INSTRUCTIONS

PREPARING TRANSFORMERS FOR OPERATION WITH NITROGEN GAS

GAS-PROTECTED TRANSFORMERS may be installed with air in the gas space when simplicity of installation is of prime importance. In time, depending upon the oil temperature, the oxygen content is depleted by oxidizing oil leaving a blanket of inert gas above the oil. The amount of oxidation caused by this oxygen is so small that it is not harmful to the oil. During the early part of this period, when the oxygen content is greater than 7 percent, the transformer is not completely protected against the possibility of secondary explosion or fire in event of an internal fault. Therefore, if the customer wishes to obtain initial increased protection to the transformer, he can do so by purging the oxygen from the transformer with nitrogen.

METHODS OF PURGING OXYGEN FROM THE TRANSFORMER

Vacuum Filling. If the instruction plate specifies that the transformer tank will withstand full vacuum and a vacuum pump is available, the procedure outlined below can be followed for complete removal of oxygen from the gas space and oil:

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a "purging" nitrogen cylinder (Westinghouse nitrogen P.D.S. 5622 or 6306); attach a vacuum line to the gas sampling valve in the nitrogen cabinet; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then allow nitrogen gas to flow from the second stage of the pressure reducing unit of the Inertaire system into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Replace the purging cylinder with the operating cylinder.

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); remove vacuum vent plug and seal with a pipe plug; attach a vacuum line to the gas sampling valve on the Sealedaire equipment; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve and allow low pressure nitrogen to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device. Close sampling valve and remove nitrogen equipment. Replace standard vacuum vent plug.

Gas-oil Seal.

1. Assemble the transformer complete for operation (with the oil at the proper level); seal off the gas-oil seal compartment with the back-seating angle valve; attach a vacuum line to the gas sampling valve on the transformer; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve and allow low pressure nitrogen to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Reopen the back-seating angle valve. Allow enough nitrogen to flow into the lower gas space of the gas oil seal unit to force all the oil into the upper compartment (indicated by gas bubbling from the lower to the upper compartment). Close the sampling valve, and remove the nitrogen cylinder.

Transferring Oil from One Unit to Another. Where two units are being installed, they may be piped together through their drain valves or lower filter press connections. Nitrogen pressure can then be used to force oil from the first unit into the second until the oil flows from the gas sampling valve (which must be left open before starting).

This will leave less than one inch of gas space above the oil in the Sealedaire transformer. The oil can be forced back into the first unit with nitrogen pressure as mentioned above. Nitrogen pressure can then be added to the first unit with the connection between the tanks open until the oil in the two tanks is at the same level. The entire process is repeated after several hours.

When more than two units are being installed, they may be connected in series with the last unit connected to the first unit. Oil is forced from the first unit to the second unit, then to the third unit, etc. The procedure is the same as described in the previous paragraph and must also be repeated after several hours.

This method is applicable for Inertaire, Sealedaire and Gas-Oil Sealed units.

BLOWING OUT WITH NITROGEN

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a purging nitrogen cylinder; open the test valve on the pressure reducing unit; turn the shut-off valve to the mid-position (see Instruction Leaflet "Inertaire Equipment"); open the sampling valve and open the nitrogen cylinder valve. This permits the nitrogen to flow into the gas space, forcing the air out of the sampling valve. The nitrogen should be allowed to flow until the oxygen in the escaping gas is reduced to 3 percent.

2. Continue tests specified in Instruction Leaflet "Inertaire Equipment".

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve on the Sealedaire Equipment.

2. Build up the pressure in the gas space until the pressure limiting valve opens. Disconnect the pressure hose and allow the gas to discharge through the sampling valve to the atmosphere.

3. Repeat this operation three times, allowing a few minutes at the full pressure each time for the nitrogen to diffuse through the gas space. After the third discharge, build up the pressure to that limited by the pressure limiting valve and then close the needle valve on the transformer.

4. Allow the unit to stand for a day and then discharge the pressure, and again build up to the maximum. After another day repeat this procedure and leave the unit with this pressure.

Gas-oil Sealed.

1. Assemble the transformer complete for operation (with the oil at the proper level); attach a nitrogen cylinder with a pressure reducing unit, to the gas sampling valve on the transformer; open the gas sampling valve in the lower gas space of the gas-oil seal compartment; and open the back-seating angle valve in the line between the transformer and compartment.

2. Allow the nitrogen to flow into the transformer gas space, to the lower gas space of the gas-oil seal compartment, and out through the sampling valve. The nitrogen should flow until the oxygen in the escaping gas is reduced to 3 percent.

3. Return valves to normal conditions, and remove nitrogen cylinder.

Note: For initial deoxygenation, or where the transformer oil has been open to the 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 percent as from 20 to 3 percent.

During shipment the oil may absorb oxygen which will be replaced slowly by the nitrogen. Thus the oxygen content of the gas space may actually increase after installation requiring additional purging.

Caution: If a manhole cover or handhole cover of an Inertaire, Sealedaire, or Gas Oil Sealed unit is removed, do not enter the transformer until the gas space has been opened to the atmosphere for several minutes, as the gas will not contain sufficient oxygen to sustain life.

PRESSURE REDUCING UNITS

The standard pressure reducing unit used on Inertaire equipment is the preferred device for delivering low pressure gas in the deoxygenation work. However, if it is not available a special fitting should be used to reduce the cylinder pressure to a few pounds-per-square-inch which is re-

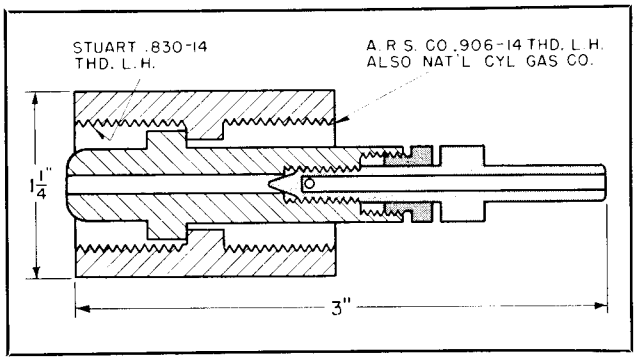

FIG. 1. Standard Pressure Reducing Unit.

quired for purging a gas space. This fitting, style number 1165 915, should be ordered from the Sharon Plant when required (see Fig. 1).

NITROGEN

The nitrogen used for purging oxygen from 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 percent by weight and impurity content less than 0.30 percent by volume should be used.

If the customer has chosen to purge the transformer he may order nitrogen from the supplier as Westinghouse nitrogen, P.D.S. 5622. **Do not use any other grade of nitrogen or any other gas.** Purging cylinders are the property of the nitrogen supplier and should be promptly returned since demurrage will be charged after 30 days.

Operating cylinders which are furnished with Inertaire equipment are the property of the customer. Nitrogen for these cylinders is covered by Westinghouse nitrogen P.D.S. 6306. Proper ordering information is contained in the Instruction Leaflet "Inertaire Equipment".

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to the addresses 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 Gas 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 S. 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.
Betterdorf, 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.

LIST OF RECOMMENDED NITROGEN SUPPLIERS (Continued)

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 Trafficway
Kansas City 8, Mo.

Send cylinders to
1000 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 Chestnut 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 Graves Street
Milwaukee 3, Wisconsin

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

INSTRUCTIONS

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METHODS OF PURGING OXYGEN FROM THE TRANSFORMER

Vacuum Filling. If the instruction plate specifies that the transformer tank will withstand full vacuum and a vacuum pump is available, the procedure outlined below can be followed for complete removal of oxygen from the gas space and oil:

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a "purging" nitrogen cylinder (Westinghouse nitrogen P.D.S. 5622 or 6306); close the shut-off valve (clockwise to limit); attach a vacuum line to the gas sampling valve in the nitrogen cabinet; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour, open test valve and cylinder valve, and then open the shut-off valve slowly three turns to mid-position. (Do not exceed the vacuum limits of the transformer pressure indicator.) Allow nitrogen gas to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Replace the purging cylinder with the operating cylinder.

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); remove vacuum vent plug and seal with a pipe plug; remove vacuum gauge; attach a vacuum line to the 1/4 inch pipe mounting for the vacuum gauge and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve and allow low pressure nitrogen to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device. Close sampling valve and remove nitrogen equipment. Replace standard vacuum vent plug and vacuum gauge.

Gas-oil Seal.

1. Assemble the transformer complete for operation (with the oil at the proper level); seal off the gas-oil seal compartment with the back-seating angle valve; attach a vacuum line to the gas sampling valve on the transformer; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve and allow low pressure nitrogen to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Reopen the back-seating angle valve. Allow enough nitrogen to flow into the lower gas space of the gas oil seal unit to force all the oil into the upper compartment (indicated by gas bubbling from the lower to the upper compartment). Close the sampling valve, and remove the nitrogen cylinder.

Transferring Oil from One Unit to Another. Where two units are being installed, they may be piped together through their drain valves or lower filter press connections. Nitrogen pressure can then be used to force oil from the first unit into the second until the oil flows from the gas sampling valve (which must be left open before starting).

This will leave less than one inch of gas space above the oil in the Sealedaire transformer. The oil can be forced back into the first unit with nitrogen pressure as mentioned above. Nitrogen pressure can then be added to the first unit with the connection between the tanks open until the oil in the two tanks is at the same level. The entire process is repeated after several hours.

When more than two units are being installed, they may be connected in series with the last unit connected to the first unit. Oil is forced from the first unit to the second unit, then to the third unit, etc. The procedure is the same as described in the previous paragraph and must also be repeated after several hours.

This method is applicable for Inertaire, Sealedaire and Gas-Oil Sealed units.

BLOWING OUT WITH NITROGEN

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a purging nitrogen cylinder; open the test valve on the pressure reducing unit; turn the shut-off valve to the mid-position (see Instruction Leaflet "Inertaire Equipment"); open the sampling valve and open the nitrogen cylinder valve. This permits the nitrogen to flow into the gas space, forcing the air out of the sampling valve. The nitrogen should be allowed to flow until the oxygen in the escaping gas is reduced to 3 percent.

2. Continue tests specified in Instruction Leaflet "Inertaire Equipment".

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve on the Sealedaire Equipment.

2. Build up the pressure in the gas space until the pressure limiting valve opens. Disconnect the pressure hose and allow the gas to discharge through the sampling valve to the atmosphere.

3. Repeat this operation three times, allowing a few minutes at the full pressure each time for the nitrogen to diffuse through the gas space. After the third discharge, build up the pressure to that limited by the pressure limiting valve and then close the needle valve on the transformer.

4. Allow the unit to stand for a day and then discharge the pressure, and again build up to the maximum. After another day repeat this procedure and leave the unit with this pressure.

Gas-oil Sealed.

1. Assemble the transformer complete for operation (with the oil at the proper level); attach a nitrogen cylinder with a pressure reducing unit, to the gas sampling valve on the transformer; open the gas sampling valve in the lower gas space of the gas-oil seal compartment; and open the back-seating angle valve in the line between the transformer and compartment.

2. Allow the nitrogen to flow into the transformer gas space, to the lower gas space of the gas-oil seal compartment, and out through the sampling valve. The nitrogen should flow until the oxygen in the escaping gas is reduced to 3 percent.

3. Return valves to normal conditions, and remove nitrogen cylinder.

Note: For initial deoxygenation, or where the transformer oil has been open to the 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 percent as from 20 to 3 percent.

During shipment the oil may absorb oxygen which will be replaced slowly by the nitrogen. Thus the oxygen content of the gas space may actually increase after installation requiring additional purging.

Caution: If a manhole cover or handhole cover of an Inertaire, Sealedaire, or Gas Oil Sealed unit is removed, do not enter the transformer until the gas space has been opened to the atmosphere for several minutes, as the gas will not contain sufficient oxygen to sustain life.

PRESSURE REDUCING UNITS

The standard pressure reducing unit used on Inertaire equipment is the preferred device for delivering low pressure gas in the deoxygenation work. However, if it is not available a special fitting should be used to reduce the cylinder pressure to a few pounds-per-square-inch which is re-

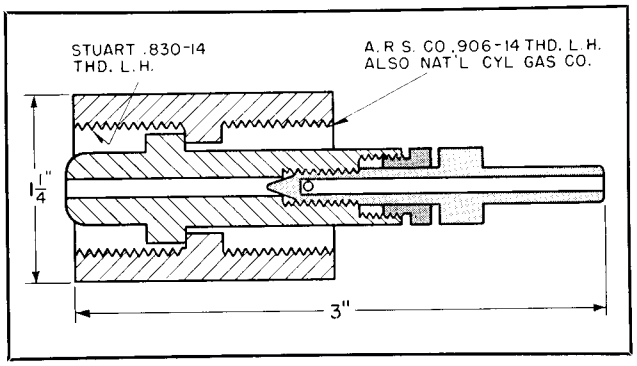

FIG. 1. Standard Pressure Reducing Unit.

quired for purging a gas space. This fitting, style number 1165 915, should be ordered from the Sharon Plant when required (see Fig. 1).

NITROGEN

The nitrogen used for purging oxygen from 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 percent by weight and impurity content less than 0.30 percent by volume should be used.

If the customer has chosen to purge the transformer he may order nitrogen from the supplier as Westinghouse nitrogen, P.D.S. 5622. **Do not use any other grade of nitrogen or any other gas.** Purging cylinders are the property of the nitrogen supplier and should be promptly returned since demurrage will be charged after 30 days.

Operating cylinders which are furnished with Inertaire equipment are the property of the customer. Nitrogen for these cylinders is covered by Westinghouse nitrogen P.D.S. 6306. Proper ordering information is contained in the Instruction Leaflet "Inertaire Equipment".

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to the addresses 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 Gas 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 S. 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.
Betterdorf, 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.

LIST OF RECOMMENDED NITROGEN SUPPLIERS (Continued)

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 Trafficway
Kansas City 8, Mo.

Send cylinders to
1000 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 Chestnut 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 Graves Street
Milwaukee 3, Wisconsin

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

PREPARING TRANSFORMERS FOR OPERATION WITH NITROGEN GAS

GAS-PROTECTED TRANSFORMERS may be installed with air in the gas space when simplicity of installation is of prime importance. In time, depending upon the oil temperature, the oxygen content is depleted by oxidizing oil leaving a blanket of inert gas above the oil. The amount of oxidation caused by this oxygen is so small that it is not harmful to the oil. During the early part of this period, when the oxygen content is greater than 7 percent, the transformer is not completely protected against the possibility of secondary explosion or fire in event of an internal fault. Therefore, if the customer wishes to obtain initial increased protection to the transformer, he can do so by purging the oxygen from the transformer with nitrogen.

METHODS OF PURGING OXYGEN FROM THE TRANSFORMER

Vacuum Filling. If the instruction plate specifies that the transformer tank will withstand full vacuum and a vacuum pump is available, the procedure outlined below can be followed for complete removal of oxygen from the gas space and oil:

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a "purging" nitrogen cylinder (Westinghouse nitrogen P.D.S. 5622 or 6306); close the shut-off valve (clockwise to limit); attach a vacuum line to the gas sampling valve in the nitrogen cabinet; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour, open test valve and cylinder valve, and then open the shut-off valve slowly three turns to mid-position. (Do not exceed the vacuum limits of the transformer pressure indicator.) Allow nitrogen gas to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Replace the purging cylinder with the operating cylinder.

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); remove vacuum gauge and attach a vacuum line to the 1/4 inch pipe mounting for the vacuum gauge. If the Sealedaire equipment is as shown on I.L. 46-710-7 remove vacuum vent plug and seal with a pipe plug. If the equipment is as shown on I.L. 46-710-11, seal the open end of the relief valve with a rubber stopper or plug. Pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve and allow low pressure nitrogen to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device. Close sampling valve and remove nitrogen equipment. Replace standard vacuum gauge. Replace vacuum vent plug or remove rubber stopper.

Gas-oil Seal.

1. Assemble the transformer complete for operation (with the oil at the proper level); seal off the gas-oil seal compartment with the back-seating angle valve; attach a vacuum line to the gas sampling valve on the transformer; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve and allow low pressure nitrogen to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Reopen the back-seating angle valve. Allow enough nitrogen to flow into the lower gas space of the gas oil seal unit to force all the oil into the upper compartment (indicated by gas bubbling from the lower to the upper compartment). Close the sampling valve, and remove the nitrogen cylinder.

Transferring Oil from One Unit to Another. Where two units are being installed, they may be

piped together through their drain valves or lower filter press connections. Nitrogen pressure can then be used to force oil from the first unit into the second until the oil flows from the gas sampling valve (which must be left open before starting). This will leave less than one inch of gas space above the oil in the Sealedaire transformer. The oil can be forced back into the first unit with nitrogen pressure as mentioned above. Nitrogen pressure can then be added to the first unit with the connection between the tanks open until the oil in the two tanks is at the same level. The entire process is repeated after several hours.

When more than two units are being installed, they may be connected in series with the last unit connected to the first unit. Oil is forced from the first unit to the second unit, then to the third unit, etc. The procedure is the same as described in the previous paragraph and must also be repeated after several hours.

This method is applicable for Inertaire, Sealedaire and Gas-Oil Sealed units.

BLOWING OUT WITH NITROGEN

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a purging nitrogen cylinder; open the test valve on the pressure reducing unit; turn the shut-off valve to the mid-position (see Instruction Leaflet "Inertaire Equipment"); open the sampling valve and open the nitrogen cylinder valve. This permits the nitrogen to flow into the gas space, forcing the air out of the sampling valve. The nitrogen should be allowed to flow until the oxygen in the escaping gas is reduced to 3 percent.

2. Continue tests specified in Instruction Leaflet "Inertaire Equipment".

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); attach a nitrogen cylinder, with a pressure reducing unit, to the gas sampling valve on the Sealedaire Equipment.

2. Build up the pressure in the gas space until the pressure limiting valve opens. Disconnect the pressure hose and allow the gas to discharge through the sampling valve to the atmosphere.

3. Repeat this operation three times, allowing a few minutes at the full pressure each time for the nitrogen to diffuse through the gas space. After the third discharge, build up the pressure to that limited by the pressure limiting valve and then close the needle valve on the transformer.

4. Allow the unit to stand for a day and then discharge the pressure, and again build up to the maximum. After another day repeat this procedure and leave the unit with this pressure.

Gas-oil Sealed.

1. Assemble the transformer complete for operation (with the oil at the proper level); attach a nitrogen cylinder with a pressure reducing unit, to the gas sampling valve on the transformer; open the gas sampling valve in the lower gas space of the gas-oil seal compartment; and open the back-seating angle valve in the line between the transformer and compartment.

2. Allow the nitrogen to flow into the transformer gas space, to the lower gas space of the gas-oil seal compartment, and out through the sampling valve. The nitrogen should flow until the oxygen in the escaping gas is reduced to 3 percent.

3. Return valves to normal conditions, and remove nitrogen cylinder.

Note: For initial deoxygenation, or where the transformer oil has been open to the 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 percent as from 20 to 3 percent.

During shipment the oil may absorb oxygen which will be replaced slowly by the nitrogen. Thus the oxygen content of the gas space may actually increase after installation requiring additional purging.

Caution: If a manhole cover or handhole cover of an Inertaire, Sealedaire, or Gas Oil Sealed unit is removed, do not enter the transformer until the gas space has been opened to the atmosphere for several minutes, as the gas will not contain sufficient oxygen to sustain life.

PRESSURE REDUCING UNITS

The standard pressure reducing unit used on Inertaire equipment is the preferred device for delivering low pressure gas in the deoxygenation work. However, if it is not available a special fitting should be used to reduce the cylinder pressure to a few pounds-per-square-inch which is re-

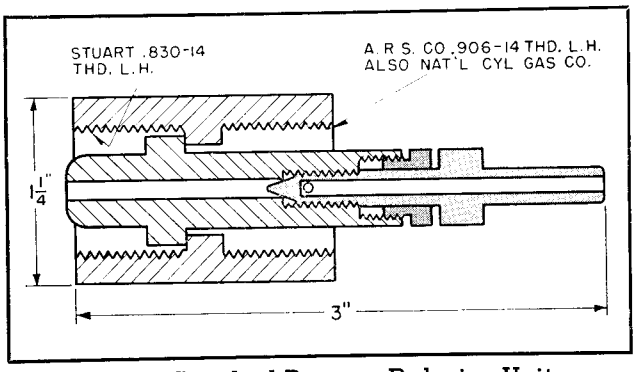

FIG. 1. Standard Pressure Reducing Unit.

quired for purging a gas space. This fitting, style number 1165 915, should be ordered from the Sharon Plant when required (see Fig. 1).

NITROGEN

The nitrogen used for purging oxygen from 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 percent by weight and impurity content less than 0.30 percent by volume should be used.

If the customer has chosen to purge the transformer he may order nitrogen from the supplier as Westinghouse nitrogen, P.D.S. 5622. **Do not use any other grade of nitrogen or any other gas.** Purging cylinders are the property of the nitrogen supplier and should be promptly returned since demurrage will be charged after 30 days.

Operating cylinders which are furnished with Inertaire equipment are the property of the customer. Nitrogen for these cylinders is covered by Westinghouse nitrogen P.D.S. 6306. Proper ordering information is contained in the Instruction Leaflet "Inertaire Equipment".

The following is a list of recommended nitrogen suppliers. Send orders and cylinders to the addresses 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 Gas 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 S. 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.
Betterdorf, 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.

LIST OF RECOMMENDED NITROGEN SUPPLIERS (Continued)

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 Trafficway
Kansas City 8, Mo.

Send cylinders to
1000 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
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or
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National Cylinder Gas Co.
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Memphis, Tenn.

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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

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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 Graves Street
Milwaukee 3, Wisconsin

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