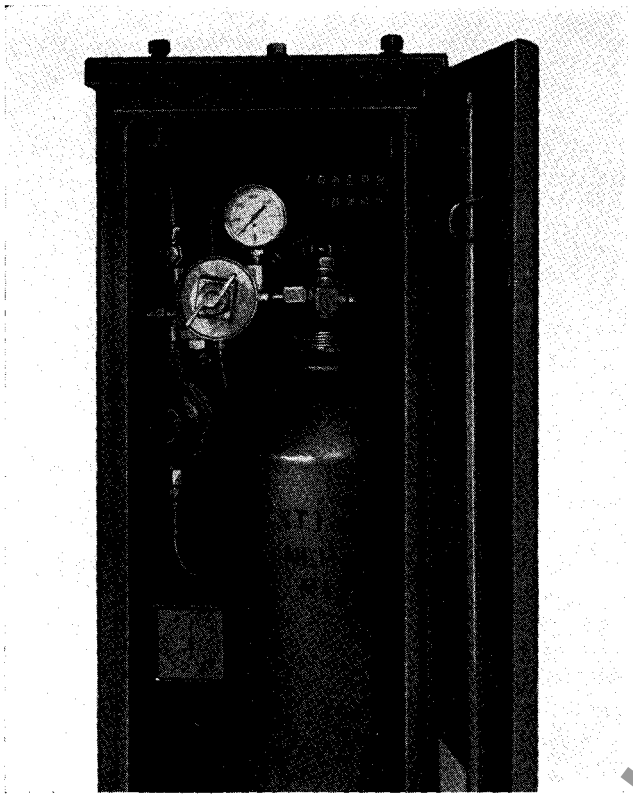


FIG. 5. Reducing Valve on Nitrogen Cylinder.

Sampling Valve. The sampling valve is a needle valve, connected to the gas space, above the oil, through a pipe attached to the tank wall. It is used for obtaining samples of the gas from the gas space for oxygen content analysis. When sampling for oxygen content, sufficient gas should be allowed to flow to clear the line before taking the sample. This valve may be used also as an exhaust valve when purging the oxygen from the gas space.

RV Inertaire. In those cases where it is desired to limit the pressure to 5 pounds per square inch, and specifically ordered, a diaphragm type of relief valve will be mounted on the oil sump. The relief valve is set at the factory and the pressure screw sealed by solder. The relief pressure is stamped on the pressure screw. Also, the two alarm micro-switches on the compound pressure gauge are adjusted so that one operates at abnormal high pressures (over 5½ psi, and the other operates at vacuum (—1½ psi) should it occur. (See Fig. 4.) Equipment ordered for this special condition is classed as RV inertaire. The higher rate of use of nitrogen requires that an extra tank of nitrogen be provided with each unit.

INSTALLATION

Mounting. Inertaire equipment usually is shipped separate from the transformer tank and consists of: (1) the reducing valve; (2) one operating nitrogen cylinder; (3) two short copper tubes which connect between the cabinet and the tank; (4) mounting hardware; (5) the cabinet with all other parts of the equipment mounted in it; (6) flexible alarm leads.

The copper connecting tubes should be connected at the top of the cabinet by means of union nuts on the copper tubing. Care should be taken to make a gas-tight connection. A small amount of thread cement placed on the joining compression surfaces will assist.

Install the reducing valve on the support pins and connect synthetic tubing between test valve and shut-off valve. Also connect third stage outlet to oil sump assembly with synthetic tubing.

Remove cylinder valve protecting cap from cylinder and place cylinder in cabinet. The cylinder valve protecting cap should be kept in cabinet for use when cylinder is sent away for refill. Before connecting reducing valve high pressure union to cylinder valve, be sure cylinder valve is free of any dirt. Open the cylinder valve slightly so that any dirt lodged in its passages may be blown out.

Note: Do not have valve opening pointed toward any one as a small object blown from the valve with such high pressure might cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union on with the fingers and then open the cylinder valve *very little* letting gas leak by the threads to blow off any fine dirt that might be on the union seat or in the threads. Tighten union nut with a wrench until this leakage stops and open cylinder valve full.

Note: Always open cylinder valve very slowly. The sudden shock of high pressure admitted to the reducing valve is likely to injure the high pressure gauge or the reducing valve seat.

Tank Leak Test. If the tank is to be tested for leaks by filling completely with oil and applying an additional oil head, close the shut-off valve (clock-wise) and the sampling valve. When leak test is completed, the oil should be lowered in the following manner: Open the test valve on the reducing valve; open the nitrogen cylinder valve;

start to draw down the oil; open the transformer shut-off valve to mid-position (3 turns). This procedure will blow most of the oil in the connection between the transformer tank and cabinet back into the tank and fill the gas space with pure nitrogen, thus accomplishing the initial deoxygenation of the gas space.

Open the oil sump drain valve on the oil sump assembly and draw off any oil which may have entered the sump; close the sump drain; open sampling valve to drain off the oil in this line. Nitrogen will come out of this valve when line is free of oil. Close the sampling valve. Close the test valve, check relief pressure of relief valve.

Deoxygenation. *Inertaire transformers may be installed with air in the gas space for simplicity of installation.* However, for the efficient usage of Inertaire equipment, the transformer should be purged with nitrogen. If it is the customer's practice to purge transformers to obtain initial increased protection to the transformer, he can do so as described below.

Replace operating cylinder by extra cylinders used only for purging.

For this operation the test valve on the reducing valve is opened. With the shut-off valve in mid-position (3 turns from either extreme position) and the sampling valve wide open, open the nitrogen cylinder valve. This permits the nitrogen to flow into the gas space, forcing the air out the sampling valve. The nitrogen should be allowed to flow until the oxygen in the escaping gas is reduced to 3 percent.

For initial deoxygenation, or where the transformer oil has been open to atmosphere for more than 48 hours, it is a waste of nitrogen to try to reduce oxygen content to less than 3 percent. This waste is due to: (1) sufficient oxygen is in the oil to require subsequent purging (2) about four times as much nitrogen is required to purge oxygen down from 3 to 1%, as from 20 to 3%.

During shipment the oil may absorb oxygen which will be replaced slowly by the nitrogen. Thus the oxygen content of the gas may actually increase after installation. Additional purging operations may be necessary as explained under Maintenance. If the customer has chosen to purge the transformer to obtain the initial protection he may order nitrogen from the supplier as Westinghouse nitrogen, P. D. S. 5622. Purging cylinders are the property of the nitrogen supplier and should be promptly returned since demurrage will be charged after 30 days. The suppliers for purging nitrogen are the same as for operating nitrogen and are listed at the conclusion of this Instruction Leaflet.

While the equipment is connected for deoxygenation, it is usually convenient to check the tank for leaks, and to check the relief pressure of the relief valve. These procedures are explained below.

Testing for Leaks. If an oil pressure test cannot be conveniently made to check the tightness of the tank and fittings, the following method is suggested:

After the deoxygenation process is completed, close the sampling valve and carefully allow the pressure in the gas space to reach 8 pounds per square inch. (5 psi for RV Inertaire). Close the nitrogen cylinder valve.

Allow the transformer to stand several hours with this pressure. If the pressure falls off, a leak is present and it can best be found by applying soapy water to all joints and connections. In checking for leaks, the newly-made Inertaire connection should not be overlooked.

Caution: Extreme care should be observed, when purging the gas space with nitrogen from a high pressure container, not to seal the transformer off tight until the gas in the gas space has reached ambient temperature. The expansion of nitrogen from a very high pressure (1500 to 2000 pounds per square inch) to atmospheric pressure results in the nitrogen entering the gas space at a very low temperature. Unless the gas is free to expand as it warms up to ambient temperature, the pressure within the tank may increase to such a value as to operate the relief device. If no relief device is provided, the pressure may distort the tank.

If the relief valve assembly is connected to the gas space, it will relieve any pressure in excess of 8 pounds per square inch (5 psi for RV Inertaire) if the pressure is built up gradually.

Checking the Relief Pressure of Relief Valve. Having completed the test for leaks, the relief pressure of the relief valve should be checked. This is done by first isolating the gas space from the Inertaire equipment (turn shut-off valve clockwise to the limit). With the test valve set for a very small gas flow build the pressure up slowly in the relief valve. Gas will escape from the relief valve when the proper pressure is reached.

Important: This pressure must not exceed 8 ± ¼ psi (5 ± ¼ psi for RV Inertaire equipment). The relief valve for RV Inertaire is sealed and no attempt should be made to adjust the pressure setting. The nearest Westinghouse office should be notified if the valve does not operate correctly. If the relief valve for the RB Inertaire does not operate at the proper pressure an exception may be made to the "no adjustment" rule mentioned under "Description" of the "Reducing Valve and High Pressure Gauge". This exception allows for field adjustment of the relief valve by following these steps (beginning at the completion of test for the relief pressure):

1. Close test valve and return second stage adjusting handle back to its original position.

2. Reduce pressure in sump to less than 6 psi by opening and then closing oil drain valve at bottom of oil sump.

3. Remove die cast cap over third stage valve adjusting screw.

4. Remove the outer threaded adjustment nut which is the ½ psi reducing valve adjustment. Count number of turns to remove this adjustment nut so it may be replaced exactly same as before.

5. Remove flat, solid, round washer and compression spring. This exposes the relief valve adjusting screw.

6. By means of an $^{11}/_{32}$" socket wrench, unscrew the adjusting screw to lower the relief pressure. One quarter turn gives approximately 1 psi difference in pressure. Do not exert side pressure on the adjusting screw as it may cause the metal valve part to slide on the rubber valve seat preventing proper seating subsequently.

7. Reassemble compression spring, flat washer and adjustment nut and cap exactly the same as originally found.

8. Retest for relief pressure as given above.

9. If different than 8 psi repeat adjustments and tests as given above until proper relief pressure is obtained.

10. After the correct relief pressure is obtained the relief valve should be checked for leaks.

a. Return second stage adjusting handle to original position. (Approximately 6 psi).
b. Reduce pressure in sump to less than 6 psi and close sump drain valve.
c. Open test valve until pressure in sump is steady (Approx. 6 psi). Close test valve and record pressure in sump. A drop of ½ psi in ¼ hour will indicate a leak. Apply soapy water at relief vent and at sump drain valve and watch for leaks.

11. If no leaks are present, return three-way shut-off valve to operating position (counter-clockwise to limit).

The equipment is now ready for normal operation and the purging cylinder should be replaced by the operating cylinder. To do this, seal off the gas space (turn shut-off valve clockwise to the limit) close nitrogen cylinder valve and disconnect cylinder from reducing valve. Remove purging cylinder from the cabinet.

Remove valve protecting cap from the operating cylinder. Wipe off any dirt on the cylinder valve and then slightly crack open the valve to blow out any dirt which may be lodged in the valve. It is imperative that absolutely no dirt gets into reducing valve. Do not have valve opening pointed toward anyone as a small object blown from the valve with such high pressure might easily cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union nut on with fingers and then slowly open the valve a little and let the gas flow past the threads, blowing off any dirt that may be on the seat or in the threads. Tighten union nut tight. Open cylinder valve, but be careful not to open it very fast, for fear of injuring the reducing valve or gauge by sudden high pressure. Open shut-off valve counter-clockwise to limit. The unit is now ready for normal operation with the operating cylinder installed.

Important: ***When checking circuits through the instruments it is necessary to follow Table No. 1. This means that a low voltage bell ringer cannot be used unless switched through a high impedance relay. An indicating light type device is generally recognized as best for checking circuits through instruments containing micro-switches or switches of similar capacities.***

TABLE NO. 1

VOLTAGE	NON-INDUCTIVE LOAD-AMPS.	INDUCTIVE LOAD AMPS. L/R=.026*
125 A-C	10	10
250 A-C	5	5
125 D-C	0.5	0.05
250 D-C	0.25	0.025

*Equal to or less than .026. If greater, refer to factory for adjusted rating.

MAINTENANCE

Westinghouse Inertaire transformers are designed to require very little maintenance and attention on the part of the customer. Since the tank is nearly always under a positive pressure of at least ½ pound per square inch, there is small likelihood of the oxygen or moisture content becoming high.

The amount of nitrogen used by the transformer and the frequency of cylinder replacement will depend on the tightness of the tank as well as the load cycle. In order to be sure that the equipment is operating correctly and that there are no leaks in the system, it is recommended that the following readings be taken during the first month of operation:

1. Weekly oxygen content-analysis to determine when the additional purging is necessary. This should be done before the oxygen content reaches 7 percent, which is the permissible upper limit which will prevent explosions in the gas space.

If a flue gas analyzer is not obtainable, the use of Fyrite Oxygen Indicator, S# 1408 196 is recommended. This may be purchased from the Westinghouse Electric Corporation, Sharon Plant. Complete instructions for determining the oxygen content is supplied with each analyzer.

Additional purging may be accomplished in the same manner as previously described.

2. For the first week, take daily readings of nitrogen cylinder pressure, transformer tank pressure as indicated by the tank pressure gauge, transformer oil temperature and ambient temperature. Weekly readings of the above will suffice for the remainder of the month.

After the first month of observation has shown that the equipment is functioning properly, no further readings are necessary except that check-analysis of the oxygen content should be made in about three months. During normal operation, the oxygen content should remain below 1 percent.

Nitrogen Cylinders. Since the nitrogen used in Inertaire equipment will last a relatively long time, it is not feasible to rent cylinders from a nitrogen supplier. The cylinders which are used with the equipment are shipped to the customer with the transformer and becomes the property of the customer. These cylinders are painted gray so that they may be easily identified.

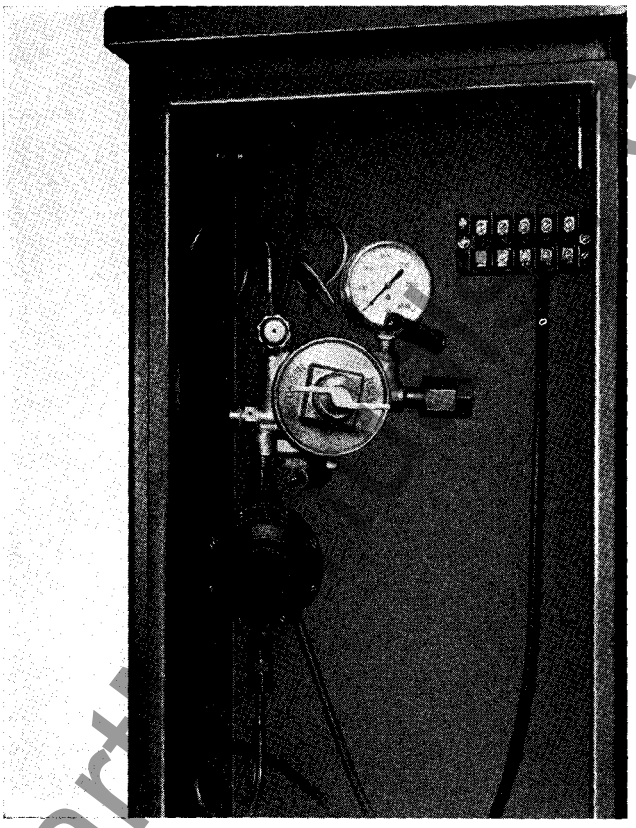


FIG. 6. Reducing Valve Detached from Cylinder and Plugged.

Westinghouse cylinders for regular use with Inertaire equipment may be identified as follows:

a. Each Westinghouse cylinder is painted gray and is marked with black letters about 1½ inches high, "Westinghouse Inertaire Nitrogen."

b. Each cylinder is provided with a tag, Form # 17212.

c. Each cylinder is originally shipped from the Sharon Plant with the transformer.

When the pressure in the operating cylinder drops to between 150 and 200 pounds per square inch, it should be replaced with a full cylinder of nitrogen. The nitrogen used on Inertaire transformers must be dry. Commercial nitrogen is not always free from moisture; therefore, only oil pumped nitrogen or nitrogen supplied under a guarantee that the moisture content is less than 0.03% by weight, and impurity content is less than 0.3% by volume, should be used. Nitrogen can be ordered from suppliers as Westinghouse nitrogen, P. D. S. 6306. ***Do not use any other grade of nitrogen or any other gas.***

The reducing valve is left supported on the two pins while the cylinder is being refilled.

During the time the reducing valve is not connected to the nitrogen cylinder, the union on the reducing valve should be closed by a plug supplied for this purpose. The reducing valve plug is located on the bracket on the door. If the plug is not used, lowered pressure in the tank may cause the reducing valve to open, permitting more or less free breathing through the reducing valve. These cylinders can be properly refilled only by the listed suppliers.

Since it is usual for nitrogen suppliers to exchange cylinders, it is suggested that the customer's requisition for normal operating gas reads as follows: "Refill cylinder, Serial No. 000000 with Westinghouse Inertaire Nitrogen, PDS #6306 and return same cylinder to purchaser." The serial number will be found stenciled on the side of the gray and black operating cylinder.

Drain the oil sump once a year to prevent any appreciable oil coming in contact with the regulator.

Check the relief pressure of the relief valve to determine if any change has occurred since last inspection. Refer to paragraphs under Installation for instruction.

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to address given, unless otherwise specified.

LIST OF RECOMMENDED NITROGEN SUPPLIERS

ALABAMA

Air Reduction Co.
2825 No. 29th Ave.
N. Birmingham 7, Ala.
Send cylinders to Fairfield, Ala.

ARKANSAS

National Cylinder Gas Co.
700 Wheeler Ave.
Ft Smith, Ark.

CALIFORNIA

Air Reduction Pacific Co.
Park Ave. & Halleck St.
Emeryville 8, California

Air Reduction Pacific Co.
2423 E. 58th St.
Los Angeles, California

National Cylinder Gas Co.
11705 S. Alameda St.
Los Angeles 2, California

National Cylinder Gas Co.
P.O. Box 427
Wilmington, California

CONNECTICUT

National Cylinder Co.
Main Street
South Meriden, Conn.

FLORIDA

National Cylinder Gas Co.
P.O. Box 2849
Jacksonville 3, Florida

GEORGIA

National Cylinder Gas Co.
471 Peters Street, S.W.
Atlanta, Georgia

ILLINOIS

Air Reduction Company
3100 So. Homan Avenue
Chicago 23, Ill.

National Cylinder Gas Co.
1501 W. 44th Street
Chicago, Illinois

National Cylinder Gas Co.
10305 Torrence Ave.
South Chicago, Illinois

National Cylinder Gas Co.
P.O. Box 350
LaGrange, Illinois

National Cylinder Gas Co.
P.O. Box 627
Peoria 1, Illinois

INDIANA

National Cylinder Gas Co.
P.O. Box 784
Evansville 1, Indiana

National Cylinder Gas Co.
3209 Madison Ave.
Indianapolis, Indiana

National Cylinder Gas Co.
601 Erie Avenue
Logansport, Indiana

IOWA

Air Reduction Co.
2561 State St.
Bettendorf, Ia.

KANSAS

National Cylinder Gas Co.
1614-26 State Ave.
Kansas City 2, Kansas

KENTUCKY

Air Reduction Co.
550 So. 5th St.
Louisville 1, Ky.

Send cylinders to 1256 Logan St.
Louisville, Ky.

LOUISIANA

Air Reduction Co.
1406 So. Rendon St.
New Orleans 2, La.

National Cylinder Gas Co.
569 Felicity St.
New Orleans 9, La.

National Cylinder Gas Co.
P.O. Box 284
Shreveport, Louisiana

MARYLAND

Air Reduction Co.
1310 N. Calvert St.
Baltimore 2, Md.

Send cylinders to 4501 E. Fayette St
Baltimore, Md.

National Cylinder Gas Co.
1700 S. Newkirk Street
Baltimore 24, Maryland

MASSACHUSETTS

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston, Mass.

National Cylinder Gas Co.
205 Medford Street
Malden 48, Mass.

MICHIGAN

Air Reduction Co.
2994 E. Grand Blvd.
Detroit 2, Mich.

Send cylinders to
7991 Hartwick St.
Detroit, Mich.

National Cylinder Gas Co.
P.O. Box 30
Ferndale 20, Michigan

National Cylinder Gas Co.
P.O. Box 35, Roosevelt Sq.
Grand Rapids 9, Mich.

MINNESOTA

Air Reduction Co.
1111 Nicollet Ave.
Minneapolis 2, Minn.
Send cylinders to
327 25th St. S.E.
Minneapolis, Minn.

National Cylinder Gas Co.
965 North Lexington Parkway
St. Paul 3, Minnesota

MISSOURI

Air Reduction Co.
2701 Warwick Traficway
Kansas City 8, Mo.
Send cylinders to
100 W. 26th St.
Kansas City, Mo.

Air Reduction Co.
630 So. 2nd Street
St Louis, Mo.

National Cylinder Gas Co.
1520 S. Vandeventer Ave.
St Louis 10, Missouri

NORTH CAROLINA

National Cylinder Gas Co.
2414 S. Boulevard
Charlotte 3, N.C.

NEW JERSEY

Air Reduction Co.
181 Pacific Avenue
Jersey City 4, N.J.

National Cylinder Gas Co.
2136—85th Street
North Bergen, N.J.

NEW YORK

Air Reduction Co.
730 Grant Street
Buffalo 13, N.Y.

National Cylinder Gas Co.
South & Front Streets
Hornell, N.Y.

National Cylinder Gas Co.
Buffalo Ave. & 53rd St.
Niagara Falls, N.Y.

OHIO

National Cylinder Gas Co.
4620 Este Avenue
Cincinnati 32, Ohio

Air Reduction Co.
1210 W. 69th St.
Cleveland, Ohio

National Cylinder Gas Co.
765 Woodrow Ave.
Columbus 7, Ohio

Air Reduction Co.
P.O. Box 923
Dayton 1, Ohio
Send cylinders to Sellers Rd. at
Springboro Pike
(Moraine City)
Dayton, Ohio

National Cylinder Gas Co.
1151 East 222nd St.
Euclid 17, Ohio

National Cylinder Gas Co.
P.O. Box 86
Lowellville, Ohio

OKLAHOMA

National Cylinder Gas Co.
P.O. Box 1534
Oklahoma City 1, Oklahoma

National Cylinder Gas Co.
P.O. Box 168
Tulsa 3, Oklahoma

OREGON

Air Reduction Pacific Co.
430 N.W. 10th Ave.
Portland 9, Oregon
Send cylinders to
2949 N.W. Front Ave.
Portland, Oregon

National Cylinder Gas Co.
2720 North West Yeon Ave.
Portland 10, Oregon

PENNSYLVANIA

National Cylinder Gas Co.
P.O. Box 7
Conshohocken, Pa.

National Cylinder Gas Co.
Davis Island Yards
McKees Rocks, Pa.

Air Reduction Co.
Allegheny Ave. & 17th St.
Philadelphia 40, Pa.
Send cylinders to
Germantown & Allegheny Aves.
Philadelphia, Pa.
or
Bethlehem, Pa.

Air Reduction Co.
2010 Clark Building
Pittsburgh 22, Pa.
Send cylinders to
Midland, Pa.
or
1116 Ridge Ave.
Pittsburgh, Pa.

RHODE ISLAND

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston 25, Mass.
Send cylinders to
Central Falls, R. I.

TENNESSEE

National Cylinder Gas Co.
1329 Chesnut Street
Chattanooga 2, Tenn.

National Cylinder Gas Co.
P.O. Box 3545
Memphis, Tenn.

TEXAS

National Cylinder Gas Co.
P.O. Box 5416
Dallas, Texas

National Cylinder Gas Co.
319 N.E. 23rd Street
Ft. Worth 6, Texas

Magnolia Airco Gas Products Co.
2405 Collingsworth Ave.
Houston 6, Texas

National Cylinder Gas Co.
P.O. Box 2106
Houston 1, Texas

National Cylinder Gas Co.
P.O. Box 1557
Lubbock, Texas

VIRGINIA

Air Reduction Co.
P.O. Box 1192
Richmond 9, Va.
Send cylinders to Bickerstaff Rd.
East of Osborne Tpke.
Richmond, Va.

WASHINGTON

Air Reduction Pacific Co.
3623 East Marginal Way
Seattle, Washington

National Cylinder Gas Co.
5510 East Marginal Way
Seattle 4, Washington

WEST VIRGINIA

Air Reduction Co.
94—29th St.
Wheeling, W. Va.

WISCONSIN

National Cylinder Gas Co.
6313—31st Avenue
Kenosha, Wisconsin

Air Reduction Co.
818 W. Winnebago St.
Milwaukee 5, Wisc.
Send cylinders to
3435 No. Buffum St.
Milwaukee, Wisc.

National Cylinder Gas Co.
2615 West Greves Street
Milwaukee 3, Wisconsin

Printed in U.S.A.

DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

INERTAIRE® EQUIPMENT

Types RB and RV

INERTAIRE is the name originally given by Westinghouse to a system for removing oxygen and moisture from the air being drawn into a transformer tank when decreasing temperature would create a partial vacuum within the tank. With the oxygen and moisture removed, the remaining inert gases are almost wholly nitrogen. Subsequent development has evolved means for feeding dry nitrogen at low pressure into the transformer tank from high pressure nitrogen cylinders, instead of depending on removing oxygen and moisture from the air drawn in during breathing.

Westinghouse Type RB and RV Inertaire equipment maintains a cushion of inert dry gas above the oil of transformers or similar oil-filled equipment.

The nitrogen is supplied from a steel cylinder which is initially filled to a pressure of 2,000 pounds per square inch. A pressure reducing valve automatically feeds nitrogen into the transformer whenever the transformer pressure falls below ½ pound per square inch.

A relief valve assembly incorporated in the final stage of the reducing valve conserves the nitrogen in the gas space by permitting it to escape to the atmosphere only when the pressure in the transformer, due to the expansion of the oil with temperature, exceeds the predetermined value of 8 pounds per square inch (5 psi if RV). A sampling valve connected to the gas space provides means for taking a sample of the gas to determine its oxygen content.

DESCRIPTION

Reducing Valve and High Pressure Gauge. A three-stage reducing valve, Fig. 1, is used to reduce nitrogen cylinder pressure of 2000 psi to ½ psi minimum operating pressure. The first stage is compensated to give constant pressure and flow to the second stage regardless of drop in cylinder pressure. In passing through the first stage the pressure is reduced from 2000 psi to approximately 100 psi.

The second stage further reduces the pressure to approximately 6 to 10 psi before the gas enters the third and final stage reducer where the pressure is reduced to ½ psi. The nitrogen is fed into the transformer gas space at this final pressure when the pressure in the gas space falls below ½ psi.

A high pressure relief is provided in the event of excessive heat near the cylinder causing the cylinder pressure to increase to a dangerous value.

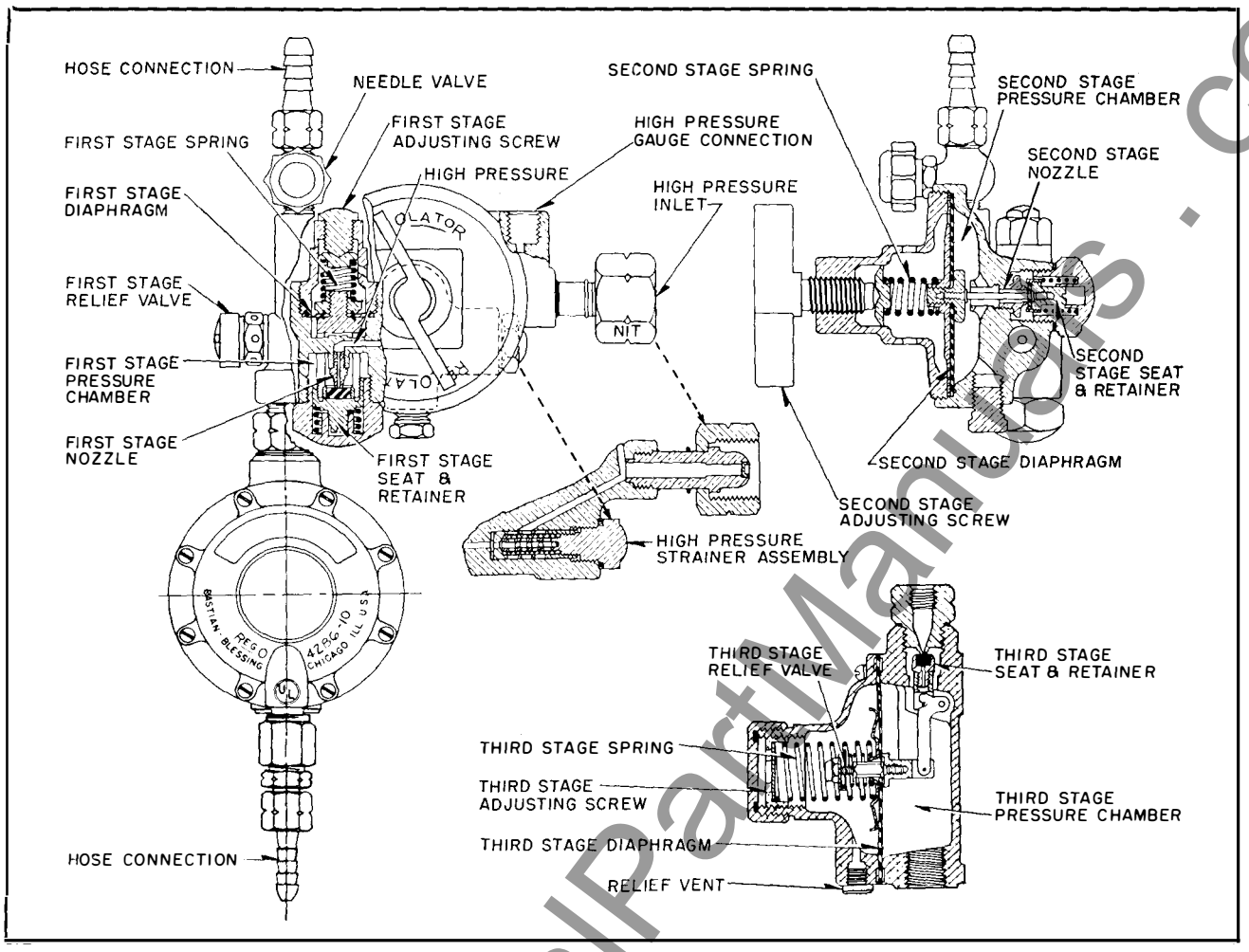


FIG. 1. Reducing and Relief Valve Assembly.

The high pressure relief consists of a diaphragm backed by rose metal. When excessive heat occurs, the rose metal backing the diaphragm melts, leaving the diaphragm unsupported. The diaphragm then ruptures, permitting the gas to escape to the atmosphere through several holes arranged to distribute the thrust in all directions.

The test needle valve with a hose connection is located at the outlet of the second stage. This connection provides a relatively low pressure source (3 to 10 psi) for checking the relief pressure of a relief valve incorporated as part of the third stage. This connection may also be used for purging the gas space if desired.

The pressure at this connection can be adjusted by turning the adjusting screw (or T-handle) clockwise to raise the pressure or counterclockwise to lower the pressure.

Note: After using this connection, the adjustment should be reset to provide approximately 6 pounds per square inch pressure, (but never less than 3 pounds per square inch), since 6 pounds per square inch pressure gives the best performance in the following stage.

The third stage of the valve is the lower portion of the device. It is adjusted at the factory to feed nitrogen into the gas space when the pressure in the transformer falls below ½ pound per square inch, and to seal off the gas space from the nitrogen supply when this pressure rises above ½ pound per square inch. This setting should not be disturbed under any circumstances. Incorporated within the third stage is a relief valve which acts to prevent the transformer pressure from exceeding 8 pounds per square inch. It is a spring loaded diaphragm valve. When the gas pressure on the transformer side exceeds 8 pounds per square inch, the valve opens slightly, permitting the gas to escape to the atmosphere through a relief vent in the body of the valve thus relieving the excess pressure. As soon as the pressure falls below 8

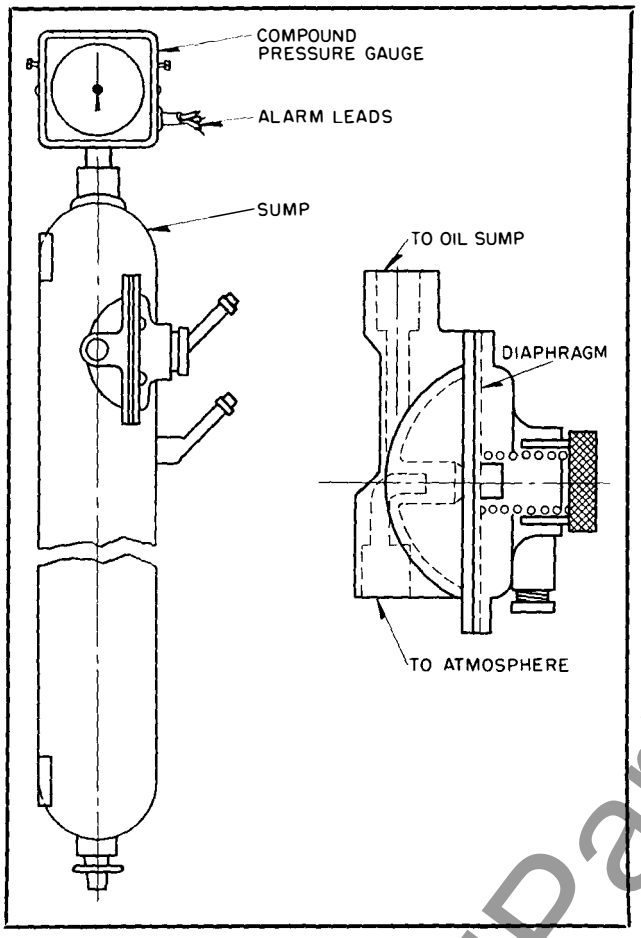


FIG. 2. Sump, Compound Pressure Gauge, and Diaphragm Type Breathing Regulator. (Regulator on Type RV Only.)

pounds per square inch the valve closes, preventing further loss of gas. In case of RV equipment excess pressure (over 5 psi) is relieved by a separate relief valve installed on the sump.

Important: The reducing valve is a precision instrument and adjustment other than the one mentioned in the previous Note should not be attempted. If the valve does not operate correctly, notify the nearest Westinghouse Office and send the valve to the Westinghouse Electric Corporation, Sharon, Pa., for repair. Repair of reducing valves and high pressure gauges should not be attempted in the field.

A 3000 pound per square inch pressure gauge is connected to the high pressure chamber of the reducing valve, and indicates the nitrogen pressure in the cylinder. The gauge is equipped with electrical contacts which close when the cylinder pressure falls to 200 pounds per square inch, plus or minus 10 percent and thus warns the operator that only 10 percent of a full cylinder of nitrogen is left. (See Fig. 4). The switch ratings are given in Table No. 1. The reducing valve will continue to function, however, until the cylinder is empty.

No vacuum relief is provided as the reducing valve feeds nitrogen into the transformer tank before a vacuum is reached. The slight amount of vacuum which might occur when the cylinder has been shipped away to be refilled will not be detrimental to the transformer or the Inertaire Equipment.

Compound Pressure Gauge. A compound pressure gauge, Fig. 2, mounted on top of the sump, is used to indicate pressure in the transformer gas space. It is of the diaphragm type, with increments of one-tenth psi and major divisions every 1 psi from −10 to +10 psi. The gauge is equipped with two alarm micro-switches, one to operate at abnormal high pressure and the other to operate at vacuum should it occur. Refer to Fig. 4. The standard compound pressure gauge is supplied with normally open contacts (Fig. 4b), but a special compound pressure gauge with normally closed contacts (Fig. 4a) may be supplied on request. The switches are set 8½ psi on the pressure side and —3 psi on the vacuum side (RB Inertaire). The switch ratings are given in Table No. 1.

These values are recommended but if other than the above is required, setscrews on the side of the gauge are provided for adjustment of the switches.

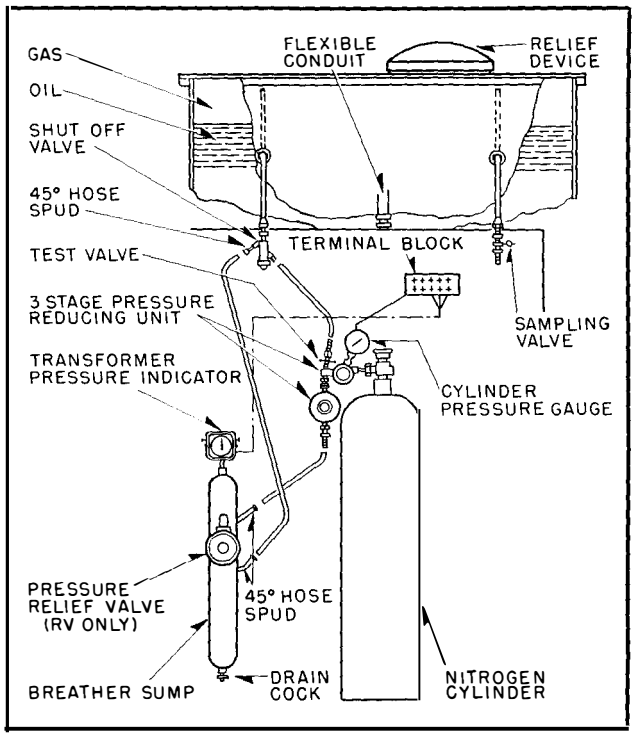


FIG. 3. Schematic Diagram of Equipment.

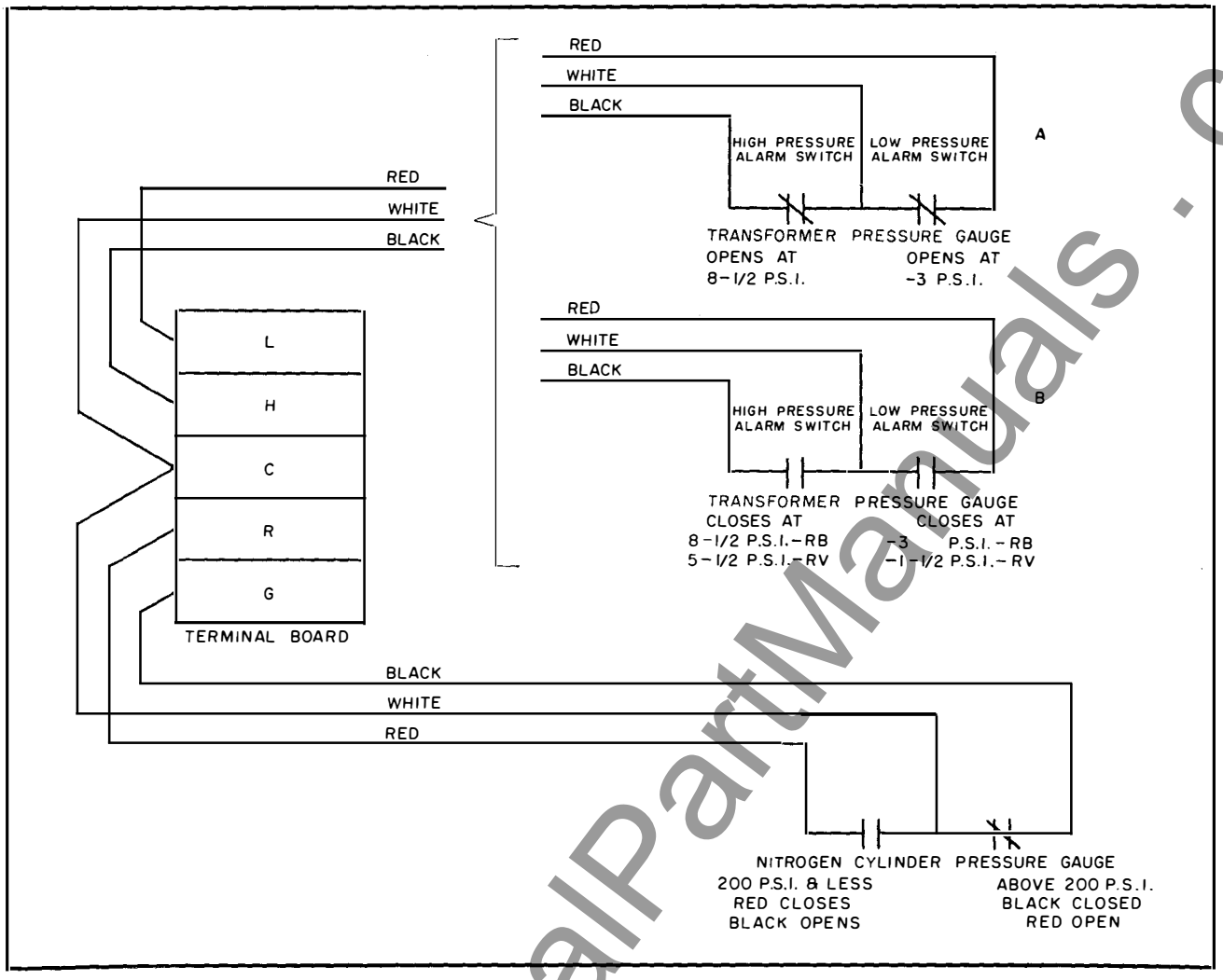


FIG. 4. Connection Diagram of Pressure Gauge Alarm Switches, Showing Alternate Arrangement.

These setscrews are hex-head screws and can be turned with a small open-end or box-end wrench.

The differential of the switches is approximately 1/4 psi. That is, if the high alarm operates, the pressure must fall only 1/4 psi before the switch is reset; if the low alarm operates, the pressure must increase 1/4 psi for the switch to reset.

It should be noted that the vacuum switch will never operate except in case the nitrogen cylinder is allowed to become empty. The pressure switch will not operate unless the relief valve should fail to perform its function, or the pressure builds up faster than it can be relieved by the relief valve due to a fault in the transformer.

Shut-off Valve. A three-way shut-off valve with two 45-degree hose spuds, located above the reducing valve, connects the gas space above the transformer oil level to the sump assembly or the test valve on the outlet of the first stage of the reducing valve. The three positions of the valve are as follows:

1. ***Shut-off*** (clockwise to limit). This shuts off the gas space and connects the relief valve through the hose to the test valve. This position is used to seal the gas space, and also for testing the operating pressure of the relief valve.

2. ***Mid-position*** (approximately 3 turns from either limit). In this position of the valve, the gas space, the relief valve, and the test valve are connected together. This position is used when it is desired to purge the oxygen from the gas space initially with dry nitrogen.

3. ***Operating*** (counter-clockwise to limit). In this position, the gas space is connected to the relief valve through the oil sump, and the connection to the test valve closed.

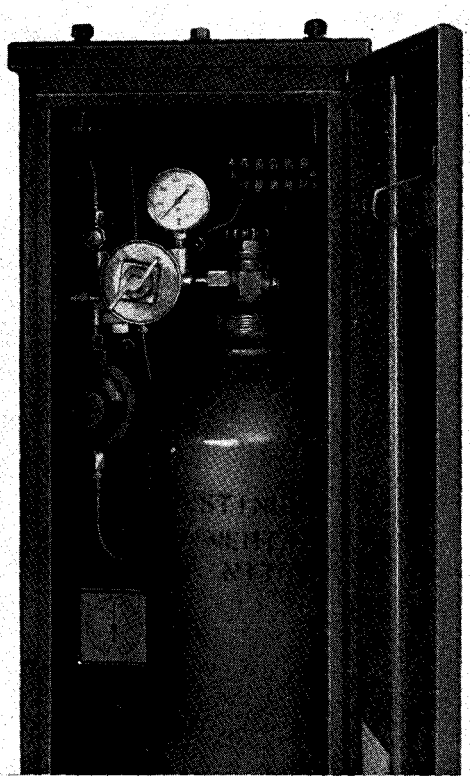


FIG. 5. Reducing Valve on Nitrogen Cylinder.

Sampling Valve. The sampling valve is a needle valve, connected to the gas space, above the oil, through a pipe attached to the tank wall. It is used for obtaining samples of the gas from the gas space for oxygen content analysis. When sampling for oxygen content, sufficient gas should be allowed to flow to clear the line before taking the sample. This valve may be used also as an exhaust valve when purging the oxygen from the gas space.

RV Inertaire. In those cases where it is desired to limit the pressure to 5 pounds per square inch, and specifically ordered, a diaphragm type of relief valve will be mounted on the oil sump. The relief valve is set at the factory and the pressure screw sealed by solder. The relief pressure is stamped on the pressure screw. Also, the two alarm micro-switches on the compound pressure gauge are adjusted so that one operates at abnormal high pressures (over 5½ psi,) and the other operates at vacuum (—1½ psi) should it occur. (See Fig. 4.) Equipment ordered for this special condition is classed as RV Inertaire. The higher rate of use of nitrogen requires that an extra tank of nitrogen be provided with each unit.

INSTALLATION

Mounting. Inertaire equipment usually is shipped separate from the transformer tank and consists of: (1) the reducing valve; (2) one operating nitrogen cylinder; (3) two short copper tubes which connect between the cabinet and the tank; (4) mounting hardware; (5) the cabinet with all other parts of the equipment mounted in it; (6) flexible alarm leads.

The copper connecting tubes should be connected at the top of the cabinet by means of union nuts on the copper tubing. Care should be taken to make a gas-tight connection. A small amount of thread cement placed on the joining compression surfaces will assist.

Install the reducing valve on the support pins and connect synthetic tubing between test valve and shut-off valve. Also connect third stage outlet to oil sump assembly with synthetic tubing.

Remove cylinder valve protecting cap from cylinder and place cylinder in cabinet. The cylinder valve protecting cap should be kept in cabinet for use when cylinder is sent away for refill. Before connecting reducing valve high pressure union to cylinder valve, be sure cylinder valve is free of any dirt. Open the cylinder valve slightly so that any dirt lodged in its passages may be blown out.

Note: Do not have valve opening pointed toward any one as a small object blown from the valve with such high pressure might cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union on with the fingers and then open the cylinder valve *very little* letting gas leak by the threads to blow off any fine dirt that might be on the union seat or in the threads. Tighten union nut with a wrench until this leakage stops and open cylinder valve full.

Note: Always open cylinder valve very slowly. The sudden shock of high pressure admitted to the reducing valve is likely to injure the high pressure gauge or the reducing valve seat.

Tank Leak Test. If the tank is to be tested for leaks by filling completely with oil and applying an additional oil head, close the shut-off valve (clock-wise) and the sampling valve. When leak test is completed, the oil should be lowered in the following manner: Open the test valve on the reducing valve; open the nitrogen cylinder valve;

start to draw down the oil; open the transformer shut-off valve to mid-position (3 turns). This procedure will blow most of the oil in the connection between the transformer tank and cabinet back into the tank and fill the gas space with pure nitrogen, thus accomplishing the initial deoxygenation of the gas space.

Open the oil sump drain valve on the oil sump assembly and draw off any oil which may have entered the sump; close the sump drain; open sampling valve to drain off the oil in this line. Nitrogen will come out of this valve when line is free of oil. Close the sampling valve. Close the test valve, check relief pressure of relief valve.

Deoxygenation. *Inertaire transformers may be installed with air in the gas space for simplicity of installation.* However, for the efficient usage of Inertaire equipment, the transformer should be purged with nitrogen. If it is the customer's practice to purge transformers to obtain initial increased protection to the transformer, he should refer to I.L. 46-710-9, "Preparing Transformers for Operation with Nitrogen Gas" for the proper procedure.

Testing for Leaks. If an oil pressure test cannot be conveniently made to check the tightness of the tank and fittings, the following method is suggested:

After the deoxygenation process is completed, close the sampling valve and carefully allow the pressure in the gas space to reach 8 pounds per square inch. (5 psi for RV Inertaire). Close the nitrogen cylinder valve.

Allow the transformer to stand several hours with this pressure. If the pressure falls off, a leak is present and it can best be found by applying soapy water to all joints and connections. In checking for leaks, the newly-made Inertaire connection should not be overlooked.

Caution: Extreme care should be observed, when purging the gas space with nitrogen from a high pressure container, not to seal the transformer off tight until the gas in the gas space has reached ambient temperature. The expansion of nitrogen from a very high pressure (1500 to 2000 pounds per square inch) to atmospheric pressure results in the nitrogen entering the gas space at a very low temperature. Unless the gas is free to expand as it warms up to ambient temperature, the pressure within the tank may increase to such a value as to operate the relief device. If no relief device is provided, the pressure may distort the tank.

If the relief valve assembly is connected to the gas space, it will relieve any pressure in excess of 8 pounds per square inch (5 psi for RV Inertaire) if the pressure is built up gradually.

Checking the Relief Pressure of Relief Valve. Having completed the test for leaks, the relief pressure of the relief valve should be checked. This is done by first isolating the gas space from the Inertaire equipment (turn shut-off valve clockwise to the limit). With the test valve set for a very small gas flow build the pressure up slowly in the relief valve. Gas will escape from the relief valve when the proper pressure is reached.

Important: This pressure must not exceed 8 $\pm$ 1/4 psi (5 $\pm$ 1/4 psi for RV Inertaire equipment). The relief valve for RV Inertaire is sealed and no attempt should be made to adjust the pressure setting. The nearest Westinghouse office should be notified if the valve does not operate correctly. If the relief valve for the RB Inertaire does not operate at the proper pressure an exception may be made to the "no adjustment" rule mentioned under "Description" of the "Reducing Valve and High Pressure Gauge". This exception allows for field adjustment of the relief valve by following these steps (beginning at the completion of test for the relief pressure):

1. Close test valve and return second stage adjusting handle back to its original position.

2. Reduce pressure in sump to less than 6 psi by opening and then closing oil drain valve at bottom of oil sump.

3. Remove die cast cap over third stage valve adjusting screw.

4. Remove the outer threaded adjustment nut which is the 1/2 psi reducing valve adjustment. Count number of turns to remove this adjustment nut so it may be replaced exactly same as before.

5. Remove flat, solid, round washer and compression spring. This exposes the relief valve adjusting screw.

6. By means of an 11/32" socket wrench, unscrew the adjusting screw to lower the relief pressure. One quarter turn gives approximately 1 psi difference in pressure. Do not exert side pressure on the adjusting screw as it may cause the metal valve part to slide on the rubber valve seat preventing proper seating subsequently.

7. Reassemble compression spring, flat washer and adjustment nut and cap exactly the same as originally found.

8. Retest for relief pressure as given above.

9. If different than 8 psi repeat adjustments and tests as given above until proper relief pressure is obtained.

10. After the correct relief pressure is obtained the relief valve should be checked for leaks.

a. Return second stage adjusting handle to original position. (Approximately 6 psi).

b. Reduce pressure in sump to less than 6 psi and close sump drain valve.

c. Open test valve until pressure in sump is steady (Approx. 6 psi). Close test valve and record pressure in sump. A drop of ½ psi in ¼ hour will indicate a leak. Apply soapy water at relief vent and at sump drain valve and watch for leaks.

11. If no leaks are present, return three-way shut-off valve to operating position (counter-clockwise to limit).

The equipment is now ready for normal operation and the purging cylinder should be replaced by the operating cylinder. To do this, seal off the gas space (turn shut-off valve clockwise to the limit) close nitrogen cylinder valve and disconnect cylinder from reducing valve. Remove purging cylinder from the cabinet.

Remove valve protecting cap from the operating cylinder. Wipe off any dirt on the cylinder valve and then slightly crack open the valve to blow out any dirt which may be lodged in the valve. It is imperative that absolutely no dirt gets into reducing valve. Do not have valve opening pointed toward anyone as a small object blown from the valve with such high pressure might easily cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union nut on with fingers and then slowly open the valve a little and let the gas flow past the threads, blowing off any dirt that may be on the seat or in the threads. Tighten union nut tight. Open cylinder valve, but be careful not to open it very fast, for fear of injuring the reducing valve or gauge by sudden high pressure. Open shut-off valve counter-clockwise to limit. The unit is now ready for normal operation with the operating cylinder installed.

Important: *When checking circuits through the instruments it is necessary to follow Table No. 1. This means that a low voltage bell ringer cannot be used unless switched through a high impedance relay. An indicating light type device is generally recognized as best for checking circuits through instruments containing micro-switches or switches of similar capacities.*

TABLE NO. 1

VOLTAGE	NON-INDUCTIVE LOAD-AMPS.	INDUCTIVE LOAD AMPS. L/R = .026*
125 A-C	10	10
250 A-C	5	5
125 D-C	0.5	0.05
250 D-C	0.25	0.025

*Equal to or less than .026. If greater, refer to factory for adjusted rating.

MAINTENANCE

Westinghouse Inertaire transformers are designed to require very little maintenance and attention on the part of the customer. Since the tank is nearly always under a positive pressure of at least ½ pound per square inch, there is small likelihood of the oxygen or moisture content becoming high.

The amount of nitrogen used by the transformer and the frequency of cylinder replacement will depend on the tightness of the tank as well as the load cycle. In order to be sure that the equipment is operating correctly and that there are no leaks in the system, it is recommended that the following readings be taken during the first month of operation:

1. Weekly oxygen content-analysis to determine when the additional purging is necessary. This should be done before the oxygen content reaches 7 percent, which is the permissible upper limit which will prevent explosions in the gas space.

If a flue gas analyzer is not obtainable, the use of Fyrite Oxygen Indicator, S# 1408 196 is recommended. This may be purchased from the Westinghouse Electric Corporation, Sharon Plant. Complete instructions for determining the oxygen content is supplied with each analyzer.

Additional purging may be accomplished in the same manner as previously described.

2. For the first week, take daily readings of nitrogen cylinder pressure, transformer tank pressure as indicated by the tank pressure gauge, transformer oil temperature and ambient temperature. Weekly readings of the above will suffice for the remainder of the month.

After the first month of observation has shown that the equipment is functioning properly, no further readings are necessary except that check-analysis of the oxygen content should be made in about three months. During normal operation, the oxygen content should remain below 1 percent.

Nitrogen Cylinders. Since the nitrogen used in Inertaire equipment will last a relatively long time, it is not feasible to rent cylinders from a nitrogen supplier. The cylinders which are used with the equipment are shipped to the customer with the transformer and becomes the property of the customer. These cylinders are painted gray so that they may be easily identified.

Westinghouse cylinders for regular use with Inertaire equipment may be identified as follows:

a. Each Westinghouse cylinder is painted gray and is marked with black letters about 1½ inches high, "Westinghouse Inertaire Nitrogen."

b. Each cylinder is provided with a tag, Form ⁄ 17212.

c. Each cylinder is originally shipped from the Sharon Plant with the transformer.

When the pressure in the operating cylinder drops to between 150 and 200 pounds per square inch, it should be replaced with a full cylinder of nitrogen. The nitrogen used on Inertaire transformers must be dry. Commercial nitrogen is not always free from moisture; therefore, only oil pumped nitrogen or nitrogen supplied under a guarantee that the moisture content is less than 0.03% by weight, and impurity content is less than 0.3% by volume, should be used. Nitrogen can be ordered from suppliers as Westinghouse nitrogen, P. D. S. 6306. ***Do not use any other grade of nitrogen or any other gas.***

The reducing valve is left supported on the two pins while the cylinder is being refilled.

During the time the reducing valve is not connected to the nitrogen cylinder, the union on the reducing valve should be closed by a plug supplied for this purpose. The reducing valve plug is located on the bracket on the door. If the plug is not used, lowered pressure in the tank may cause the reducing valve to open, permitting more or less free breathing through the reducing valve. These cylinders can be properly refilled only by the listed suppliers.

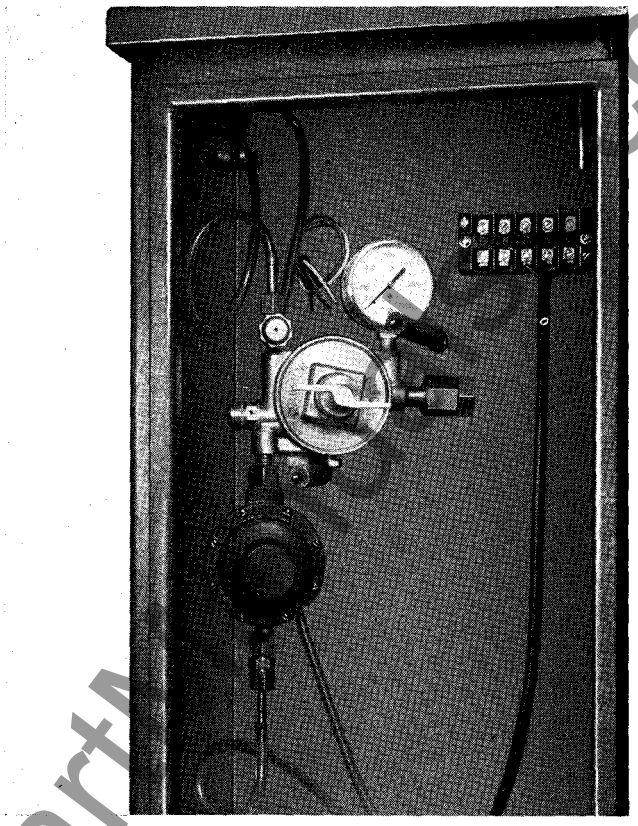


FIG. 6. Reducing Valve Detached from Cylinder and Plugged.

Since it is usual for nitrogen suppliers to exchange cylinders, it is suggested that the customer's requisition for normal operating gas read as follows: "Refill cylinder, Serial No. 000000 with Westinghouse Inertaire Nitrogen, PDS ⁄ 6306 and return same cylinder to purchaser." The serial number will be found stenciled on the side of the gray and black operating cylinder.

Drain the oil sump once a year to prevent any appreciable oil coming in contact with the regulator.

Check the relief pressure of the relief valve to determine if any change has occurred since last inspection. Refer to paragraphs under Installation for instruction.

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to address given, unless otherwise specified.

LIST OF RECOMMENDED NITROGEN SUPPLIERS

ALABAMA

Air Reduction Co.
2825 No. 29th Ave.
N. Birmingham 7, Ala.
Send cylinders to Fairfield, Ala.

ARKANSAS

National Cylinder Gas Co.
700 Wheeler Ave.
Ft Smith, Ark.

CALIFORNIA

Air Reduction Pacific Co.
Park Ave. & Halleck St.
Emeryville 8, California

Air Reduction Pacific Co.
2423 E. 58th St.
Los Angeles, California

National Cylinder Gas Co.
11705 S. Alameda St.
Los Angeles 2, California

National Cylinder Gas Co.
P.O. Box 427
Wilmington, California

CONNECTICUT

National Cylinder Co.
Main Street
South Meriden, Conn.

FLORIDA

National Cylinder Gas Co.
P.O. Box 2849
Jacksonville 3, Florida

GEORGIA

National Cylinder Gas Co.
471 Peters Street, S.W.
Atlanta, Georgia

ILLINOIS

Air Reduction Company
3100 So. Homan Avenue
Chicago 23, Ill.

National Cylinder Gas Co.
1501 W. 44th Street
Chicago, Illinois

National Cylinder Gas Co.
10305 Torrence Ave.
South Chicago, Illinois

National Cylinder Gas Co.
P.O. Box 350
LaGrange, Illinois

National Cylinder Gas Co.
P.O. Box 627
Peoria 1, Illinois

INDIANA

National Cylinder Gas Co.
P.O. Box 784
Evansville 1, Indiana

National Cylinder Gas Co.
3209 Madison Ave.
Indianapolis, Indiana

National Cylinder Gas Co.
601 Erie Avenue
Logansport, Indiana

IOWA

Air Reduction Co.
2561 State St.
Bettendorf, Ia.

KANSAS

National Cylinder Gas Co.
1614-26 State Ave.
Kansas City 2, Kansas

KENTUCKY

Air Reduction Co.
550 So. 5th St.
Louisville 1, Ky.

Send cylinders to 1256 Logan St.
Louisville, Ky.

LOUISIANA

Air Reduction Co.
1406 So. Rendon St.
New Orleans 2, La.

National Cylinder Gas Co.
569 Felicity St.
New Orleans 9, La.

National Cylinder Gas Co.
P.O. Box 284
Shreveport, Louisiana

MARYLAND

Air Reduction Co.
1310 N. Calvert St.
Baltimore 2, Md.

Send cylinders to 4501 E. Fayette St
Baltimore, Md.

National Cylinder Gas Co.
1700 S. Newkirk Street
Baltimore 24, Maryland

MASSACHUSETTS

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston, Mass.

National Cylinder Gas Co.
205 Medford Street
Malden 48, Mass.

MICHIGAN

Air Reduction Co.
2994 E. Grand Blvd.
Detroit 2, Mich.

Send cylinders to
7991 Hartwick St.
Detroit, Mich.

National Cylinder Gas Co.
P.O. Box 30
Ferndale 20, Michigan

National Cylinder Gas Co.
P.O. Box 35, Roosevelt Sq.
Grand Rapids 9, Mich.

MINNESOTA

Air Reduction Co.
1111 Nicollet Ave.
Minneapolis 2, Minn.

Send cylinders to
327 25th St. S.E.
Minneapolis, Minn.

National Cylinder Gas Co.
965 North Lexington Parkway
St. Paul 3, Minnesota

MISSOURI

Air Reduction Co.
2701 Warwick Traficway
Kansas City 8, Mo.
Send cylinders to
100 W. 26th St.
Kansas City, Mo.

Air Reduction Co.
630 So. 2nd Street
St Louis, Mo.

National Cylinder Gas Co.
1520 S. Vandeventer Ave.
St Louis 10, Missouri

NORTH CAROLINA

National Cylinder Gas Co.
2414 S. Boulevard
Charlotte 3, N.C.

NEW JERSEY

Air Reduction Co.
181 Pacific Avenue
Jersey City 4, N.J.

National Cylinder Gas Co.
2136—85th Street
North Bergen, N.J.

NEW YORK

Air Reduction Co.
730 Grant Street
Buffalo 13, N.Y.

National Cylinder Gas Co.
South & Front Streets
Hornell, N.Y.

National Cylinder Gas Co.
Buffalo Ave. & 53rd St.
Niagara Falls, N.Y.

OHIO

National Cylinder Gas Co.
4620 Este Avenue
Cincinnati 32, Ohio

Air Reduction Co.
1210 W. 69th St.
Cleveland, Ohio

National Cylinder Gas Co.
765 Woodrow Ave.
Columbus 7, Ohio

Air Reduction Co.
P.O. Box 923
Dayton 1, Ohio
Send cylinders to Sellers Rd. at
Springboro Pike
(Moraine City)
Dayton, Ohio

National Cylinder Gas Co.
1151 East 222nd St.
Euclid 17, Ohio

National Cylinder Gas Co.
P.O. Box 86
Lowellville, Ohio

OKLAHOMA

National Cylinder Gas Co.
P.O. Box 1534
Oklahoma City 1, Oklahoma

National Cylinder Gas Co.
P.O. Box 168
Tulsa 3, Oklahoma

OREGON

Air Reduction Pacific Co.
430 N.W. 10th Ave.
Portland 9, Oregon
Send cylinders to
2949 N.W. Front Ave.
Portland, Oregon

National Cylinder Gas Co.
2720 North West Yeon Ave.
Portland 10, Oregon

PENNSYLVANIA

National Cylinder Gas Co.
P.O. Box 7
Conshohocken, Pa.

National Cylinder Gas Co.
Davis Island Yards
McKees Rocks, Pa.

Air Reduction Co.
Allegheny Ave. & 17th St.
Philadelphia 40, Pa.
Send cylinders to
Germantown & Allegheny Aves.
Philadelphia, Pa.
or
Bethlehem, Pa.

Air Reduction Co.
2010 Clark Building
Pittsburgh 22, Pa.
Send cylinders to
Midland, Pa.
or
1116 Ridge Ave.
Pittsburgh, Pa.

RHODE ISLAND

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston 25, Mass.
Send cylinders to
Central Falls, R. I.

TENNESSEE

National Cylinder Gas Co.
1329 Chesnut Street
Chattanooga 2, Tenn.

National Cylinder Gas Co.
P.O. Box 3545
Memphis, Tenn.

TEXAS

National Cylinder Gas Co.
P.O. Box 5416
Dallas, Texas

National Cylinder Gas Co.
319 N.E. 23rd Street
Ft. Worth 6, Texas

Magnolia Airco Gas Products Co.
2405 Collingsworth Ave.
Houston 6, Texas

National Cylinder Gas Co.
P.O. Box 2106
Houston 1, Texas

National Cylinder Gas Co.
P.O. Box 1557
Lubbock, Texas

VIRGINIA

Air Reduction Co.
P.O. Box 1192
Richmond 9, Va.
Send cylinders to Bickerstaff Rd.
East of Osborne Tpke.
Richmond, Va.

WASHINGTON

Air Reduction Pacific Co.
3623 East Marginal Way
Seattle, Washington

National Cylinder Gas Co.
5510 East Marginal Way
Seattle 4, Washington

WEST VIRGINIA

Air Reduction Co.
94—29th St.
Wheeling, W. Va.

WISCONSIN

National Cylinder Gas Co.
6313—31st Avenue
Kenosha, Wisconsin

Air Reduction Co.
818 W. Winnebago St.
Milwaukee 5, Wisc.
Send cylinders to
3435 No. Buffum St.
Milwaukee, Wisc.

National Cylinder Gas Co.
2615 West Greves Street
Milwaukee 3, Wisconsin

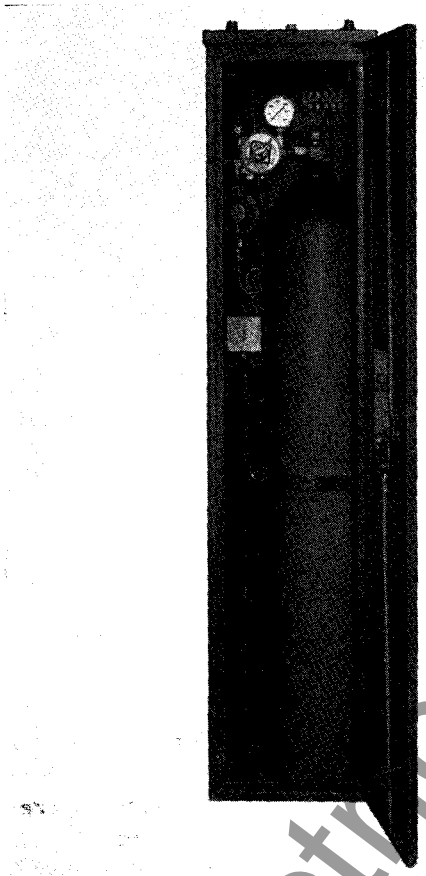
WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.
Printed in U.S.A.

DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

INERTAIRE® EQUIPMENT

Types RB and RV



INERTAIRE is the name originally given by Westinghouse to a system for removing oxygen and moisture from the air being drawn into a transformer tank when decreasing temperature would create a partial vacuum within the tank. With the oxygen and moisture removed, the remaining inert gases are almost wholly nitrogen. Subsequent development has evolved means for feeding dry nitrogen at low pressure into the transformer tank from high pressure nitrogen cylinders, instead of depending on removing oxygen and moisture from the air drawn in during breathing.

Westinghouse Types RB and RV Inertaire equipment maintain a cushion of inert dry gas above the oil of transformers or similar oil-filled equipment.

The nitrogen is supplied from a steel cylinder which is initially filled to a pressure of 2000 pounds per square inch. A pressure reducing valve automatically feeds nitrogen into the transformer whenever the transformer pressure falls below ½ pound per square inch.

A relief valve assembly incorporated in the final stage of the reducing valve conserves the nitrogen in the gas space by permitting it to escape to the atmosphere only when the pressure in the transformer, due to the expansion of the oil with temperature, exceeds the predetermined value of 8 pounds per square inch (5 psi if RV). A sampling valve connected to the gas space provides means for taking a sample of the gas to determine its oxygen content.

DESCRIPTION

Reducing Valve and High Pressure Gauge. A three-stage reducing valve, Fig. 1, is used to reduce nitrogen cylinder pressure of 2000 psi to ½ psi minimum operating pressure. The first stage is compensated to give constant pressure and flow to the second stage regardless of drop in cylinder pressure. In passing through the first stage the pressure is reduced from 2000 psi to approximately 100 psi.

The second stage further reduces the pressure to approximately 6 to 10 psi before the gas enters the third and final stage reducer where the pressure is reduced to ½ psi. The nitrogen is fed into the transformer gas space at this final pressure when the pressure in the gas space falls below ½ psi.

A high pressure relief is provided in the event of excessive heat near the cylinder causing the cylinder pressure to increase to a dangerous value.

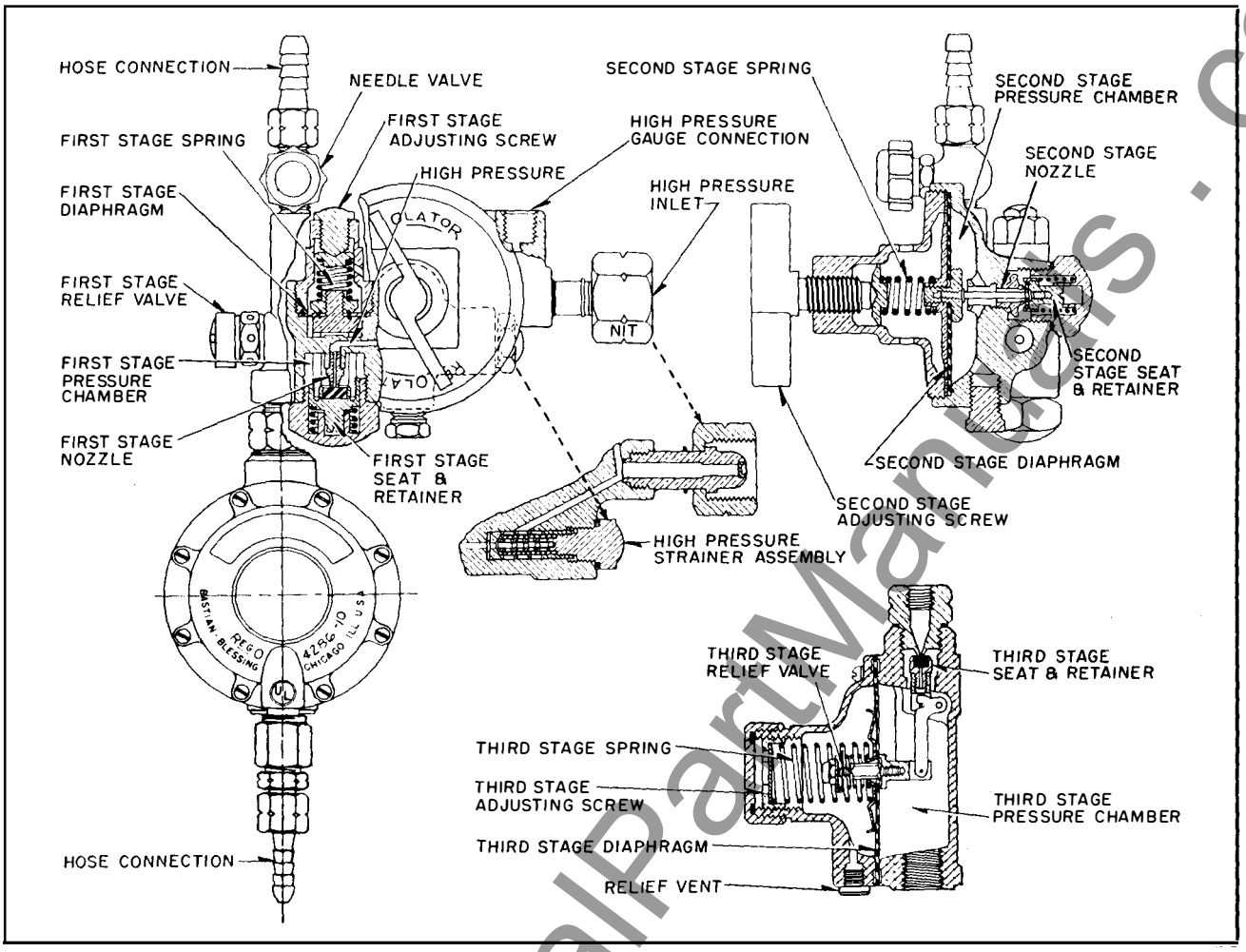


FIG. 1. Reducing and Relief Valve Assembly.

The high pressure relief consists of a diaphragm backed by rose metal. When excessive heat occurs, the rose metal backing the diaphragm melts, leaving the diaphragm unsupported. The diaphragm then ruptures, permitting the gas to escape to the atmosphere through several holes arranged to distribute the thrust in all directions.

The test needle valve with a hose connection is located at the outlet of the second stage. This connection provides a relatively low pressure source (3 to 10 psi) for checking the relief pressure of a relief valve incorporated as part of the third stage. This connection may also be used for purging the gas space if desired.

The pressure at this connection can be adjusted by turning the adjusting screw (or T-handle) clockwise to raise the pressure or counterclockwise to lower the pressure.

Note: After using this connection, the adjustment should be reset to provide approximately 6 pounds per square inch pressure, (but never less than 3 pounds per square inch), since 6 pounds per square inch pressure gives the best performance in the following stage.

The third stage of the valve is the lower portion of the device. It is adjusted at the factory to feed nitrogen into the gas space when the pressure in the transformer falls below ½ pound per square inch, and to seal off the gas space from the nitrogen supply when this pressure rises above ½ pound per square inch. This setting should not be disturbed under any circumstances. Incorporated within the third stage is a relief valve which acts to prevent the transformer pressure from exceeding 8 pounds per square inch. It is a spring loaded diaphragm valve. When the gas pressure on the transformer side exceeds 8 pounds per square inch, the valve opens slightly, permitting the gas to escape to the atmosphere through a relief vent in the body of the valve thus relieving the excess pressure. As soon as the pressure falls below 8

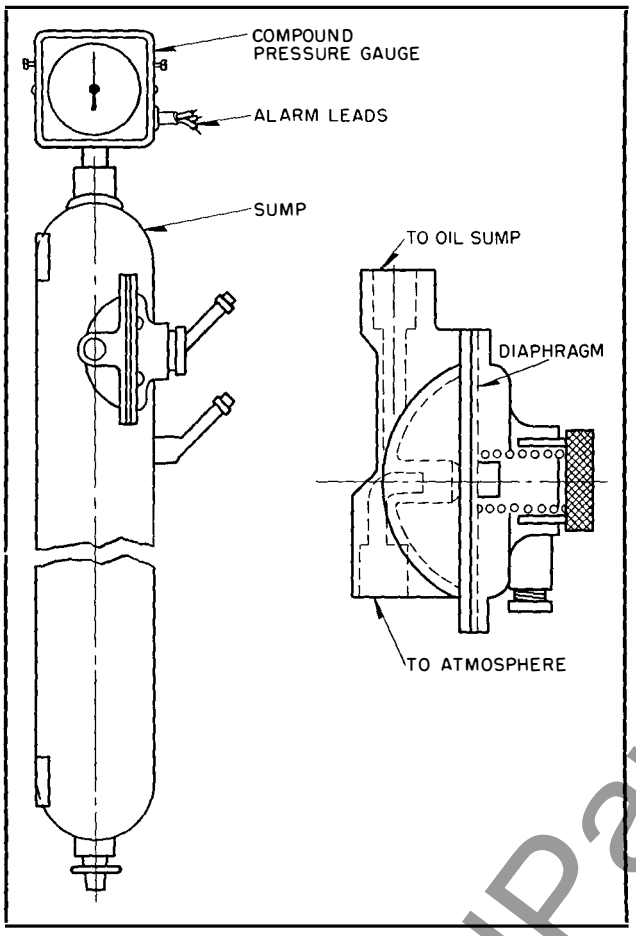


FIG. 2. Sump, Compound Pressure Gauge, and Diaphragm Type Breathing Regulator. (Regulator on Type RV Only.)

pounds per square inch the valve closes, preventing further loss of gas. In case of RV equipment excess pressure (over 5 psi) is relieved by a separate relief valve installed on the sump.

Important: The reducing valve is a precision instrument and adjustment other than the one mentioned in the previous Note should not be attempted. If the valve does not operate correctly, notify the nearest Westinghouse Office and send the valve to the Westinghouse Electric Corporation, Sharon, Pa., for repair. Repair of reducing valves and high pressure gauges should not be attempted in the field.

A 3000 pound per square inch pressure gauge is connected to the high pressure chamber of the reducing valve, and indicates the nitrogen pressure in the cylinder. The gauge is equipped with electrical contacts which close when the cylinder pressure falls to 200 pounds per square inch, plus or minus 10 percent and thus warns the operator that only 10 percent of a full cylinder of nitrogen is left. (See Fig. 4). The switch ratings are given in Table No. 1. The reducing valve will continue to function, however, until the cylinder is empty.

No vacuum relief is provided as the reducing valve feeds nitrogen into the transformer tank before a vacuum is reached. The slight amount of vacuum which might occur when the cylinder has been shipped away to be refilled will not be detrimental to the transformer or the Inertaire Equipment.

Compound Pressure Gauge. A compound pressure gauge, Fig. 2, mounted on top of the sump, is used to indicate pressure in the transformer gas space. It is of the diaphragm type, with increments of one-tenth psi and major divisions every 1 psi from −10 to +10 psi. The gauge is equipped with two alarm micro-switches, one to operate at abnormal high pressure and the other to operate at vacuum should it occur. Refer to Fig. 4. The standard compound pressure gauge is supplied with normally open contacts (Fig. 4b), but a special compound pressure gauge with normally closed contacts (Fig. 4a) may be supplied on request. The switches are set 8½ psi on the pressure side and —3 psi on the vacuum side (RB Inertaire). The switch ratings are given in Table No. 1.

These values are recommended but if other than the above is required, setscrews on the side of the gauge are provided for adjustment of the switches.

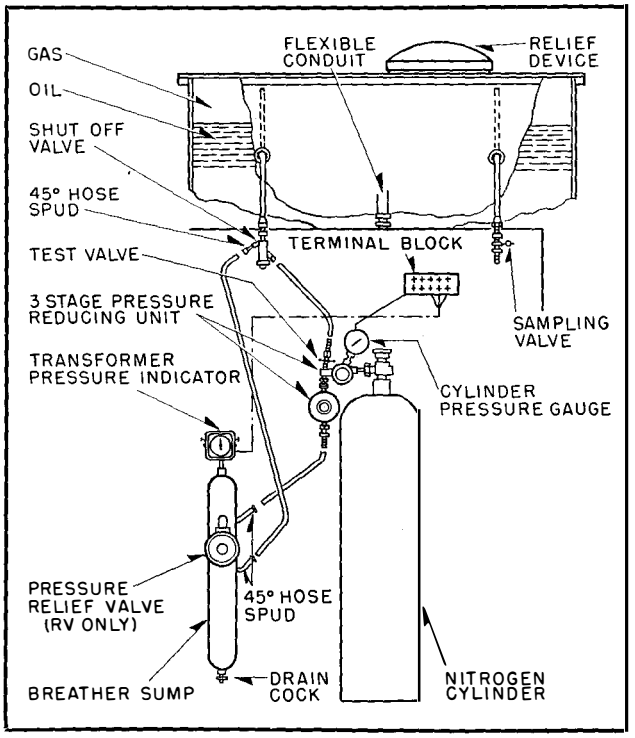


FIG. 3. Schematic Diagram of Equipment.

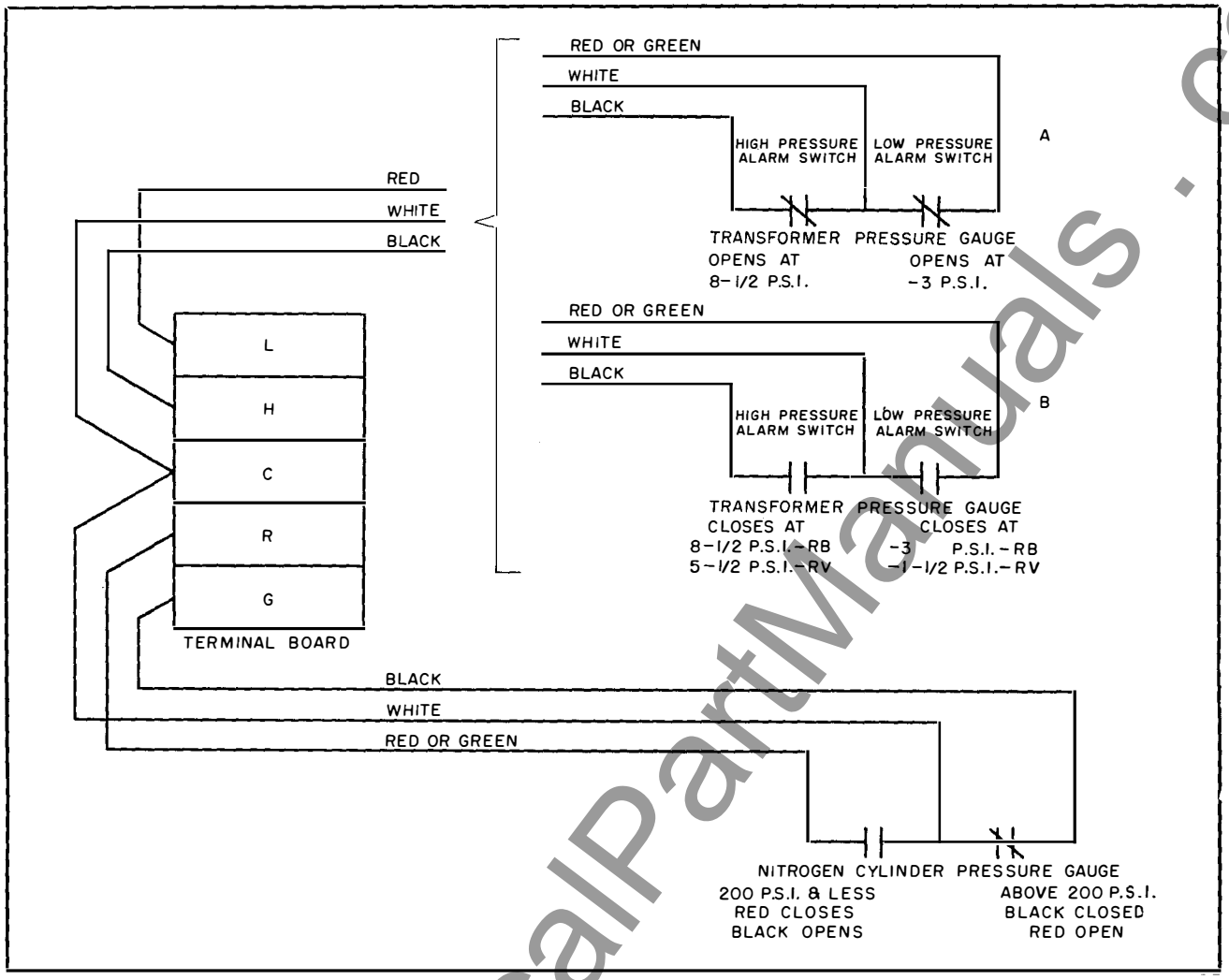


FIG. 4. Connection Diagram of Pressure Gauge Alarm Switches, Showing Alternate Arrangement.

These setscrews are hex-head screws and can be turned with a small open-end or box-end wrench.

The differential of the switches is approximately 1/4 psi. That is, if the high alarm operates, the pressure must fall only 1/4 psi before the switch is reset; if the low alarm operates, the pressure must increase 1/4 psi for the switch to reset.

It should be noted that the vacuum switch will never operate except in case the nitrogen cylinder is allowed to become empty. The pressure switch will not operate unless the relief valve should fail to perform its function, or the pressure builds up faster than it can be relieved by the relief valve due to a fault in the transformer.

Shut-off Valve. A three-way shut-off valve with two 45-degree hose spuds, located above the reducing valve, connects the gas space above the transformer oil level to the sump assembly or the test valve on the outlet of the first stage of the reducing valve. The three positions of the valve are as follows:

1. ***Shut-off*** (clockwise to limit). This shuts off the gas space and connects the relief valve through the hose to the test valve. This position is used to seal the gas space, and also for testing the operating pressure of the relief valve.

2. ***Mid-position*** (approximately 3 turns from either limit). In this position of the valve, the gas space, the relief valve, and the test valve are connected together. This position is used when it is desired to purge the oxygen from the gas space initially with dry nitrogen.

3. ***Operating*** (counter-clockwise to limit). In this position, the gas space is connected to the relief valve through the oil sump, and the connection to the test valve closed.

FIG. 5. Reducing Valve on Nitrogen Cylinder.

Sampling Valve. The sampling valve is a needle valve, connected to the gas space, above the oil, through a pipe attached to the tank wall. It is used for obtaining samples of the gas from the gas space for oxygen content analysis. When sampling for oxygen content, sufficient gas should be allowed to flow to clear the line before taking the sample. This valve may be used also as an exhaust valve when purging the oxygen from the gas space.

RV Inertaire. In those cases where it is desired to limit the pressure to 5 pounds per square inch, and specifically ordered, a diaphragm type of relief valve will be mounted on the oil sump. The relief valve is set at the factory and the pressure screw sealed by solder. The relief pressure is stamped on the pressure screw. Also, the two alarm micro-switches on the compound pressure gauge are adjusted so that one operates at abnormal high pressures (over 5½ psi,) and the other operates at vacuum (—1½ psi) should it occur. (See Fig. 4.) Equipment ordered for this special condition is classed as RV Inertaire. The higher rate of use of nitrogen requires that an extra tank of nitrogen be provided with each unit.

INSTALLATION

Mounting. Inertaire equipment usually is shipped separate from the transformer tank and consists of: (1) the reducing valve; (2) one operating nitrogen cylinder; (3) two short copper tubes which connect between the cabinet and the tank; (4) mounting hardware; (5) the cabinet with all other parts of the equipment mounted in it; (6) flexible alarm leads.

The copper connecting tubes should be connected at the top of the cabinet by means of union nuts on the copper tubing. Care should be taken to make a gas-tight connection. A small amount of thread cement placed on the joining compression surfaces will assist.

Install the reducing valve on the support pins and connect synthetic tubing between test valve and shut-off valve. Also connect third stage outlet to oil sump assembly with synthetic tubing.

Remove cylinder valve protecting cap from cylinder and place cylinder in cabinet. The cylinder valve protecting cap should be kept in cabinet for use when cylinder is sent away for refill. Before connecting reducing valve high pressure union to cylinder valve, be sure cylinder valve is free of any dirt. Open the cylinder valve slightly so that any dirt lodged in its passages may be blown out.

Note: Do not have valve opening pointed toward any one as a small object blown from the valve with such high pressure might cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union on with the fingers and then open the cylinder valve *very little* letting gas leak by the threads to blow off any fine dirt that might be on the union seat or in the threads. Tighten union nut with a wrench until this leakage stops and open cylinder valve full.

Note: When opening the cylinder valve:

1. Always open the valve very slowly. The sudden shock of high pressure admitted to the reducing valve is likely to injure the high pressure gauge or the reducing valve seat.

2. Always back-seat the valve with as much force as would be used in closing the valve.

Tank Leak Test. If the tank is to be tested for leaks by filling completely with oil and applying an additional oil head, close the shut-off valve (clock-wise) and the sampling valve. When leak test is completed, the oil should be lowered in the following manner: Open the test valve on the reducing valve; open the nitrogen cylinder valve;

start to draw down the oil; open the transformer shut-off valve to mid-position (3 turns). This procedure will blow most of the oil in the connection between the transformer tank and cabinet back into the tank and fill the gas space with pure nitrogen, thus accomplishing the initial deoxygenation of the gas space.

Open the oil sump drain valve on the oil sump assembly and draw off any oil which may have entered the sump; close the sump drain; open sampling valve to drain off the oil in this line. Nitrogen will come out of this valve when line is free of oil. Close the sampling valve. Close the test valve, check relief pressure of relief valve.

Deoxygenation. *Inertaire transformers may be installed with air in the gas space for simplicity of installation.* However, for the efficient usage of Inertaire equipment, the transformer should be purged with nitrogen. If it is the customer's practice to purge transformers to obtain initial increased protection to the transformer, he should refer to I.L. 46-710-9, "Preparing Transformers for Operation with Nitrogen Gas" for the proper procedure.

Testing for Leaks. If an oil pressure test cannot be conveniently made to check the tightness of the tank and fittings, the following method is suggested:

After the deoxygenation process is completed, close the sampling valve and carefully allow the pressure in the gas space to reach 8 pounds per square inch. (5 psi for RV Inertaire). Close the nitrogen cylinder valve.

Allow the transformer to stand several hours with this pressure. If the pressure falls off, a leak is present and it can best be found by applying soapy water to all joints and connections. In checking for leaks, the newly-made Inertaire connection should not be overlooked.

Caution: Extreme care should be observed, when purging the gas space with nitrogen from a high pressure container, not to seal the transformer off tight until the gas in the gas space has reached ambient temperature. The expansion of nitrogen from a very high pressure (1500 to 2000 pounds per square inch) to atmospheric pressure results in the nitrogen entering the gas space at a very low temperature. Unless the gas is free to expand as it warms up to ambient temperature, the pressure within the tank may increase to such a value as to operate the relief device. If no relief device is provided, the pressure may distort the tank.

If the relief valve assembly is connected to the gas space, it will relieve any pressure in excess of 8 pounds per square inch (5 psi for RV Inertaire) if the pressure is built up gradually.

Checking the Relief Pressure of Relief Valve. Having completed the test for leaks, the relief pressure of the relief valve should be checked. This is done by first isolating the gas space from the Inertaire equipment (turn shut-off valve clockwise to the limit). With the test valve set for a very small gas flow build the pressure up slowly in the relief valve. Gas will escape from the relief valve when the proper pressure is reached.

Important: This pressure must not exceed 8 $\pm$ 1/4 psi (5 $\pm$ 1/4 psi for RV Inertaire equipment). The relief valve for RV Inertaire is sealed and no attempt should be made to adjust the pressure setting. The nearest Westinghouse office should be notified if the valve does not operate correctly. If the relief valve for the RB Inertaire does not operate at the proper pressure an exception may be made to the "no adjustment" rule mentioned under "Description" of the "Reducing Valve and High Pressure Gauge". This exception allows for field adjustment of the relief valve by following these steps (beginning at the completion of test for the relief pressure):

1. Close test valve and return second stage adjusting handle back to its original position.

2. Reduce pressure in sump to less than 6 psi by opening and then closing oil drain valve at bottom of oil sump.

3. Remove die cast cap over third stage valve adjusting screw.

4. Remove the outer threaded adjustment nut which is the 1/2 psi reducing valve adjustment. Count number of turns to remove this adjustment nut so it may be replaced exactly same as before.

5. Remove flat, solid, round washer and compression spring. This exposes the relief valve adjusting screw.

6. By means of an $^{11}/_{32}$" socket wrench, unscrew the adjusting screw to lower the relief pressure. One quarter turn gives approximately 1 psi difference in pressure. Do not exert side pressure on the adjusting screw as it may cause the metal valve part to slide on the rubber valve seat preventing proper seating subsequently.

7. Reassemble compression spring, flat washer and adjustment nut and cap exactly the same as originally found.

8. Retest for relief pressure as given above.

9. If different than 8 psi repeat adjustments and tests as given above until proper relief pressure is obtained.

10. After the correct relief pressure is obtained the relief valve should be checked for leaks.

a. Return second stage adjusting handle to original position. (Approximately 6 psi).

b. Reduce pressure in sump to less than 6 psi and close sump drain valve.

c. Open test valve until pressure in sump is steady (Approx. 6 psi). Close test valve and record pressure in sump. A drop of ½ psi in ¼ hour will indicate a leak. Apply soapy water at relief vent and at sump drain valve and watch for leaks.

11. If no leaks are present, return three-way shut-off valve to operating position (counter-clockwise to limit).

The equipment is now ready for normal operation and the purging cylinder should be replaced by the operating cylinder. To do this, seal off the gas space (turn shut-off valve clockwise to the limit) close nitrogen cylinder valve and disconnect cylinder from reducing valve. Remove purging cylinder from the cabinet.

Remove valve protecting cap from the operating cylinder. Wipe off any dirt on the cylinder valve and then slightly crack open the valve to blow out any dirt which may be lodged in the valve. It is imperative that absolutely no dirt gets into reducing valve. Do not have valve opening pointed toward anyone as a small object blown from the valve with such high pressure might easily cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union nut on with fingers and then slowly open the valve a little and let the gas flow past the threads, blowing off any dirt that may be on the seat or in the threads. Tighten union nut tight. Open cylinder valve, but be careful not to open it very fast, for fear of injuring the reducing valve or gauge by sudden high pressure. Open shut-off valve counter-clockwise to limit. The unit is now ready for normal operation with the operating cylinder installed.

Important: *When checking circuits through the instruments it is necessary to follow Table No. 1. This means that a low voltage bell ringer cannot be used unless switched through a high impedance relay. An indicating light type device is generally recognized as best for checking circuits through instruments containing micro-switches or switches of similar capacities.*

TABLE NO. 1

VOLTAGE	NON-INDUCTIVE LOAD-AMPS.	INDUCTIVE LOAD AMPS. L/R=.026*
125 A-C	10	10
250 A-C	5	5
125 D-C	0.5	0.05
250 D-C	0.25	0.025

*Equal to or less than .026. If greater, refer to factory for adjusted rating.

MAINTENANCE

Westinghouse Inertaire transformers are designed to require very little maintenance and attention on the part of the customer. Since the tank is nearly always under a positive pressure of at least ½ pound per square inch, there is small likelihood of the oxygen or moisture content becoming high.

The amount of nitrogen used by the transformer and the frequency of cylinder replacement will depend on the tightness of the tank as well as the load cycle. In order to be sure that the equipment is operating correctly and that there are no leaks in the system, it is recommended that the following readings be taken during the first month of operation:

1. Weekly oxygen content-analysis to determine when the additional purging is necessary. This should be done before the oxygen content reaches 7 percent, which is the permissible upper limit which will prevent explosions in the gas space.

If a flue gas analyzer is not obtainable, the use of Fyrite Oxygen Indicator, S# 1408 196 is recommended. This may be purchased from the Westinghouse Electric Corporation, Sharon Plant. Complete instructions for determining the oxygen content is supplied with each analyzer.

Additional purging may be accomplished in the same manner as previously described.

2. For the first week, take daily readings of nitrogen cylinder pressure, transformer tank pressure as indicated by the tank pressure gauge, transformer oil temperature and ambient temperature. Weekly readings of the above will suffice for the remainder of the month.

After the first month of observation has shown that the equipment is functioning properly, no further readings are necessary except that check-analysis of the oxygen content should be made in about three months. During normal operation, the oxygen content should remain below 1 percent.

Nitrogen Cylinders. Since the nitrogen used in Inertaire equipment will last a relatively long time, it is not feasible to rent cylinders from a nitrogen supplier. The cylinders which are used with the equipment are shipped to the customer with the transformer and becomes the property of the customer. These cylinders are painted gray so that they may be easily identified.

Westinghouse cylinders for regular use with Inertaire equipment may be identified as follows:

a. Each Westinghouse cylinder is painted gray and is marked with black letters about 1½ inches high, "Westinghouse Inertaire Nitrogen."

b. Each cylinder is provided with a tag, Form ⁎17212.

c. Each cylinder is originally shipped from the Sharon Plant with the transformer.

When the pressure in the operating cylinder drops to between 150 and 200 pounds per square inch, it should be replaced with a full cylinder of nitrogen. The nitrogen used on Inertaire transformers must be dry. Commercial nitrogen is not always free from moisture; therefore, only oil pumped nitrogen or nitrogen supplied under a guarantee that the moisture content is less than 0.03% by weight, and impurity content is less than 0.3% by volume, should be used. Nitrogen can be ordered from suppliers as Westinghouse nitrogen, P. D. S. 6306. ***Do not use any other grade of nitrogen or any other gas.***

The reducing valve is left supported on the two pins while the cylinder is being refilled.

During the time the reducing valve is not connected to the nitrogen cylinder, the union on the reducing valve should be closed by a plug supplied for this purpose. The reducing valve plug is located on the bracket on the door. If the plug is not used, lowered pressure in the tank may cause the reducing valve to open, permitting more or less free breathing through the reducing valve. These cylinders can be properly refilled only by the listed suppliers.

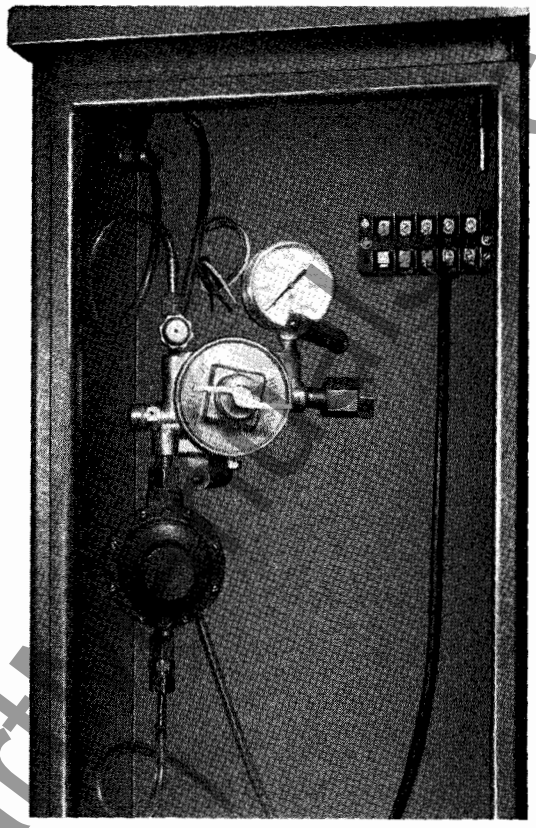


FIG. 6. Reducing Valve Detached from Cylinder and Plugged.

Since it is usual for nitrogen suppliers to exchange cylinders, it is suggested that the customer's requisition for normal operating gas read as follows: "Refill cylinder, Serial No. 000000 with Westinghouse Inertaire Nitrogen, PDS ⁎6306 and return same cylinder to purchaser." The serial number will be found stenciled on the side of the gray and black operating cylinder.

Drain the oil sump once a year to prevent any appreciable oil coming in contact with the regulator.

Check the relief pressure of the relief valve to determine if any change has occurred since last inspection. Refer to paragraphs under Installation for instruction.

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to address given, unless otherwise specified.

LIST OF RECOMMENDED NITROGEN SUPPLIERS

ALABAMA

Air Reduction Co.
2825 No. 29th Ave.
N. Birmingham 7, Ala.
Send cylinders to Fairfield, Ala.

ARKANSAS

National Cylinder Gas Co.
700 Wheeler Ave.
Ft Smith, Ark.

CALIFORNIA

Air Reduction Pacific Co.
Park Ave. & Halleck St.
Emeryville 8, California

Air Reduction Pacific Co.
2423 E. 58th St.
Los Angeles, California

National Cylinder Gas Co.
11705 S. Alameda St.
Los Angeles 2, California

National Cylinder Gas Co.
P.O. Box 427
Wilmington, California

CONNECTICUT

National Cylinder Co.
Main Street
South Meriden, Conn.

FLORIDA

National Cylinder Gas Co.
P.O. Box 2849
Jacksonville 3, Florida

GEORGIA

National Cylinder Gas Co.
471 Peters Street, S.W.
Atlanta, Georgia

ILLINOIS

Air Reduction Company
3100 So. Homan Avenue
Chicago 23, Ill.

National Cylinder Gas Co.
1501 W. 44th Street
Chicago, Illinois

National Cylinder Gas Co.
10305 Torrence Ave.
South Chicago, Illinois

National Cylinder Gas Co.
P.O. Box 350
LaGrange, Illinois

National Cylinder Gas Co.
P.O. Box 627
Peoria 1, Illinois

INDIANA

National Cylinder Gas Co.
P.O. Box 784
Evansville 1, Indiana

National Cylinder Gas Co.
3209 Madison Ave.
Indianapolis, Indiana

National Cylinder Gas Co.
601 Erie Avenue
Logansport, Indiana

IOWA

Air Reduction Co.
2561 State St.
Bettendorf, Ia.

KANSAS

National Cylinder Gas Co.
1614-26 State Ave.
Kansas City 2, Kansas

KENTUCKY

Air Reduction Co.
550 So. 5th St.
Louisville 1, Ky.

Send cylinders to 1256 Logan St.
Louisville, Ky.

LOUISIANA

Air Reduction Co.
1406 So. Rendon St.
New Orleans 2, La.

National Cylinder Gas Co.
569 Felicity St.
New Orleans 9, La.

National Cylinder Gas Co.
P.O. Box 284
Shreveport, Louisiana

MARYLAND

Air Reduction Co.
1310 N. Calvert St.
Baltimore 2, Md.

Send cylinders to 4501 E. Fayette St.
Baltimore, Md.

National Cylinder Gas Co.
1700 S. Newkirk Street
Baltimore 24, Maryland

MASSACHUSETTS

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston, Mass.

National Cylinder Gas Co.
205 Medford Street
Malden 48, Mass.

MICHIGAN

Air Reduction Co.
2994 E. Grand Blvd.
Detroit 2, Mich.

Send cylinders to
7991 Hartwick St.
Detroit, Mich.

National Cylinder Gas Co.
P.O. Box 30
Ferndale 20, Michigan

National Cylinder Gas Co.
P.O. Box 35, Roosevelt Sq.
Grand Rapids 9, Mich.

MINNESOTA

Air Reduction Co.
1111 Nicollet Ave.
Minneapolis 2, Minn.

Send cylinders to
327 25th St. S.E.
Minneapolis, Minn.

National Cylinder Gas Co.
965 North Lexington Parkway
St. Paul 3, Minnesota

MISSOURI

Air Reduction Co.
2701 Warwick Traficway
Kansas City 8, Mo.

Send cylinders to
100 W. 26th St.
Kansas City, Mo.

Air Reduction Co.
630 So. 2nd Street
St Louis, Mo.

National Cylinder Gas Co.
1520 S. Vandeventer Ave.
St Louis 10, Missouri

NORTH CAROLINA

National Cylinder Gas Co.
2414 S. Boulevard
Charlotte 3, N.C.

NEW JERSEY

Air Reduction Co.
181 Pacific Avenue
Jersey City 4, N.J.

National Cylinder Gas Co.
2136—85th Street
North Bergen, N.J.

NEW YORK

Air Reduction Co.
730 Grant Street
Buffalo 13, N.Y.

National Cylinder Gas Co.
South & Front Streets
Hornell, N.Y.

National Cylinder Gas Co.
Buffalo Ave. & 53rd St.
Niagara Falls, N.Y.

OHIO

National Cylinder Gas Co.
4620 Este Avenue
Cincinnati 32, Ohio

Air Reduction Co.
1210 W. 69th St.
Cleveland, Ohio

National Cylinder Gas Co.
765 Woodrow Ave.
Columbus 7, Ohio

Air Reduction Co.
P.O. Box 923
Dayton 1, Ohio
Send cylinders to Sellers Rd. at
Springboro Pike
(Moraine City)
Dayton, Ohio

National Cylinder Gas Co.
1151 East 222nd St.
Euclid 17, Ohio

National Cylinder Gas Co.
P.O. Box 86
Lowellville, Ohio

OKLAHOMA

National Cylinder Gas Co.
P.O. Box 1534
Oklahoma City 1, Oklahoma

National Cylinder Gas Co.
P.O. Box 168
Tulsa 3, Oklahoma

OREGON

Air Reduction Pacific Co.
430 N.W. 10th Ave.
Portland 9, Oregon
Send cylinders to
2949 N.W. Front Ave.
Portland, Oregon

National Cylinder Gas Co.
2720 North West Yeon Ave.
Portland 10, Oregon

PENNSYLVANIA

National Cylinder Gas Co.
P.O. Box 7
Conshohocken, Pa.

National Cylinder Gas Co.
Davis Island Yards
McKees Rocks, Pa.

Air Reduction Co.
Allegheny Ave. & 17th St.
Philadelphia 40, Pa.
Send cylinders to
Germantown & Allegheny Aves.
Philadelphia, Pa.
or
Bethlehem, Pa.

Air Reduction Co.
2010 Clark Building
Pittsburgh 22, Pa.
Send cylinders to
Midland, Pa.
or
1116 Ridge Ave.
Pittsburgh, Pa.

RHODE ISLAND

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston 25, Mass.
Send cylinders to
Central Falls, R. I.

TENNESSEE

National Cylinder Gas Co.
1329 Chesnut Street
Chattanooga 2, Tenn.

National Cylinder Gas Co.
P.O. Box 3545
Memphis, Tenn.

TEXAS

National Cylinder Gas Co.
P.O. Box 5416
Dallas, Texas

National Cylinder Gas Co.
319 N.E. 23rd Street
Ft. Worth 6, Texas

Magnolia Airco Gas Products Co.
2405 Collingsworth Ave.
Houston 6, Texas

National Cylinder Gas Co.
P.O. Box 2106
Houston 1, Texas

National Cylinder Gas Co.
P.O. Box 1557
Lubbock, Texas

VIRGINIA

Air Reduction Co.
P.O. Box 1192
Richmond 9, Va.
Send cylinders to Bickerstaff Rd.
East of Osborne Tpke.
Richmond, Va.

WASHINGTON

Air Reduction Pacific Co.
3623 East Marginal Way
Seattle, Washington

National Cylinder Gas Co.
5510 East Marginal Way
Seattle 4, Washington

WEST VIRGINIA

Air Reduction Co.
94—29th St.
Wheeling, W. Va.

WISCONSIN

National Cylinder Gas Co.
6313—31st Avenue
Kenosha, Wisconsin

Air Reduction Co.
818 W. Winnebago St.
Milwaukee 5, Wisc.
Send cylinders to
3435 No. Buffum St.
Milwaukee, Wisc.

National Cylinder Gas Co.
2615 West Greves Street
Milwaukee 3, Wisconsin

WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.
Printed in U.S.A.

DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

INERTAIRE® EQUIPMENT

Types RB and RV

INERTAIRE is the name originally given by Westinghouse to a system for removing oxygen and moisture from the air being drawn into a transformer tank when decreasing temperature would create a partial vacuum within the tank. With the oxygen and moisture removed, the remaining inert gases are almost wholly nitrogen. Subsequent development has evolved means for feeding dry nitrogen at low pressure into the transformer tank from high pressure nitrogen cylinders, instead of depending on removing oxygen and moisture from the air drawn in during breathing.

Westinghouse Types RB and RV Inertaire equipment maintain a cushion of inert dry gas above the oil of transformers or similar oil-filled equipment.

The nitrogen is supplied from a steel cylinder which is initially filled to a pressure of 2000 pounds per square inch. A pressure reducing valve automatically feeds nitrogen into the transformer whenever the transformer pressure falls below ½ pound per square inch.

A relief valve assembly incorporated in the final stage of the reducing valve conserves the nitrogen in the gas space by permitting it to escape to the atmosphere only when the pressure in the transformer, due to the expansion of the oil with temperature, exceeds the predetermined value of 8 pounds per square inch (5 psi if RV). A sampling valve connected to the gas space provides means for taking a sample of the gas to determine its oxygen content.

DESCRIPTION

Reducing Valve and High Pressure Gauge. A three-stage reducing valve, Fig. 1, is used to reduce nitrogen cylinder pressure of 2000 psi to ½ psi minimum operating pressure. The first stage is compensated to give constant pressure and flow to the second stage regardless of drop in cylinder pressure. In passing through the first stage the pressure is reduced from 2000 psi to approximately 100 psi.

The second stage further reduces the pressure to approximately 6 to 10 psi before the gas enters the third and final stage reducer where the pressure is reduced to ½ psi. The nitrogen is fed into the transformer gas space at this final pressure when the pressure in the gas space falls below ½ psi.

A high pressure relief is provided in the event of excessive heat near the cylinder causing the cylinder pressure to increase to a dangerous value.

® Registered Trade-mark.

SUPERSEDES I.L. 46-710-5C

JULY, 1956

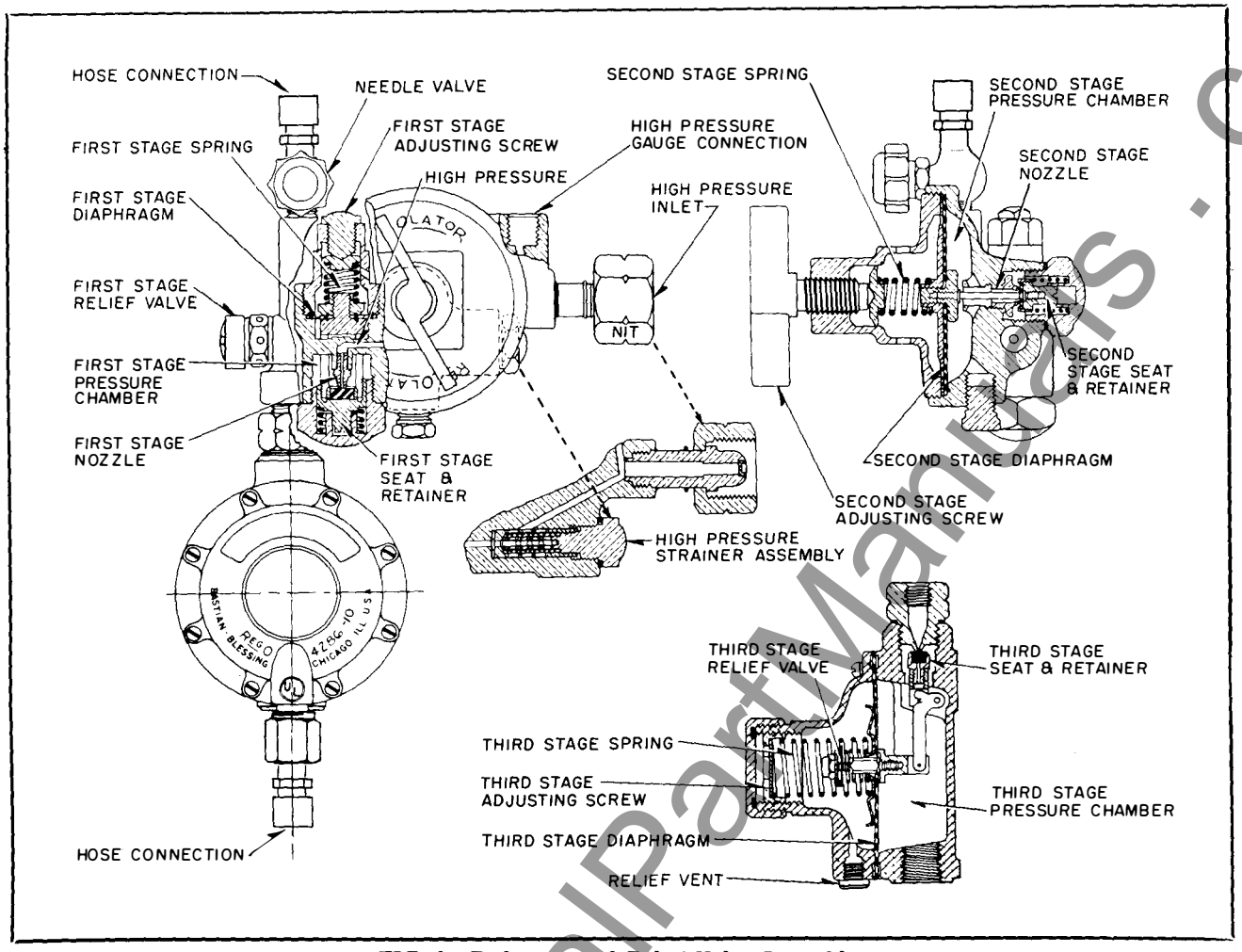


FIG. 1. Reducing and Relief Valve Assembly

The high pressure relief consists of a diaphragm backed by rose metal. When excessive heat occurs, the rose metal backing the diaphragm melts, leaving the diaphragm unsupported. The diaphragm then ruptures, permitting the gas to escape to the atmosphere through several holes arranged to distribute the thrust in all directions.

The test needle valve with a hose connection is located at the outlet of the second stage. This connection provides a relatively low pressure source (3 to 10 psi) for checking the relief pressure of a relief valve incorporated as part of the third stage. This connection may also be used for purging the gas space if desired.

The pressure at this connection can be adjusted by turning the adjusting screw (or T-handle) clockwise to raise the pressure or counterclockwise to lower the pressure.

Note: After using this connection, the adjustment should be reset to provide approximately 6 pounds per square inch pressure, (but never less than 3 pounds per square inch), since 6 pounds per square inch pressure gives the best performance in the following stage.

The third stage of the valve is the lower portion of the device. It is adjusted at the factory to feed nitrogen into the gas space when the pressure in the transformer falls below ½ pound per square inch, and to seal off the gas space from the nitrogen supply when this pressure rises above ½ pound per square inch. This setting should not be disturbed under any circumstances. Incorporated within the third stage is a relief valve which acts to prevent the transformer pressure from exceeding 8 pounds per square inch. It is a spring loaded diaphragm valve. When the gas pressure on the transformer side exceeds 8 pounds per square inch, the valve opens slightly, permitting the gas to escape to the atmosphere through a relief vent in the body of the valve thus relieving the excess pressure. As soon as the pressure falls below 8

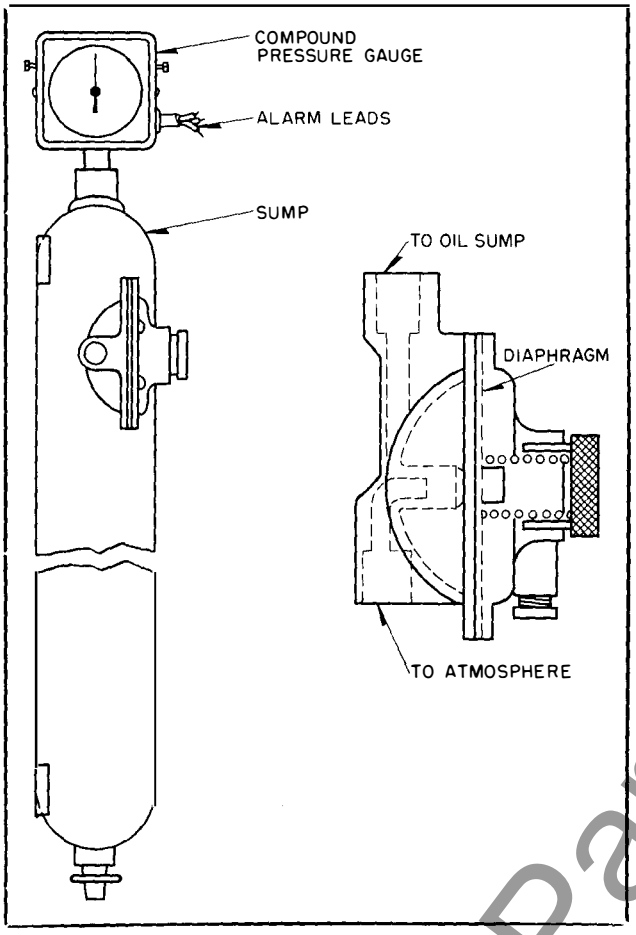


FIG. 2. Sump, Compound Pressure Gauge, and Diaphragm Type Breathing Regulator (Regulator on Type RV Only.)

pounds per square inch the valve closes, preventing further loss of gas. In case of RV equipment excess pressure (over 5 psi) is relieved by a separate relief valve installed on the sump.

Important: The reducing valve is a precision instrument and adjustment other than the one mentioned in the previous Note should not be attempted. If the valve does not operate correctly, notify the nearest Westinghouse Office and send the valve to the Westinghouse Electric Corporation, Sharon, Pa., for repair. Repair of reducing valves and high pressure gauges should not be attempted in the field.

A 3000 pound per square inch pressure gauge is connected to the high pressure chamber of the reducing valve, and indicates the nitrogen pressure in the cylinder. The gauge is equipped with electrical contacts which close when the cylinder pressure falls to 200 pounds per square inch, plus or minus 10 percent and thus warns the operator that only 10 percent of a full cylinder of nitrogen is left. (See Fig. 4). The switch ratings are given in Table No. 1. The reducing valve will continue to function, however, until the cylinder is empty.

No vacuum relief is provided as the reducing valve feeds nitrogen into the transformer tank before a vacuum is reached. The slight amount of vacuum which might occur when the cylinder has been shipped away to be refilled will not be detrimental to the transformer or the Inertaire Equipment.

Compound Pressure Gauge. A compound pressure gauge, Fig. 2, mounted on top of the sump, is used to indicate pressure in the transformer gas space. It is of the diaphragm type, with increments of one-tenth psi and major divisions every 1 psi from −10 to +10 psi. The gauge is equipped with two alarm micro-switches, one to operate at abnormal high pressure and the other to operate at vacuum should it occur. Refer to Fig. 4. The standard compound pressure gauge is supplied with normally open contacts (Fig. 4b), but a special compound pressure gauge with normally closed contacts (Fig. 4a) may be supplied on request. The switches are set 8½ psi on the pressure side and —3 psi on the vacuum side (RB Inertaire). The switch ratings are given in Table No. 1.

These values are recommended but if other than the above is required, setscrews on the side of the gauge are provided for adjustment of the switches.

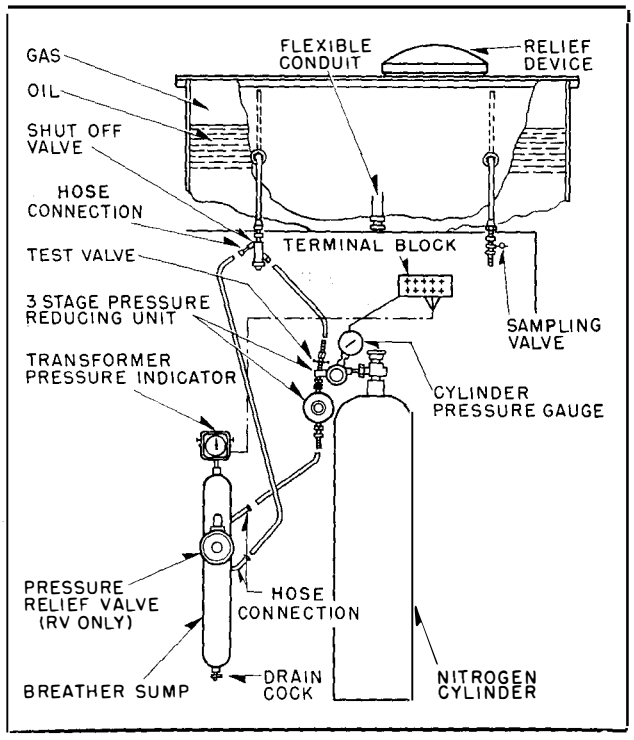


FIG. 3. Schematic Diagram of Equipment

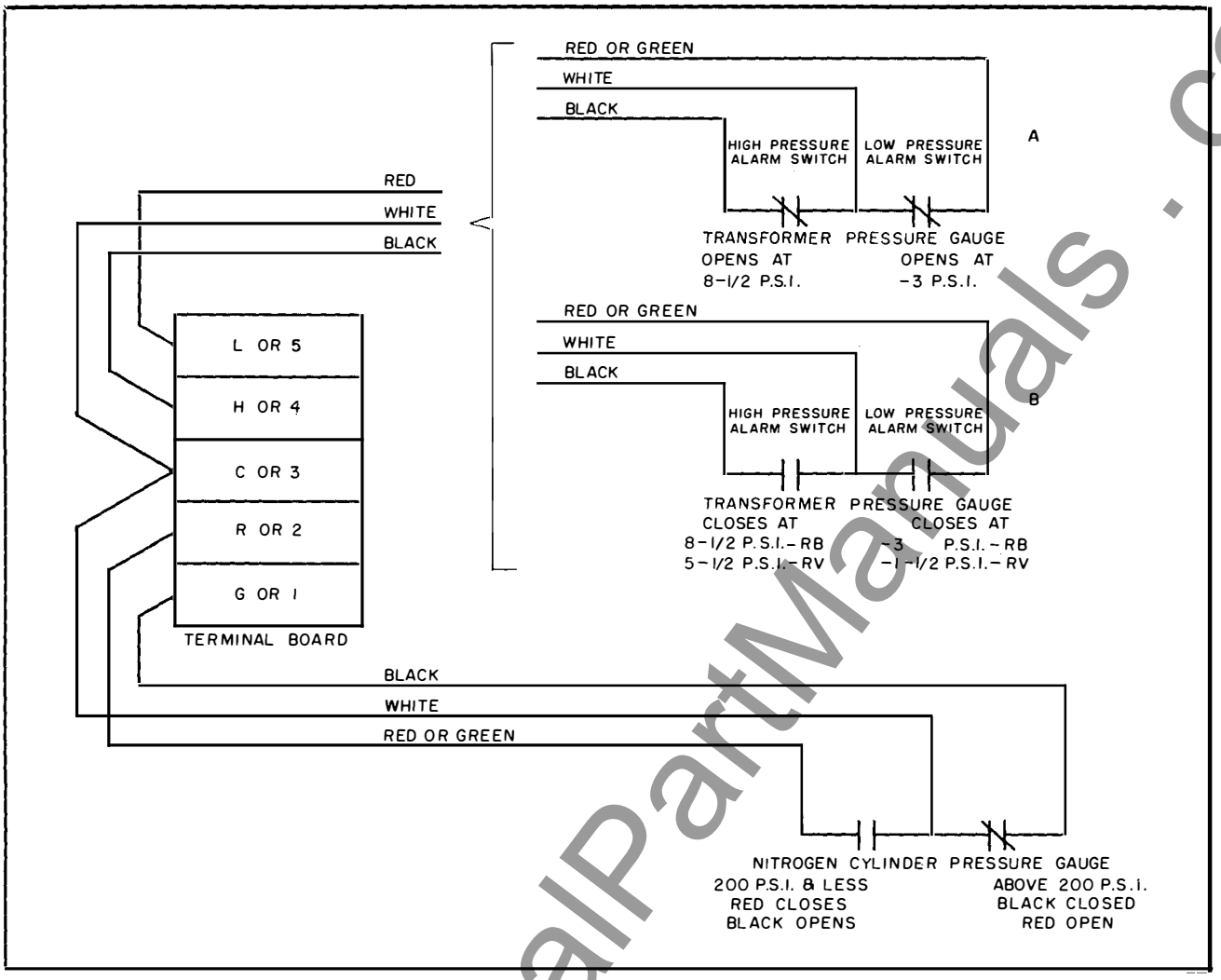


FIG. 4. Connection Diagram of Pressure Gauge Alarm Switches, Showing Alternate Arrangement

These setscrews are hex-head screws and can be turned with a small open-end or box-end wrench.

The differential of the switches is approximately 1/4 psi. That is, if the high alarm operates, the pressure must fall only 1/4 psi before the switch is reset; if the low alarm operates, the pressure must increase 1/4 psi for the switch to reset.

It should be noted that the vacuum switch will never operate except in case the nitrogen cylinder is allowed to become empty. The pressure switch will not operate unless the relief valve should fail to perform its function, or the pressure builds up faster than it can be relieved by the relief valve due to a fault in the transformer.

Shut-off Valve. A three- way shut-off valve with two hose connections, located above the reducing valve, connects the gas space above the transformer oil level to the sump assembly or the test valve on the outlet of the first stage of the reducing valve. The three positions of the valve are as follows:

1. ***Shut-off*** (clockwise to limit). This shuts off the gas space and connects the relief valve through the hose to the test valve. This position is used to seal the gas space, and also for testing the operating pressure of the relief valve.

2. ***Mid-position*** (approximately 3 turns from either limit). In this position of the valve, the gas space, the relief valve, and the test valve are connected together. This position is used when it is desired to purge the oxygen from the gas space initially with dry nitrogen.

3. ***Operating*** (counter-clockwise to limit). In this position, the gas space is connected to the relief valve through the oil sump, and the connection to the test valve closed.

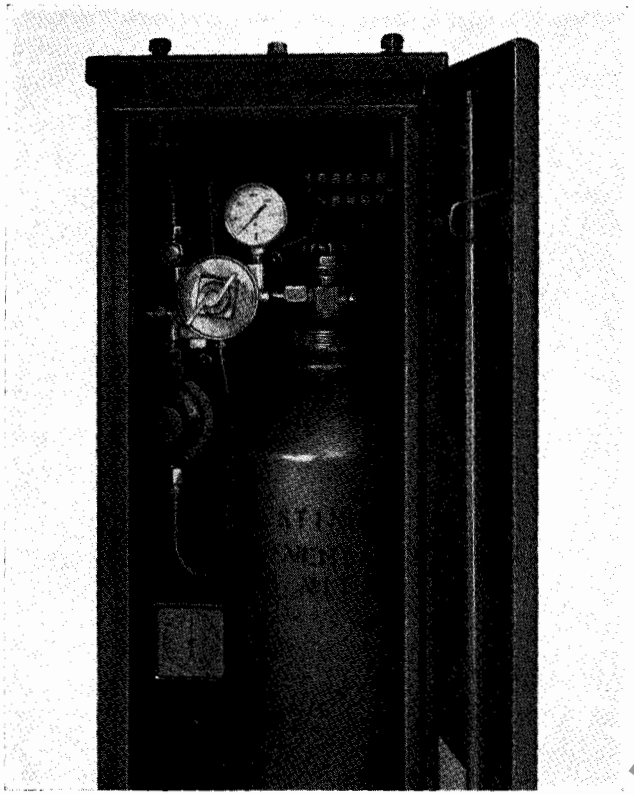


FIG. 5. Reducing Valve on Nitrogen Cylinder

Sampling Valve. The sampling valve is a needle valve, connected to the gas space, above the oil, through a pipe attached to the tank wall. It is used for obtaining samples of the gas from the gas space for oxygen content analysis. When sampling for oxygen content, sufficient gas should be allowed to flow to clear the line before taking the sample. This valve may be used also as an exhaust valve when purging the oxygen from the gas space.

RV Inertaire. In those cases where it is desired to limit the pressure to 5 pounds per square inch, and specifically ordered, a diaphragm type of relief valve will be mounted on the oil sump. The relief valve is set at the factory and the pressure screw sealed by solder. The relief pressure is stamped on the pressure screw. Also, the two alarm micro-switches on the compound pressure gauge are adjusted so that one operates at abnormal high pressures (over 5½ psi,) and the other operates at vacuum (—1½ psi) should it occur. (See Fig. 4.) Equipment ordered for this special condition is classed as RV Inertaire. The higher rate of use of nitrogen requires that an extra tank of nitrogen be provided with each unit.

INSTALLATION

Mounting. Inertaire equipment usually is shipped separate from the transformer tank and consists of: (1) the reducing valve; (2) one operating nitrogen cylinder; (3) two short flexible hose assemblies which connect between the cabinet and the tank; (4) three anti-vibration mounting pieces; (5) the cabinet with all other parts of the equipment mounted in it; (6) flexible alarm leads.

In mounting the cabinet on the transformer, the three vibration dampeners (Fig. 6) are to be mounted on the three pads on the transformer tank wall. Next, remove the cap nut on the center stud of the vibration dampeners and set the holes in the cabinet brackets over the studs. Replace the cap nuts.

The flexible hose should be connected at the top of the cabinet by means of the union type connections. Care should be taken to make a gas-tight connection. A small amount of thread cement placed on the joining compression surfaces will assist.

Install the reducing valve on the support pins and connect synthetic tubing between test valve and shut-off valve. Also connect third stage outlet to oil sump assembly with synthetic tubing.

Remove cylinder valve protecting cap from cylinder and place cylinder in cabinet. The cylinder valve protecting cap should be kept in cabinet for use when cylinder is sent away for refill. Before connecting reducing valve high pressure union to cylinder valve, be sure cylinder

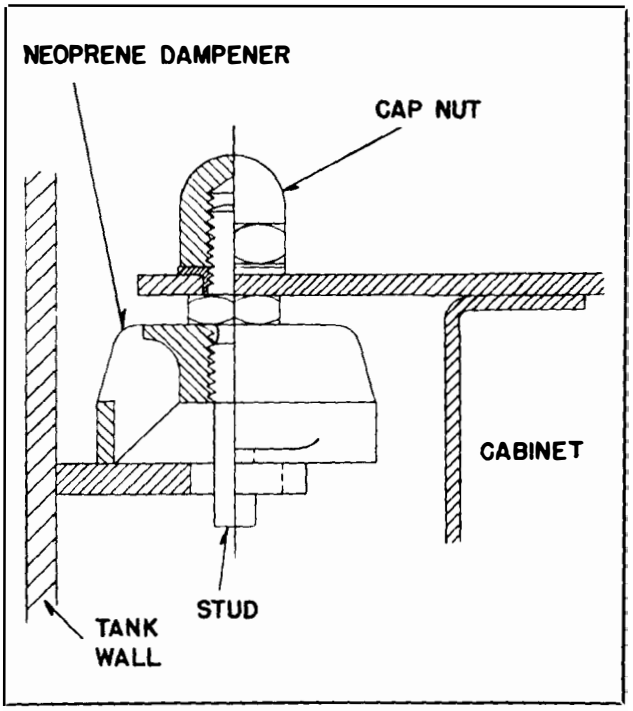


FIG. 6. Vibration Dampeners

valve is free of any dirt. Open the cylinder valve slightly so that any dirt lodged in its passages may be blown out.

Note: Do not have valve opening pointed toward any one as a small object blown from the valve with such high pressure might cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union on with the fingers and then open the cylinder valve *very little* letting gas leak by the threads to blow off any fine dirt that might be on the union seat or in the threads. Tighten union nut with a wrench until this leakage stops and open cylinder valve full.

Note: When opening the cylinder valve:

1. Always open the valve very slowly. The sudden shock of high pressure admitted to the reducing valve is likely to injure the high pressure gauge or the reducing valve seat.

2. Always back-seat the valve with as much force as would be used in closing the valve.

Tank Leak Test. If the tank is to be tested for leaks by filling completely with oil and applying an additional oil head, close the shut-off valve (clock-wise) and the sampling valve. When leak test is completed, the oil should be lowered in the following manner: Open the test valve on the reducing valve; open the nitrogen cylinder valve; start to draw down the oil; open the transformer shut-off valve to mid-position (3 turns). This procedure will blow most of the oil in the connection between the transformer tank and cabinet back into the tank and fill the gas space with pure nitrogen, thus accomplishing the initial deoxygenation of the gas space.

Open the oil sump drain valve on the oil sump assembly and draw off any oil which may have entered the sump; close the sump drain; open sampling valve to drain off the oil in this line. Nitrogen will come out of this valve when line is free of oil. Close the sampling valve. Close the test valve, check relief pressure of relief valve.

Deoxygenation. *Inertaire transformers may be installed with air in the gas space for simplicity of installation.* However, for the efficient usage of Inertaire equipment, the transformer should be purged with nitrogen. If it is the customer's practice to purge transformers to obtain initial increased protection to the transformer, he should refer to I.L. 46-710-9, "Preparing Transformers for Operation with Nitrogen Gas" for the proper procedure.

Testing for Leaks. If an oil pressure test cannot be conveniently made to check the tightness of the tank and fittings, the following method is suggested:

After the deoxygenation process is completed, close the sampling valve and carefully allow the pressure in the gas space to reach 8 pounds per square inch. (5 psi for RV Inertaire). Close the nitrogen cylinder valve.

Allow the transformer to stand several hours with this pressure. If the pressure falls off, a leak is present and it can best be found by applying soapy water to all joints and connections. In checking for leaks, the newly-made Inertaire connection should not be overlooked.

Caution: Extreme care should be observed, when purging the gas space with nitrogen from a high pressure container, not to seal the transformer off tight until the gas in the gas space has reached ambient temperature. The expansion of nitrogen from a very high pressure (1500 to 2000 pounds per square inch) to atmospheric pressure results in the nitrogen entering the gas space at a very low temperature. Unless the gas is free to expand as it warms up to ambient temperature, the pressure within the tank may increase to such a value as to operate the relief device. If no relief device is provided, the pressure may distort the tank.

If the relief valve assembly is connected to the gas space, it will relieve any pressure in excess of 8 pounds per square inch (5 psi for RV Inertaire) if the pressure is built up gradually.

Checking the Relief Pressure of Relief Valve. Having completed the test for leaks, the relief pressure of the relief valve should be checked. This is done by first isolating the gas space from the Inertaire equipment (turn shut-off valve clockwise to the limit). With the test valve set for a very small gas flow build the pressure up slowly in the relief valve. Gas will escape from the relief valve when the proper pressure is reached.

Important: This pressure must not exceed 8 $\pm$ 1/4 psi (5 $\pm$ 1/4 psi for RV Inertaire equipment). The relief valve for RV Inertaire is sealed and no attempt should be made to adjust the pressure setting. The nearest Westinghouse office should be notified if the valve does not operate correctly. If the relief valve for the RB Inertaire does not operate at the proper pressure an exception may be made to the "no adjustment" rule mentioned

under "Description" of the "Reducing Valve and High Pressure Gauge". This exception allows for field adjustment of the relief valve by following these steps (beginning at the completion of test for the relief pressure):

1. Close test valve and return second stage adjusting handle back to its original position.

2. Reduce pressure in sump to less than 6 psi by opening and then closing oil drain valve at bottom of oil sump.

3. Remove die cast cap over third stage valve adjusting screw.

4. Remove the outer threaded adjustment nut which is the ½ psi reducing valve adjustment. Count number of turns to remove this adjustment nut so it may be replaced exactly same as before.

5. Remove flat, solid, round washer and compression spring. This exposes the relief valve adjusting screw.

6. By means of an $\frac{11}{32}$" socket wrench, unscrew the adjusting screw to lower the relief pressure. One quarter turn gives approximately 1 psi difference in pressure. Do not exert side pressure on the adjusting screw as it may cause the metal valve part to slide on the rubber valve seat preventing proper seating subsequently.

7. Reassemble compression spring, flat washer and adjustment nut and cap exactly the same as originally found.

8. Retest for relief pressure as given above.

9. If different than 8 psi repeat adjustments and tests as given above until proper relief pressure is obtained.

10. After the correct relief pressure is obtained the relief valve should be checked for leaks.

a. Return second stage adjusting handle to original position. (Approximately 6 psi).

b. Reduce pressure in sump to less than 6 psi and close sump drain valve.

c. Open test valve until pressure in sump is steady (Approx. 6 psi). Close test valve and record pressure in sump. A drop of ½ psi in ¼ hour will indicate a leak. Apply soapy water at relief vent and at sump drain valve and watch for leaks.

11. If no leaks are present, return three-way shut-off valve to operating position (counter-clockwise to limit).

The equipment is now ready for normal operation and the purging cylinder should be replaced by the operating cylinder. To do this, seal off the gas space (turn shut-off valve clockwise to the limit) close nitrogen cylinder valve and disconnect cylinder from reducing valve. Remove purging cylinder from the cabinet.

Remove valve protecting cap from the operating cylinder. Wipe off any dirt on the cylinder valve and then slightly crack open the valve to blow out any dirt which may be lodged in the valve. It is imperative that absolutely no dirt gets into reducing valve. Do not have valve opening pointed toward anyone as a small object blown from the valve with such high pressure might easily cause serious injury.

When connecting the reducing valve to the cylinder valve, screw the union nut on with fingers and then slowly open the valve a little and let the gas flow past the threads, blowing off any dirt that may be on the seat or in the threads. Tighten union nut tight. Open cylinder valve, but be careful not to open it very fast, for fear of injuring the reducing valve or gauge by sudden high pressure. Open shut-off valve counter-clockwise to limit. The unit is now ready for normal operation with the operating cylinder installed.

Important: ***When checking circuits through the instruments it is necessary to follow Table No. 1. This means that a low voltage bell ringer cannot be used unless switched through a high impedance relay. An indicating light type device is generally recognized as best for checking circuits through instruments containing micro-switches or switches of similar capacities.***

TABLE NO. 1

VOLTAGE	NON-INDUCTIVE LOAD-AMPS.	INDUCTIVE LOAD AMPS. L/R = .026*
125 A-C	10	10
250 A-C	5	5
125 A-C	0.5	0.05
250 D-C	0.25	0.025

*Equal to or less than .026. If greater refer to factory for adjusted rating.

MAINTENANCE

Westinghouse Inertaire transformers are designed to require very little maintenance and attention on the part of the customer. Since the tank is nearly always under a positive pressure of at least

½ pound per square inch, there is small liklihood of the oxygen or moisture content becoming high.

The amount of nitrogen used by the transformer and the frequency of cylinder replacement will depend on the tightness of the tank as well as the load cycle. In order to be sure that the equipment is operating correctly and that there are no leaks in the system, it is recommended that the following readings be taken during the first month of operation:

1. Weekly oxygen content-analysis to determine when the additional purging is necessary. This should be done before the oxygen content reaches 7 percent, which is the permissible upper limit which will prevent explosions in the gas space.

If the flue gas analyzer is not obtainable, the use of Fyrite Oxygen Indicator, S# 1408 196 is recommended. This may be purchased from the Westinghouse Electric Corporation, Sharon Plant. Complete instructions for determining the oxygen content is supplied with each analyzer.

Additional purging may be accomplished in the same manner as previously described.

2. For the first week, take daily readings of nitrogen cylinder pressure, transformer tank pressure as indicated by the tank pressure gauge, transformer oil temperature and ambient temperature. Weekly readings of the above will suffice for the remainder of the month.

After the first month of observation has shown that the equipment is functioning properly, no further readings are necessary except that check-analysis of the oxygen content should be made in about three months. During normal operation, the oxygen content should remain below 1 percent.

Nitrogen Cylinders. Since the nitrogen used in Inertaire equipment will last a relatively long time, it is not feasible to rent cylinders from a nitrogen supplier. The cylinders which are used with the equipment are shipped to the customer with the transformer and becomes the property of the customer. These cylinders are painted gray so that they may be easily identified.

Westinghouse cylinders for regular use with Inertaire equipment may be identified as follows:

a. Each Westinghouse cylinder is painted gray and is marked with black letters about 1½ inches high, "Westinghouse Inertaire Nitrogen."

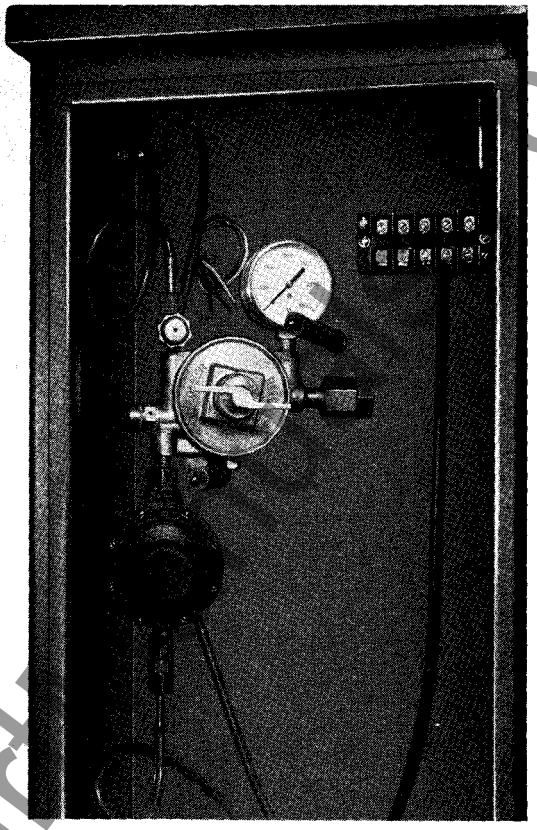


FIG. 7. Reducing Valve Detached from Cylinder and Plugged

b. Each cylinder is provided with a tag, Form #17212.

c. Each cylinder is originally shipped from the Sharon Plant with the transformer.

When the pressure in the operating cylinder drops to between 150 and 200 pounds per square inch, it should be replaced with a full cylinder of nitrogen. The nitrogen used on Inertaire transformers must be dry. Commercial nitrogen is not always free from moisture; therefore, only oil pumped nitrogen or nitrogen supplied under a guarantee that the moisture content is less than 0.03% by weight, and impurity content is less than 0.3% by volume, should be used. Nitrogen can be ordered from suppliers as Westinghouse nitrogen, P. D. S. 6306. ***Do not use any other grade of nitrogen or any other gas.***

The reducing valve is left supported on the two pins while the cylinder is being refilled.

During the time the reducing valve is not connected to the nitrogen cylinder, the union on the reducing valve should be closed by a plug supplied for this purpose. The reducing valve plug is located on the bracket on the door. If the plug is not used,

lowered pressure in the tank may cause the reducing valve to open, permitting more or less free breathing through the reducing valve. These cylinders can be properly refilled only by the listed suppliers.

Since it is usual for nitrogen suppliers to exchange cylinders, it is suggested that the customer's requisition for normal operating gas read as follows: "Refill cylinder, Serial No. 000000 with Westinghouse Inertaire Nitrogen, PDS # 6306 and return same cylinder to purchaser." The serial number will be found stenciled on the side of the gray and black operating cylinder.

Drain the oil sump once a year to prevent any appreciable oil coming in contact with the regulator.

Check the relief pressure of the relief valve to determine if any change has occurred since last inspection. Refer to paragraphs under Installation for instruction.

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to address given, unless otherwise specified.

LIST OF RECOMMENDED NITROGEN SUPPLIERS

ALABAMA

Air Reduction Co.
2825 No. 29th Ave.
N. Birmingham 7, Ala.
Send cylinders to Fairfield, Ala.

ARKANSAS

National Cylinder Gas Co.
700 Wheeler Ave.
Ft Smith, Ark.

CALIFORNIA

Air Reduction Pacific Co.
Park Ave. & Halleck St.
Emeryville 8, California

Air Reduction Pacific Co.
2423 E. 58th St.
Los Angeles, California

National Cylinder Gas Co.
11705 S. Alameda St.
Los Angeles 2, California

National Cylinder Gas Co.
P.O. Box 427
Wilmington, California

CONNECTICUT

National Cylinder Co.
Main Street
South Meriden, Conn.

FLORIDA

National Cylinder Gas Co.
P.O. Box 2849
Jacksonville 3, Florida

GEORGIA

National Cylinder Gas Co.
471 Peters Street, S.W.
Atlanta, Georgia

ILLINOIS

Air Reduction Company
3100 So. Homan Avenue
Chicago 23, Ill.

National Cylinder Gas Co.
1501 W. 44th Street
Chicago, Illinois

National Cylinder Gas Co.
10305 Torrence Ave.
South Chicago, Illinois

National Cylinder Gas Co.
P.O. Box 350
LaGrange, Illinois

National Cylinder Gas Co.
P.O. Box 627
Peoria 1, Illinois

INDIANA

National Cylinder Gas Co.
P.O. Box 784
Evansville 1, Indiana

National Cylinder Gas Co.
3209 Madison Ave.
Indianapolis, Indiana

National Cylinder Gas Co.
601 Erie Avenue
Logansport, Indiana

IOWA

Air Reduction Co.
2561 State St.
Bettendorf, Ia.

KANSAS

National Cylinder Gas Co.
1614-26 State Ave.
Kansas City 2, Kansas

KENTUCKY

Air Reduction Co.
550 So. 5th St.
Louisville 1, Ky.

Send cylinders to 1256 Logan St.
Louisville, Ky.

LOUISIANA

Air Reduction Co.
1406 So. Rendon St.
New Orleans 2, La.

National Cylinder Gas Co.
569 Felicity St.
New Orleans 9, La.

National Cylinder Gas Co.
P.O. Box 284
Shreveport, Louisiana

MARYLAND

Air Reduction Co.
1310 N. Calvert St.
Baltimore 2, Md.

Send cylinders to 4501 E. Fayette St
Baltimore, Md.

National Cylinder Gas Co.
1700 S. Newkirk Street
Baltimore 24, Maryland

MASSACHUSETTS

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston, Mass.

National Cylinder Gas Co.
205 Medford Street
Malden 48, Mass.

MICHIGAN

Air Reduction Co.
2994 E. Grand Blvd.
Detroit 2, Mich.

Send cylinders to
7991 Hartwick St.
Detroit, Mich.

National Cylinder Gas Co.
P.O. Box 30
Ferndale 20, Michigan

National Cylinder Gas Co.
P.O. Box 35, Roosevelt Sq.
Grand Rapids 9, Mich.

MINNESOTA

Air Reduction Co.
1111 Nicollet Ave.
Minneapolis 2, Minn.

Send cylinders to
327 25th St. S.E.
Minneapolis, Minn.

National Cylinder Gas Co.
965 North Lexington Parkway
St. Paul 3, Minnesota

MISSOURI

Air Reduction Co.
2701 Warwick Traficway
Kansas City 8, Mo.

Send cylinders to
100 W. 26th St.
Kansas City, Mo.

Air Reduction Co.
630 So. 2nd Street
St Louis, Mo.

National Cylinder Gas Co.
1520 S. Vandeventer Ave.
St Louis 10, Missouri

NORTH CAROLINA

National Cylinder Gas Co.
2414 S. Boulevard
Charlotte 3, N.C.

NEW JERSEY

Air Reduction Co.
181 Pacific Avenue
Jersey City 4, N.J.

National Cylinder Gas Co.
2136—85th Street
North Bergen, N.J.

NEW YORK

Air Reduction Co.
730 Grant Street
Buffalo 13, N.Y.

National Cylinder Gas Co.
South & Front Streets
Hornell, N.Y.

National Cylinder Gas Co.
Buffalo Ave. & 53rd St.
Niagara Falls, N.Y.

OHIO

National Cylinder Gas Co.
4620 Este Avenue
Cincinnati 32, Ohio

Air Reduction Co.
1210 W. 69th St.
Cleveland, Ohio

National Cylinder Gas Co.
765 Woodrow Ave.
Columbus 7, Ohio

Air Reduction Co.
P.O. Box 923
Dayton 1, Ohio
Send cylinders to Sellers Rd. at
Springboro Pike
(Moraine City)
Dayton, Ohio

National Cylinder Gas Co.
1151 East 222nd St.
Euclid 17, Ohio

National Cylinder Gas Co.
P.O. Box 86
Lowellville, Ohio

OKLAHOMA

National Cylinder Gas Co.
P.O. Box 1534
Oklahoma City 1, Oklahoma

National Cylinder Gas Co.
P.O. Box 168
Tulsa 3, Oklahoma

OREGON

Air Reduction Pacific Co.
430 N.W. 10th Ave.
Portland 9, Oregon

Send cylinders to
2949 N.W. Front Ave.
Portland, Oregon

National Cylinder Gas Co.
2720 North West Yeon Ave.
Portland 10, Oregon

PENNSYLVANIA

National Cylinder Gas Co.
P.O. Box 7
Conshohocken, Pa.

National Cylinder Gas Co.
Davis Island Yards
McKees Rocks, Pa.

Air Reduction Co.
Allegheny Ave. & 17th St.
Philadelphia 40, Pa.

Send cylinders to
Germantown & Allegheny Aves.
Philadelphia, Pa.
or
Bethlehem, Pa.

Air Reduction Co.
2010 Clark Building
Pittsburgh 22, Pa.

Send cylinders to
Midland, Pa.
or
1116 Ridge Ave.
Pittsburgh, Pa.

RHODE ISLAND

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston 25, Mass.

Send cylinders to
Central Falls, R. I.

TENNESSEE

National Cylinder Gas Co.
1329 Chesnut Street
Chattanooga 2, Tenn.

National Cylinder Gas Co.
P.O. Box 3545
Memphis, Tenn.

TEXAS

National Cylinder Gas Co
P.O. Box 5416
Dallas, Texas

National Cylinder Gas Co
319 N.E. 23rd Street
Ft. Worth 6, Texas

Magnolia Airco Gas Products Co.
2405 Collingsworth Ave.
Houston 6, Texas

National Cylinder Gas Co.
P.O. Box 2106
Houston 1, Texas

National Cylinder Gas Co.
P.O. Box 1557
Lubbock, Texas

VIRGINIA

Air Reduction Co.
P.O. Box 1192
Richmond 9, Va.

Send cylinders to Bickerstaff Rd.
East of Osborne Tpke.
Richmond, Va.

WASHINGTON

Air Reduction Pacific Co.
3623 East Marginal Way
Seattle, Washington

National Cylinder Gas Co.
5510 East Marginal Way
Seattle 4, Washington

WEST VIRGINIA

Air Reduction Co.
94—29th St.
Wheeling, W. Va.

WISCONSIN

National Cylinder Gas Co.
6313—31st Avenue
Kenosha, Wisconsin

Air Reduction Co.
818 W. Winnebago St.
Milwaukee 5, Wisc.

Send cylinders to
3435 No. Buffum St.
Milwaukee, Wisc.

National Cylinder Gas Co.
2615 West Greves Street
Milwaukee 3, Wisconsin

WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.
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