UNITED FIRE SYSTEMS

NITROGEN N_2 PAC

SPRINKLER CORROSION INHIBITING SYSTEM

M SERIES

INSTALLATION, COMMISSIONING, AND MAINTENANCE MANUAL

Serial Number _____

Date of Installation _____ **Date of Commissioning** _____

UNITED Fire Systems

Division of UNITED Fire Protection Corporation

1 Mark Road

Kenilworth, NJ USA 07033

908-688-0300

www.unitedfiresystems.net

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LIST OF ABBREVIATIONS

The following is an explanation of abbreviations used in this manual.

ABBREVIATION	MEANING
A	Amperes (unit of electric current)
BC	Bolt Circle
CTA	Compressor / Tank Assembly
°F	Degrees Fahrenheit (unit of temperature)
FR	Filter / Regulator
H	Height
Hz	Hertz (unit of frequency – cycles per second)
in	Inches
L	Length
lbs.	Pounds (weight)
MIC	Microbiologically Influenced Corrosion
NA	N2 Analyzer
N2	Nitrogen (2 represents two atoms of nitrogen in a naturally-occurring diatomic molecule)
NFPA	National Fire Protection Association
NGM	Nitrogen Generator Module
NMD	Nitrogen Maintenance Device
NPT	National Pipe Thread - Tapered
NR	Nitrogen Receiver
OSHA	Occupational Safety and Health Administration
RD	Refrigerated Dryer
PSID	Pounds per Square Inch, Differential (unit of pressure difference)
PSIG	Pounds per Square Inch, Gauge (unit of pressure)
PVA	Purge Vent Assembly
SCFM	Standard Cubic Feet per Minute (unit of gas volumetric flow rate)
Sch.	Schedule (refers to standard expression of pipe wall thickness)
VAC	Volts, Alternating Current (unit of electromotive force)
v/v	Volume / volume (refers to concentration expressed as a volumetric ratio)
W	Width

SAFETY INFORMATION

This manual contains safety information that is important to know and understand. This information is provided for the safety of installers, operators, and users of the UNITED Fire Systems **NITROGEN-PAC™** equipment. Carefully read, understand, and follow instructions identified by these symbols.

 **DANGER** 

The use of the word “DANGER” identifies an immediate hazard with a likelihood of death or serious personal injury if instructions, including recommended precautions, are not followed.

 WARNING

The use of the word “WARNING” identifies the presence of hazards or unsafe practices that could result in death, personal injury, or serious property damage if instructions, including recommended precautions, are not followed.

 CAUTION

The use of the word “CAUTION” identifies possible hazards or unsafe practices that could result in personal injury or property damage if instructions, including recommended precautions, are not followed.

 IMPORTANT

The use of the word “IMPORTANT” identifies special instructions, not related to hazards, that should be followed.

IMPORTANT NOTICES TO INSTALLERS AND USERS

This manual must be read thoroughly and completely understood before installation and operation of UNITED Fire Systems **NITROGEN-PAC™** equipment. All appropriate safety standards for handling of gases as determined by local or national laws and regulations should be followed at all times.

WARNING

Do not operate unit if damage occurred during shipping, handling, or use. Contact UNITED Fire Systems immediately. Failure to do so could result in death, personal injury, or serious property damage.

General Safety Information

IMPORTANT

Read all of the safety information in this manual before operating this equipment. Use of the equipment in a manner not specified within this manual may impair the protection provided by the UNITED Fire Systems **NITROGEN-PAC™** equipment and could result in an unplanned release of pressure, which may cause serious injury or damage. Only competent personnel, who have been trained, qualified, and approved by UNITED Fire Systems should perform commissioning, servicing, and repair procedures.

When handling, installing, or operating this equipment, personnel must employ safe engineering practices and observe all related local regulations, health, and safety procedures, and legal requirements for safety.

Ensure that the equipment is depressurized and electrically isolated before carrying out any of the scheduled maintenance instructions specified in this manual.

Nitrogen is not a poisonous gas. However, in a concentrated form, there is a risk of asphyxiation. The Nitrogen Generator Module produces both a flow of nitrogen and a flow of oxygen enriched air which quickly disperses in the atmosphere. However, do not directly inhale the output gas from the outlet pipe.

The Nitrogen Generator Module is classified as non-hazardous for transportation purposes and as non-flammable for fire regulations. This equipment is for indoor use only. Do not operate outdoors.

WARNING

Do not connect Nitrogen Generator Module to compressed air sources that can exceed its maximum rated pressure. Failure to do so could cause rupture, leading to death, personal injury, or serious property damage.

Specific procedures must be followed for maintenance of the Nitrogen Generator Module and the equipment to which the module is connected. Appropriate labels must be continuously displayed in all areas where personnel might be exposed to a nitrogen atmosphere.

FOREWORD

This manual is written for those who install, operate and maintain UNITED Fire Systems **NITROGEN-PAC™** sprinkler corrosion inhibiting systems. The manual contains installation, operation, and maintenance information for these assemblies.

IMPORTANT

UNITED Fire Systems assumes no responsibility for the installation, operation, or maintenance of any systems other than those addressed in this manual. The data contained in this manual is for information purposes only. UNITED Fire Systems believes this data to be accurate at the time of publication, but the data is published and presented without any guarantee or warranty whatsoever. UNITED Fire Systems disclaims any liability for any use that may be made of the data and information contained in this manual by any and all parties.

IMPORTANT

The UNITED Fire Systems **NITROGEN-PAC™** sprinkler corrosion inhibiting system is a vital part of the fire protection of any facility where these units are installed. Life safety and property protection depends on continuing proper operation of the assembly. The owner of the **NITROGEN-PAC™** is responsible for the condition of the assembly and its continued proper operation. UNITED Fire Systems strongly recommends that all owners of **NITROGEN-PAC™** systems engage the services of qualified, trained fire protection professionals to design the system containing the assembly, and to install and maintain the assembly.

UNITED Fire Systems **NITROGEN-PAC™** sprinkler corrosion inhibiting systems are to be installed and maintained by qualified, trained personnel in accordance with:

- This Installation, Operation, and Maintenance Manual P/N 30-NPMIOM-000.
- National Fire Protection Association No. 13, “Standard for the Installation of Sprinkler Systems.”
- National Fire Protection Association No. 25, “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.”
- National Fire Protection Association No. 70, “National Electrical Code®”.

Any questions on the information in this manual should be addressed to:

UNITED Fire Systems
Division of United Fire Protection Corporation
1 Mark Road
Kenilworth, NJ USA 07033
908-688-0300
www.unitedfiresystems.net

LIMITED WARRANTY
NITROGEN-PAC™

What Does This Warranty Cover?
This warranty covers all manufacturing defects in material and workmanship in all equipment supplied for new **NITROGEN-PAC™** sprinkler corrosion inhibiting systems.

How Long Does The Coverage Last?
This warranty lasts for eighteen (18) months from the date of shipment to the original purchaser.

What Will UNITED Fire Systems Do?
UNITED Fire Systems will repair, replace, or refund the purchase price of, at its option, any defective **NITROGEN-PAC™** equipment at no charge.

What Does This Warranty Not Cover?
Equipment that is not properly installed and maintained per UNITED Fire Systems manual P/N 30-NPMIOM-000 is not covered. Equipment that has been repaired or tampered with not in accordance with the instructions in manual P/N 30-NPMIOM-000 is not covered. This warranty does not cover ordinary maintenance in accordance with manual P/N 30-NPMIOM-000. Transportation and shipping charges to return product to UNITED Fire Systems or for UNITED Fire Systems to ship repaired or replacement product are not covered. Also, consequential and incidental damages are not recoverable under this warranty. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply.

How Do You Obtain Service?
In order to eligible for service under this warranty, you must return the warranty registration form within 5 days of installation. If something goes wrong with your **NITROGEN-PAC™**, contact:

UNITED Fire Systems
Division of UNITED Fire Protection Corporation
1 Mark Road
Kenilworth, NJ USA 07033
908-688-0300
www.unitedfiresystems.net

Is This The Entire Warranty?
This limited warranty is the entire warranty given by UNITED Fire Systems to the purchaser of **NITROGEN-PAC™** equipment. There are no other warranties expressed or implied, beyond those required by law.

How Do State and Federal Laws Apply?
This warranty gives you specific legal rights per Federal law. You may also have other rights which vary from state to state.

1. GENERAL INFORMATION

1.1. GLOSSARY. All glossary terms are defined in reference to their use in this manual. Refer to this glossary for definitions of unfamiliar terms encountered when reading and using this manual.

1.1.1. Air. Air is the naturally occurring gas making up Earth's atmosphere. Air consists of a mixture of gases, of which two predominate (see the glossary terms Nitrogen and Oxygen).

1.1.2. Coalescing Filter. The coalescing filter used in **NITROGEN-PAC™** systems is located in the Nitrogen Generator Module. This filter separates oil from the dried compressed air, avoiding contamination of the separator membrane.

1.1.3. Compressed Air. Compressed air refers to the output of the **NITROGEN-PAC™** Compressor / Tank Assembly. This air has NOT been conditioned for entry into the Nitrogen Generator Module. The compressed air requires drying by the Refrigerated Dryer before entering the Nitrogen Generator Module.

1.1.4. Pressure Dew Point. The temperature at which the water vapor in a compressed gas at given pressure condenses into liquid water at the same rate at which it evaporates. At temperatures below the pressure dew point, liquid water will leave the gas. At temperatures above the pressure dew point, liquid water will be taken up by the gas.

1.1.5. Dried Compressed Air. Dried compressed air refers to the output of the **NITROGEN-PAC™** Refrigerated Dryer. This compressed air has been conditioned for entry into the Nitrogen Generator Module.

1.1.6. Microbiologically Influenced Corrosion (MIC). Microbiologically influenced corrosion (also known as MIC) occurs inside steel dry and preaction sprinkler pipes in the presence of certain microbes. This form of corrosion causes thinning of pipe walls, possibly leading to failure under water pressure. Pinhole leaks can occur, leading to water damage. Roughening of the internal pipe surface leads to unpredictable hydraulics, impairing the effectiveness of the sprinkler system. The tubercles formed by the microbes can loosen, clogging sprinkler heads and impairing or preventing the discharge of water onto a fire. MIC microbes can be aerobic, growing in the presence of oxygen, or anaerobic, not needing oxygen but growing in the presence of water. Prevention of MIC results in longer life and better functionality of the sprinkler system. MIC can be inhibited by using nitrogen to displace oxygen and dry out the inside of the pipe.

1.1.7. Nitrogen (N_2). Nitrogen is a naturally occurring diatomic gas present in Earth's atmosphere at a concentration of approximately 78% (v/v). All references to "nitrogen" in this manual are the output from the nitrogen outlet of the Nitrogen Generator Module. This outlet delivers gas that is at least 98 percent (v/v) nitrogen, at a pressure dew point of approximately -40°F. The pressure dew point of nitrogen is much lower than of compressed air, making nitrogen much more effective at drying out the inside of a sprinkler pipe.

1.1.8. Oxidation Corrosion. Oxidation corrosion (also known as rust) occurs inside steel dry and preaction sprinkler pipes in the presence of oxygen and water. This form of corrosion causes thinning of pipe walls, possibly leading to failure under water pressure. Pinhole leaks can occur, leading to water damage. Roughening of the internal pipe surface leads to unpredictable hydraulics, impairing the effectiveness of the sprinkler system. Loose rust particles can clog sprinkler heads, impairing or preventing the discharge of water onto a fire. Prevention of oxidation corrosion results in longer life and better functionality of the sprinkler system. Oxidation corrosion can be inhibited by using nitrogen to displace oxygen and dry out the inside of the pipe.

1.1.9. Oxygen (O_2). Oxygen is a naturally occurring diatomic gas present in Earth's atmosphere at a concentration of approximately 21% (v/v). Oxygen is discharged from the Nitrogen Generator Module after being separated from dried compressed air by the separator membrane.

1.1.10. Particulate Filter. The particulate filter used in **NITROGEN-PAC™** systems is located in the Nitrogen Generator Module. This filter separates particulate matter from the dried compressed air stream, avoiding contamination of the separator membrane.

1.1.11. Purging. Because of its low dew point, the nitrogen introduced into the sprinkler piping by the **NITROGEN-PAC™** system absorbs liquid water. To ensure complete drying of the pipe interior, saturated nitrogen within the pipe must be replaced by dry nitrogen. Purging ensures that this process occurs. Purge devices can be used to manually exhaust saturated nitrogen.

1.1.12. Separator Membrane. When dried compressed air is supplied to the separator membrane in the **NITROGEN-PAC™** Nitrogen Generator Module, the smaller oxygen and other gas molecules permeate through the walls of hollow fiber membranes. The larger nitrogen molecules flow through the fibers and exit through the ends of the fibers.

1.2. SYSTEM PURPOSE. The United Fire Systems **NITROGEN-PAC™** M Series Sprinkler Corrosion Inhibiting System is a fully integrated nitrogen generating system designed to introduce high-purity nitrogen into preaction or dry sprinkler piping. **NITROGEN-PAC™** replaces the existing air compressor, providing the necessary supervisory pressure in the form of nitrogen instead of air. **NITROGEN-PAC™** occupies minimal space, operates quietly, and can be installed near the sprinkler system riser(s).

The interior of preaction and dry sprinkler piping is subject to corrosion, which can lead to clogged sprinkler heads, leaks, and pipe failure. This corrosion can be of two distinct types. Oxidation corrosion takes place in the presence of oxygen, and is accelerated by the presence of water. Microbiologically influenced corrosion (MIC) takes place in the presence of certain microbes that attack metal, again in the presence of water and in many cases oxygen. Reducing the damaging effects of corrosion is best accomplished by greatly reducing or eliminating the amount of water and oxygen left in the pipe. Ordinary air compressors used to provide supervisory pressure keep the oxygen concentration inside the pipe the same as normal air – ideal for oxidation corrosion to take place. Ordinary compressors also do not dry the air – residual water from system testing remains in low points, and moist air can actually increase standing water within pipes from condensation. The introduction of high-purity dry nitrogen with a low dew point reduces or eliminates these two problems. The interior of the pipe remains dry, with very little oxygen remaining to attack the metal.

DANGER

Rapid release of nitrogen gas into an enclosed space displaces oxygen and can cause an asphyxiation hazard. Inhalation of nitrogen in increased concentration can result in unconsciousness and asphyxiation without warning. All areas containing nitrogen system equipment MUST be adequately ventilated. All nitrogen gas leaks discovered during installation, commissioning, and maintenance of M Series nitrogen generating equipment MUST be corrected promptly. Failure to comply can result in death or serious personal injury.

1.3. FUNCTIONAL DESCRIPTION. Refer to Figure 1.

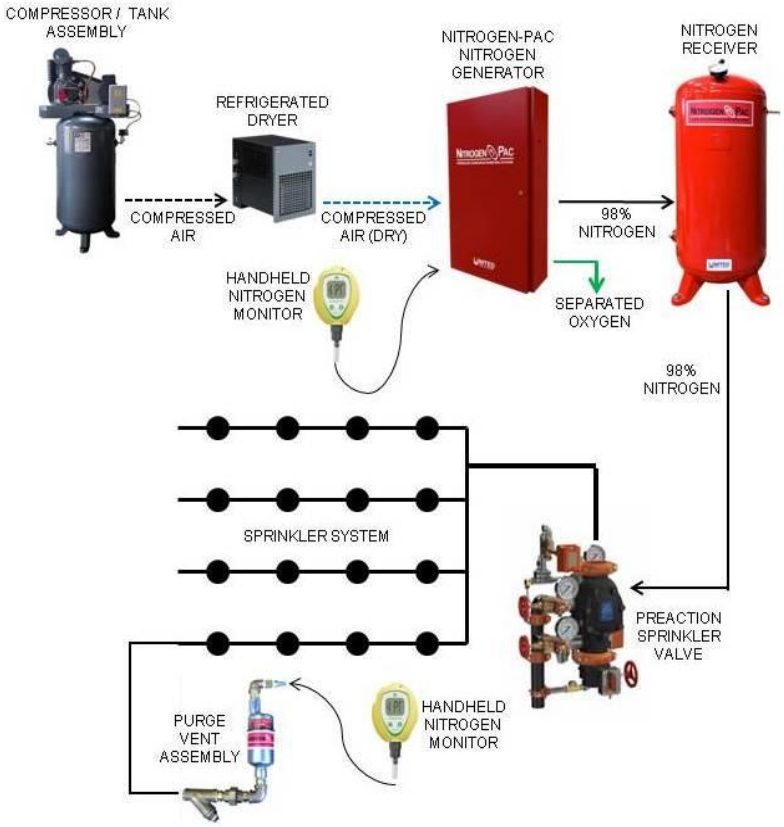


Figure 1 – Functional Description

A. The compressor on the Compressor / Tank Assembly compresses atmospheric air for storage in the tank. Typically, the pressure is 100 – 175 PSIG.
B. The regulator on the outlet of the Compressor / Tank Assembly reduces the compressed air pressure to approximately the design value.
C. The compressed air enters the Refrigerated Dryer.
D. Dried compressed air leaves the Refrigerated Dryer and enters the Nitrogen Generator Module.
E. Coalescing and particulate filters in the Nitrogen Generator Module remove oil and particulate matter from the dried compressed air.
F. The separator membrane in the Nitrogen Generator Module separates oxygen from the dried compressed air. The 98% pure nitrogen is piped to the Nitrogen Receiver Assembly. The separated oxygen is vented to the interior of the module cabinet, and openings in the cabinet release this oxygen back into the atmosphere.
G. The Nitrogen Receiver Assembly stores nitrogen for use in the sprinkler piping.
H. Nitrogen is provided to the sprinkler system valve trim through a Nitrogen Maintenance Device (not shown).
J. Air is gradually displaced by nitrogen as air leaves through the Purge Vent Assembly.
K. Even when 98% pure nitrogen is established in the sprinkler pipe, purging can continue to allow the dry nitrogen to remove the water.

1.4. COMPONENT DESCRIPTIONS.

1.4.1. Compressor / Tank Assemblies. A compressor / tank assembly consists of a compressor assembled to a steel tank acting as an air reservoir. The assembly can provide air for 30 minute fill of dry sprinkler piping per NFPA 13, and supplies compressed air for the production of nitrogen. The assembly is equipped with an isolation valve, particulate filter, and pressure regulator.

1.4.1.1. Models. Refer to **NITROGEN-PAC™** M Series Design Manual P/N 30-NPMDEM-000 for information on choosing the proper compressor / tank assembly for the application. The model numbers of the assemblies are coded as follows:

CTA – XXX(X) – XX – XXX – X

- **CTA** – Codes Compressor / Tank Assembly
- **XXX(X)** – Codes Motor Horsepower
  - 150 = 1.5 HP
  - 200 = 2 HP
  - 300 = 3 HP
  - 500 = 5 HP
  - 750 = 7.5HP
  - 1000 = 10 HP
- **XX** – Codes Tank Capacity
  - 30 = 30 Gallons
  - 60 = 60 Gallons
  - 80 = 80 Gallons
- **XXX** – Codes Power Supply Voltage
  - 208 = 208 VAC
  - 230 = 230 VAC
  - 460 = 460 VAC
- **X** – Codes Power Supply Phase(s)
  - 1 = Single Phase
  - 3 = Three Phase

IMPORTANT – Not every combination of codes is available. Refer to Tables 5 and 6 for available compressor / tank assemblies.

Figure 2 – Compressor / Tank Assembly - Vertical (Typical)

Figure 3 – Compressor / Tank Assembly – Horizontal (Typical)

1.4.2. Refrigerated Dryer. The refrigerated dryer removes moisture from compressed air from the Compressor / Tank Assembly, creating dried compressed air suitable for the operating characteristics of the separator membrane within the Nitrogen Generator Module. Drying the compressed air is also important for generating nitrogen with a pressure dew point low enough for effective drying of the inside of the sprinkler pipe.

1.4.2.1. Principle of Operation. Refer to Figure 4. Warm, saturated air is pre-cooled by the air-to-air heat exchanger (12) before moving to the evaporator (5) where it is cooled by refrigerant being controlled by a hot gas bypass valve (4). Water vapor condenses into a liquid and is removed by a moisture separator (11), for removal through the automatic condensate drain (10). The cold, dry air is re-warmed as it passes back through the air-to-air heat exchanger (12), preventing condensation on downstream piping. The condenser (2) re-condenses the vaporized refrigerant.

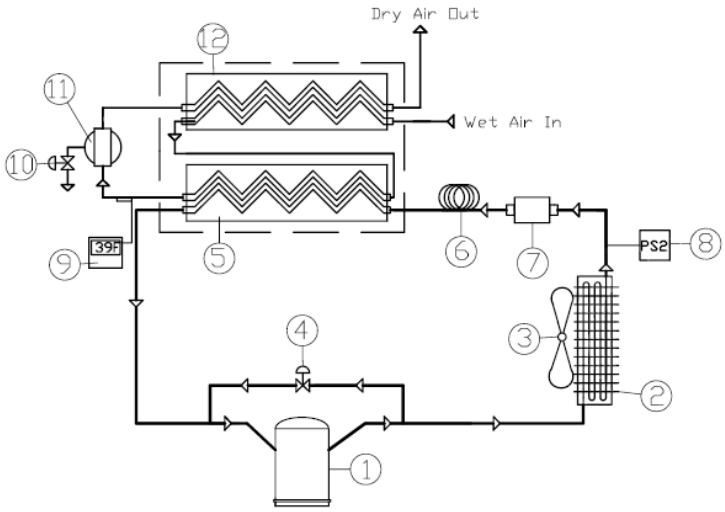


DIAGRAM LEGEND	
1 – Compressor	7 – Refrigerant Filter / Dryer
2 – Condenser	8 – Fan Cycling Switch
3 – Fan	9 – Dew Point Indicator
4 – Hot Gas Bypass Valve	10 – Automatic Condensate Drain
5 - Evaporator	11 – Moisture Separator
6 – Expansion Device	12 – Air-to-Air Heat Exchanger

Figure 4 – Refrigerated Dryer – Schematic Diagram

1.4.2.2. Models. Refer to **NITROGEN-PAC™** M Series Design Manual P/N 30-NPMDEM-000 for information on choosing the proper refrigerated dryer for the application. The model numbers of the refrigerated dryers are coded as follows:

RD – XX – XXX – 1

- RD: Codes Refrigerated Dryer
- XX: Codes Rated Capacity
  - 10 = 10 SCFM
  - 20 = 25 SCFM
  - 25 = 25 SCFM
  - 40 = 40 SCFM
  - 55 = 55 SCFM
- XXX: Codes Power Supply Voltage
  - 110 = 110 VAC
  - 220 = 220 VAC
- 1: Codes Single Phase Power

Figure 5 – Refrigerated Dryer
(Typical)

1.4.3. NITROGEN-PAC™ Nitrogen Generator Module. The Nitrogen Generator Module is the heart of the **NITROGEN-PAC™** modular sprinkler corrosion inhibiting system. The module contains the membrane that separates nitrogen from compressed air. Also included are coalescing and particulate filters which prolong the life of the membrane, and valves for operation of the module

1.4.3.1. Particulate and Coalescing Filters. Each filter has a rugged cast aluminum housing and a filter element constructed with a stainless steel support core and high performance filter media. A filter element comes pre-installed into each housing. The filter elements are easy to replace. The particulate and coalescing filters are factory installed inside the **NITROGEN-PAC™** M Series nitrogen generator. Compressed air enters the inlet port of the filter and passes through the single filter element. In the coalescing filter, air flows from the inside to the outside of the element. In the particulate filter, air flows from the outside of the element to the inside. Clean air exits the opposite side of the filter.

1.4.3.2. Membrane Technology. A membrane is a selective barrier, allowing gases to move through the membrane at different rates. A helium-filled balloon is an example of a membrane - helium passes through pores in the balloon over time, causing the balloon to deflate. The membrane separator used in the **NITROGEN-PAC™** Nitrogen Generator Module work on a similar principle, involving the permeation of gases through a polymer membrane fiber. The membrane separator contains thousands of fibers installed into a housing shell which is made from ABS plastic. Dried compressed air is fed into the separator, forcing the gas down the bores of the hollow fibers. Nitrogen molecules can't pass quickly through the fibers, so they concentrate as they travel down the length of the separator and exit the separator under pressure. Oxygen and other gas molecules quickly permeate through the wall of the hollow fibers and exit through a different port.

1.4.3.3. Bypass Valves. Valves accessible when the Nitrogen Generator Module cover is open allow bypassing of the filters and membrane. This facilitates the "fast-fill" of the sprinkler system piping with compressed air, as required by NFPA 13.

WARNING

The Nitrogen Generator Module (NGM) creates a 30% to 40% oxygen concentration exhaust that may present a flammability hazard. Ensure the NGM is NOT located in an area where and oxygen-enriched atmosphere will be a hazard. Failure to comply with this warning can result in increased risk from fire, including death, serious personal injury and property damage.

IMPORTANT

Adequate ventilation is important for the Nitrogen Generator Module (NGM). While natural ventilation or existing openings may be adequate, consideration should be given to providing additional ventilation when locating the NGM in a closet or other small space. A louvered door or 1-1/2 inch gap between the door and floor should be sufficient. Check with the owner and local codes before modifying any door.

1.4.3.4. Models. Refer to **NITROGEN-PAC™** M Series Design Manual P/N 30-NPMDEM-000 for information on choosing the proper nitrogen generator module for the application. The model numbers of the nitrogen generator modules are coded as follows:

NGM - X

- **NGM** — Codes Nitrogen Generator Module
- **X** — Codes Specific Model
  - S = Small
  - M = Medium
  - L = Large
  - (NOTE: Code refers to system size, not enclosure size.)

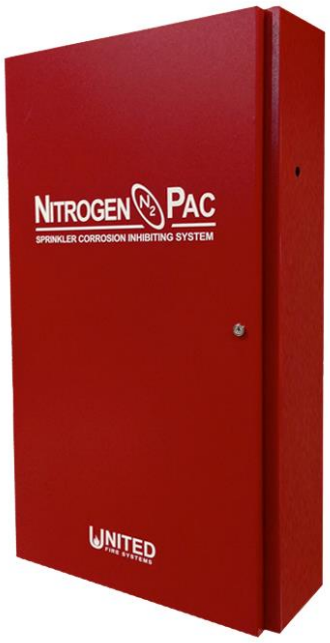


Figure 6 – Nitrogen Generator Module (Typical)
(Shown with door closed)

1.4.4. Nitrogen Receiver. The Nitrogen Receiver is vertical steel tank for receiving and storing nitrogen from a **NITROGEN-PAC™** M Series sprinkler corrosion inhibiting system nitrogen generator module. The receiver is free-standing, with integral mounting feet, and is intended to be fastened to the surface upon which it rests. The receiver is equipped with a pressure gauge and safety relief valve.

1.4.4.1. Models. Refer to **NITROGEN-PAC™** M Series Design Manual P/N 30-NPMDEM-000 for information on choosing the proper nitrogen receiver for the application. The model numbers of the nitrogen receivers are coded as follows:

NR - XX

Codes Nitrogen Receiver

Codes Receiver Capacity
30 = 30 Gallons
60 = 60 Gallons
80 = 80 Gallons

Figure 7 – Nitrogen Receiver
(Typical)

1.4.5. Purge Vent Assembly – Fixed Orifice Model PVA-1. This device purges gas from the interior of the sprinkler pipe, allowing the **NITROGEN-PAC™** system to replace air with nitrogen, and also allowing nitrogen to remove liquid water from inside the pipe. This assembly can be connected to the sprinkler piping in the vicinity of the inspector's test connection or near the sprinkler valve. A float valve prevents the escape of water when the preaction valve opens and the sprinkler piping fills with water. A fixed orifice regulates the amount of gas leaving the pipe. The purge vent also serves as a connection point for an N2 Purity Analyzer – Hand-Held Model NA-1 to assess the percent of nitrogen in the pipe.

Figure 8 – Purge Vent Assembly – Fixed Orifice
Model PVA-1

1.4.6. N2 Purity Analyzer – Hand-Held Model NA-1. The N2 Purity Analyzer is a hand held device designed to permit manual monitoring of the percent nitrogen at either a **NITROGEN-PAC™** purge vent or at the system's nitrogen generator module. Occasional monitoring at the nitrogen generator provides assurance that the generator is performing as intended. Monitoring at the system's purge vent(s) provides assurance that 98% nitrogen is present, and air has been expelled. The Model NA-1 analyzer is hand-held, battery operated, and contains a large, 3-digit display directly reading the percent nitrogen when attached to a sampling point. The analyzer is equipped with a length of flexible tubing and half of a quick-connect, compatible with both the sampling point on the nitrogen generator and on the purge vent(s).

Figure 9 – N2 Purity Analyzer – Hand-Held
Model NA-1

1.4.7. Nitrogen Maintenance Device Model AMD-1. The Nitrogen / Air Maintenance Device is a device designed to automatically regulate and maintain the flow of nitrogen or air from a **NITROGEN-PAC™** system into dry or preaction sprinkler pipe. The nitrogen pressure flows through a regulator so that upon activation of a sprinkler head, the nitrogen pressure will not interfere with the operation of the sprinkler valve or lengthen the time until the piping fills with water. Shutoff and bypass ball valves are provided to permit "fast-fill" of the pipe with air, in accordance with the NFPA 13 mandated time requirement of 30 minutes or less. A "Y" strainer protects the regulator from particulate matter.

Figure 10 – Nitrogen Maintenance Device
Model AMD-1

2. INSTALLATION

DANGER

Rapid release of nitrogen gas into an enclosed space displaces oxygen and can cause an asphyxiation hazard. Inhalation of nitrogen in increased concentration can result in unconsciousness and asphyxiation without warning. All areas containing nitrogen system equipment MUST be adequately ventilated. All nitrogen gas leaks discovered during installation, commissioning, and maintenance of M Series nitrogen generating equipment MUST be corrected promptly. Failure to comply can result in death or serious personal injury.

2.1. Unpacking. Check shipment of the United Fire Systems **NITROGEN-PAC™** system packaging and equipment for damage. If there is any damage or missing parts, the transportation company's agent should make a notation to the effect on the Bill of Lading. Claims should be settled directly with the transportation company. Verify that all parts were received in the shipment as ordered. Contact the factory immediately if there are any missing parts or discrepancies.

CAUTION

Understand and follow all safety recommendations when moving heavy pieces of equipment. Equipment may be easily tipped over when moving. Failure to use caution can result in equipment damage and personal injury.

2.2. Equipment Locations. Due consideration must be given to all of the following considerations when locating equipment.

2.2.1. Engineering Drawings (if available). If a survey was conducted, and engineering drawings prepared, locate all equipment per these drawings.

2.2.2. Proximity. **NITROGEN-PAC™** equipment should be installed in reasonably close proximity to the system riser(s) being protected. The most logical location is in the same sprinkler room as the riser(s). If necessary, the equipment may be installed remotely. Documentation and signage should be clear to identify which equipment in remote locations is connected together.

2.2.3. Weight. Carefully check the applicable tables for the weight of each piece of equipment. Ensure that the mounting surface, whether horizontal or vertical, is capable of supporting the weight, with a clear safety margin. Consult a structural engineer when necessary to verify suitability of locations.

2.2.4. Noise. Motor-operated **NITROGEN-PAC™** equipment (Compressor / Tank Assemblies and Refrigerated Dryers) do emit noise when running. Consideration should be given to locating equipment where normal operating noise does not interfere with building operations.

2.2.5. Clearance. Sufficient clearance should be available after installation for maintenance operations to take place on equipment. Leave at least (3) feet of clearance for personnel to access equipment for maintenance. The **NITROGEN-PAC™** Nitrogen Generator Module has a hinged door. Allow sufficient clearance for the door to be swung completely open.

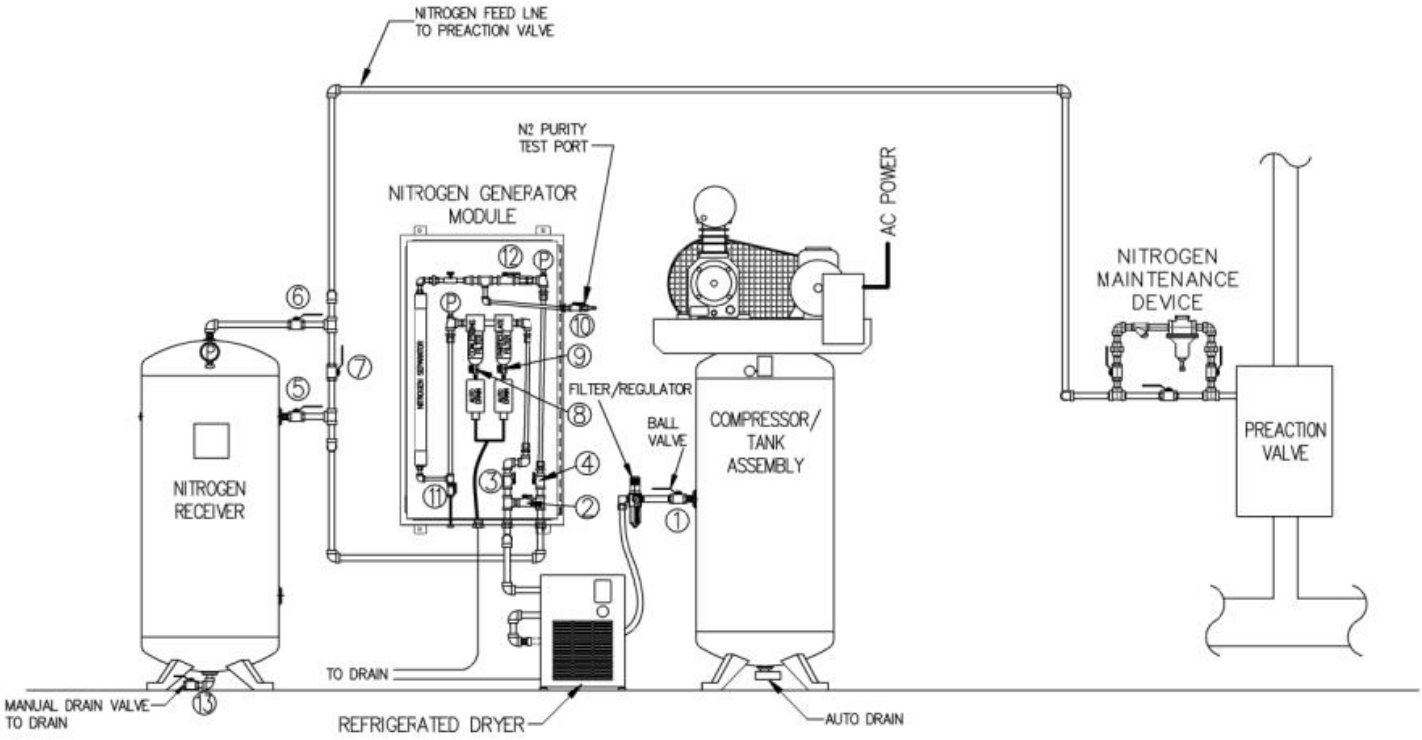


Figure 11 – NITROGEN-PAC M Series
General Installation Arrangement

2.3. Compressor / Tank Assembly. The Compressor / Tank Assembly is shipped directly from the manufacturer. Installation Kits for each assembly are shipped from UNITED Fire Systems. Before proceeding, ensure that all Compressor / Tank Assemblies and all Installation Kits have been received, and are matched up properly with each other. The Compressor / Tank Assembly is factory-packaged to protect against shipping damage. Upon unpacking, inspect for damage or missing parts. If there is any damage or missing parts, the transportation company's agent should make a notation to the effect on the Bill of Lading. Claims should be settled directly with the transportation company.

2.3.1. Installation Kit. The Installation Kit contains the items necessary to complete the installation of the Compressor / Tank Assembly. There are two Installation Kits. Refer to Table 1 for the proper Installation Kit to be used with each Compressor / Tank Assembly. Refer to Table 2 for the contents of the Installation Kits. Follow the instructions on the Instruction Sheet provided with each Installation Kit to accomplish the installation. NOTE: Each specific Installation Kit contains a serial number nameplate with a unique serial number assigned by UNITED Fire Systems. Ensure that the proper serial number is applied to each Compressor / Tank Assembly.

Compressor / Tank Assembly	Installation Kit
CTA-150-30-XXX-X	30-500500-200
CTA-200-60-XXX-X	30-500500-100
CTA-300-60-XXX-X	30-500500-100
CTA-500-60-XXX-X	30-500500-100
CTA-750-80-XXX-X	30-500500-100
CTA-1000-80-XXX-X	30-500500-100

Table 1 – Installation Kits To Be Used for
Compressor / Tank Assemblies

Qty.	Description
1	Filter / Regulator Assembly
1	Hose, 1/2 Inch NPT-Male x JIC-37 Swivel
1	Tie Marker Flag with “1”
1	Decal, “United Fire Systems’
1	Decal, NITROGEN-PAC Logo
1	Nameplate, Serial Number
1	Alcohol Wipe
1	Sheet, Filter / Regulator Instructions
1	Sheet, Instructions for Installation Kit

Table 2 – Contents of Installation Kits

2.3.2. Manufacturer Information. Before installing the Compressor / Tank Assembly, read this section and applicable Appendix in their entirety.

UFS Model No.	Manufacturer’s Assembly Model No.	Manufacturer’s Pump (Compressor) Model No.	Applicable Appendix
CTA-150-30-XXX-X	VT-DMT-404	D-412	A
CTA-200-60-XXX-X	VT-720-60	703	D
CTA-300-60-XXX-X	VT-730-60	705	D
CTA-500-60-XXX-X	VT-735-80	705	D
CTA-750-80-XXX-X	745-80	707	D
CTA-1000-80-XXX-X	755-80	707	D

Table 3 – Compressor / Tank Assemblies – Manufacturer’s Identification and Applicable Appendix

DANGER

OSHA requires installation of a totally enclosed belt guard covering the motor pulley, belts and flywheel of the compressor. Each compressor provided as part of a **NITROGEN-PAC™** Compressor / Tank Assembly is equipped with such a guard. DO NOT operate the compressor unless the guard is properly secured in place! Failure to comply with this instruction can result in death or serious personal injury.

WARNING

The applicable Appendix contains warnings which must be read, understood, and followed when installing and operating the **NITROGEN-PAC™** Compressor / Tank Assembly. Failure to read, understand, and follow these warnings could result in death, serious personal injury, or property damage.

2.3.3. Location. Locate Compressor / Tank Assembly in location to be mounted. Follow instructions in applicable Appendix regarding installation location. If there is inadequate room in one location for all **NITROGEN-PAC™** components, the Compressor / Tank Assembly may be located remotely, with pipe connecting the Compressor / Tank Assembly to the Refrigerated Dryer.

2.3.4. Mounting. The Compressor / Tank Assembly does not require fastening to the floor surface. In fact, improperly installed fasteners can result in cracking and failure of the feet. The weight of the assembly should be sufficient to hold it in place. If the assembly is properly leveled, movement should not occur.

2.3.4.1. On level concrete slab: Place Compressor / Tank Assembly in its final location. No further fastening is required.

2.3.4.2. On uneven concrete slab: Place Compressor / Tank Assembly in its final location. Use shims under feet to make the unit level. No further fastening is required.

2.3.4.3. On precast concrete floors, or similar floor systems that transmit vibrations: Place Compressor / Tank Assembly in its final location. Use vibration mounts under each foot. Vibration mounts similar to Grainger Stock No. 4C977 should be adequate.

2.3.4.4. If the assembly does move from its original location due to vibration, the installation of stud anchors can be considered. The use of nuts on the stud anchors should not be necessary. If nuts are used, INSTALL HAND-TIGHT ONLY. Damage to tank feet will occur if anchor nuts are used and are over-tightened.

Model No.	Length (L) inches	Width (W) inches	Height (H) inches	Base Bolt Square or Base Bolt Rectangle (in x in)
CTA-150-30-XXX-X	25	21	53	20-3/4 x 20-3/4
CTA-200-60-XXX-X	34	26	74	23 x 23
CTA-300-60-XXX-X	34	26	74	23 x 23
CTA-500-60-XXX-X	34	29	74	25-1/2 x 25-1/2
CTA-750-80-XXX-X	63	21	47	40 x 19
CTA-1000-80-XXX-X	63	21	47	40 x 19

Table 4 – Compressor / Tank Assemblies - Dimensions

Model No.	Tank Capacity (Gallons)	Compressor Stage(s)	Max Outlet Pressure (PSIG)	Capacity (CFM Delivered @ PSIG)	Outlet Size (NPT)	Weight (lbs.)
CTA-150-30-208-1	30	Single	150	5.9 @ 100	1/2”	225
CTA-150-30-230-1	30	Single	150	5.9 @ 100	1/2”	225
CTA-150-30-208-3	30	Single	150	5.9 @ 100	1/2”	225
CTA-150-30-230-3	30	Single	150	5.9 @ 100	1/2”	225
CTA-150-30-460-3	30	Single	150	5.9 @ 100	1/2”	225
CTA-200-60-208-1	60	Two	175	7.5 @ 175	1/2”	543
CTA-200-60-230-1	60	Two	175	7.5 @ 175	1/2”	543
CTA-200-60-208-3	60	Two	175	7.5 @ 175	1/2”	543
CTA-200-60-230-3	60	Two	175	7.5 @ 175	1/2”	543
CTA-200-60-460-3	60	Two	175	7.5 @ 175	1/2”	543
CTA-300-60-208-1	60	Two	175	11.1 @ 175	1/2”	565
CTA-300-60-230-1	60	Two	175	11.1 @ 175	1/2”	565
CTA-300-60-208-3	60	Two	175	11.1 @ 175	1/2”	565
CTA-300-60-230-3	60	Two	175	11.1 @ 175	1/2”	565
CTA-300-60-460-3	60	Two	175	11.1 @ 175	1/2”	565
CTA-500-60-208-1	60	Two	175	17.3 @ 175	1/2”	648
CTA-500-60-230-1	60	Two	175	17.3 @ 175	1/2”	648
CTA-500-60-208-3	60	Two	175	17.3 @ 175	1/2”	648
CTA-500-60-230-3	60	Two	175	17.3 @ 175	1/2”	648
CTA-500-60-460-3	60	Two	175	17.3 @ 175	1/2”	648
CTA-750-80-208-1	80	Two	175	26.9 @ 175	1/2”	729
CTA-750-80-230-1	80	Two	175	26.9 @ 175	1/2”	729
CTA-750-80-208-3	80	Two	175	26.9 @ 175	1/2”	729
CTA-750-80-230-3	80	Two	175	26.9 @ 175	1/2”	729
CTA-750-80-460-3	80	Two	175	26.9 @ 175	1/2”	729
CTA-1000-80-208-3	80	Two	175	34.4 @ 175	1/2”	749
CTA-1000-80-230-3	80	Two	175	34.4 @ 175	1/2”	749
CTA-1000-80-460-3	80	Two	175	34.4 @ 175	1/2”	749

Table 5 – Compressor / Tank Assemblies – Tank and Compressor Specifications

2.3.5. Assembly. See 2.3.1. Follow instructions packed with Installation Kit to complete assembly.

2.3.6. Lubrication. Check that crankcase of compressor is filled with lubricant. If necessary, add lubricant to the crankcase as instructed in Appendix A or D, as applicable.

CAUTION

The crankcase of the compressor MUST be properly filled with lubricant before operation. Failure to follow this instruction will result in severe damage to the compressor.

2.3.7. Electrical Installation.

Model No.	Motor Voltage (V)	Frequency (Hz)	Phase	Current (A)	Horsepower (HP)
CTA-150-30-208-1	208	60	1	11.0	1.5
CTA-150-30-230-1	230	60	1	10.5	1.5
CTA-150-30-208-3	208	60	3	4.5	1.5
CTA-150-30-230-3	230	60	3	4.4	1.5
CTA-150-30-460-3	460	60	3	2.2	1.5
CTA-200-60-208-1	208	60	1	16.8	2
CTA-200-60-230-1	230	60	1	16.0	2
CTA-200-60-208-3	208	60	3	8.5	2
CTA-200-60-230-3	230	60	3	8.4	2
CTA-200-60-460-3	460	60	3	4.2	2
CTA-300-60-208-1	208	60	1	16.8	3
CTA-300-60-230-1	230	60	1	16.0	3
CTA-300-60-208-3	208	60	3	8.5	3
CTA-300-60-230-3	230	60	3	8.4	3
CTA-300-60-460-3	460	60	3	4.2	3
CTA-500-60-208-1	208	60	1	22.7	5
CTA-500-60-230-1	230	60	1	20.6	5
CTA-500-60-208-3	208	60	3	14.0	5
CTA-500-60-230-3	230	60	3	13.2	5
CTA-500-60-460-3	460	60	3	6.6	5
CTA-750-80-208-1	208	60	1	33.0	7.5
CTA-750-80-230-1	230	60	1	31.0	7.5
CTA-750-80-208-3	208	60	3	20.4	7.5
CTA-750-80-230-3	230	60	3	19.4	7.5
CTA-750-80-460-3	460	60	3	9.7	7.5
CTA-1000-80-208-3	208	60	3	26.0	10
CTA-1000-80-230-3	230	60	3	25.0	10
CTA-1000-80-460-3	460	60	3	12.5	10

Table 6 – Compressor / Tank Assemblies – Motor Specifications


DANGER


RISK OF ELECTROCUTION

Voltages and currents associated with Compressor / Tank Assemblies are **LETHAL**. Follow all instructions provided. Work involving Compressor / Tank Assembly power MUST be performed ONLY by qualified individuals. All required precautions to prevent contact with live electrical conductors and equipment MUST be taken. Failure to comply with these instructions is an immediate hazard with a likelihood of death or serious personal injury!

2.3.7.1. Codes. All compressor wiring and wiring methods shall be in strict compliance with NEC and local codes.

2.3.7.2. Personnel. All wiring shall be performed by a licensed electrician.

2.3.7.3. Electrical Disconnect Switch. For safety and convenience during maintenance, UNITED Fire Systems recommends the installation of a dedicated electrical disconnect switch for each Compressor / Tank Assembly motor.

2.3.7.4. Wiring Diagrams. Figures 12 and 13 are the wiring diagrams for single-phase and three-phase assemblies.

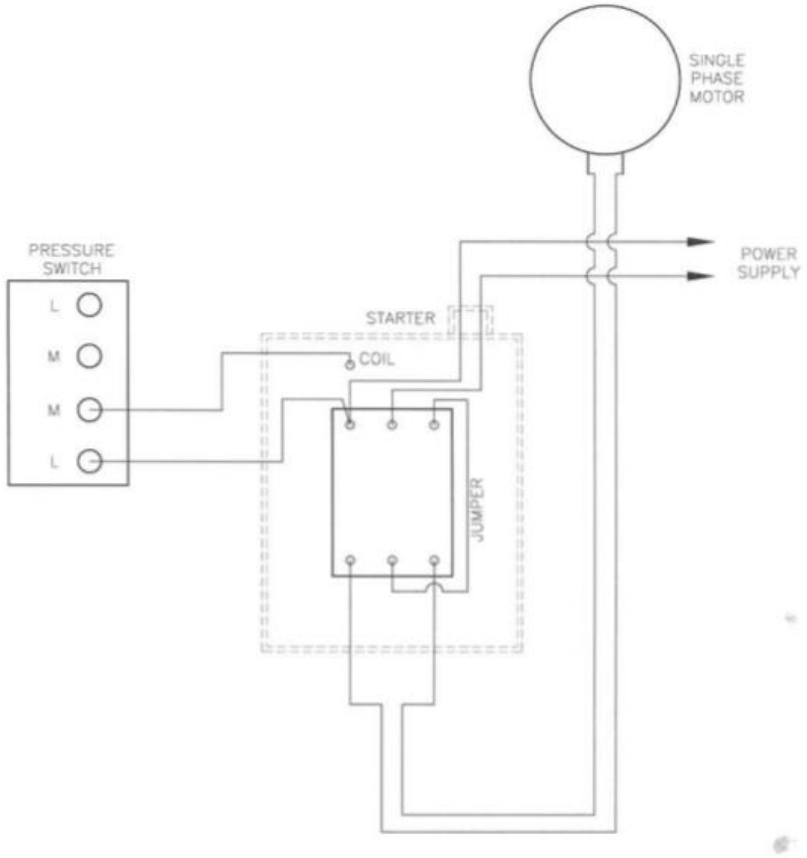


Figure 12 - Wiring Diagram – Compressor / Tank Assemblies Single Phase

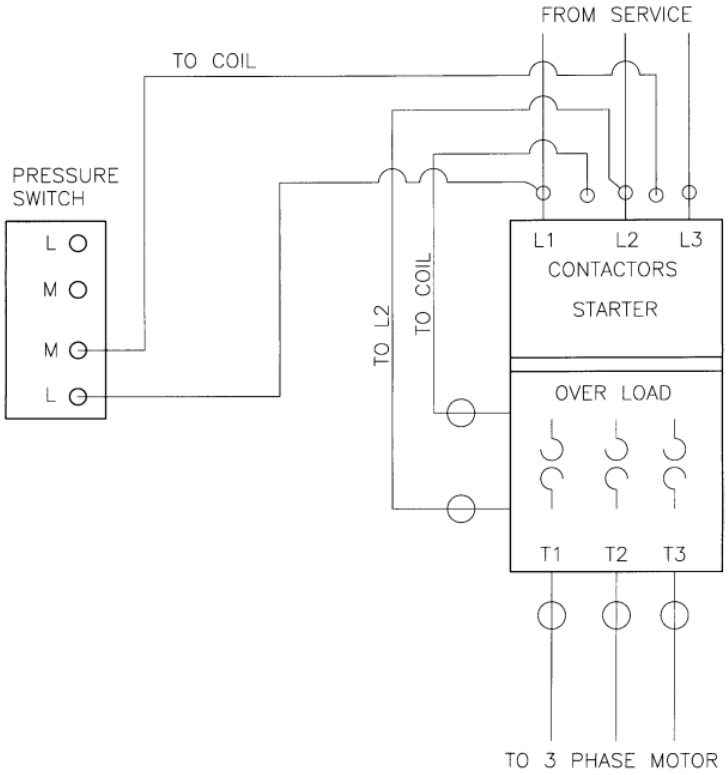


Figure 13 – Wiring Diagram – Compressor / Tank Assemblies Three Phase

2.4. Refrigerated Dryer. The Refrigerated Dryer is shipped as a complete assembly from UNITED Fire Systems.

2.4.1. Manufacturer Information. Before installing the Refrigerated Dryer, read this section and Appendix G in their entirety.

IMPORTANT
During unpacking and installation, DO NOT tip the Refrigerated Dryer on its side, or turn it upside-down.

2.4.2. Location. Locate Refrigerated Dryer in permanent installation location. Follow recommendations in Appendix G for clearances.

Model No.	Length (L) inches	Width (W) Inches)	Height (H) inches
RD-10-115-1	13	15	11
RD-10-220-1	13	15	11
RD-20-115-1	17	12	20
RD-20-220-1	17	12	20
RD-25-115-1	17	12	20
RD-25-220-1	17	12	20
RD-40-115-1	17	12	20
RD-40-220-1	17	12	20
RD-55-115-1	17	12	20
RD-55-220-1	17	12	20

Table 7 – Refrigerated Dryers - Dimensions

Model No.	Rated Capacity* (SCFM)**	Pressure Drop* (PSID)***	Min / Max Air Inlet Pressure (PSIG)	Max Air Inlet Temperature (°F)	Min / Max Ambient Temperature (°F)	Inlet / Outlet Size (NPT)	Weight (lbs.)
RD-10-115-1	10	1.4	20 / 230	180	45 / 110	3/8” / 3/8”	77
RD-10-220-1	10	1.4	20 / 230	180	45 / 110	3/8” / 3/8”	77
RD-20-115-1	20	1.6	20 / 230	180	45 / 110	1/2” / 1/2”	80
RD-20-220-1	20	1.6	20 / 230	180	45 / 110	1/2” / 1/2”	80
RD-25-115-1	25	1.75	20 / 230	180	45 / 110	1/2” / 1/2”	85
RD-25-220-1	25	1.75	20 / 230	180	45 / 110	1/2” / 1/2”	85
RD-40-115-1	40	1.75	20 / 230	180	45 / 110	1/2” / 1/2”	90
RD-40-220-1	40	1.75	20 / 230	180	45 / 110	1/2” / 1/2”	90
RD-55-115-1	55	1.8	20 / 230	180	45 / 110	1/2” / 1/2”	95
RD-55-220-1	55	1.8	20 / 230	180	45 / 110	1/2” / 1/2”	95
*Conditions for rated capacity and pressure drop rating = Inlet pressure 100 PSIG; inlet temperature 100°F saturated; ambient temperature 100°F; pressure dew point 38°F							
**SCFM = Standard Cubic Feet per Minute							
***PSID = Pounds per Square Inch Differential							

Table 8 – Refrigerated Dryers – General Specifications

2.4.3. Air Piping. Install air piping from Refrigerated Dryer to **NITROGEN-PAC™** Nitrogen Generator Module, and attach to Refrigerated Dryer as shown in Appendix G. NOTE: For this application, bypass valving is not required.

2.4.4. Condensate Piping. Install piping from Refrigerated Dryer condensate outlet connection to an appropriate drain location. Follow all local regulations for draining of condensate.

IMPORTANT

Local regulations may require the installation of an oil / water separator in condensate drain piping. Verify local requirements before completing installation. UNITED Fire Systems does not supply oil / water separators.

2.4.5. Electrical Installation.

DANGER

RISK OF ELECTROCUTION

Voltages and currents associated with Refrigerated Dryers are **LETHAL**. Follow all instructions provided. Work involving Refrigerated Dryer power MUST be performed ONLY by qualified individuals. All required precautions to prevent contact with live electrical conductors and equipment MUST be taken. Failure to comply with these instructions is an immediate hazard with a likelihood of death or serious personal injury!

2.4.5.1. Codes. All refrigerated dryer wiring and wiring methods shall be in strict compliance with NEC and local codes .

2.4.5.2. Personnel. All wiring shall be performed by a licensed electrician.

2.4.5.3. Wiring. Each Refrigerated Dryer is equipped with a plug-type cordset intended to be plugged in to a wall receptacle. UNITED Fire Systems recommends that the cordset be plugged directly in to a suitable receptacle in close proximity to the installation location. DO NOT use an extension cord between the Refrigerated Dryer cordset and the wall receptacle. Refer to Table 9. Ensure that the circuit breaker protecting the wall receptacle circuit has sufficient ampacity to handle the additional load of the Refrigerated Dryer, while complying with code requirements for ampacity protection of the conductors. It is permissible to install a mechanical lock to ensure that the cordset cannot be inadvertently pulled out of the receptacle (not supplied by UNITED Fire Systems).

Model No.	Motor Voltage (V)	Frequency (Hz)	Phase	Current (A)
RD-10-115-1	115	60	1	4.1
RD-10-220-1	220	60	1	2.3
RD-20-115-1	115	60	1	4.7
RD-20-220-1	220	60	1	2.3
RD-25-115-1	115	60	1	6.7
RD-25-220-1	220	60	1	2.8
RD-40-115-1	115	60	1	6.7
RD-40-220-1	220	60	1	3.4
RD-55-115-1	115	60	1	11.5
RD-55-220-1	220	60	1	6.0

Table 9 – Refrigerated Dryers – Motor Specifications

2.5. NITROGEN-PAC™ M Series Nitrogen Generator Module. The Nitrogen Generator Module is shipped as a complete assembly from UNITED Fire Systems.

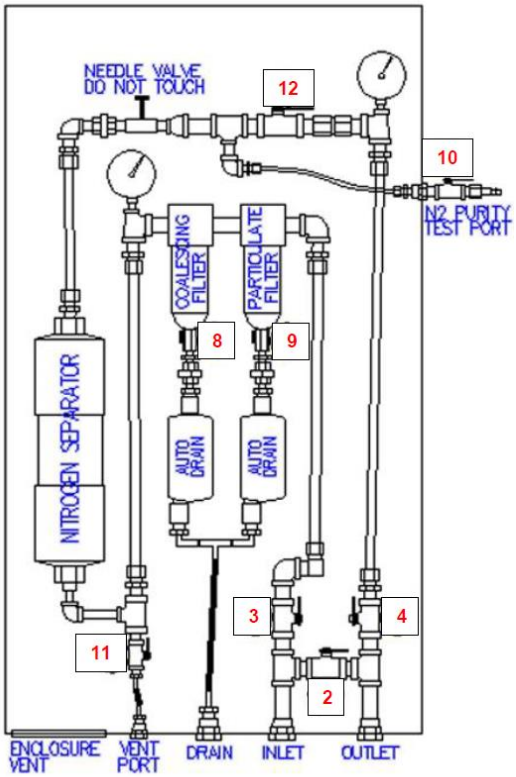


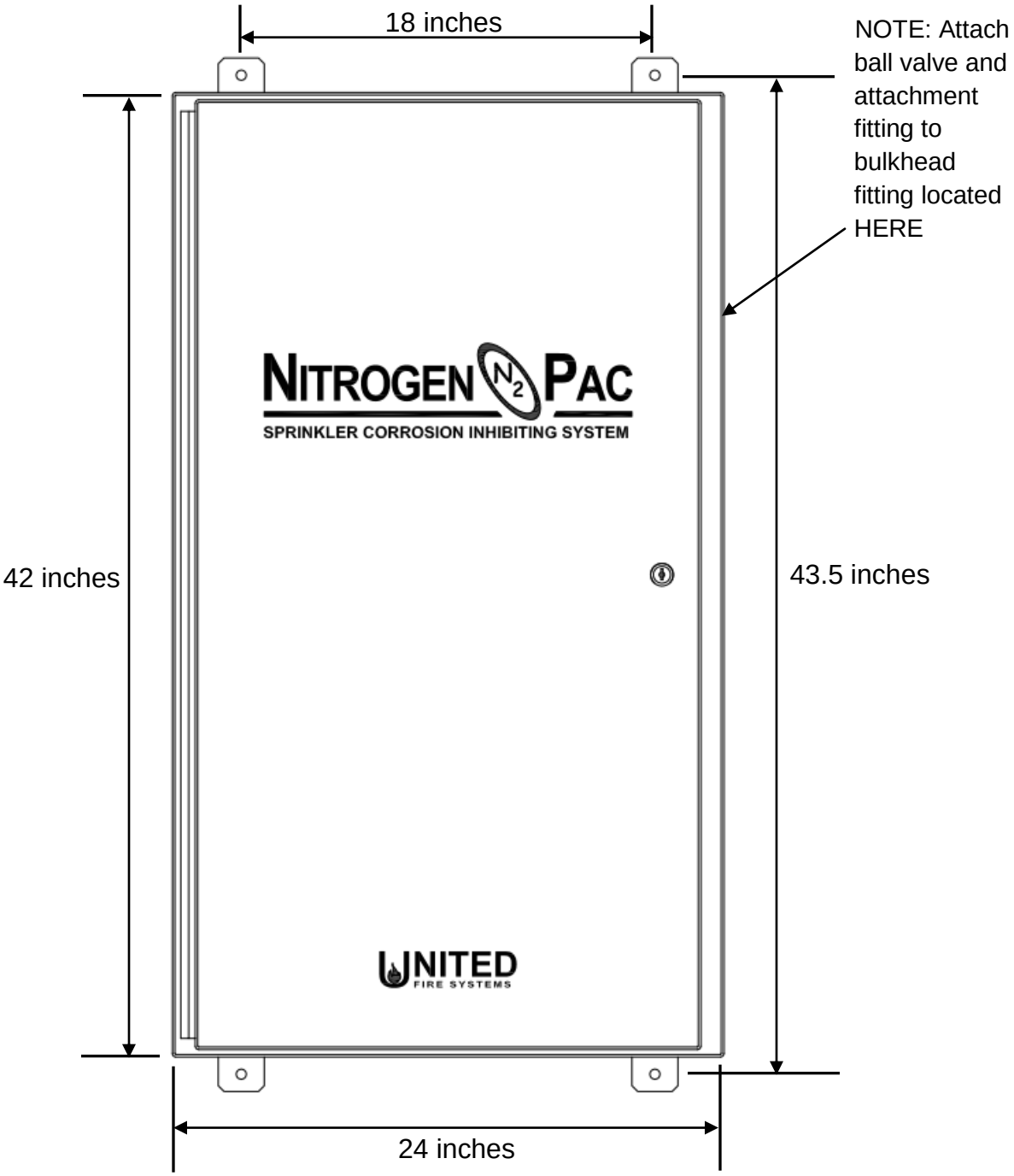
Figure 14 – Diagram of Interior – Nitrogen Generator Module
NOTE: Numbers are valve designations. See Section 3 for designations.

2.5.1. Location. Choose a location for the **NITROGEN-PAC™** Nitrogen Generator Module based on the following considerations:

- The module must be mounted on a wall, in the vertical position.
- The module weighs approximately 75 lbs. Choose a wall with construction capable of supporting this weight.
- Sufficient clearance is required in front of and to the left of the module to permit the door to be swung open. Plan so that the door may be swung open more than 90 degrees. 180 degree door swing is ideal.
- Leave a minimum of 3 feet in front of the module for personnel to perform maintenance inside the module with the door open.
- Leave a minimum of 2 feet of clearance to the right of the module for assembly of and access to the N2 Purity Analyzer – Hand Held attachment ball valve and fitting.
- Leave a minimum of 2 feet of clearance below the module for attachment of inlet, outlet, and drain piping. Do not block the drain fitting or the enclosure vent.

WARNING

The Nitrogen Generator Module (NGM) creates a 30% to 40% oxygen concentration exhaust that may present a flammability hazard. Ensure the NGM is NOT located in an area where and oxygen-enriched atmosphere will be a hazard. Failure to comply with this warning can result in increased risk from fire, including death, serious personal injury and property damage.



NOTE: Depth of module is approx. 8-1/2 inches with door closed.

Figure 15 – Nitrogen Generator Module Installation

2.5.2. Mounting. Mount the **NITROGEN-PAC™** Nitrogen Generator Module to a wall as shown in Figure 15. The module must be mounted vertically as shown. The weight of the Nitrogen Generator Module is 75 lbs. Use good standard practice and appropriate fasteners.

2.5.3. Connections and Openings. Refer to Figure 14.

2.5.3.1. Enclosure Vent. The purpose of the Enclosure Vent is to allow oxygen-rich gas from the separator membrane to exit the enclosure. Leave the Enclosure Vent clear.

2.5.3.2. Vent Port. The Vent Port is used when it is necessary to bleed pressure from the piping in the Nitrogen Generator Module for maintenance. At installation, remove the plastic plug from the Vent Port and discard. Make no other connection to the Vent Port.

2.5.3.3. Drain. The Drain port is internally connected to the Auto Drains on the filters. Occasionally, water that is not removed by the Refrigerated Dryer may accumulate and be released by the Auto Drains. At installation, remove the plastic plug from the Drain port and discard. The Drain port may be left unconnected, or may be connected via tubing to an appropriate drain location. The Drain port is 1/2 inch NPT female.

2.5.3.4. Inlet. At installation, remove the plastic plug from the Inlet port and discard. Attach piping from Refrigerated Dryer to Inlet port. The Inlet port is 1/2 inch NPT female. Use 1/2 inch black steel pipe minimum Sch. 40 and threaded black steel fittings minimum Class 150.

2.5.3.5. Outlet. At installation, remove the plastic plug from the Outlet port and discard. Attach piping from Outlet of Nitrogen Generator Module to Inlet of Nitrogen Receiver Assembly. The Outlet port is 1/2 inch NPT female. Use 1/2 inch black steel pipe minimum Sch. 40 and threaded black steel fittings minimum Class 150.

2.5.3.6. N2 Purity Analyzer Connection. Refer to Figure 15 for location of N2 Purity Analyzer Connection on right side of module. Locate ball valve and attachment fitting for N2 Purity Analyzer Connection packed within interior of module. Remove the plastic plug from the N2 purity analyzer connection and discard. Attach ball valve and attachment fitting to connection point.

IMPORTANT

Adequate ventilation is important for the Nitrogen Generator Module (NGM). While natural ventilation or existing openings may be adequate, consideration should be given to providing additional ventilation when locating the NGM in a closet or other small space. A louvered door or 1-1/2 inch gap between the door and floor should be sufficient. Check with the owner and local codes before modifying any door.

2.6. Nitrogen Receiver Assembly. The Nitrogen Receiver Assembly is shipped as a complete assembly from UNITED Fire Systems.

Model No.	Capacity (Gallons)	Inlet Size (NPT)	Outlet Size (NPT)	Pressure Gauge Scale (PSIG)	Max Pressure (PSIG)	Safety Relief Valve Setting (PSIG)	Weight (lbs.)
NR-30	30	1/2”	1/2”	0 - 200	200	175	79
NR-60	60	3/4”	3/4”	0 - 200	200	175	151
NR-80	80	3/4”	3/4”	0 - 200	200	175	225

Table 10 – Nitrogen Receivers - Specifications

Model No.	Diameter (inches)	L (inches)	E (inches)	F (inches)	BC (Bolt Circle) (inches)
NR-30	16	38	8	1.75	18.75
NR-60	20	48	9	2.25	23.75
NR-80	24	46	11	2.38	25.50

Table 11 – Nitrogen Receivers – Dimensions
(Refer to Figure 17)

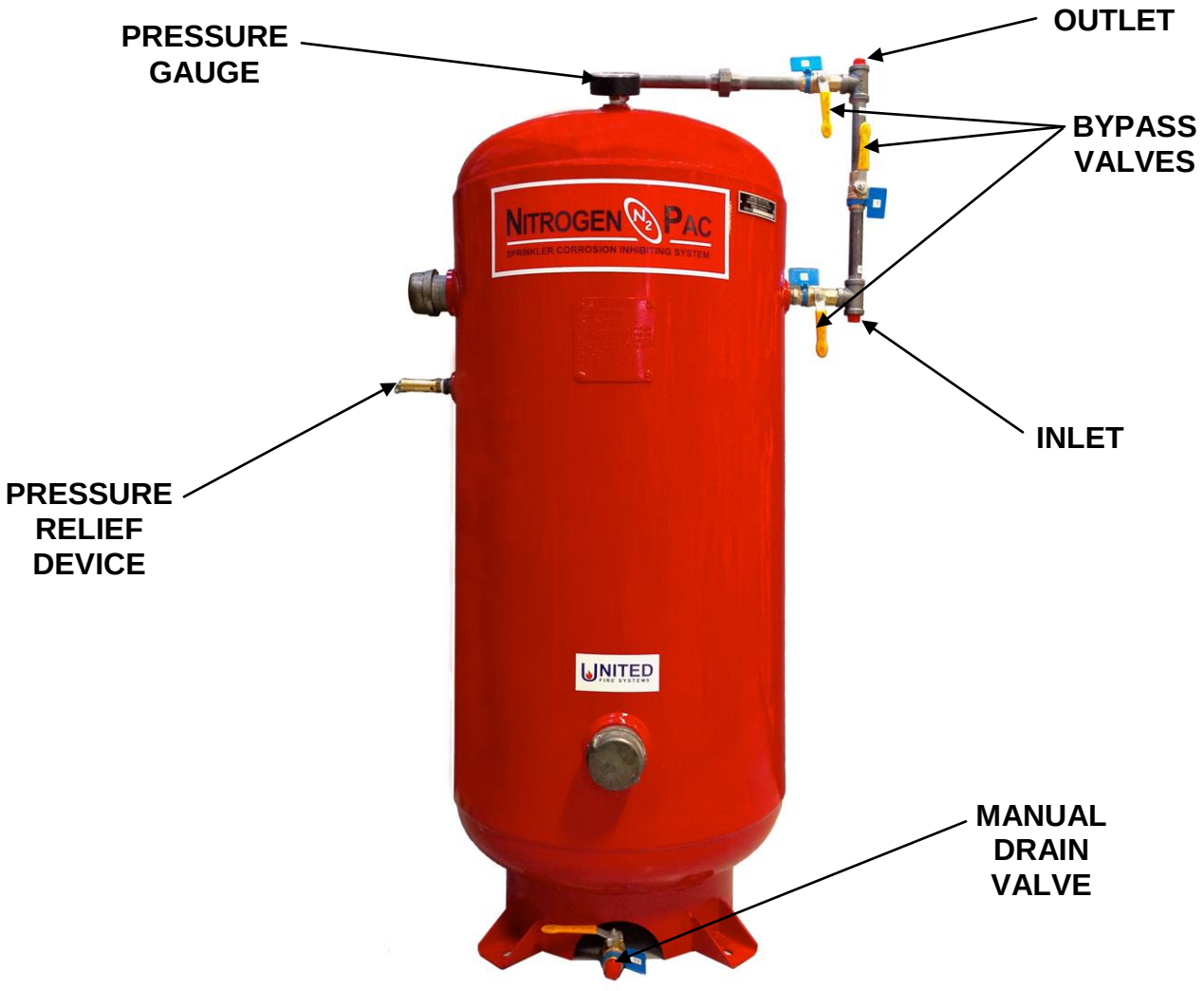


Figure 16 – Nitrogen Receiver
General Arrangement

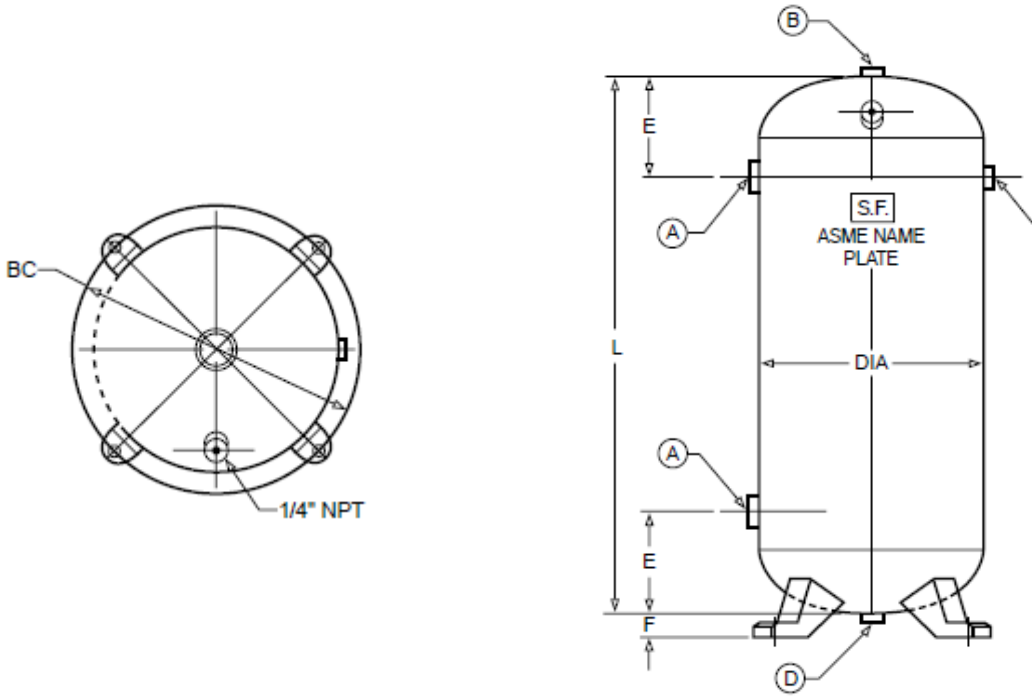


Figure 17 – Nitrogen Receiver
Dimensions

2.6.1. Location. Locate Nitrogen Receiver Assembly in location to be mounted.

2.6.2. Fastening. Securely fasten Nitrogen Receiver Assembly to slab. Use Table 11 to determine appropriate bolt pattern.

2.6.3. Connections.

2.6.3.1. Inlet. At installation, remove the plastic plug from the Inlet port and discard. Attach piping from Outlet of Nitrogen Generator Module to Inlet of Nitrogen Receiver Assembly. The Inlet port is 1/2 inch NPT female. Use 1/2 inch black steel pipe minimum Sch. 40 and threaded black steel fittings minimum Class 150.

2.6.3.2. Outlet. At installation, remove the plastic plug from the Outlet port and discard. Attach piping from the Outlet port to the Inlet port of the Nitrogen Maintenance Device. The Outlet port is 1/2 inch NPT female. Use 1/2 inch black steel pipe minimum Sch. 40 and threaded black steel fittings minimum Class 150.

2.6.3.3. Manual Drain Valve. The outlet of the Manual Drain Valve may be run to a convenient drain using pipe or tubing.

2.7. Nitrogen / Air Maintenance Device (AMD-1). The Nitrogen / Air Maintenance Device should be installed in convenient proximity to the sprinkler valve receiving nitrogen.

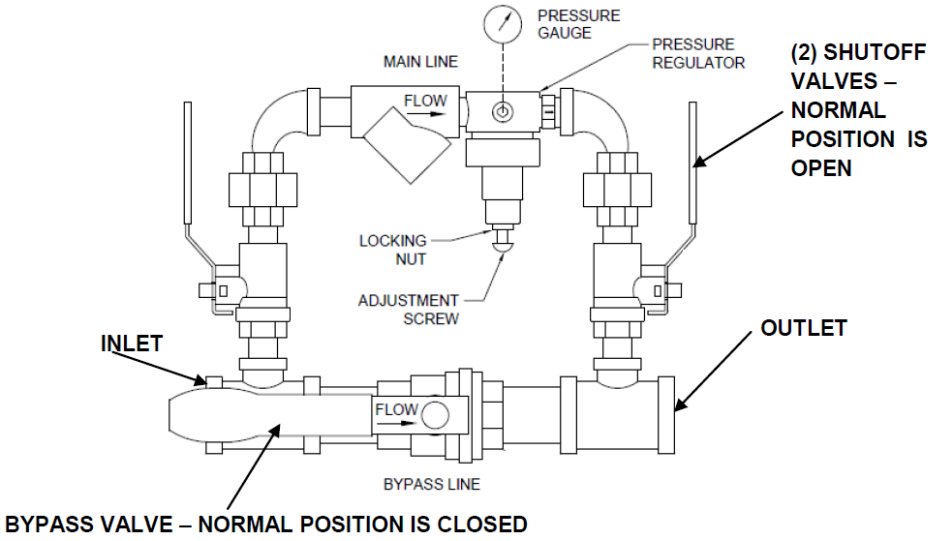


Figure 18 – Nitrogen Maintenance Device Installation

2.7.1. Inlet. Attach piping from the Outlet port of the Nitrogen Receiver Assembly to the Inlet port of the Nitrogen / Air Maintenance Device. The Inlet port is 1/2 inch NPT female. Use 1/2 inch black steel pipe minimum Sch. 40 and threaded black steel fittings minimum Class 150.

2.7.2. Outlet. Attach piping to the Outlet port of the Nitrogen / Air Maintenance Device. Run piping to the trim of the sprinkler valve receiving nitrogen. The Outlet port is 1/2 inch NPT female. Use 1/2 inch black steel pipe minimum Sch. 40 and threaded black steel fittings minimum Class 150.

2.8. Purge Vent Assembly – Fixed Orifice.

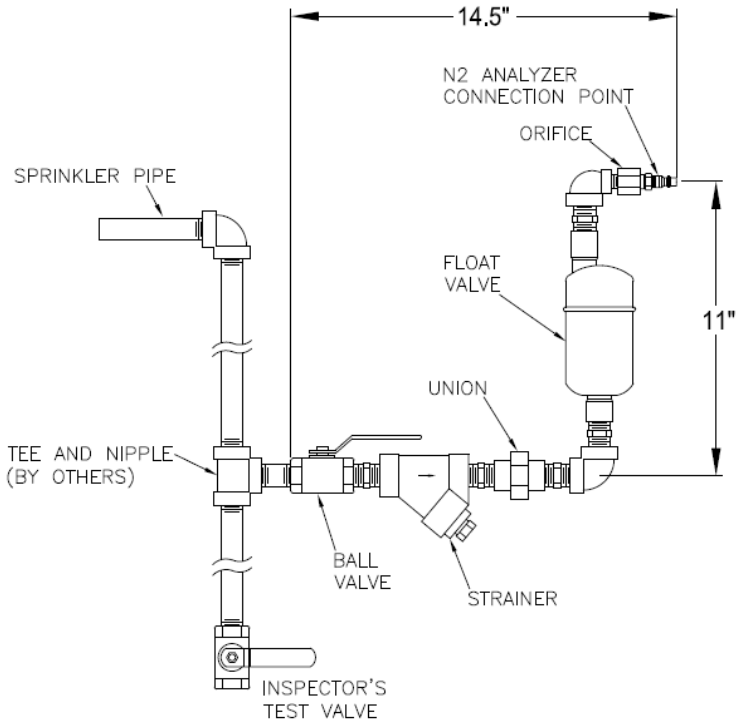


Figure 19 – Purge Vent Assembly – Fixed Orifice Model PVA-1
Dimensions and Installation

IMPORTANT

DO NOT disassemble Purge Vent Assembly to install! The union (see Figure 19) may be used to facilitate installation.

2.8.1. Refer to Figure 19. Determine location to install the Purge Vent Assembly. The assembly should be located near the inspector's test valve or at an accessible remote branch line end point.

2.8.2. Confirm that sprinkler piping system is NOT pressurized.

CAUTION

Failure to confirm that the sprinkler piping is NOT pressurized could result in personal injury and / or property damage.

2.8.3. Install tee and nipple as shown in Figure 19. For proper positioning of the Purge Vent Assembly, the tee should be installed in a vertical pipe, with the tee outlet horizontal, as indicated. It is acceptable to install additional pipe and elbows before the assembly to accommodate proper installation.

2.8.4. Attach Purge Vent Assembly to nipple. For float valve to function properly, assembly MUST be installed vertically, as shown. Use union to facilitate installation and properly position assembly.

2.8.5. Ball valve should remain closed until commissioning.

2.9. N2 Purity Analyzer – Hand-Held. This device requires no installation. A clean, dry, permanent storage location should be identified and used to permit use of the device and prevent damage.

2.10. Drains. Removal of liquid water from the air stream is vitally important for the efficiency and longevity of the nitrogen separator membrane. To accomplish this removal, liquid water is removed at five different points in the system. These five points are:

2.10.1. Compressor / Tank Assembly Auto-Drain. This drain automatically releases liquid water which condenses in the tank. The drain port is 1/4 inch NPT female. See Figure 21.

2.10.2. Compressor / Tank Assembly Filter / Regulator Auto-Drain. This drain automatically releases liquid water collected by the filter. The drain port is 1/4 inch NPT female.

2.10.3. Refrigerated Dryer Auto-Drain. This drain automatically releases liquid water collected by the refrigerated dryer. A timer internal to the dryer controls the drain. This is the point in the system where the greatest amount of water to be released can be expected. The drain port is a push-to-connect fitting that accepts 3/8 inch OD tubing.

2.10.4. Nitrogen Generator Module (NGM) Drain. The particulate and coalescing filters in the Nitrogen Generator Module (NGM) will collect a small amount of water just before the air stream enters the nitrogen separator membrane. Float valves on the bottom ports of the filters will release this water automatically. The outlets of the float valves are connected to a drain port on the bottom of the cabinet. This drain port is 1/2 inch NPT female.

2.10.5. Nitrogen Receiver Drain. This is a manual drain to release the very small amount of water which may occasionally collect in the bottom of this tank. This drain port is 1/2 inch NPT female.

2.10.6. Piping To Drain. It is recommended that each of these drains (2.10.5 optional) be run to a building drain or an environmentally-approved condensate collection / disposal system. The drains may be run individually or piped together. If run to a building drain, environmental regulations may require installation of an oil / water separator. Drain runs may be pipe or tubing. Consult with relevant authorities having jurisdiction, local codes, or building owner for approved materials and discharge location.

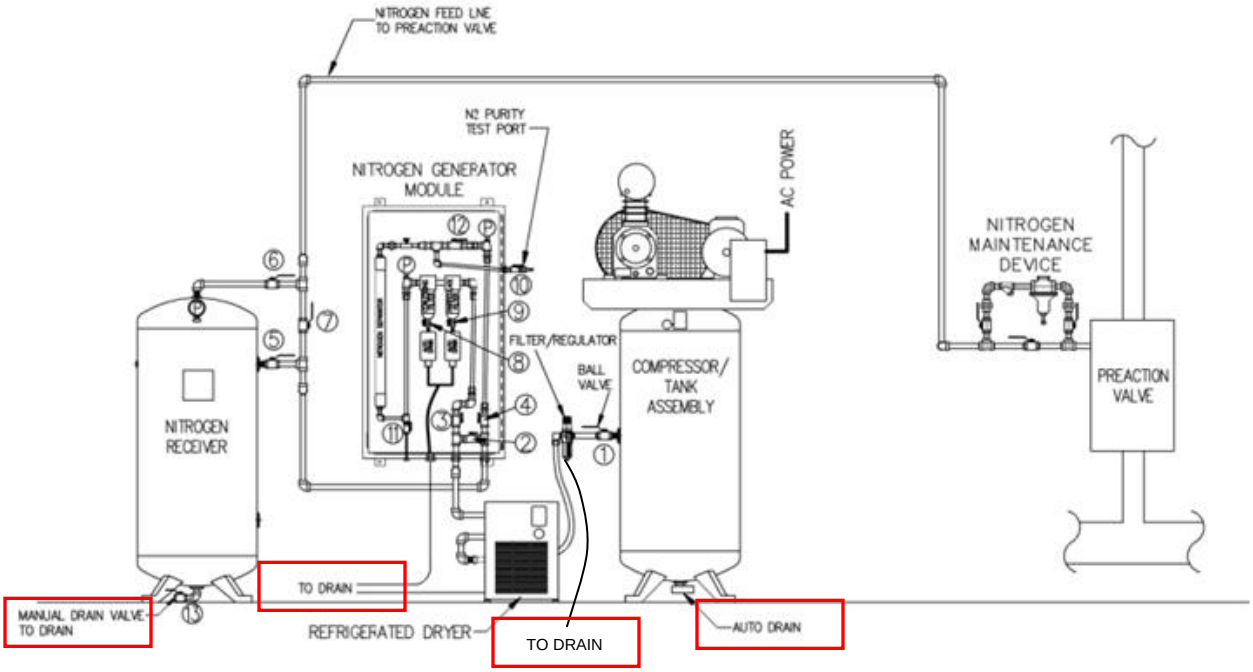


Figure 20
Locations of Drain Points

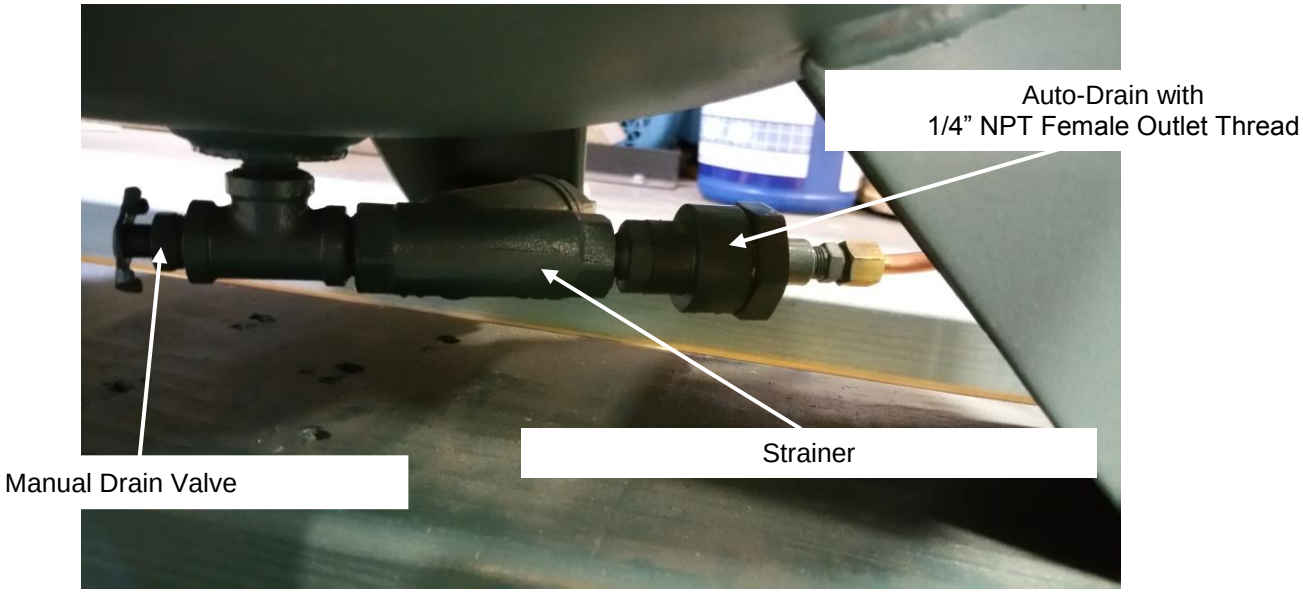


Figure 21
Auto-Drain – Compressor / Tank Assembly

3. COMMISSIONING. The process of system commissioning is important for achieving satisfactory results.

DANGER

Rapid release of nitrogen gas into an enclosed space displaces oxygen and can cause an asphyxiation hazard. Inhalation of nitrogen in increased concentration can result in unconsciousness and asphyxiation without warning. All areas containing nitrogen system equipment MUST be adequately ventilated. All nitrogen gas leaks discovered during installation, commissioning, and maintenance of M Series nitrogen generating equipment MUST be corrected promptly. Failure to comply can result in death or serious personal injury.

IMPORTANT

Prior to commissioning the M Series nitrogen generating system, the owner, sprinkler contractor, or other sprinkler service professional shall inspect and test the sprinkler piping to establish that maximum leakage is within the allowable limit set by NFPA Standard 13. If excessive leakage exists, correct leaks and re-test. Nitrogen generating systems do not reverse pipe corrosion, stop leaks, or overcome excessive leakage.

- UNITED Fire Systems recommends that the technician performing the commissioning become thoroughly familiar with this entire manual, as well as the actual installation, before beginning the process.
- Follow the steps as indicated.
- Each valve in the system is identified by number. See Figure 22 for valve locations and numbers, and Table 12 for valve purposes. Each valve has a blue flag marker with the number (see Table 12 for exceptions). Look for and identify all valves before proceeding.
- Use a copy of the Commissioning Worksheet / Checklist during the procedure to record all values as indicated and steps followed.
- Open and close all valves *carefully* and *slowly*.

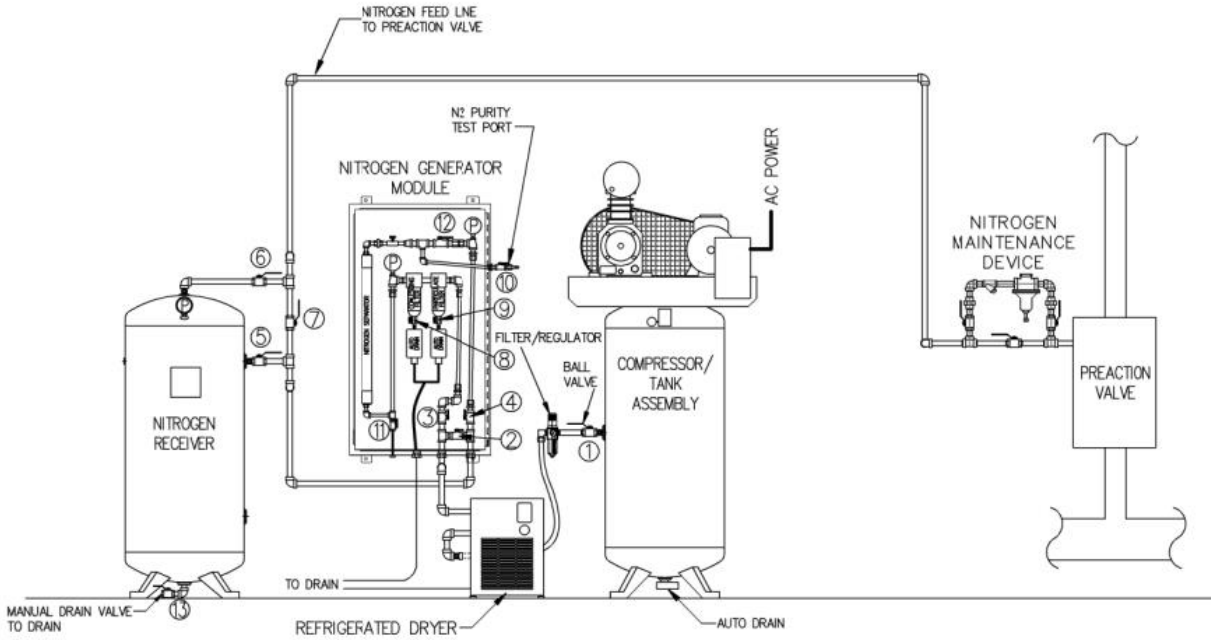


Figure 22 – Typical Installation
Showing Valve Locations and Numbers

Valve Number	Component Containing Valve	Valve Purpose
1	Compressor / Tank Assembly	Shutoff
2	Nitrogen Generator Module	Bypass
3	Nitrogen Generator Module	Inlet
4	Nitrogen Generator Module	Outlet
5	Nitrogen Receiver	Inlet
6	Nitrogen Receiver	Outlet
7	Nitrogen Receiver	Bypass
8	Nitrogen Generator Module	Coalescing Filter Drain*
9	Nitrogen Generator Module	Particulate Filter Drain*
10	Nitrogen Generator Module	N2 Purity Test Port
11	Nitrogen Generator Module	Vent
12	Nitrogen Generator Module	Shutoff
13	Nitrogen Receiver	Manual Drain

*** If valve is present, number will be directly on valve body, NOT on blue flag marker. Later system models may delete these valves.**

Table 12 – Valve Numbers and Purposes

DANGER

The nitrogen generator module (NGM) must be installed in an adequately ventilated area. The NGM creates a 30% to 40% oxygen stream which may pose a flammability problem in an oxygen-sensitive environment. Pipe per installation requirements and ensure the area surrounding the nitrogen generator is adequately ventilated. Failure to do so creates an increased flammability hazard that can lead to serious property damage, serious injury, or death.

DANGER

The nitrogen generator module (NGM) must be installed in an adequately ventilated area. While nitrogen is nontoxic and largely inert, rapid release of nitrogen gas into an enclosed space displaces oxygen. Inhalation of nitrogen in excessive concentrations can result in unconsciousness without any warning symptoms. Failure to do so can create an asphyxiation hazard, resulting in personal injury or death.

IMPORTANT

DO NOT open Nitrogen Generator Module (NGM) Valves 2 (Bypass), 3 (Inlet), and 4 (Outlet) at the same time.
DO NOT open Nitrogen Receiver (NR) Valves 5 (Inlet), 6 (Outlet) and 7 (Bypass) at the same time.

3.1. Preliminary.

Step	Procedure
Preliminary 1	Prepare copy of Commissioning Worksheet / Checklist for use during procedure.
Preliminary 2	Verify that all electrical connections to Compressor / Tank Assembly (CTA) and Refrigerated Dryer (RD) are complete in accordance with this manual.
Preliminary 3	Verify that all piping connections are complete in accordance with this manual.
Preliminary 4	Examine oil sight glass to verify that compressor on CTA is filled with oil to the proper level. If oil level is low, add oil per Appendix A or D, as applicable.
Preliminary 5	Ensure that N2 Purity Test Port valve is attached on outside of Nitrogen Generator Module (NGM). If not, attach at this time.
Preliminary 6	Turn off water supply to sprinkler valve.
Preliminary 7	Ensure that all system valves are CLOSED, including all valves in Table 12, all PVA-1 valves, and all NMD-1 valves.
SYSTEM IS NOW READY FOR STARTUP – PROCEED TO STARTUP 1	

3.2. Startup.

Step	Procedure
Startup 1	Operate switch on Refrigerated Dryer (RD) to ON. Allow 15 minutes for RD to stabilize.
Startup 2	While waiting for RD to stabilize, operate Compressor /Tank Assembly (CTA) disconnect switch (or panelboard circuit breaker) to ON. Compressor should start. Gauge on right side of CTA should begin to indicate.
Startup 3	When compressor automatically shuts off, and at least 15 minutes have elapsed from Startup 1, *carefully* OPEN Valve 1 all the way.
Startup 4	*Carefully* adjust knob on top of Filter / Regulator until gauge on Filter / Regulator reads 145 PSIG. Approach this value from LESS than 145 PSIG while adjusting knob.
Startup 5	Check all piping / hose connections from CTA and RD, and RD to Nitrogen Generator Module (NGM) for leaks. If leaks are found, piping must be depressurized and leaks corrected before proceeding.
Startup 6	OPEN Valves 8 and 9 (if present) and Valve 12.
Startup 7	*Carefully* OPEN Valve 3. Gauges in NGM should indicate.
Startup 8	Switch Nitrogen Analyzer (NA-1) ON. Calibrate if indicated – see Appendix I.
Startup 9	Attach NA-1 to N2 Purity Test Port on the NGM.
Startup 10	*Carefully* OPEN Valve 10 just until hissing is heard from holes on NA-1.
Startup 11	Allow 15 minutes for membrane separator in NGM to stabilize.
Startup 12	After 15 minutes, examine reading on NA-1. • If reading is 98% N2 or more, NGM has been successfully started. Proceed to Step Startup 13. • If reading is above 78% and still increasing, allow 15 more minutes to elapse and examine again. • If reading is stabilized below 98%, adjustment of needle valve may be necessary. Contact UNITED Fire Systems before proceeding! • If reading is 78%, troubleshooting is necessary. Contact UNITED Fire Systems.
Startup 13	CLOSE Valves 3 and 10.
Startup 14	OPEN Valve 2.
Startup 15	OPEN Valve 5. Nitrogen Receiver (NR) gauge should begin to indicate.
Startup 16	Check all piping connections from NGM to NR. If leaks are found, piping must be depressurized and leaks corrected before proceeding.
Startup 17	OPEN Valve 6.
Startup 18	Check all piping connections from NR to NMD-1. If leaks are found, piping must be depressurized and leaks corrected before proceeding.
Startup 19	OPEN NMD-1 Inlet Valve(s). NMD-1 pressure gauge(s) should indicate pressure.

Startup 20	Adjust NMD-1 regulator(s) to indicate gauge pressure approximately 5-10% above minimum pressure required by valve pressure switch. Examples: • If valve pressure switch operates at 13 PSI, adjust regulator so that gauge indicates approximately 15 PSI. • If valve pressure switch operates at 40 PSI, adjust regulator so that gauge indicates approximately 44 PSI. IN NO CASE should regulator be adjusted for pressure higher than can be handled by sprinkler valve.
SYSTEM IS READY FOR 30 MINUTE FIRST FILL – PROCEED TO FIRST FILL 1.	

3.3. 30 Minute First Fill.

Step	Procedure
First Fill 1	Verify that Valve 1 is OPEN.
First Fill 2	Verify that Valves 2, 3 and 4 are CLOSED.
First Fill 3	Verify that Valves 5, 6 and 7 are CLOSED.
First Fill 4	CLOSE NMD-1 Inlet and Outlet Valve(s).
First Fill 5	OPEN NMD-1 Bypass Valve(s).
First Fill 6	OPEN Valves 2 and 7. Sprinkler system should begin to fill with air
First Fill 7	After 30 minutes or less, supervisory pressure should be reached. Valve pressure switch should be satisfied. Signal indicating low pressure should not be present when control unit is reset. If supervisory pressure is NOT reached in 30 minutes or less, troubleshoot sprinkler system for leaks.
SYSTEM IS READY FOR PURGING – PROCEED TO PURGE 1.	

3.4. Purging. The system is now filled with air. It is necessary to purge the air and replace it with 98% nitrogen. This process will take a period of time to accomplish.

Step	Procedure
Purge 1	CLOSE Valve 2.
Purge 2	OPEN Valves 3 and 4
Purge 3	CLOSE Valve 7.
Purge 4	OPEN Valves 5 and 6.
Purge 5	CLOSE NMD-1 Bypass Valve(s).
Purge 6	OPEN NMD-1 Inlet and Outlet Valve(s).
Purge 7	OPEN valves on all PVA-1s.
Purge 8	Double check to ensure all valves are in NORMAL position (see Quick Reference Valve Position Table).
Purge 9	Measure and record N2 purity percentage at Nitrogen Generator Module Test Port using NA-1 Nitrogen Analyzer.
Purge 10	Measure and record nitrogen percentage at each PVA-1 using NA-1 Nitrogen Analyzer.
Purge 11	Measure and record values on all system gauges: • Gauge attached to filter / regulator on Compressor / Tank Assembly outlet • Gauge on inlet side of membrane in Nitrogen Generator Module • Gauge on outlet side of membrane in Nitrogen Generator Module • Gauge on Nitrogen Receiver • Gauge(s) on Nitrogen Maintenance Device(s).
SYSTEM IS NOW ON PURGE. N2 CONCENTRATION IN SPRINKLER SYSTEM PIPE SHOULD BEGIN TO INCREASE. PROCEED TO FINAL ACCEPTANCE 1.	

3.5. Final Acceptance.

Step	Procedure
Final Acceptance 1	After approximately 2 weeks, return to site.
Final Acceptance 2	Measure and record N2 purity percentage at Nitrogen Generator Module Test Port using NA-1 Nitrogen Analyzer.
Final Acceptance 3	If nitrogen percentage at Nitrogen Generator Module Test Port is below 98%, needle valve may require adjustment. Contact UNITED Fire Systems before proceeding!
Final Acceptance 4	Measure and record nitrogen percentage at each PVA-1 using NA-1 Nitrogen Analyzer.
Final Acceptance 5	If nitrogen percentage at any PVA-1s is less than 98%, purge is not complete. Return every 2 days and re-measure. Nitrogen percentage should be increasing between visits.
Final Acceptance 6	If nitrogen percentage is not increasing, or does not reach 98%, troubleshoot sprinkler system for leaks.
Final Acceptance 7	When nitrogen percentage at each PVA-1 reaches 98%, system commissioning is complete, and system can be turned over to customer.
SYSTEM IS NOW IN SERVICE.	

QUICK REFERENCE VALVE POSITION TABLE								
	A	B	C	D	E	F	G	H
VALVE	NORMAL	FAST FILL	PURGE	CTA FILTER SERVICE	NGM FILTER SERVICE	N2 PURITY AT NGM	N2 PURITY AT PVA-1s	DRAIN NR
1	Open	Open	Open	Closed	Closed	Open	Open	Open
2	Closed	Open	Closed	Open	Open	Closed	Closed	Closed
3	Open	Closed	Open	Open	Closed	Open	Open	Open
4	Open	Closed	Open	Closed	Closed	Open	Open	Open
5	Open	Closed	Open	Closed	Closed	Open	Open	Open
6	Open	Closed	Open	Open	Closed	Open	Open	Open
7	Closed	Open	Closed	Closed	Open	Closed	Closed	Closed
8*	Open	Open	Open	Open	Open	Open	Open	Open
9*	Open	Open	Open	Open	Open	Open	Open	Open
10	Closed	Closed	Closed	Closed	Closed	Open	Closed	Closed
11	Closed	Closed	Closed	Open	Open	Closed	Closed	Closed
12	Open	Open	Open	Open	Closed	Open	Open	Open
13	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Open**
NMD-1 Inlet(s)	Open	Closed	Open	Open	Open	Open	Open	Open
NMD-1 Outlet(s)	Open	Open	Open	Open	Open	Open	Open	Open
NMD-1 Bypass(es)	Closed	Open	Closed	Closed	Closed	Closed	Closed	Closed
PVA-1 Inlet(s)	Closed	Closed	Open	Closed	Closed	Closed	Open	Closed

NOTES
A – NORMAL – system is providing nitrogen into preaction sprinkler system(s).
B – FAST FILL – compressed air is routed to preaction sprinkler system(s) to pressurize max. 30 minutes per NFPA 13.
C – PURGE – system(s) are purging air out of sprinkler piping, replacing air with nitrogen.
D – CTA FILTER SERVICE – filter element in CTA filter / regulator is to be replaced.
E – NGM FILTER SERVICE – filter elements in NGM filters are to be replaced.
F – N2 PURITY AT NGM – nitrogen purity at NGM is to be checked with NA-1 hand-held meter.
G – N2 PURITY AT PVA-1 – nitrogen purity at PVA-1 Purge Vent Assembly is to be checked with NA-1 hand-held meter.
H – DRAIN NR – draining accumulated moisture from Nitrogen Receiver.
* Valves may not be present on later models.
** Open CAREFULLY.

Table 13
Quick-Reference Valve Position Table

DATE	

LOCATION INFORMATION	
User	
Address 1	
Address 2	
City, State, Zip	

SPRINKLER SYSTEM INFORMATION	
NO. OF RISERS	
SYSTEM GALLONS	

NITROGEN-PAC™ SYSTEM INFORMATION – SERIAL NUMBERS	
Compressor / Tank Assembly (CTA)	
Refrigerated Dryer (RD)	
Nitrogen Generator Module (NGM)	
Nitrogen Receiver (NR)	

PRELIMINARY	OK	NOT OK
Are all electrical connections complete?		
Are all piping connections complete?		
Is the compressor properly filled with oil?		
Is the N2 purity test port on the Nitrogen Generator Module (NGM) properly attached?		
Is the water supply to the sprinkler valve off?		
Are all system valves CLOSED, including all valves in Table 12 and all NMD-1 valves?		

STARTUP	OK	NOT OK
Has the Refrigerated Dryer (RD) been turned ON, and allowed to stabilize for minimum 15 minutes?		
Has the power to the Compressor / Tank Assembly (CTA) been turned ON; has the compressor started; and has the gauge on the right size of the CTA begun to indicate?		
Has the compressor shut off, and has Valve 1 been *carefully* opened all the way?		
Has the Filter / Regulator been adjusted to read 145 PSIG on its gauge?		
Has all piping from CTA to RD, and from RD to NGM, been checked for leaks, and if any leaks were found, were the leaks corrected?		
Have Valves 8 and 9 (if present) and Valve 12 been opened?		
Has Valve 3 been *carefully* opened, and have the gauges in the NGM begun to indicate?		
Has the Nitrogen Analyzer (NA-1) been switched ON, and calibrated if necessary?		
Has the NA-1 been connected to the N2 Purity Test Port on the NGM?		
Has Valve 10 been *carefully* opened just until hissing is heard from the holes on the NA-1?		
Has 15 minutes elapsed to allow membrane separator to stabilize?		
Have Valves 3 and 10 been closed?		
Has Valve 2 been opened?		
Has Valve 5 been opened, and has the gauge on the Nitrogen Receiver (NR) begun to indicate?		

STARTUP (Continued)	OK	NOT OK
Has all piping from NGM to NR been checked for leaks, and if any leaks were found, were the leaks corrected?		
Has Valve 6 been opened?		
Has all piping from NR to NMD-1 been checked for leaks, and if any leaks were found, were the leaks corrected?		
Has the NMD-1 inlet valve been opened, and has the NMD-1 pressure gauge begun to indicate?		
Has the NMD-1 regulator been adjusted to indicate a gauge pressure 5-10% above the minimum pressure required by the valve pressure switch?		

30 MINUTE FIRST FILL	OK	NOT OK
Is Valve 1 open?		
Are valves 2, 3, and 4 closed?		
Are valves 5, 6, and 7 closed?		
Are NMD-1 inlet / outlet valve(s) closed?		
Are NMD-1 bypass valves open?		
Are Valves 2 and 7 open? Is sprinkler system beginning to fill with air?		
Did sprinkler system reach supervisory pressure in 30 minutes or less?		
If sprinkler system did not reach supervisory pressure in 30 minutes or less, has sprinkler system been checked for leaks and have leaks been corrected?		

PURGING	OK	NOT OK
Has Valve 2 been closed, and have Valves 3 and 4 been opened?		
Has Valve 7 been closed, and have Valves 5 and 6 been opened?		
Have the NMD-1 inlet / outlet valve(s) been opened, and the NMD-1 bypass valves been closed?		
Have the valves on all PVA-1s been opened?		
Have all valves been checked to ensure they are in the NORMAL position per the Quick Reference Valve Position Table?		
Has the N2 purity percentage been measured and recorded at the NGM, and is it 98%/		
Has the N2 purity percentage been measured and recorded at each PVA-1?		
Have the values on all system gauges been recorded?		

RECORDED VALUES AT START OF PURGING	VALUE	UNITS
Gauge on Filter / Regulator attached to Compressor / Tank Assembly (CTA)		PSIG
Gauge on inlet side of membrane in Nitrogen Generator Module (NGM)		PSIG
Gauge on outlet side of membrane in Nitrogen Generator Module (NGM)		PSIG
Gauge on Nitrogen Receiver (NR)		PSIG
Gauge on Nitrogen Maintenance Device (NMD-1)		PSIG
Nitrogen Analyzer (NA-1) reading attached to Purity Test Port on NGM		% N2
Nitrogen Analyzer (NA-1) reading attached to Purge Vent Assembly (PVA-1)		% N2

FINAL ACCEPTANCE	OK	NOT OK
Is the N2 purity reading at the NGM 98% or more?		
Is the N2 purity reading at the PVA-1(s) 98% or more?		
Has the system been turned over to the customer / user?		

FINAL ACCEPTANCE SIGNATURES			
	PRINT NAME	SIGNATURE	DATE
CUSTOMER			
INSTALLING CONTRACTOR			

4. MAINTENANCE

DANGER

Rapid release of nitrogen gas into an enclosed space displaces oxygen and can cause an asphyxiation hazard. Inhalation of nitrogen in increased concentration can result in unconsciousness and asphyxiation without warning. All areas containing nitrogen system equipment MUST be adequately ventilated. All nitrogen gas leaks discovered during installation, commissioning, and maintenance of M Series nitrogen generating equipment MUST be corrected promptly. Failure to comply can result in death or serious personal injury.

4.1. Monthly Maintenance

4.1.1 Compressor / Tank Assembly - Monthly			
Number	Procedure	Refer To	OK / NG
4.1.1.1	Check filter / regulator pressure gauge to make sure the reading is in the range 145 + /- 5 PSIG.	Appendices C and F	
4.1.1.2	Check level of compressor pump oil. Add oil if necessary. Never over fill.	Appendices A and D	
4.1.1.3	Check ball valves for NORMAL operating position.	Table 13 – Page 35	

4.1.2 Refrigerated Dryer - Monthly			
Number	Procedure	Refer To	OK / NG
4.1.2.1	Check operation of the automatic drain valve.	Appendix G	
4.1.2.2	Check dew point indicator to make sure it is the range 35 to 39 °F	Appendix G	
4.1.2.3	Make sure the high temp warning light is not on.	Appendix G	

4.1.3 NITROGEN-PAC™ Nitrogen Generator Module - Monthly			
Number	Procedure	Refer To	OK / NG
4.1.3.1	Check pressure gauges to make sure the readings are in the proper ranges: • Gauge 1 = 135 – 150 PSIG • Gauge 2 = 40 – 145 PSIG		
4.1.3.2	Check ball valves for NORMAL operating position.	Table 13 – Page 35	
4.1.3.3	Use N2 Purity Analyzer to verify percent of nitrogen output.	Appendix I	

4.1.4 Nitrogen Receiver Assembly - Monthly			
Number	Procedure	Refer To	OK / NG
4.1.4.1	Check pressure gauge to make sure the reading is in the proper range. • Min = 10% above setting of preaction valve pressure switch. • Max = 145 PSIG.		
4.1.4.2	Check ball valves for NORMAL operating position.	Table 13 – Page 35	
4.1.4.3	Manually drain receiver of water.	4.3.1	

4.1.5 N2 Purity Analyzer – Hand-Held - Monthly			
Number	Procedure	Refer To	OK / NG
4.1.5.1	Check to endure that analyzer is located in proper storage location, and that location continues to be clean and dry.	Appendix I	
4.1.5.2	Check status of device batteries.	Appendix I	

4.1.6 Nitrogen Maintenance Device - Monthly			
Number	Procedure	Refer To	OK / NG
4.1.6.1	Check ball valves for NORMAL operating position.	Table 13 – Page 35	

4.1.7 Item NOT Requiring Monthly Maintenance
• Purge Vent Assembly – Fixed Orifice

4.2. Annual Maintenance

4.2.1 Compressor / Tank Assembly - Annual			
Number	Procedure	Refer To	OK / NG
4.2.1.1	Perform monthly maintenance per 4.1.1.	Appendices A and D	
4.2.1.2	Change compressor oil.	Appendices A and D; 4.3.2	
4.2.1.3	Replace air inlet filter.	Appendices A and D; 4.3.3	
4.2.1.4	Replace filter / regulator filter element.	Appendices C and F; 4.3.4	

4.2.2 Refrigerated Dryer - Annual			
Number	Procedure	Refer To	OK / NG
4.2.2.1	Perform monthly maintenance per 4.1.2.		
4.2.2.2	Clean air cooled condenser coils. Blow off all dust and dirt that is on the condenser fins with a compressed air maintenance gun. While cleaning the condenser fins, do not damage.	Appendix G; 4.3.5	
4.2.2.3	Check operation of condensate drain.	Appendix G; 4.3.6	

4.2.3 NITROGEN-PAC™ Nitrogen Generator Module - Annual			
Number	Procedure	Refer To	OK / NG
4.2.3.1	Perform monthly maintenance per 4.1.3.		
4.2.3.2	Clean automatic float drains.	4.3.7	
4.2.3.3	Replace filter elements.	4.3 8 - Appendix H	
4.2.3.4	Measure N2 purity.	3.2 steps 8 through 12	

4.2.4 Nitrogen Receiver Assembly – Annual			
Number	Procedure	Refer To	OK / NG
4.2.4.1	Perform monthly maintenance per 4.1.4.		

4.2.5 N2 Purity Analyzer – Hand-Held - Annual			
Number	Procedure	Refer To	OK / NG
4.2.5.1	Perform monthly maintenance per 4.1.5	Appendix I	
4.2.5.2	Replace batteries.	Appendix I	

4.3. Specific Procedures

4.3.1. Manually Drain Nitrogen Receiver Assembly of Water.

- *Carefully* and *slowly* open Valve 13.

CAUTION

If Valve 13 is NOT connected to drain tubing, water and air will be exhausted to atmosphere upon opening Valve 13. For safety, remain clear of valve discharge. Discharge will be noisy! Wear hearing protection while discharging from Valve 13. Failure to abide by this notice may result in personal injury and hearing impairment.

- NOTE - It is not necessary to open Valve 13 fully to exhaust accumulated water.
- Leave Valve 13 open until all water is drained from tank. Re-close Valve 13 when operation is complete.

4.3.2. Change Compressor Oil (see 4.2.1.2).

- Refer to proper Appendix, as follows:
  CTA-150 – Appendix A
  CTA-200, -300, -500, -750, and -1000 – Appendix D
- See diagrams in applicable Appendix for oil drain plug, oil fill sight gauge, and oil fill plug.
- Use quantity and grade of oil as recommended in applicable Appendix.
- Dispose of used oil properly and responsibly in accordance with local requirements.

4.3.3. Replace Compressor Inlet Filter (see 4.2.1.3).

- Refer to proper Appendix, as follows:
  CTA-150 – Appendix A
  CTA-200, -300, -500, -750, and -1000 – Appendix D
- Order replacement filter elements from UNITED Fire Systems, as follows:
  Filter for CTA-150 = Qty. (1) UFS P/N 30-500012-002.
  Filter for CTA-200, -300, and -500 = Qty. (1) UFS P/N 30-500012-001.
  Filters for CTA-750 and -1000 = Qty. (2) UFS P/N 30-500012-001.
- Follow instructions in applicable Appendix to remove old filter(s) and replace with new filter(s).

4.3.4. Replace Filter / Regulator Filter Element (see 4.2.1.4).

- Refer to proper Appendix, as follows:
  CTA-150 = Appendix B
  CTA-200, -300, -500, -750, and -1000 = Appendix F
- Order replacement filter elements from UNITED Fire Systems, as follows:
  CTA-150 = 30-500002-426
  CTA-200, -300, -500, -750, and -1000 = 30-500002-401
- Follow instructions in applicable Appendix to remove old filter(s) and replace with new filter(s).

4.3.5. Clean Refrigerated Dryer Air Cooled Condenser Coils (see 4.2.2.2). Refer to Appendix G.

4.3.6. Check Operation of Refrigerated Dryer Condensate Drain (see 4.2.2.3). Refer to Appendix G.

4.3.7. Clean Nitrogen Generator Module Automatic Float Drains (see 4.2.3 2).

- Refer to Table 13, Column E – NGM Filter Service. Position valves as shown. Allow pressure to bleed off CAREFULLY.
- Disconnect drain tubing from push-to-connect fitting at drain port of NGM cabinet by lifting disconnect ring and gently pulling tubing out.
- Float drains are screwed hand-tight to bottoms of filter bowls. Gently unscrew drains from filter bowls.
- Gently disassemble float drains by turning knurled ring at top.
- Clean screens and floats as needed. If new screens or floats are needed, see Section 4.4 – Table 14 – Maintenance Parts.
- Re-assemble float drains.
- If desired, perform maintenance on filter elements per 4.3.8.
- Re-attach float drains to filter bowls hand-tight.
- Re-insert drain tubing into push-to-connect fitting at drain port.
- When re-starting NGM, check connections for leaks. Correct as necessary.

4.3.8. Replace Nitrogen Generator Module Filter Elements (see 4.2.3.3 and Appendix H).

- Refer to Table 13, Column E – NGM Filter Service. Position valves as shown. Allow pressure to bleed off CAREFULLY.
- Disconnect drain tubing from push-to-connect fitting at drain port of NGM cabinet by lifting disconnecting ring and gently pulling tubing out.
- Float drains are screwed hand-tight to bottoms of filter bowls. Gently unscrew drains from filter bowls.
- Unscrew filter bowls from filter bodies. Note relative positions of filter bowls – BOWLS MUST NOT BE INTERCHANGED AT RE-ASSEMBLY.
- Remove used filter elements. Replace with new filter elements – see Section 4.4 – Table 14 – Maintenance Parts. Note relative positions of filter elements – PARTICULATE AND COALESCING FILTER ELEMENTS MUST NOT BE INTERCHAGED AT RE-ASSEMBLY.
- Re-attach filter bowls to filter bodies. Ensure proper bowl and filter are attached to proper filter body, and do not interchange.
- If desired, perform maintenance on automatic float drains per 4.3.7.
- Re-attach float drains to filter bowls hand-tight.
- Re-insert drain tubing into push-to-connect fitting at drain port.
- When re-starting NGM, check connections for leaks. Correct as necessary.

4.3.9. Replace Nitrogen Analyzer Batteries (see 4.2.5.2). Refer to Appendix I.

4.4. Maintenance Parts

Description	UFS P/N
Element, Air Filter, CTA-150	30-500012-002
Element, Air Filter, CTA-200 through CTA-1000	30-500012-001
Element, Filter / Regulator, CTA-150	30-500002-401
Element, Filter / Regulator, CTA-200 through CTA-1000	30-500006-426
Oil, Crankcase, Pump, CTA	Not available through UFS – source locally
Element, Particulate Filter, NGM	30-500002-101
Element, Coalescing Filter, NGM	30-500002-201
Screen, Float Drain, NGM	30-500003-101
Float, Float Drain, NGM	30-500003-102
Screen, Strainer, PVA-1	30-500003-301
Element, Sensing, NA-1	30-500005-001
Battery, NA-1	Not available through UFS – source locally

Table 14
Maintenance Parts

SAYLOR-BEALL MANUFACTURING CO.

ST. JOHNS, MICHIGAN

NITROGEN N_2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM

UNITED FIRE SYSTEMS

OPERATING INSTRUCTIONS BASIC AIR COMPRESSOR

TWIN CYLINDER MODELS

SERIES 62-C300 — Commencing with Serial Nos. WR-5000

SERIES 62-D400 — Commencing with Serial No. W-5000

LUBRICATION — IMPORTANT

The crankcase of this compressor was drained before shipment.

Be sure to add oil before the compressor is run.

Use a good brand of SAE No. 30 Non-Detergent, Single Grade Motor Oil. Fill the crankcase to the oil level mark on the sight guage located on the back end of the compressor away from the flywheel. Check the oil level frequently.

Low oil level means trouble. Drain the oil every 100 hours of operation and add fresh oil.

AIR CLEANER

The air cleaner consists of filter pad and a screen located in the cylinder head. Keep the pad clean. Wash the pad with Naptha often. Change pads every 100 hours. A dirty air cleaner means slow pumping time and loss of pressure.

VALVES

The intake and exhaust valves are located in the cylinder head; easily removed from the top.

The valves are precision made from the finest valve steel and will require little or no attention.

The valve springs are made from silicone type wire and calibrated to very close limits to provide maximum efficiency.

Valve leakage (indicated by slow pumping) is usually caused by carbon deposits and only after a long period of operation.

valves are removed for any reason—do one at a time—and use extreme care in cleaning and assembly.

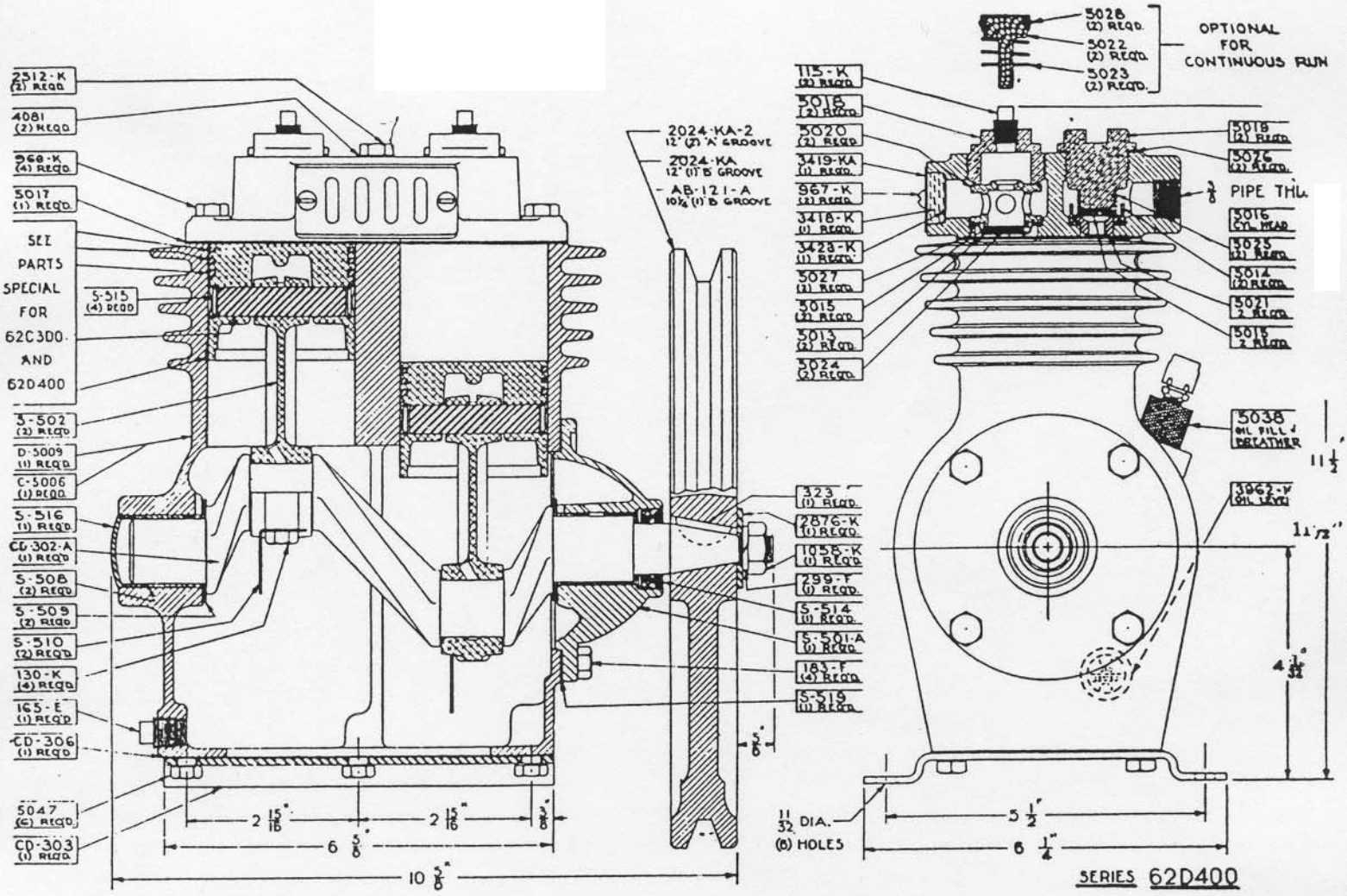
GENERAL OPERATION

The maximum pressure is 150 P.S.I.

The maximum speed is 850 R.P.M.

Always operate the compressor below maximum output for best results and longer life.

NOTE: Orders must specify pump model number and serial number when ordering replacement parts.



Recommended Operation

Pulley and Flywheel Data

TWIN CYLINDER MODEL 62-C300 SERIES 2" BORE 2" STROKE

Flywheel Diameter	Pulley Diameter	RPM	CFM	Oper. Pressure	H.P. Req.
10½	3 3/8	565	4.15	100 PSI	¾ HP
10½	4¼	720	5.2	125 PSI	1 HP
10½	4½	770	5.6	100 PSI	1 HP

TWIN CYLINDER MODEL 62-D400 SERIES 2½" BORE 2" STROKE

Flywheel Diameter	Pulley Diameter	RPM	CFM	Oper. Pressure	H.P. Req.
10½	3	495	5.6	100 PSI	1 HP
10½	4 1/8	690	7.8	125 PSI	1½ HP
12	3½	495	5.6	100 PSI	1 HP
12	4 5/8	690	7.8	125 PSI	1½ HP

A good check valve must be used with tank mounted compressors between the pump and tank.

FLYWHEELS

62-C311 10½" flywheel
62-C314 12" flywheel

62-D404 10½" flywheel
62-D403 12" flywheel—1 "B" groove
62-D403-2 12" flywheel—2 "A" groove

Prices Subject to Change Without Notice

MISCELLANEOUS PARTS (CONTINUED)

Part No.	Description	No. Reqd.
CD-302 A	Crankshaft (For Bushing Type)	1
S-502	Connecting Rod Assy. (All Models) (Includes Rod Cap & Screws)	2
S-508	Bushing—Main Bearing (Front & Rear)	2
S-510	Splash Plate	2
S-515	Lockring—Piston Pin (Included with Piston)	4
S-516	Welsh Plug (For Bushing Type)	1

PARTS SPECIAL FOR 62C300

AC-109	Pin—Piston (Included with Piston)	2
C-5006	Cylinder & Bushing Assy. (Includes Cylinder, Bushing, Welsh Plug & Sight Glass)	1
5075	Piston (Includes Pin & Lockrings)	2

PARTS SPECIAL FOR 62D400

BD-205	Pin—Piston (Included with Piston)	2
D-5009	Cylinder & Bushing Assy. (Includes Cylinder, Bushing, Welsh Plug & Sight Glass)	1
5079	Piston (Includes Pin & Lockrings)	2

PARTS SPECIAL — ROLLER BEARING COMPRESSORS 62C300-R & 62D400-R

CD-302 AH	Crankshaft	1
3615-K	Roller Bearing—Front	1
3616-K	Roller Bearing—Rear	1
C-5006-R	Cylinder & Bearing Assy. (Includes Cylinder, Roller Bearing & Sight Glass)	1
D-5009-R	Cylinder & Bushing Assy. (Includes Cylinder, Roller Bearing & Sight Glass)	1

ASSEMBLIES

S-5002-A	Cover Assy.—Front (All Bushing Type Models) Includes Cover, Bushing & Oil Seal	1
S-5002-AR	Cover Assy.—Front (All Roller Bearing Type Models) Includes Cover, Roller Bearing & Oil Seal	1
CD-5021	Cylinder Head & Valve Assy. (All Stop-Start Models) Includes Cylinder Head, Valve Assemblies, Complete Breather Assembly & Head Gasket	1
CD-5022	Cylinder Head & Valve Assy. (All Cont. Run Models "UL") Includes Cylinder Head, Valve Assemblies, Plunger Assembly & Complete Breather Assembly & Head Gasket	1
C-5047	Piston Ring Set (62C300)	1
D-5048	Piston Ring Set (62D400)	1
CD-5056	Gaskets Set (All Models) Includes Thrust Washers & Valve Gaskets	1

WARRANTY

The Saylor-Beall Manufacturing Co., Inc. warrants the compressors manufactured by it, when properly installed and lubricated as recommended, to be free from defects in material and workmanship under normal use and service. The responsibility of the Company under this warranty is limited to repair or replacement, at the Company's factory, any part or parts thereof, which shall, within one year after date of shipment to the original purchaser, be returned with transportation charges prepaid and which, upon examination, shall be found to be defective to the satisfaction of the Company. This warranty shall not apply to parts which have been subjected to misuse, negligence or accident, or to parts which have been repaired or tampered with outside of the Company's factory when in the judgment of the Company, it appears that the reliability or stability of the part or parts has been effected. Ordinary maintenance, such as adjustment and cleaning of equipment or components is the responsibility of the owner. Components purchased by Saylor-Beall for which Vendor's established warranty prevails, will be repaired or replaced if defective, only in accordance with Vendors established warranty policy. This warranty is expressly in lieu of all other warranties expressed or implied and of any other obligations or liability on the part of the Company.

THE SAYLOR-BEALL MANUFACTURING COMPANY, INC.

REPAIR PARTS

Must Specify Pump Model and Serial No.
When Ordering Parts

PARTS COMMON TO MODELS 62C300 AND 62D400

CYLINDER HEAD ASSEMBLY

Part No.	Description	No. Reqd.
115-K	Pipe Plug—Intake Retainer	2
5014	Guide—Exhaust Valve	2
5016	Head—Cylinder	1
5018	Retainer—Intake	2
5019	Retainer—Exhaust Valve	2
5020	Valve Seat—Intake	2
5021	Seat—Exhaust Valve (Press Fit in Head)	2
CD-5066	Valve Repair Kit (5015, 5024, 5025, 5026, 5027, 5013-R)	1

OPTIONAL PARTS FOR CONTINUOUS OPERATION

5046	Kit—Unloader Conversion (With Pilot Valve)	1
5061	Kit—Unloader Conversion (Without Pilot Valve)	1
S-5069-2	Repair Kit (5022, 5023, 5027, 5028)	1

AIR CLEANER PARTS — IN CYLINDER HEAD

967-K	Screw	2
3418-K	Pad	1
3419-KA	Cover	1
3423-K	Screen	1

FLYWHEELS

AB-121-A	10½" Counter Clockwise (1) "B" Groove	1
2024-KA	12" Counter Clockwise (1) "B" Groove	1
2024-KA-2	12" Counter Clockwise (2) "A" Grooves	1

MISCELLANEOUS PARTS

165-E	Pipe Plug—Oil Drain	1
183-F	Capscrew—Front Cover	4
299-F	Lockwasher—Flywheel	1
CD-303	Cover—Bottom	1
323-F	Key—Flywheel	1
S-501-A	Cover—Front (See S-5002-A or S-5002-AR)	
S-514	Oil Seal	1
966-K	Capscrew (Cyl. Head to Cylinder)	4
1058-K	Nut—Flywheel	1
2512-K	Capscrew (Cyl. Head to Cylinder)	2
2876-K	Washer—Flywheel	1
3962-K	Oil Level Gauge	1
4081	Copper Washer—For 2512-K Capscrew—Exhaust Side	1
5038	Oil Fill & Breather Assy. (Inc. Breather & O-Rings)	1
5040	O-Ring (5038 Breather)	1
5047	Capscrew—Bottom Cover	6

NITROGEN N_2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM

APPENDIX B

UNITED FIRE SYSTEMS

INSTRUCTIONS – INSTALLATION KIT FOR CTAs – P/N 30-500500-200

STEP	DESCRIPTION
1	Locate Compressor / Tank Assembly and Refrigerated Dryer in permanent installed locations.
2	Refer to Figure A. Identify Item (1) Filter / Regulator Assembly. Refer to Figure B. Attach Item (1) Filter / Regulator Assembly as indicated.
3	Refer to Figure A. Identify Item (2) Hose. Attach pipe thread end of Item (2) Hose to INLET of Refrigerated Dryer. NOTE: If hose does not reach, use 1/2" black pipe and fittings from Refrigerated Dryer to vicinity of Compressor / Tank Assembly.
4	Refer to Figure B. Attach swivel end of Item (2) Hose to outlet fitting on Filter / Regulator Assembly. IMPORTANT – DO NOT attempt to use only fixed pipe from Filter / Regulator Assembly to Refrigerated Dryer. Item (2) Hose provides important vibration attenuation.
5	Refer to Figure A. Identify Item (3) Serial Number Nameplate and Item (4) Alcohol Wipe. Refer to Figure B. Use Item (4) Alcohol Wipe to clean application surface where shown. Remove backing from Item (3) Serial Number Nameplate. DO NOT REMOVE TAPE FROM BACK OF NAMEPLATE. Adhere nameplate to cleaned surface.
6	Refer to Figure A. Identify Item (5) NITROGEN-PAC Decal. Refer to Figure B. Wipe installation location with clean cloth. Remove backing from Item (5) NITROGEN-PAC Decal and adhere as indicated.
7	Refer to Figure A. Identify Item (6) UNITED Fire Systems decal. Refer to Figure B. Wipe installation location with clean cloth. Remove backing from Item (6) UNITED Fire Systems decal and adhere as indicated.
8	Refer to Figure B. Attach Item (7) Flag marker – "1" on or near outlet ball valve as indicated.

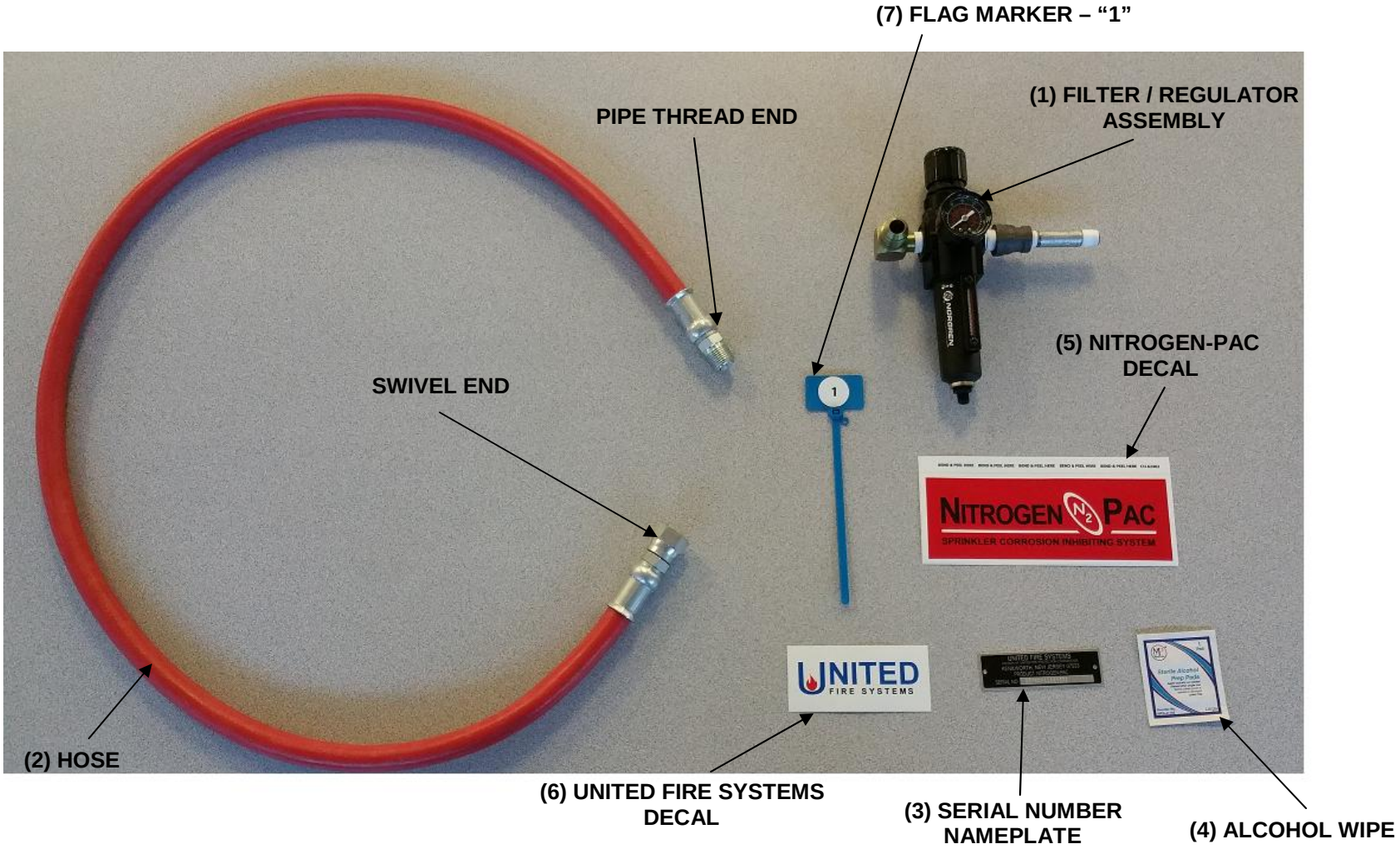


FIGURE A – CONTENTS OF INSTALLATION KIT

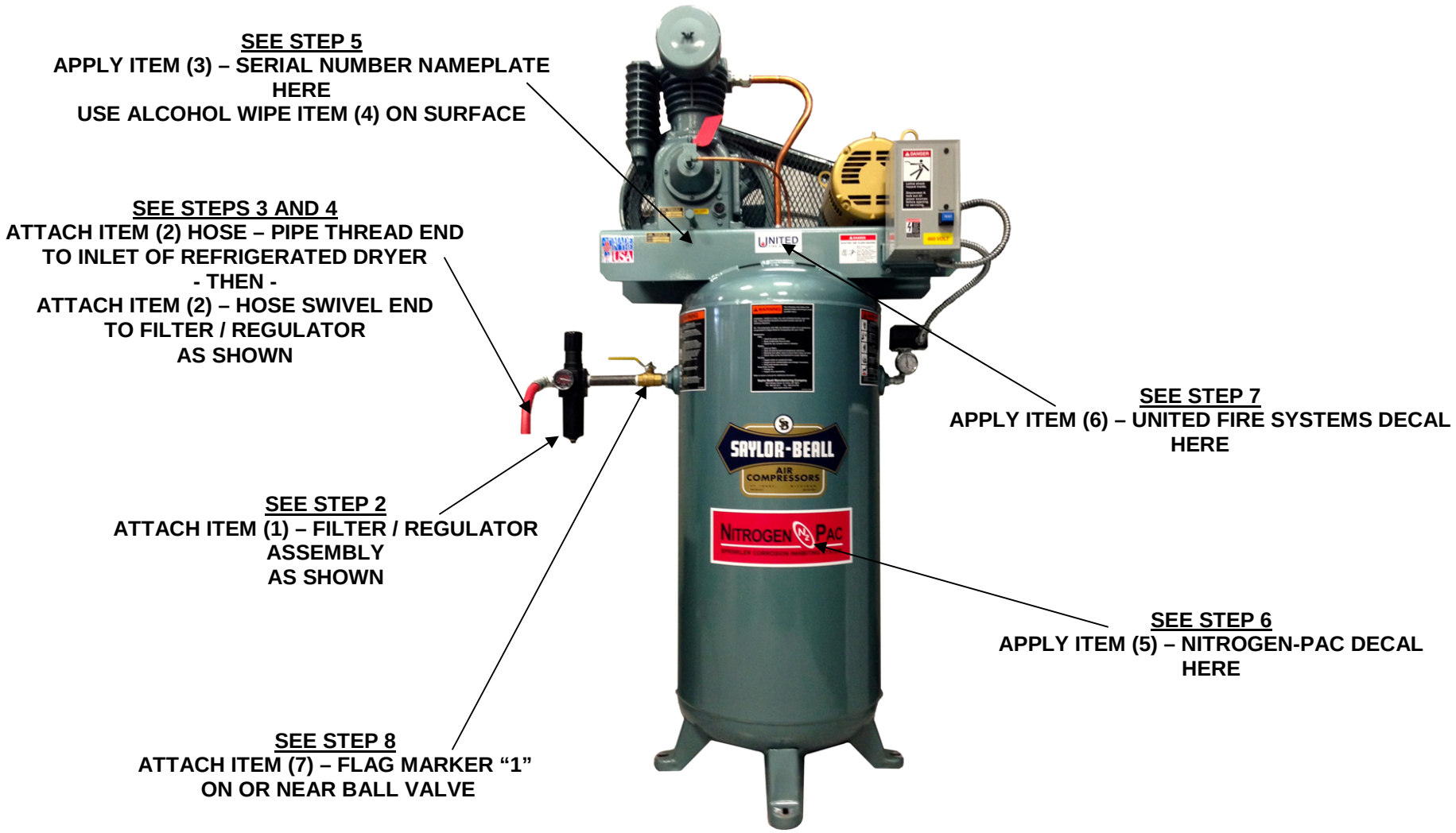


FIGURE B – LOCATIONS OF INSTALLATION KIT ITEMS

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NORGREN

UNITED FIRE SYSTEMS

APPENDIX C

B72G

Installation & Maintenance Instructions

Filter/Regulator

B72G -3AK- AE1- RMG

Port	Thread Form	Adjustment	Drain	Bowl	Element	Diaphragm	Spring (Outlet Pressure Range) *	Gauge
2....1/4"	A....PTF	K....Knob	A....Automatic	D....Short metal with liquid level indicator	1....5 µm	N....Non-relieving	C....0,3 to 2 bar (5 to 30 psig)	G....With
3....3/8"	B....ISO Rc taper	T....T-bar	Q....Manual, 1/4 turn	E....Long metal with liquid level indicator	2....25 µm	R....Relieving	F....0,3 to 4 bar (5 to 60 psig)	N....Without
	G....ISO G parallel		S....Semi automatic	T....Short transparent without guard	3....40 µm		M...0,3 to 10 bar (5 to 150 psig)	
				L....Long transparent without guard				
				W...Long transparent with guard				

* Outlet pressure can be adjusted to pressures in excess of, and less than, those specified. Do not use these units to control pressures outside of the specified ranges.

TECHNICAL DATA

Fluid: Compressed air
Maximum pressure:
- Transparent bowl: 10 bar (150 psig)
- Metal bowl:
  - Manual or semi automatic drain: 17 bar (250 psig)
  - Automatic drain: 10 bar (150 psig)

Operating temperature*:
- Transparent bowl: -34° to +50°C (-30° to +125°F)
- Metal bowl: -34° to +65°C (-30° to +150°F)

* Air supply must be dry enough to avoid ice formation at temperatures below +2°C (+35°F).
Particle removal: 5 µm, 25 µm, or 40 µm filter element
Air quality: Within ISO 8573-1, Class 3 and Class 5 (particulates)
Typical flow with 10 bar (150 psig) inlet pressure, 6,3 bar (90 psig) set pressure and 1 bar (15 psig) droop from set: 38 dm^3/s (80 scfm)
Manual drain connection: 1/8"
Semi automatic drain connection: Push on 8mm (5/16") ID tube
Semi automatic drain operating conditions (pressure operated):
- Bowl pressure required to close drain: Greater than 0,1 bar (1.5 psig)
- Bowl pressure required to open drain: Less than 0,1 bar (1.5 psig)
- Minimum air flow required to close drain: 0,5 dm^3/s (1 scfm)
- Manual operation: Lift stem to drain bowl

Automatic drain connection: 1/8"
Automatic drain operating conditions (float operated):
- Bowl pressure required to close drain: Greater than 0,3 bar (5 psig)
- Bowl pressure required to open drain: Less than 0,2 bar (3 psig)
- Minimum air flow required to close drain: 0,1 dm^3/s (0.2 scfm)
- Manual operation: Depress pin inside drain outlet

Nominal bowl size:
- Short bowl: 56 ml (1.9 fluid ounce)
- Long bowl: 65 ml (2.2 fluid ounce)

Gauge ports:
- 1⁄8 PTF with PTF main ports
- Rc1/8 with ISO Rc and ISO G main ports

Materials:
- Body: Zinc
- Bonnet: Acetal
- Valve: Brass
- Bowl:
  - Transparent: Polycarbonate
  - Transparent with guard: Polycarbonate, zinc guard
  - Metal: Zinc
  - Metal bowl liquid level indicator lens: Transparent nylon
- Element: Sintered polypropylene
- Elastomers: Neoprene and nitrile

REPLACEMENT ITEMS

Service Kit (includes items circled on exploded view):
- Relieving.....4383-500

Liquid level lens kit (46, 48, 49, 50) 4380-030
Filter element, 5µm, red speckles (53).....5925-03

Auto drain (24,25,26) (36A,36B,36C)
(45A, 45B, 45C) 4000-50R
Tamper resistant cover (knob adjustment only).....4255-51

PANEL MOUNTING DIMENSIONS

Panel mounting hole diameter: 40 mm (1.57")
Panel thickness: 2 to 4 mm (0.06" to 0.16")

INSTALLATION

1. Shut off air pressure. Install filter/regulator in air line -
   - vertically (bowl down),
   - with air flow in direction of arrow on body,
   - upstream of lubricators and cycling valves,
   - as close as possible to the device being serviced.
2. Connect piping to proper ports using pipe thread sealant on male threads only. Do not allow sealant to enter interior of unit.
3. Push bowl, or bowl with guard, into body and turn fully clockwise before pressurizing.
4. Flexible tube with 5mm (3/16") minimum I.D. can be connected to the automatic drain. Drain may fail to operate if the tube I.D. is less than 5mm (3/16"). Avoid restrictions in the tube.

5 Install a pressure gauge or plug gauge ports. Gauge ports can also be used as additional outlets for regulated air.

ADJUSTMENT

1. Before applying inlet pressure to filter/regulator, turn adjustment (1 or 7) counterclockwise to remove all force on regulating spring (12).
2. Apply inlet pressure, then turn adjustment (1 or 7) clockwise to increase and counterclockwise to decrease pressure setting.
3. Always approach the desired pressure from a lower pressure. When reducing from a higher to a lower setting, first reduce to some pressure less than that desired, then bring up to the desired pressure.

NOTE

With non-relieving filter/regulators, make pressure reductions with some air flow in the system. If made under no flow (dead-end) conditions, the filter/regulator will trap the over-pressure in the downstream line.

4. KNOB ADJUSTMENT. Push knob down to lock pressure setting. Pull knob up to release. Install tamper resistant cover (see Replacement Items) to make setting tamper resistant.

SERVICING

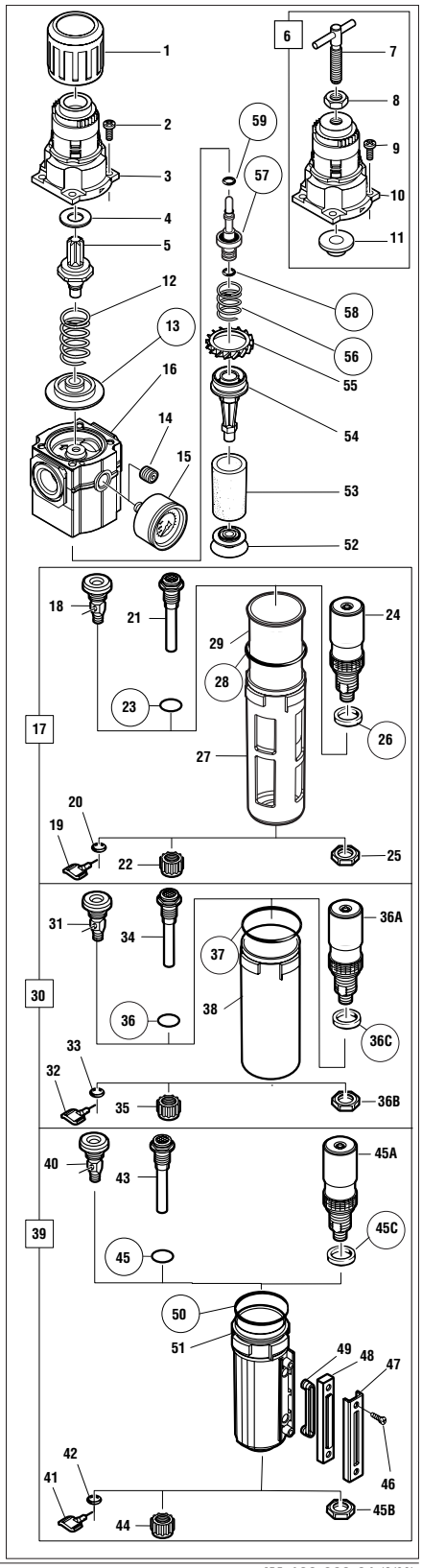
1. Open manual drain to expel accumulated liquids. Keep liquids below baffle (52).
2. Clean or replace filter element when dirty.

DISASSEMBLY

1. Filter/regulator can be disassembled without removal from air line.
2. Shut off inlet pressure. Reduce pressure in inlet and outlet lines to zero.
3. Turn adjustment (1 or 7) fully counterclockwise.
4. Remove bowl - push into body and turn counterclockwise.
5. Disassemble in general accordance with the item numbers on exploded view. Do not remove the drains unless replacement is necessary. Remove and replace drains only if they malfunction.

CLEANING

1. Clean plastic bowl (29, 38) with warm water only. Clean other parts with warm water and soap.
2. Rinse and dry parts. Blow out internal passages in body (16) with clean, dry compressed air. Blow air through filter element (53) from inside to outside to remove surface contaminants.
3. Inspect parts. Replace those found to be damaged. Replace plastic bowl with a metal bowl if plastic bowl shows signs of cracking or cloudiness.



ASSEMBLY

1. Lubricate the following items with o-ring grease.
   4 (Thrust washer) - outer circumference and both sides.
   5, 7 (Adjusting screw) - threads and tip.
   18, 31, 40 (Manual drain body) - the portion of the body that contacts the bowl, and the hole that accommodates the stem of drain valve (19, 32, 41).
   54 (Center-post) - Bore for valve (57).
   57 (Valve) - stem.
   23, 28, 36, 37, 45, 50, 58, 59 - (O-rings)
2. Assemble the unit as shown on the exploded view. Push bowl, or bowl with guard, into body and turn fully clockwise.
3. Torque Table

Item	Torque in Nm (Inch-Pounds)
2, 9 (Screw)	2,3 to 2,8 (20 to 25)
22, 35, 44, 25, 36B, 45B (Nut)	2,3 to 2,8 (20 to 25)
46 (Screw)	1,9 to 2,5 (17 to 22)
52 (Baffle)	0,5 to 0,7 (4 to 6)
54 (Center-post)	0,7 to 0,9 (6 to 8)

CAUTION

Water vapor will pass through these units and could condense into liquid form downstream as air temperature drops. Install an air dryer if water condensation could have a detrimental effect on the application.

WARNING

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under ***Technical Data***.

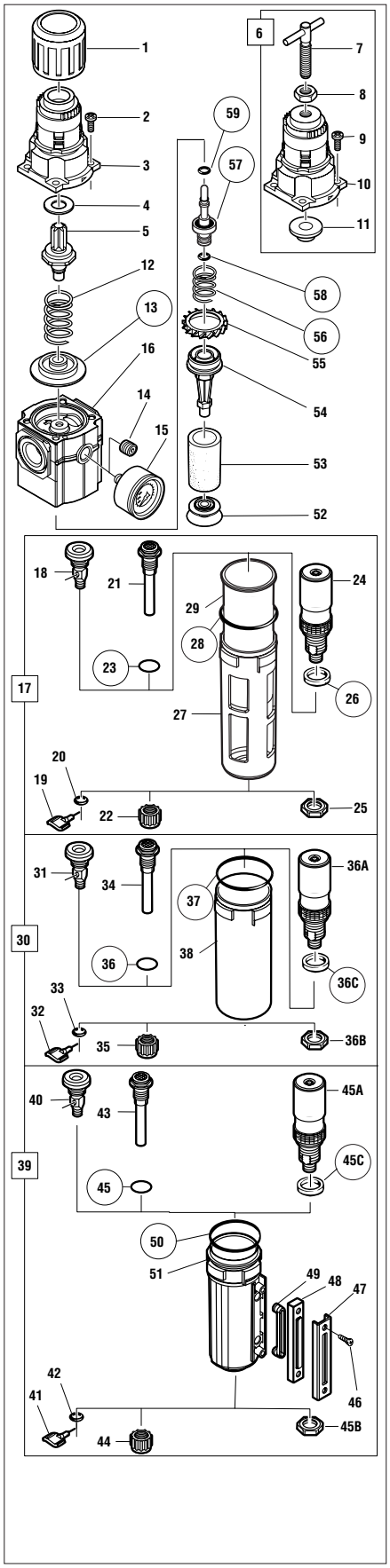
Polycarbonate plastic bowls can be damaged and possibly burst if exposed to such substances as certain solvents, strong alkalies, compressor oils containing ester-based additives or synthetic oils. Fumes of these substances in contact with the polycarbonate bowl, externally or internally, can also result in damage. Clean with warm water only.

Use metal bowl in applications where a plastic bowl might be exposed to substances that are incompatible with polycarbonate.

If outlet pressure in excess of the filter/regulator pressure setting could cause downstream equipment to rupture or malfunction, install a pressure relief device downstream of the filter/regulator. The relief pressure and flow capacity of the relief device must satisfy system requirements.

The accuracy of the indication of pressure gauges can change, both during shipment (despite care in packaging) and during the service life. If a pressure gauge is to be used with these products and if inaccurate indications may be hazardous to personnel or property, the gauge should be calibrated before initial installation and at regular intervals during use.

Before using these products with fluids other than air, for non industrial applications, or for life-support systems consult Norgren.



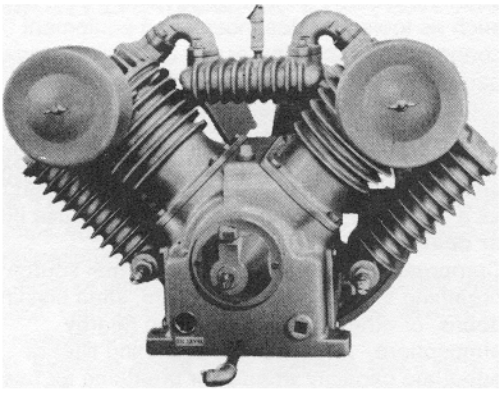
APPENDIX D

MODEL 703 705 707 PUMP

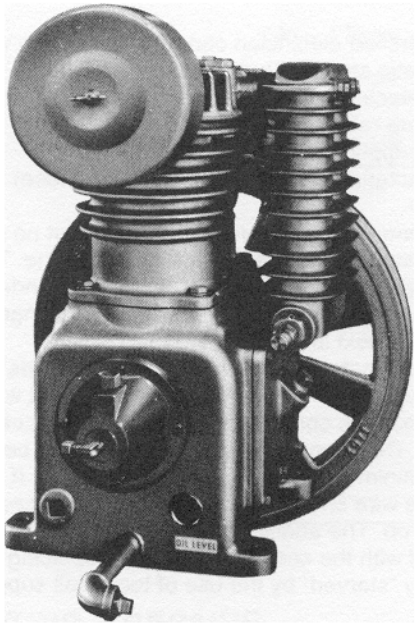
ASSEMBLY
OPERATING
INSTALLATION
INSTRUCTIONS
PARTS LIST

UNITED FIRE SYSTEMS

NITROGEN N_2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM



TYPE 707



TYPE 703 & 705

TWO STAGE

TWO CYLINDER — FOUR CYLINDER

SAYLOR BEALL MANUFACTURING COMPANY
P.O. Box 40, 400 KIBBEE STREET. ST. JOHNS, MICHIGAN 48879

Manufacturers of Air Compressors since 1915

S/B

800-248-9001 989-224-2371 989-224-8788 (FAX)

INSTALLATION AND OPERATING INSTRUCTIONS

Read all instructions carefully before starting compressor

UNPACKING INSTRUCTIONS

The two-stage compressor was inspected at the factory and packaged to protect against shipping damage. When you unpack your unit, inspect for damage or missing parts. If there is any damage or missing parts, the transportation company's agent should make a notation to the effect on the Bill of Lading. Claims should be settled directly with the transportation company.

PIPING

If a pipe line is necessary, use the same size as the tank valve since too small piping restricts the flow of air. If over 100 feet long, use the next larger size.
Bury underground lines below the frost line and avoid pockets where condensation can gather and freeze.
Make certain all pipe joints are free from leaks.
Apply pressure before underground lines are covered.

WIRING

Have a certified electrician connect the service wires to the magnetic starter. Check following:

1. The electric box is large enough. Service adequate ampere rating.
2. The supply line has the same electrical characteristics (voltage, cycles and phase) as the motor.
3. The line wire is the proper size and that no other equipment is operated from the same line. The following chart gives minimum recommended wire sizes for compressor installations. For longer lines use the next larger size wiring.

Various national and local codes and standards have been set up covering electrical apparatus and wiring. These should be consulted and local ordinances observed. Our recommended wire sizes may be larger than the minimum set up by local ordinances. If so, the larger size wire should be used to prevent excessive line voltage drop. The additional wire cost is very small compared with the cost of repairing or replacing a motor electrically "starved" by the use of too small supply wires.

BELT GUARD

OSHA requires installation of a totally enclosed belt guard covering the flywheel, belts and motor pulley.

WARNINGS

1. Compressed air systems are complex and can be dangerous. **Use an experienced compressed air systems person** when connecting this air compressor to any system.
2. Electric motor driven compressors use electricity. **Use only a certified electrician to connect to the power source**. To **avoid risk of electrocution**, do not touch or come in contact with any part of the compressor or power lines while it is connected to a power source. Prior to performance of any service or maintenance, disconnect and lock out any source of electricity.

(WARNINGS CONTINUED)

3. **Electricity can cause a fire or explosion when directly exposed to flammable chemicals, liquids or gases**. Do not locate the compressor near any dangerous material.
4. **Air pressure can cause an explosion**. Do not fill compressed air into any container beyond its rated air capacity. Do not exceed the pressure rating of any container. Containers may include cylinders, tires, air tools, air tanks, piping and other items that use compressed air in their normal operation. These items may have a pressure capacity that is lower than the pressure output of this air compressor. Check the manufacturer of any container for its pressure rating prior to inflation.
5. **Compressed air can cause injury to the eyes, ears or body parts**. Compressed air is a powerful source of energy that escapes rapidly from devices such as tools, nozzles, hoses and equipment that are connected to the compressed air. Do not allow any part of your body to come in contact directly near compressed air or where compressed air is escaping the system, tools or equipment.
6. **Compressed air may contain carbon monoxide and other impurities**. Do not use compressed air as a source of breathing air, or it may cause **illness or death**.
7. Compressed air can disturb the normal source of breathing air by mixing dust, paint, sand blasting debris, or other impurities into the nearby atmosphere. Always use a breathing filter of adequate capacity when your breathing air has been altered.
8. The **air compressor has moving parts** that are protected by an enclosed belt guard at the time of manufacture. Do not remove the belt guard, except when performing maintenance. Electric power should be disconnected and locked out as noted in item 2 prior to removal of the guard. To avoid injury, do not touch or come in contact with the air compressor while the power is connected. Keep all loose clothing and other articles away from the compressor while power is connected. The **unit may start unexpectedly** at any time power is connected.
9. Compressed air, the air compressor, and the compressed air system will be hot while operating. Do not touch any component while in operation to **avoid risk of burns.**
10. **Do not modify or repair an air tank**. Welding, drilling or other modifications may weaken the tank resulting in risk of an explosion. Always replace cracked or leaking air tanks.
11. **Never install a shutoff valve between the compressor pump and air tank**. This is extremely important for base mounted configurations, but also may apply if a tank-mounted configuration is modified. Personal injury or equipment damage may occur.
12. This air compressor is designed to compress air only. **Do not compress any gas** other than air, as an unknown result could occur, included but not limited to damage to the equipment or explosion.

MODEL 703-705-707 PUMP
TWO STAGE

INSTALLATION AND STARTING

INSPECTION: Check for possible damage in transit. All basic pumps are shipped with flywheel unmounted! Do not force flywheel on crankshaft. Use wedge in "slot" provided for easy assembly. Belt alignment and tensions must be checked carefully!

MOUNTING: Install in a clean, dry, well ventilated location away from any source of heat such as a boiler or radiator. If a unit is to be fastened to a foundation, all four feet must be firmly supported and shimmed to remove all stress from unit. Pump flywheel should be mounted towards wall with minimum clearance of 18" to allow for circulation of air and additional clearance if required for servicing.

LUBRICATION: Fill crankcase to level mark on oil gauge with an industrial compressor oil grade ISO 150 or ASTM 700.

CAUTION: Turn power off before servicing.

Ambient Temp.	Viscosity at 100° SSU	ISO Viscosity CS+	SAE No.
0° - 40°	250-350	46-68	20
40° - 80°	450-550	100	30
80° - 120°	650-750	150	40
Under 0° Over 120°	Consult Factory		

CHANGE OIL REGULARLY

Minimum – once every three months.

703 = 4 Pints

705 = 4 Pints

707 = 4 Pints

MAINTENANCE, OPERATION AND CARE

PRESSURE AND SPEED: Never operate pump at pressures or speeds in excess of those recommended by factory. Every compressor assembly must have a safety valve installed and should be set at either the maximum tank working pressure or 25 P.S.I. over the actual pressure of the pump whichever if less.

OPERATING GUIDELINES: Maximum Operating Speed, 705 @ 5 HP, 845 RPM; . Minimum operating speed, all pumps, 400 RPM. Intermittent Operation, maximum 70%. Consult dealer for applications outside these guidelines.

***DAILY:** Check for unusual noise, failure to compress, overheating, oil leaks, and vibration. Correct before serious damage develops. Drain all condensate from receiver and traps.

***WEEKLY:** Examine Intake Filter elements and if dirty, remove and clean or replace. Check oil level and add if necessary. Do not fill over level mark on sight glass! Keep compressor clean for efficient operation and appearance.

***MONTHLY:** Check and tighten all bolts and nuts as required (refer to torque chart). Check air connections for air leaks – tighten as required. Check belt tension. NOTE: This is a standard maintenance procedure which "warranty" does not cover.

***QUARTERLY:** Inspect valves, clean if necessary. NOTE: This is a standard maintenance procedure which "warranty" does not cover.

RECOMMENDED TORQUE READINGS

	Foot-Pounds
7/16 Head bolts	50-55
Valve retainer	80-90
5/16 Rod bolts	30
3/8 Crankcase bolts	30-40
5/16 Side cover bolts	30-40
5/16 Front and rear cover bolts	30-40
5/16 Manifold bolts	30-40
5/8 Flywheel bolts	65-75
5/16 Intercooler bolts	30-40

MAINTENANCE – TROUBLE SHOOTING – REPAIRS

SLOW PUMPING OR INSUFFICIENT PRESSURE

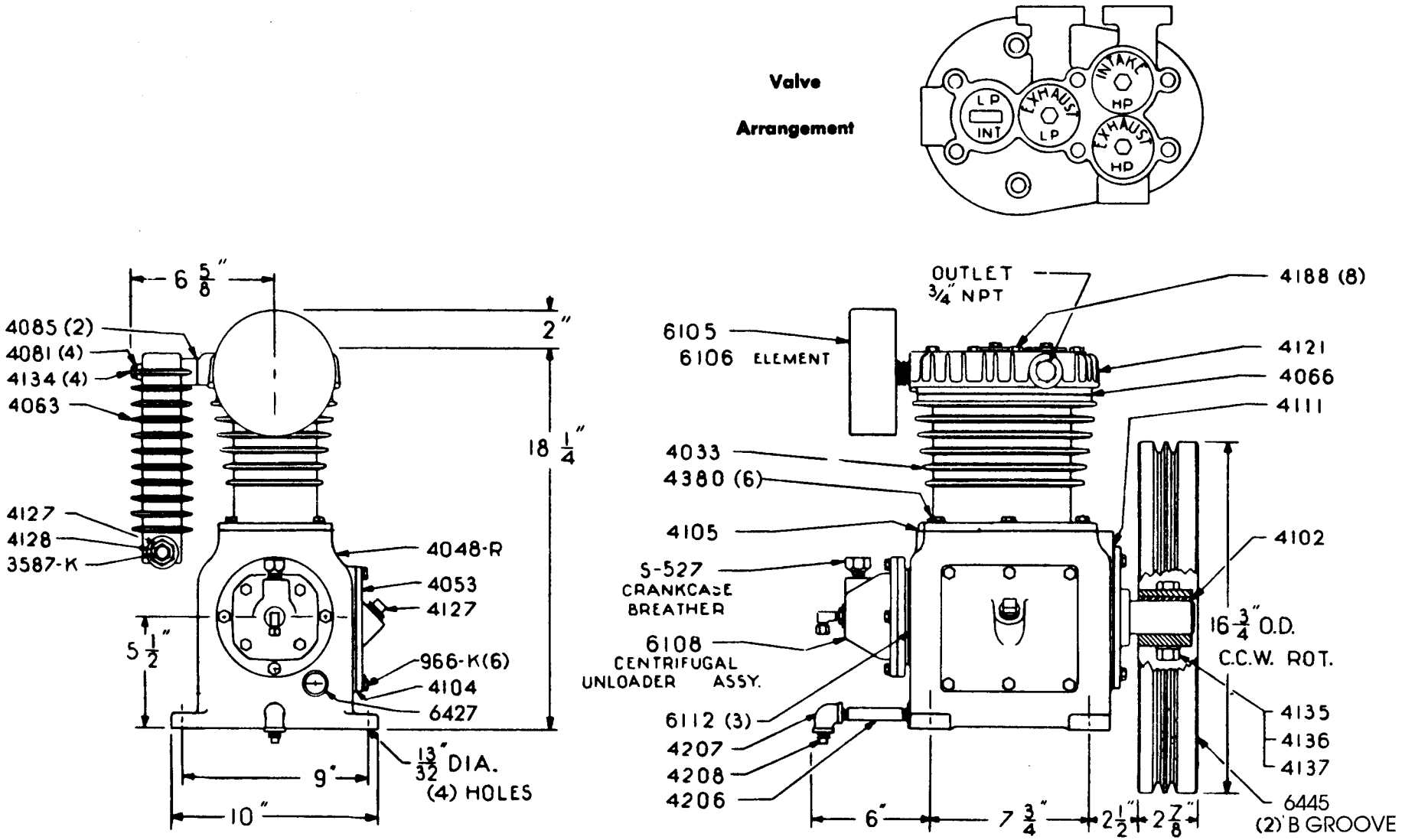
1. Clogged filter element – clean or replace.
2. Leaks in air lines – retighten or replace.
3. Insufficient air capacity – add compressor capacity – consult dealer.
4. Head valves – clean or replace (see figure 5).
5. Slipping belts – adjust or replace.

EXCESSIVE OIL CONSUMPTION

1. Too much oil – drain out excess to level mark on sight glass.
2. Worn rings – replace rings
3. Clogged air intake filters – clean or replace.
4. Improper oil – consult oil chart.
5. Oil leaks – check and tighten all bolts and nuts. Replace gaskets if necessary. See "monthly" under "operation and care."
6. Duty cycle over 70%.

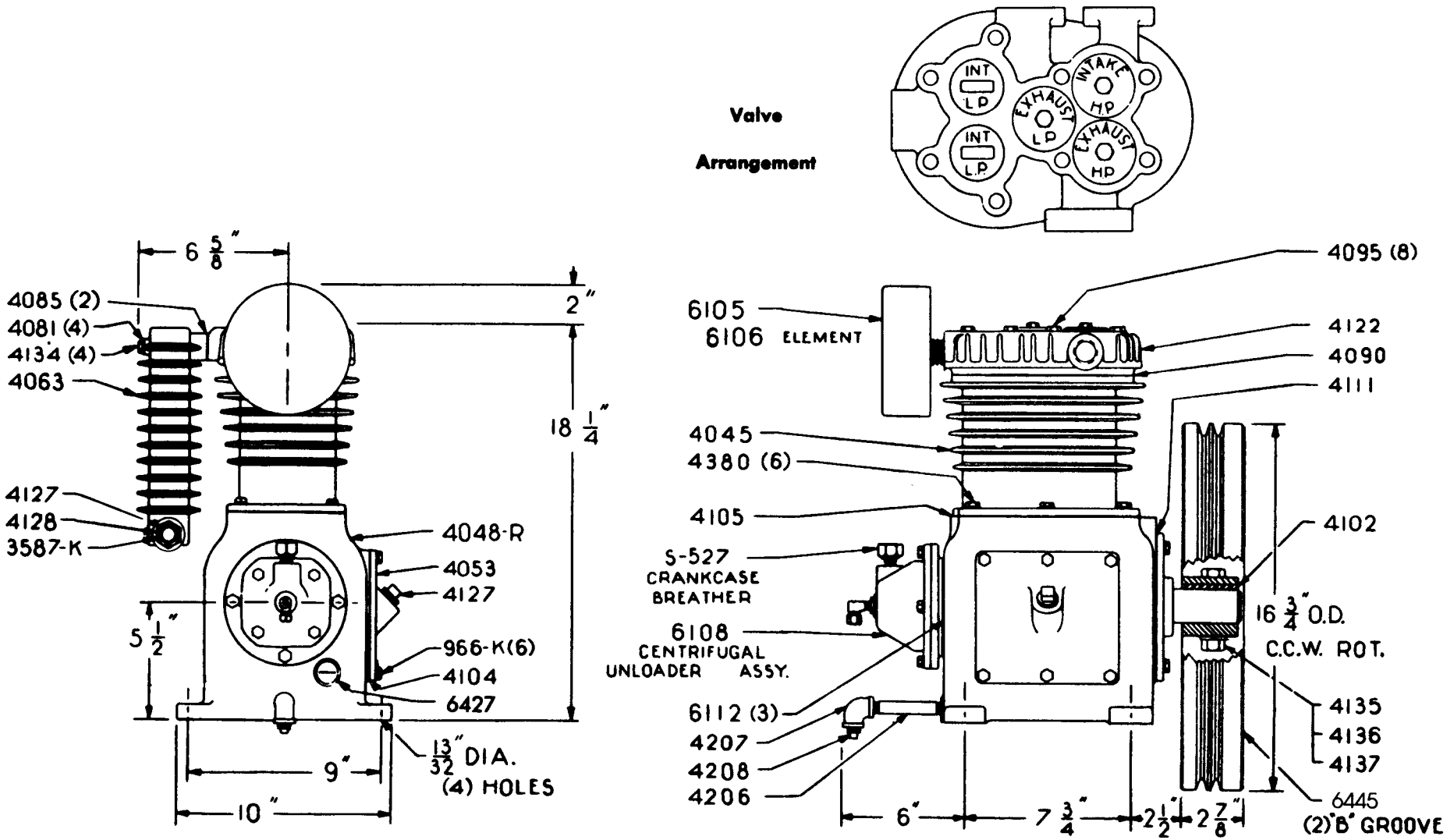
OVERHEATING

1. Pump running backwards – reverse rotation, must be CCW facing flywheel.
2. Inadequate ventilation – pipe intakes to outside and install filters to protect against weather and foreign objects.
3. High ambient – same as #2.
4. Restricted air intakes – clean or replace.
5. Loose or restricted valves – retighten, clean or replace.
6. Incorrect installation – allow 18" minimum between wall and flywheel.
7. Insufficient air capacity or excessive duty cycle.



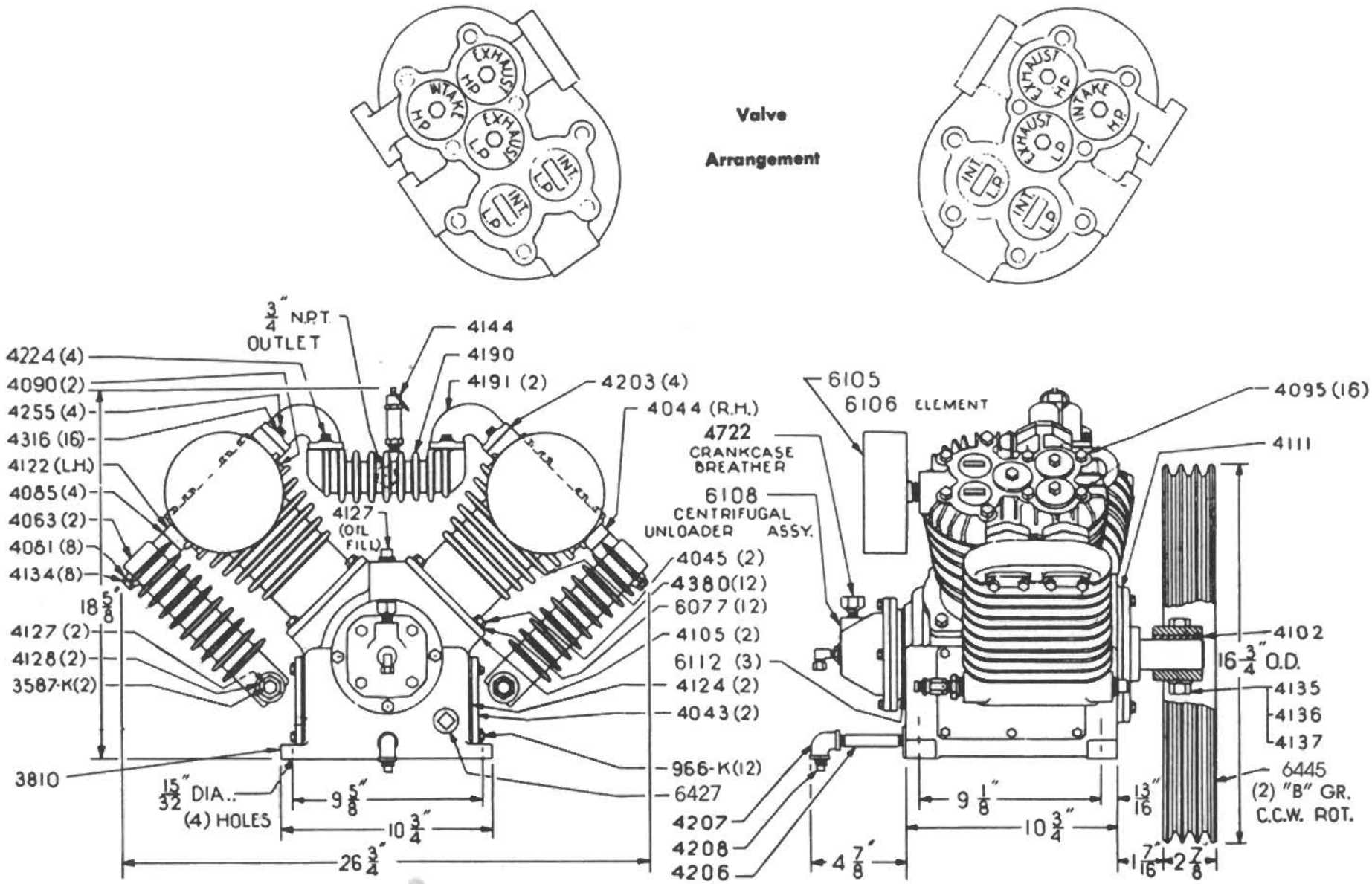
MODEL 703 COMPRESSOR

Figure 1



MODEL 705 COMPRESSOR

Figure 2



MODEL 707 COMPRESSOR

Figure 3

MODEL 703

Figure 1

Part Name	Part No.	No. Req.
Crankcase Assembly	4539	1
Crankcase	4048-R	1
Oil Sight Glass	6427	1
Cylinder	4033	1
Cylinder Head	4121	1
Intercooler Assembly	4536	1
Intercooler	4063	1
Reducer Bushing	4128	1
Pipe Plug	4127	1
Safety Valve	3587-K	1
Side Cover	4053	1
Flywheel Assembly	4537	1
Flywheel	6445	1
Bolt	4135	1
Lockwasher	4136	1
Nut	4137	1
Gasket — Cylinder Head	4066	1
Gasket — Cylinder to Crankcase	4105	1
Gasket — Front Cover	4111	1
Gasket — Side Cover	4104	1
Gasket — Intercooler	4085	2
Shims — Brg. Adj.	6112	3
Gasket Set	4310	1

MODEL 705

Figure 2

Part Name	Part No.	No. Req.
Crankcase Assembly	4539	1
Crankcase	4048-R	1
Oil Sight Glass	6427	1
Cylinder	4045	1
Cylinder Head	4122	1
Intercooler Assembly	4536	1
Intercooler	4063	1
Reducer Bushing	4128	1
Pipe Plug	4127	1
Safety Valve	3587-K	1
Side Cover	4053	1
Flywheel Assembly	4546	1
Flywheel	6445	1
Bolt	4135	1
Lockwasher	4136	1
Nut	4137	1
Gasket — Cylinder Head	4090	1
Gasket — Cylinder to Crankcase	4105	1
Gasket — Front Cover	4111	1
Gasket — Side Cover	4104	1
Gasket — Intercooler	4085	2
Shims — Brg. Adj.	6112	3
Gasket Set	4311	1

MODEL 707

Figure 3

Part Name	Part No.	No. Req.
Crankcase Assembly	4547	1
Crankcase	3810	1
Oil Sight Glass	6427	1
Cylinder	4045	2
Cylinder Head — R.H.	4044	1
Cylinder Head — L.H.	4122	1
Intercooler Assembly	4536	2
Intercooler	4063	2
Reducer Bushing	4128	2
Pipe Plug	4127	2
Safety Valve	3587-K	2
Side Cover	4043	2
Flywheel Assembly	4607	1
Flywheel	6445	1
Bolt	4135	1
Lockwasher	4136	1
Nut	4137	1
Exhaust Manifold	4190	1
Elbow — Exhaust Manifold	4191	2
Gasket — Cylinder Head	4090	2
Gasket — Cylinder to Crankcase	4105	2
Gasket — Front Cover	4111	1
Gasket — Side Cover	4124	2
Gasket — Intercooler	4085	4
Shims — Brg. Adj.	6112	3
Gasket — Exhaust Manifold	4203	4
Gasket Set	4312	1
Flat Washer	4316	8

MODEL 705

Figures 1, 2 & 3

Part Name	Part No.	No. Req. 703	705	707	
Air Filter Silencer	6105	1	1	2	
Filter Elements (6105)	6106	1	1	2	
Oil Bath Intake Filter	4462	1	1	2	
Crankcase Breather	S-527	1	1		
Centrifugal Unloader Ass'y.	6108	1	1	1	
Safety Valve	4144	—	—	1	
Pipe—Oil Drain	4206	1	1	—	
Elbow—Oil Drain	4207	1	1	—	
Plug—Oil Drain	4208	1	1	—	
Head Bolts	4188	8	—	—	- 3/8
Head Bolt	4095	—	8	16	- 7/16
Cylinder Bolts	4380	6	6	12	- 3/8
Side Cover Bolts	966-K	6	6	12	- 5/16
Intercooler Bolts	4134	4	4	8	- 5/16
Manifold Bolts	4224	—	—	4	- 5/16
Manifold Bolts	4255	—	—	4	- 5/16
Key—Flywheel	4102	1	1	1	
Washer—Cylinder	6077	—	—	12	
Washer—Copper	4081	10	10	20	
Pipe Plug—Oil Fill	4127	1	1	1	

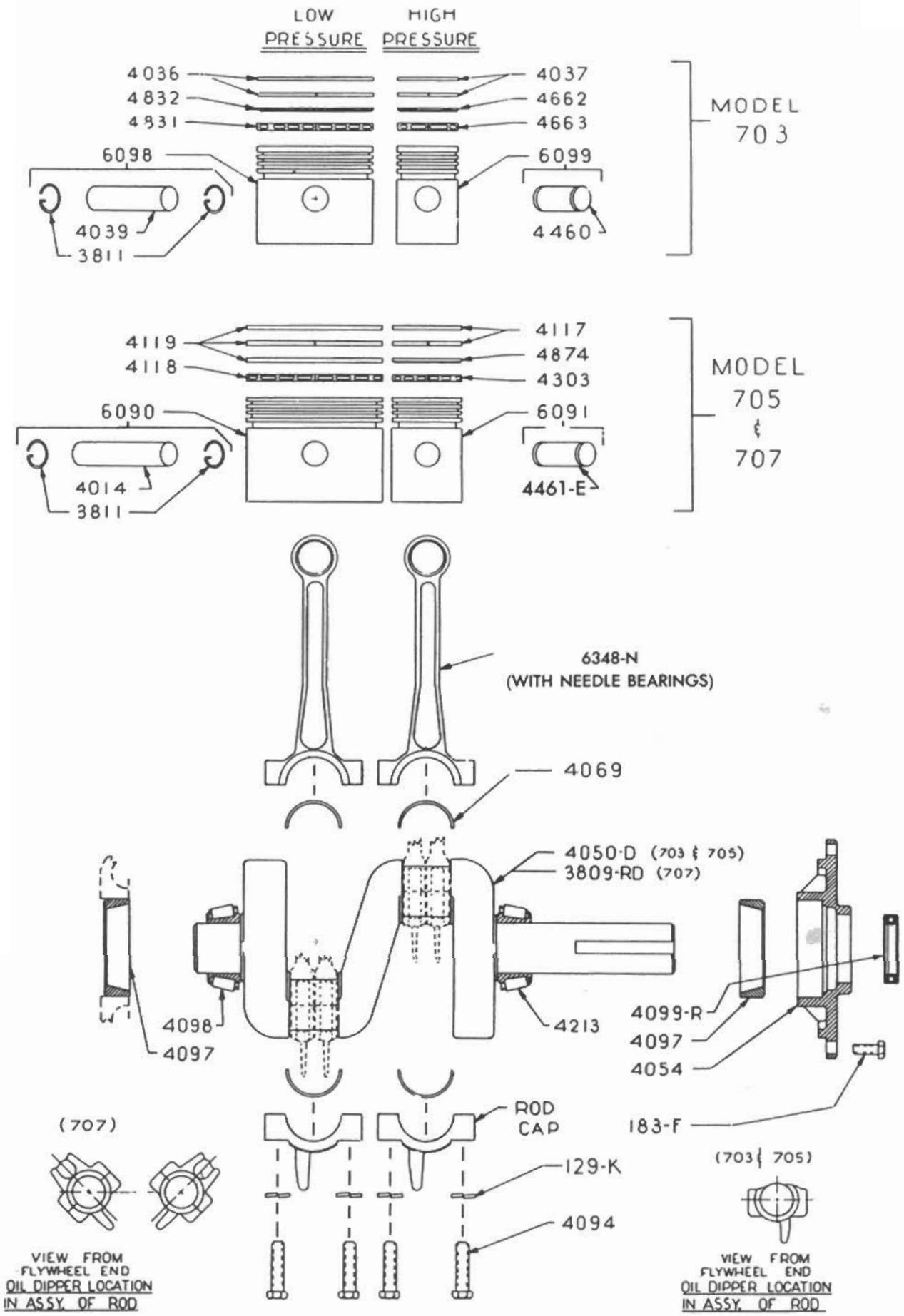

LOW PRESSURE
HIGH PRESSURE
4036
4832
4931
4037
4662
4663
6098
6099
4039
3811
4460
MODEL 703
4119
4118
4117
4874
4303
6090
6091
4014
3811
4461-E
MODEL 705 & 707
6348-N
(WITH NEEDLE BEARINGS)
4069
4050-D (703 & 705)
3809-RD (707)
4098
4097
4213
4099-R
4097
4054
183-F
ROD CAP
129-K
4094
(707)
VIEW FROM FLYWHEEL END
OIL DIPPER LOCATION
IN ASSY. OF ROD
(703 & 705)
VIEW FROM FLYWHEEL END
OIL DIPPER LOCATION
IN ASSY. OF ROD

Figure 4

MODEL 703

Figure 4

Part Name	Part No.	No. Req.
Crankshaft Assembly		
Crankshaft	4050-D	1
Bearing Cone – Front	4213	1
Bearing Cone – Rear	4098	1
Front Bearing Cover Ass'y.	4531	1
Cover	4054	1
Bearing Cup	4097	1
Shaft Seal	4099-R	1
Bolts	183-F	6
Bearing Cup – Rear	4097	1
Connecting Rod Ass'y. (LP, HP)	6381-N	2
Connecting Rod	6348-N	2
Needle Bearing (Wrist Pin)	4126	4
* * Bearing Insert (halves)	4069	4
Rod Bolts	4094	4
Lockwashers	129-K	4
* * Available in pairs only		
Piston and Ring Ass'y. – L.P. (3-1/2)	6100	1
Piston	6098	1
Wrist Pin	4039	1
Retaining Pin	3811	2
Compression Ring	4036	2
Compression Ring	4832	1
Oil Ring	4831	1
Piston Ring Ass'y. – H.P. (1 7/8)	6101	1
Piston	6099	1
Wrist Pin	4460	1
Compression Ring	4037	2
Compression Ring	4662	1
Oil Ring	4663	1
Piston Ring Set	6102	1

MODEL 705

Figure 4

Part Name	Part No.	No. Req.
Crankshaft Assembly		
Crankshaft	4050-D	1
Bearing Cone – Front	4213	1
Bearing Cone – Rear	4098	1
Front Bearing Cover Ass'y.	4531	1
Cover	4054	1
Bearing Cup	4097	1
Shaft Seal	4099-R	1
Bolts	183-F	6
Bearing Cup – Rear	4097	1
Connecting Rod Ass'y. (LP, HP)	6381-N	2
Connecting Rod	6348-N	2
* * Bearing Insert (halves)	4069	4
Needle Bearing (Wrist Pin)	4126	2
Rod Bolts	4094	4
Lockwashers	129-K	4
* * Available in pairs only		

MODEL 705

(Continued)

Part Name	Part No.	No. Req.
Piston and Ring Ass'y. – L.P. (4-1/8)	6092	1
Piston	6090	1
Wrist Pin	4014	1
Retaining Pin	3811	2
Compression Ring	4119	3
Oil Ring	4118	1
Piston Ring Ass'y. – H.P. (2 1/8)	6093	1
Piston	6091	1
Wrist Pin	4461	1
Retaining Ring	3811	2
Compression Ring	4117	2
Compression Ring	4874	1
Oil Ring	4303	1
Piston Ring Set	6094	1

MODEL 707

Figure 4

Crankshaft Assembly		
Crankshaft	3809-RD	1
Bearing Cone – Front	4213	1
Bearing Cone – Rear	4098	1
Front Bearing Cover Ass'y.	4531	1
Cover	4054	1
Bearing Cup	4097	1
Shaft Seal	4099-R	1
Bolts	183-F	6
Bearing Cup – Rear	4097	1
Connecting Rod Ass'y. (LP, HP)	6381-N	4
Connecting Rod	6348-N	4
Needle Bearing (Wrist Pin)	4126	2
Bearing Insert (halves)	4069	8
Rod Bolts	4094	8
Lockwashers	129-K	8
Piston and Ring Ass'y. – L.P. (4-1/8)	6092	2
Piston	6090	2
Wrist Pin	4014	2
Retaining Ring	3811	4
Compression Ring	4119	6
Oil Ring	4118	2
Piston and Ring Ass'y. – H.P. (2 1/8)	6093	2
Piston	6091	2
Wrist Pin	4461-E	2
Retaining Ring	3811	4
Compression Ring	4117	2
Compression Ring	4874	2
Oil Ring	4303	2
Piston Ring Set	6095	1

NOTE: When ordering parts – specify Model No. & Serial No. of Pump.

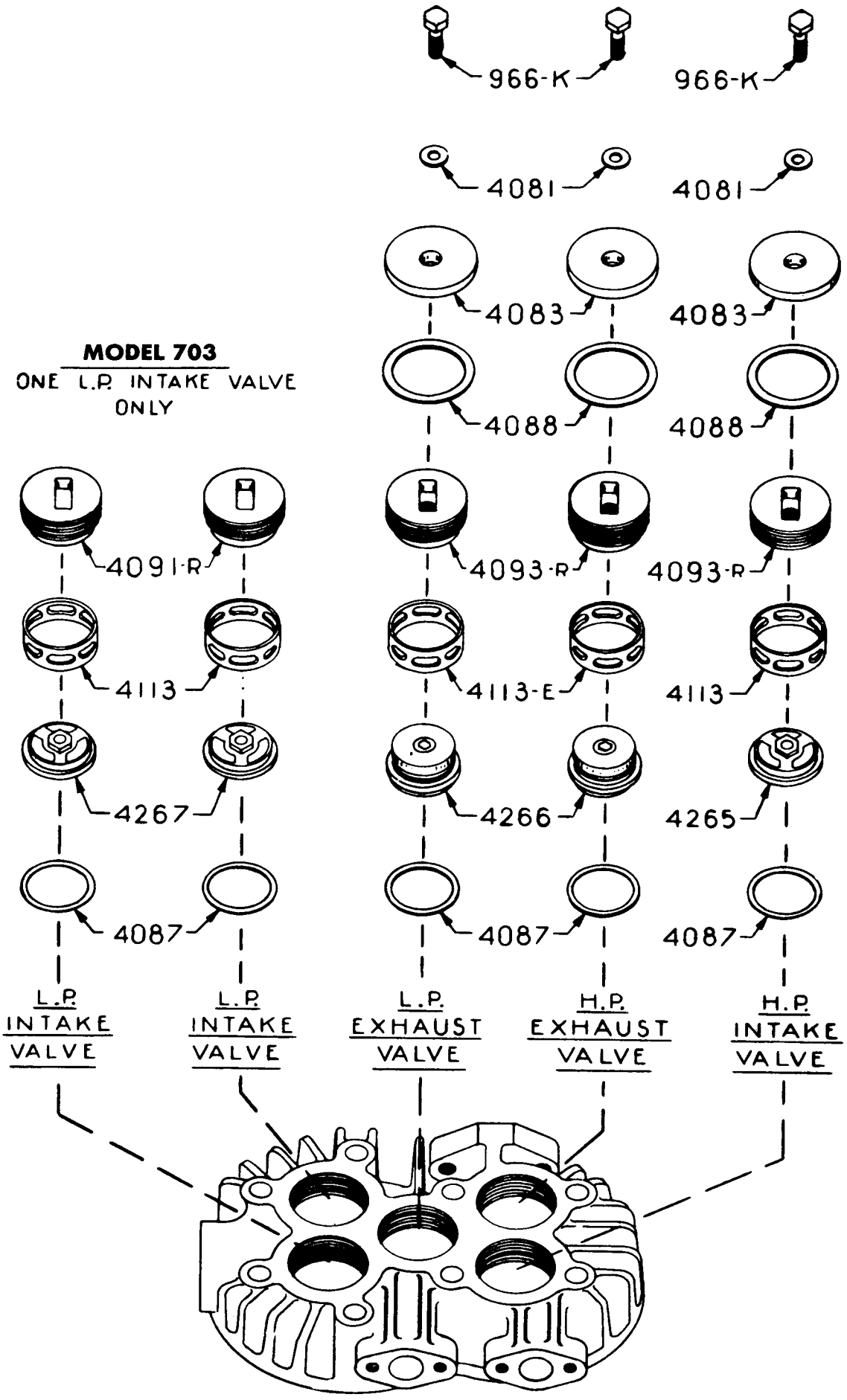

966-K
966-K
4081
4081
4083
4083
MODEL 703
ONE L.P. INTAKE VALVE ONLY
4088
4088
4091-R
4093-R
4093-R
4113
4113-E
4113
4267
4266
4265
4087
4087
4087
L.P. INTAKE VALVE
L.P. INTAKE VALVE
L.P. EXHAUST VALVE
H.P. EXHAUST VALVE
H.P. INTAKE VALVE

Figure 5

Figure 5

Start - Stop

Part Name	Part No.	No. Req. 703	705	707
Cylinder Head and Valve Assembly	4471	1	—	—
Cylinder Head and Valve Assembly	4473	—	1	1
Cylinder Head and Valve Assembly	4472	—	—	1
(2) Low Pressure Intake Valve Assembly	4267	1	2	4
(2) High Pressure Intake Valve Assembly	4265	1	1	2
(2) Exhaust Valve Assembly (HP & LP)	4266	2	2	4
(1) (2) Gasket — All Valves	4087	4	5	10
Spacer — Exh. Valves	4113-E	2	2	4
Spacer — Int. Valves	4113	2	3	6
Retainer — L.P. Intake Valve	4091-R	1	2	4
Retainer — Exhaust Valve	4093-R	2	2	4
Retainer — H.P. Intake Valve	4093-R	1	1	2
(1) (2) Gasket — Valve Cover	4088	3	3	6
Cover — Valve	4083	3	3	6
(1) (2) Copper Washer	4081	3	3	6
Bolt — Valve Cover	966-K	3	3	6
Valve Repair Kit (for 4 valves)	4805	1	—	—
Valve Repair Kit (for 5 valves)	4806	—	1	—
Valve Repair Kit (for 10 valves)	4807	—	—	1
Valve Replacement Kit (4 valves)	4812	1	—	—
Valve Replacement Kit (5 valves)	4813	—	1	—
Valve Replacement Kit (10 Valves)	4814	—	—	1

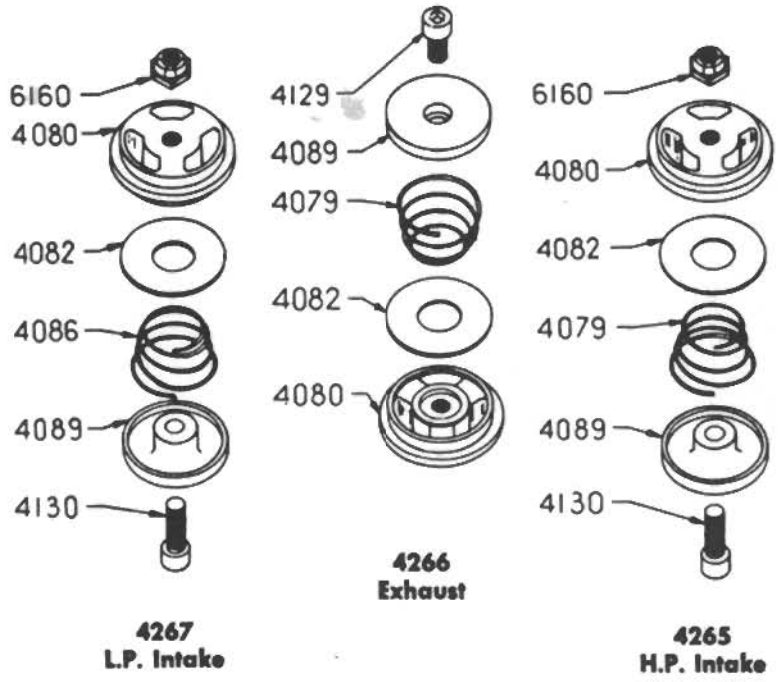


Figure 6

Valve Components

Nut	6160
(1) Spring	4079
Seat	4080
(1) Valve Plate	4082
(1) Spring	4086
Valve Guide	4089
Allen Screw	4129
Allen Screw	4130

(1) Included in Valve Repair Kits

(2) Included in Valve Replacement Kits

6108 CENTRIFUGAL UNLOADER

Figure 7

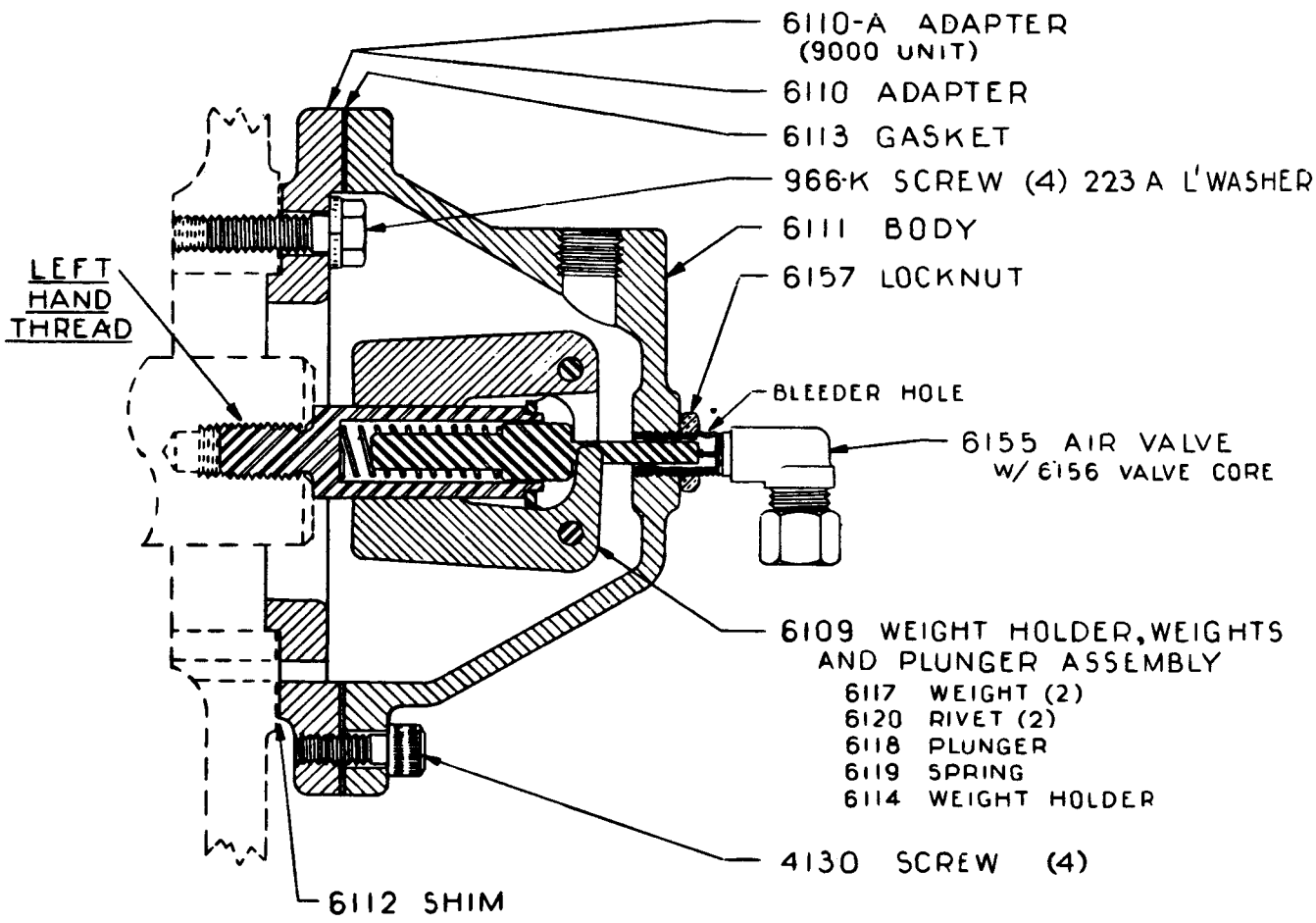


Figure 7

Part Name	Part No.	No. Req.
Adapter Plate	6110	1
Body	6111	1
Weight Holder, Weights and Plunger Assembly	6109	1
Weights	6117	2
Rivets	6120	2
Plunger	6118	1
Spring	6119	1
Weight Holder	6114	1
Air Valve Assembly	6155	1
Valve Core	6156	1
Lock Nut	6157	1
Gasket	6113	1
Shim	6112	as req.
Bolt	966-K	4
Bolt	4130	4
Lock Washer	223-A	4

Note: When ordering parts, give Model No. and Serial No. of Pump

Figure 8

CONSTANT SPEED
DISCHARGE UNLOADER VALVE

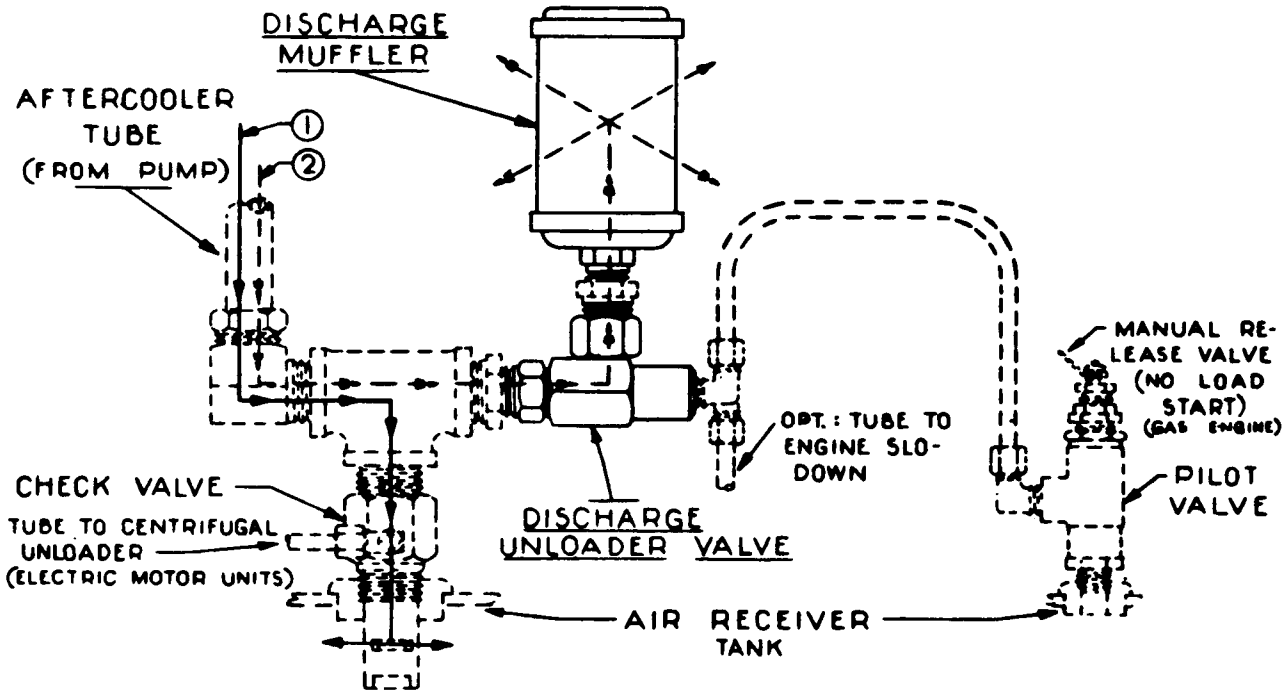
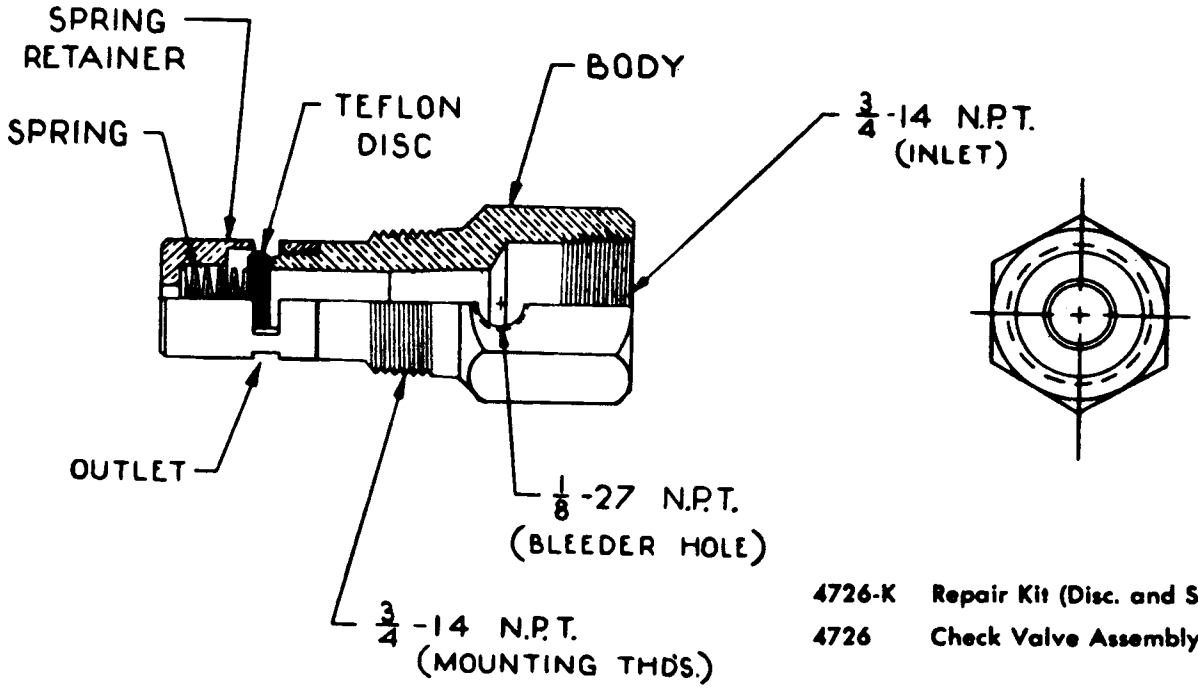


Figure 8

Part Name	Part No.
Discharge Unloader Valve (703 & 705)	6154
Discharge Unloader Valve (707)	6184
Discharge Muffler (703, 705 & 707)	6158

4726 CHECK VALVE



4726-K	Repair Kit (Disc. and Spring)
4726	Check Valve Assembly

Note: When ordering parts, give Model No. and Serial No. of Pump

DISASSEMBLY

1. Loosen motor – slide toward pump. Remove belts and flywheel. Use wedge in slot of flywheel after loosening bolt. Disconnect aftercooler tube and tube to centrifugal unloader. Remove 4 bolts, securing pump to base.

2. Remove exhaust manifold (707), cylinder heads and intercooler.

3. Mark top of pistons for reassembling in same position.

4. Remove side plates.

5. To remove connecting rod – remove rod bolts, noting position of the identification marks on one side of each so that connecting rods are re-installed in original position. **DO NOT INTERCHANGE ROD CAPS!**

6. Remove connecting rod and piston assembly thru bottom of cylinder. Cylinder must be removed from crankcase.

7. To remove pistons from connecting rod – remove two retaining rings, one on each end of wrist pin – L.P. piston only. "Tap" wrist pin out of piston.

8. To remove crankshaft – remove key from flywheel and burrs or foreign matter to prevent damage to shaft seal. Remove bolts from front cover and remove cover being careful not to let crankshaft drop. *Remove centrifugal unloader, attached to rear end of crankshaft. Slide crankshaft out thru front cover.

9. To remove valves from cylinder head – remove (3) valve cover plates (H.P. intake and exhaust valves). Remove threaded plugs (slots provided for removal) and spacers atop each valve. Lift valves out thru openings. DO NOT INTERCHANGE VALVES!

*Centrifugal unloader is assembled and disassembled by screwing the entire assembly into the end of the crankshaft. This assembly is provided with a **LEFT HAND THREAD** and must be firmly tightened. **CAUTION:** incorrect rotation of compressor unit will unscrew this assembly! Rotation must be CCW facing flywheel end.

Crankshaft Rod Journal Diameter 1.5630/1.5620
Wrist Pin Diameter ..... .7501/ .7497

Caution: Wrist pins are a "tap fit" into pistons! **DO NOT USE FORCE!** Forcing will remove "cam" from L.P. Pistons, resulting in "galling" of piston.

Oversize Bearing Inserts, Piston and Piston Rings NOT AVAILABLE.

REASSEMBLY

1. Crankshaft – install crankshaft into crankcase thru front cover hole. Install front cover over crankshaft being careful not to tear shaft seal. Install bolts and tighten. Crankshaft end play is determined by inserting or removing "shims" under rear adapter plate. Shims are provided in three thicknesses and the proper combinations must be selected so the crankshaft may be turned freely in bearings without end play!

2. Cylinder – scored cylinders should be replaced. Break glaze in cylinders if used cylinders are reinstalled. Piston, rings and connecting rod assembly must be assembled in cylinder bores before assembling cylinders. Align rods with crankshaft throws, remove rod caps (DO NOT INTERCHANGE ROD CAPS!), set cylinder on crankcase and install bolts and copper washers – tighten per torque chart.

3. Pistons – clean ring grooves and oil return holes. Assemble connecting rod in piston and push wrist pin thru – use "tap fit" on wrist pin – using "force" will remove "cam" from low pressure piston resulting in galling. If wrist pin is slightly tight – heat piston slightly before "tapping" wrist pin in. Install retaining rings on L.P. piston pins. Rings – install oil ring in bottom groove, followed by stepped scraper ring and then two compression rings. Stagger ring gaps a minimum of 90° from each other. See Figure #4.

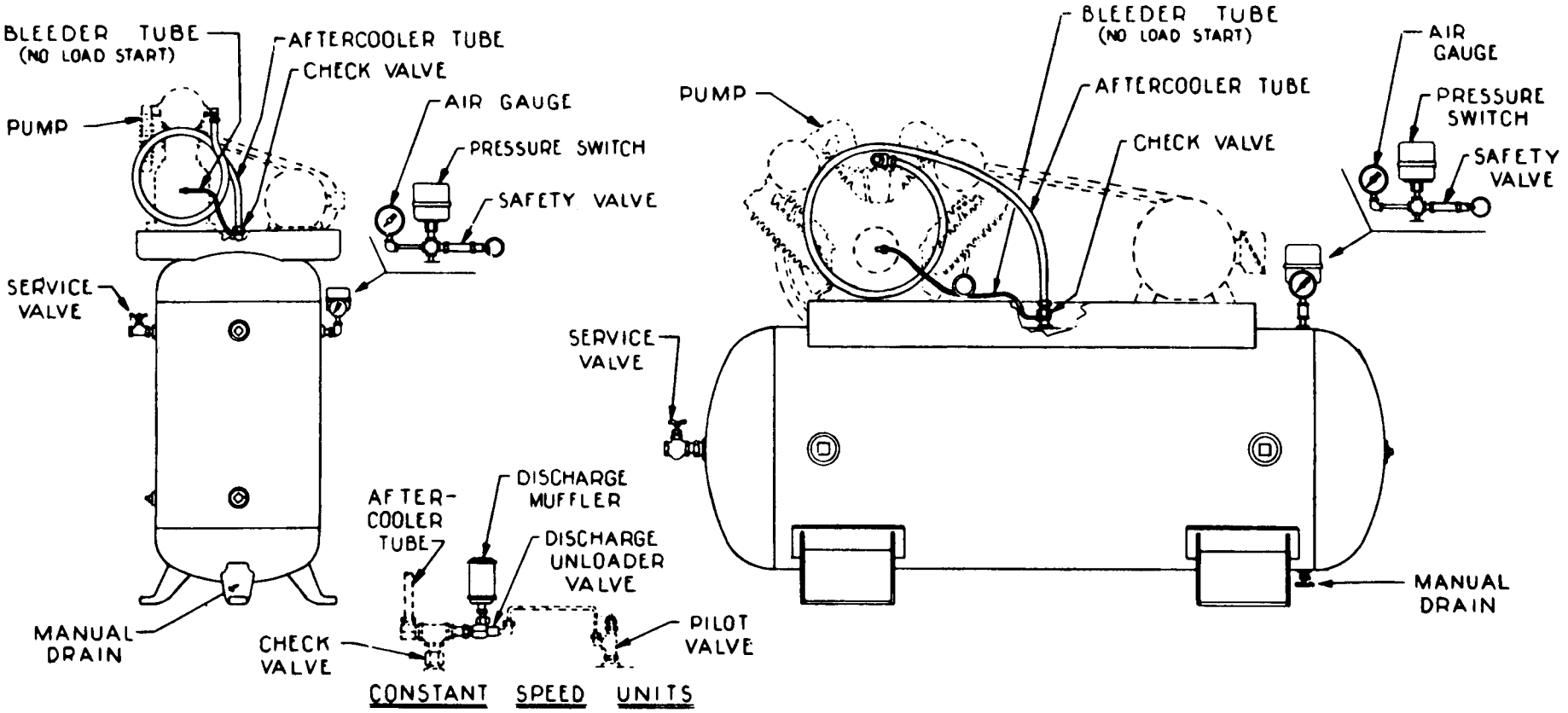
4. Connecting Rod – install the bearing inserts into the rod and cap, fitting the locating projections into grooves provided. Assemble rod cap (after oiling both halves of insert bearing) and tighten. Tap rod cap and rod to "seat" bearing inserts. Never file rod cap or use shims to adjust bearing clearance.

   Install connecting rod into piston per step 3 and piston and rod assembly into cylinder per step 2. When inserting piston and rod assembly into cylinder bore, compress rings to prevent breaking and scoring of cylinder wall.

5. Cylinder Head – install valves and components (as shown in Figure 5) being careful not to interchange valves – tighten per torque chart. Install cylinder head assembly on cylinder, install bolts and tighten.

   Install intercooler and exhaust manifold (707).

6. Turn pump over by "hand" before starting. It is recommended that the pump be "run in" a few hours.



MOTOR H.P.	PRESSURE SWITCH	AIR GAUGE	SAFETY VALVE	CHECK VALVE	SERVICE VALVE	AFTERCOOLER TUBE	MANUAL DRAIN	DISCHARGE UNL. VALVE	DISCHARGE MUFFLER	PILOT VALVE	PUMP REF.
1-1/2 & 2 HP	4876	4179	4144	4726	4167	4180-16	5-554	6154	6158	4842	703
3 HP	4876	4179	4144	4726	4262	4180-16	5-554	6154	6158	4842	705
7-1/2 & 10 HP	4876	4179	4144	4726	4262	4180-6	5-554	6184	6158	4842	707

PLEASE NOTE

WARRANTY

Saylor-Beall Manufacturing Co. warrants its compressors and parts when properly installed, lubricated and maintained as recommended and in accordance with good industry practice to be free from defects in material and workmanship under normal use and service. The responsibility of the Company under this warranty is limited to repair or replacement, at the Company's factory, any compressor or part thereof, which shall, within one year after date of shipment to the original purchaser, be returned to the company and which, upon examination, shall be found to be defective to the satisfaction of the Company.

This warranty shall not apply to compressors or parts which have been subjected to misapplication, misuse, negligence or accident, to compressors or parts which have been repaired or tampered with outside of the Company's factory when in the judgment of the Company, it appears that the reliability or stability of the compressor or part has been effected. Ordinary maintenance, such as adjustment and cleaning of equipment or components is the responsibility of the owner. All transportation and shipping charges shall be paid by purchaser.

This warranty does not apply to electric motors or gasoline engines. These are covered by the Original Manufacturer's Warranty and should be returned by the purchaser to their authorized station for service.

This warranty is expressly in lieu of all other warranties (except of title) expressed or implied and of any other obligations or liability on the part of the Company. There are not warranties of merchantability or of fitness for a particular purpose.

SAYLOR-BEALL MANUFACTURING COMPANY

QW

S/B

SAYLOR-BEALL MANUFACTURING COMPANY

ST. JOHNS, MICHIGAN 48879

Manufacturers of Air Compressors since 1915

NITROGEN N_2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM

UNITED FIRE SYSTEMS

INSTRUCTIONS – INSTALLATION KIT FOR CTAs – P/N 30-500500-100

STEP	DESCRIPTION
1	Locate Compressor / Tank Assembly and Refrigerated Dryer in permanent installed locations.
2	Refer to Figure A. Identify Item (1) Filter / Regulator Assembly. Refer to Figure B. Attach Item (1) Filter / Regulator Assembly as indicated.
3	Refer to Figure A. Identify Item (2) Hose. Attach pipe thread end of Item (2) Hose to INLET of Refrigerated Dryer. NOTE: If hose does not reach, use 1/2" black pipe and fittings from Refrigerated Dryer to vicinity of Compressor / Tank Assembly.
4	Refer to Figure B. Attach swivel end of Item (2) Hose to outlet fitting on Filter / Regulator Assembly. IMPORTANT – DO NOT attempt to use only fixed pipe from Filter / Regulator Assembly to Refrigerated Dryer. Item (2) Hose provides important vibration attenuation.
5	Refer to Figure A. Identify Item (3) Serial Number Nameplate and Item (4) Alcohol Wipe. Refer to Figure B. Use Item (4) Alcohol Wipe to clean application surface where shown. Remove backing from Item (3) Serial Number Nameplate. DO NOT REMOVE TAPE FROM BACK OF NAMEPLATE. Adhere nameplate to cleaned surface.
6	Refer to Figure A. Identify Item (5) NITROGEN-PAC Decal. Refer to Figure B. Wipe installation location with clean cloth. Remove backing from Item (5) NITROGEN-PAC Decal and adhere as indicated.
7	Refer to Figure A. Identify Item (6) UNITED Fire Systems decal. Refer to Figure B. Wipe installation location with clean cloth. Remove backing from Item (6) UNITED Fire Systems decal and adhere as indicated.
8	Refer to Figure B. Attach Item (7) Flag marker – "1" on or near outlet ball valve as indicated.

NOT SHOWN - (7) FLAG MARKER – "1"

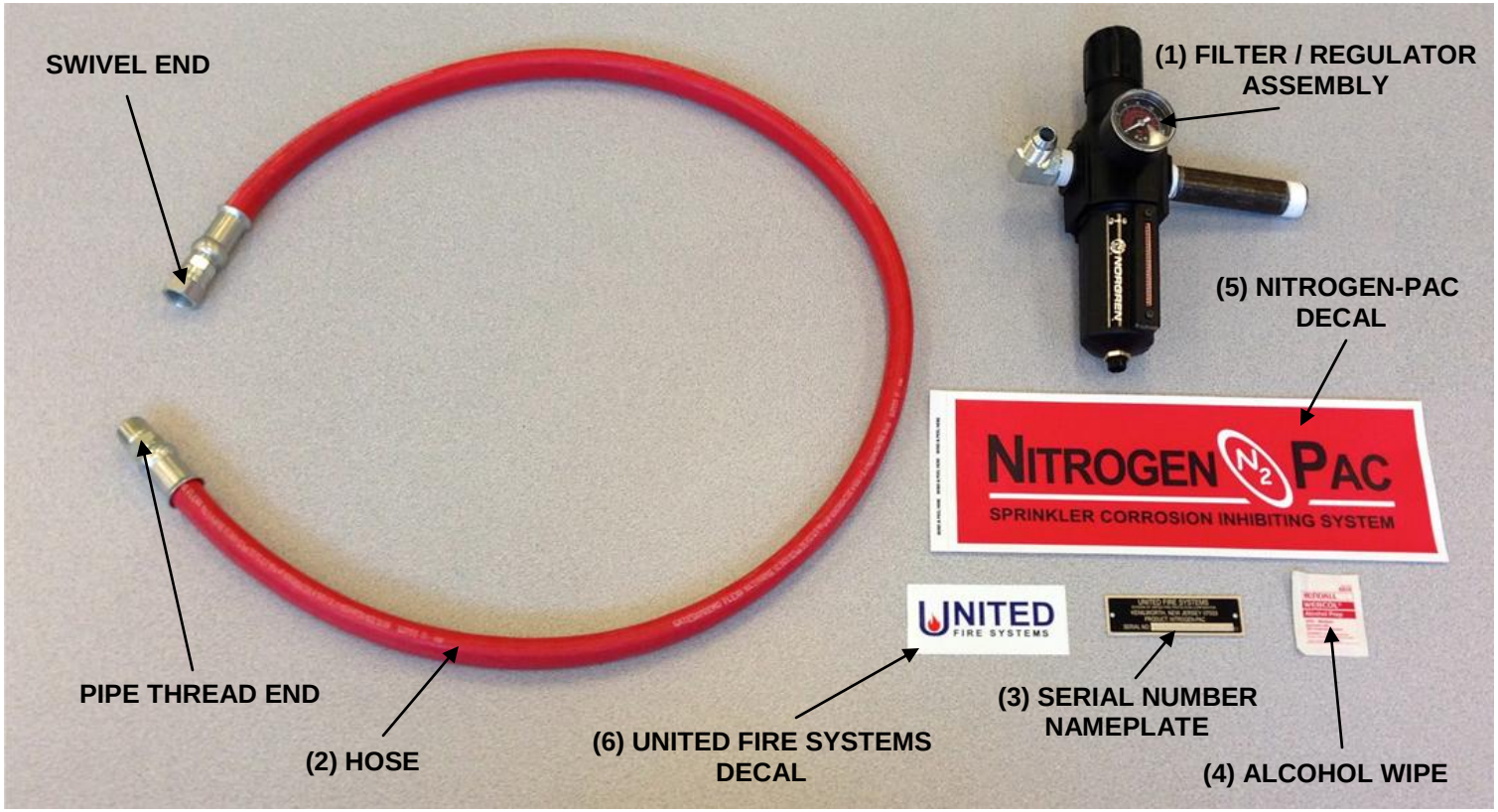


FIGURE A – CONTENTS OF INSTALLATION KIT

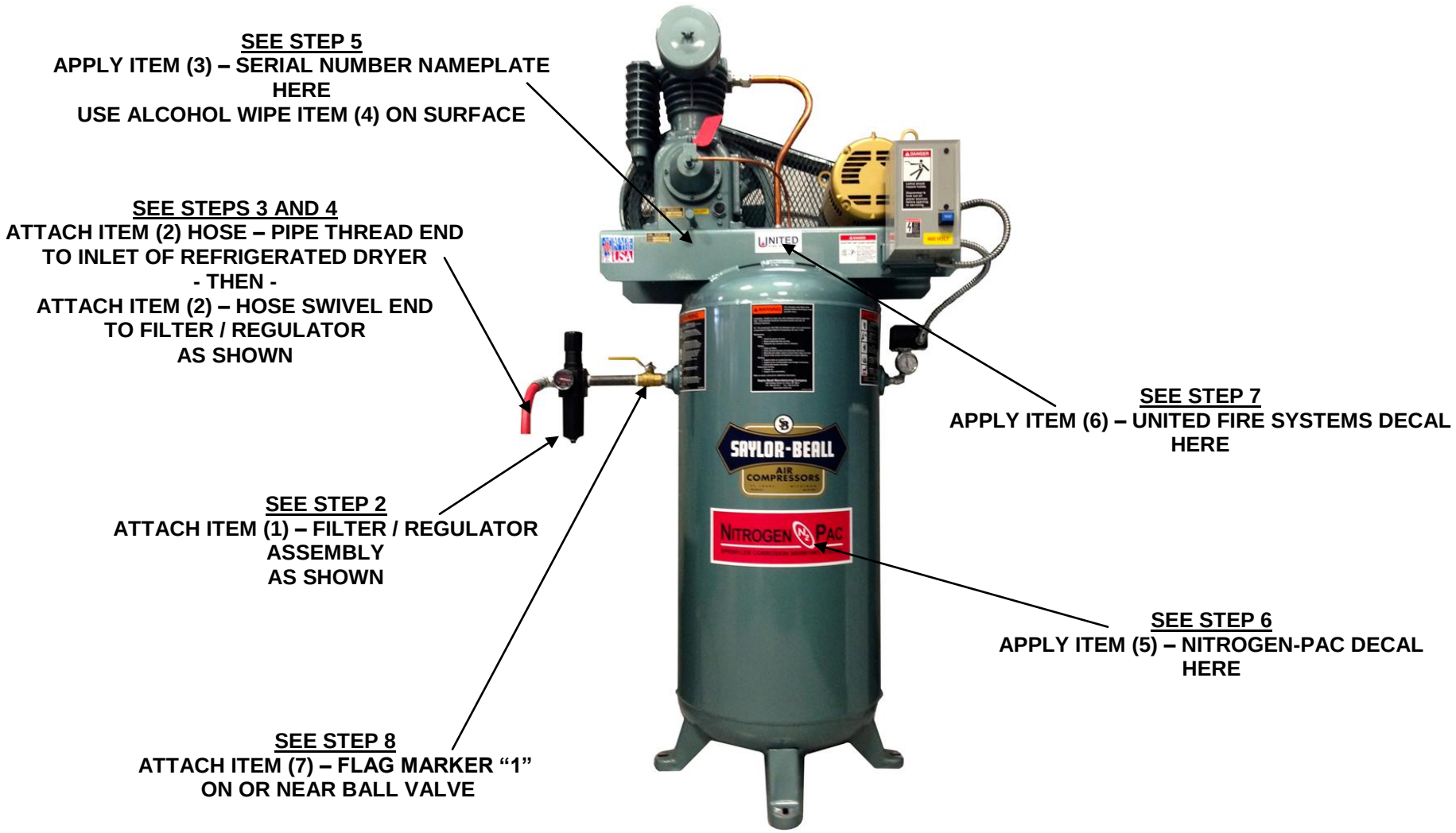


FIGURE B – LOCATIONS OF INSTALLATION KIT ITEMS

NORGREN

UNITED FIRE SYSTEMS

B74G

Installation & Maintenance Instructions

Filter/Regulator

B74G-6AK- AD1-RMG

Port	Thread Form	Adjustment	Drain	Bowl	Element	Diaphragm	Spring (Outlet Pressure Range) *	Gauge
3....3/8"	A....PTF	K....Knob	A....Automatic	D....Metal with liquid level indicator	1....5 µm	N....Non-relieving	F....0,3 to 4 bar (5 to 60 psig)	G....With
4....1/2"	B....ISO Rc taper	T....T-bar	Q....Manual, 1/4 turn	P....Transparent with guard	2....25 µm	R....Relieving	M...0,3 to 10 bar (5 to 150 psig)	N....Without
6....3/4"	G....ISO G parallel				3....40 µm		S....0,7 to 17 bar (10 to 250 psig)	

* Outlet pressure can be adjusted to pressures in excess of, and less than, those specified. Do not use these units to control pressures outside of the specified ranges.

TECHNICAL DATA

Fluid: Compressed air
Maximum pressure:
  Transparent bowl: 10 bar (150 psig)
  Metal bowl: 17 bar (250 psig)
Operating temperature*:
  Transparent bowl: -20° to +50°C (0° to +125°F)
  Metal bowl: -20° to +80°C (0° to +175°F)
* Air supply must be dry enough to avoid ice formation at temperatures below +2°C (+35°F).
Particle removal: 5 µm, 25 µm, or 40 µm filter element
Air quality: Within ISO 8573-1, Class 3 and Class 5 (particulates)
Typical flow with 10 bar (150 psig) inlet pressure, 6,3 bar (90 psig) set pressure and 1 bar (15 psig) droop from set: 100 dm^3/s (212 scfm)
Nominal bowl size: 0,2 litre (7 fluid ounce)
Manual drain connection: 1/8"
Automatic drain connection: 1/8"
Automatic drain operating conditions (float operated):
  Bowl pressure required to close drain: Greater than 0,3 bar (5 psig)
  Bowl pressure required to open drain: Less than 0,2 bar (3 psig)
  Minimum air flow required to close drain: 1 dm^3/s (2 scfm)
  Manual operation: Depress pin inside drain outlet to drain bowl
Gauge ports:
  1/4 PTF with PTF main ports
  Rc1/4 with ISO Rc main ports
  Rc1/8 with ISO G main ports
Materials:
  Body: Aluminum
  Bonnet: Aluminum
  Valve: Brass
  Bowl:
    Transparent with guard: Polycarbonate, steel guard
    Metal: Aluminum
    Metal bowl liquid level indicator lens: Transparent nylon
  Element: Sintered polypropylene
  Elastomers: Neoprene and nitrile

REPLACEMENT ITEMS

Service Kit (includes items circled on exploded view):
  Relieving.....4383-700

Liquid level lens kit (34, 36, 37, 38) 4380-050
Filter element, 5µm, red speckles (52).....4338-04

Automatic drain (21, 22, 23) (31, 32, 33)
  1/8 NPT outlet.....3000-10

Tamper resistant cover (knob adjustment only).....4355-51

PANEL MOUNTING DIMENSIONS

Panel mounting hole diameter: 52 mm (2.06")
Panel thickness: 2 to 6 mm (0.06" to 0.25")

INSTALLATION

1. Shut off air pressure. Install filter/regulator in air line -
   - vertically (bowl down),
   - with air flow in direction of arrow on body,
   - upstream of lubricators and cycling valves,
   - as close as possible to the device being serviced.
2. Connect piping to proper ports using pipe thread sealant on male threads only. Do not allow sealant to enter interior of unit.
3. Push bowl, or bowl with guard, into body and turn fully clockwise before pressurizing.
4. Flexible tube with 3mm (0.125") minimum I.D. can be connected to the automatic drain. Avoid restrictions in the tube.
5. Install a pressure gauge or plug the gauge ports. Gauge ports can also be used as additional outlets for regulated air.

ADJUSTMENT

1. Before applying inlet pressure to filter/regulator, turn adjustment (1 or 7) counterclockwise to remove all force on regulating spring.
2. Apply inlet pressure, then turn adjustment (1 or 7) clockwise to increase and counterclockwise to decrease pressure setting.
3. Always approach the desired pressure from a lower pressure. When reducing from a higher to a lower setting, first reduce to some pressure less than that desired, then bring up to the desired pressure.

   NOTE

   With non-relieving filter/regulators, make pressure reductions with some air flow in the system. If made under no flow (dead-end) conditions, the filter/regulator will trap the over-pressure in the downstream line.
4. KNOB ADJUSTMENT. Push knob down to lock pressure setting. Pull knob up to release. Install tamper resistant cover (see ***Replacement Items***) to make setting tamper resistant.

SERVICING

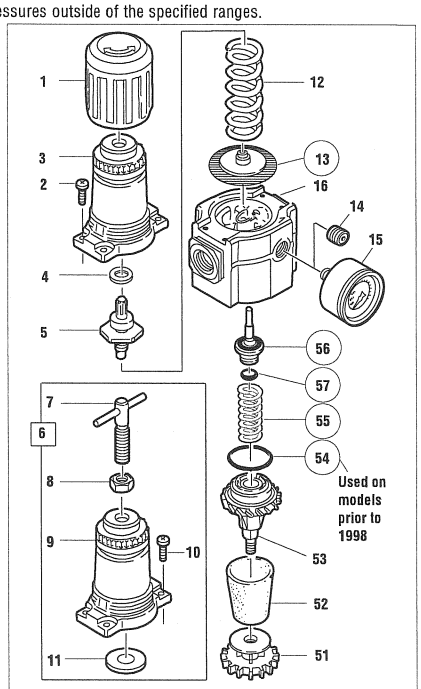
1. Open manual drain to expel accumulated liquids. Keep liquids below baffle (51).
2. Clean or replace filter element when dirty.

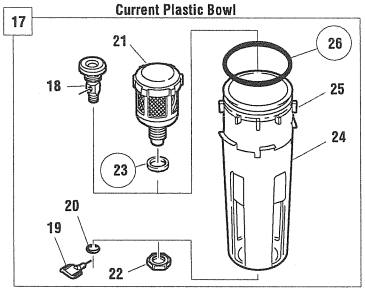
DISASSEMBLY

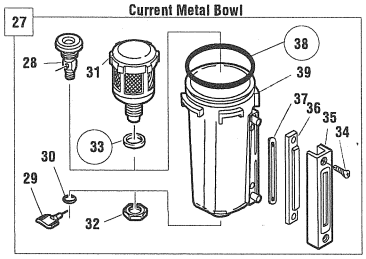
1. Filter/regulator can be disassembled without removal from air line.
2. Shut off inlet pressure. Reduce pressure in inlet and outlet lines to zero.
3. Turn adjustment (1 or 7) fully counterclockwise.
4. Remove bowl - push into body and turn counterclockwise.
5. Disassemble in general accordance with the item numbers on exploded view. Do not remove the drains unless replacement is necessary. Remove and replace only if they malfunction.

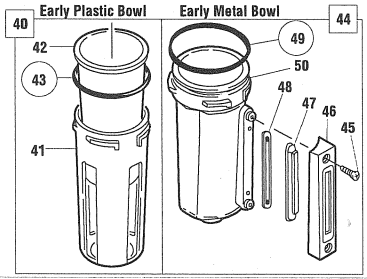
CLEANING

1. Clean plastic bowl (25, 42) with warm water only. Clean other parts with warm water and soap.
2. Rinse and dry parts. Blow out internal passages in body (16) with clean, dry compressed air. Blow air through filter element (52) from inside to outside to remove surface contaminants.
3. Inspect parts. Replace those found to be damaged. Replace plastic bowl with a metal bowl if plastic bowl shows signs of cracking or cloudiness.









ASSEMBLY

1. Lubricate the following items with o-ring grease.
   4 (Thrust washer) - outer circumference and both sides.
   5, 7 (Adjusting screw) - threads and tip.
   18, 28 (Manual drain body) - the portion of the body that contacts the bowl, and the hole that accommodates the stem of drain valve (19, 29).
   56 (Valve) - stem.
   26, 38, 43, 49, 54, 57 (O-rings)
2. Assemble the unit as shown on the exploded view. Push bowl, or bowl with guard, into body and turn fully clockwise.
3. Torque Table

Item	Torque in Nm (Inch-Pounds)
2, 10 (Screw)	2,3 to 3,9 (20 to 35)
22, 32 (Nut)	2,3 to 2,8 (20 to 25)
34, 45 (Screw)	1,7 to 2,3 (15 to 20)
53 (Center-post)	2,0 to 2,7 (18 to 24)

CAUTION

Water vapor will pass through these units and could condense into liquid form downstream as air temperature drops. Install an air dryer if water condensation could have a detrimental effect on the application.

WARNING

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under ***Technical Data***.

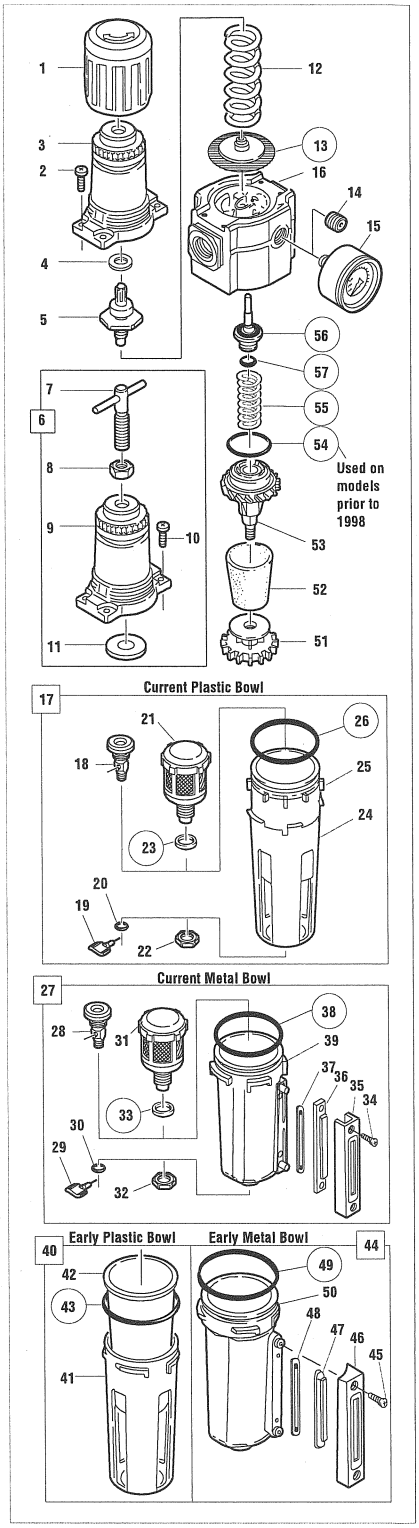
Polycarbonate plastic bowls can be damaged and possibly burst if exposed to such substances as certain solvents, strong alkalies, compressor oils containing ester-based additives or synthetic oils. Fumes of these substances in contact with the polycarbonate bowl, externally or internally, can also result in damage. Clean with warm water only.

Use metal bowl in applications where a plastic bowl might be exposed to substances that are incompatible with polycarbonate.

If outlet pressure in excess of the filter/regulator pressure setting could cause downstream equipment to rupture or malfunction, install a pressure relief device downstream of the filter/regulator. The relief pressure and flow capacity of the relief device must satisfy system requirements.

The accuracy of the indication of pressure gauges can change, both during shipment (despite care in packaging) and during the service life. If a pressure gauge is to be used with these products and if inaccurate indications may be hazardous to personnel or property, the gauge should be calibrated before initial installation and at regular intervals during use.

Before using these products with fluids other than air, for non industrial applications, or for life-support systems consult Norgren.

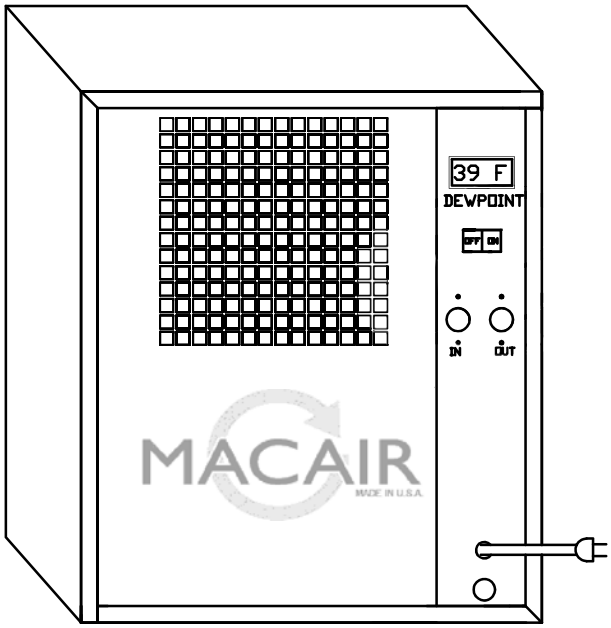


MADE IN U.S.A.

Owners Manual

Refrigerated Air Dryer

HX10 thru HX55



MODEL_____

SERIAL_____

IMPORTANT: READ THIS MANUAL CAREFULLY. IT CONTAINS INFORMATION ABOUT SAFETY AND THE SAFETY OF OTHERS. ALSO BECOME FAMILIAR WITH THE PROPER INSTALLATION AND CONTROLS OF THE AIR DRYER BEFORE OPERATING. ONLY QUALIFIED, TRAINED AND LICENSED PERSONAL SHOULD SERVICE OR OPERATE THIS EQUIPMENT.
CAUTION: THIS MACHINE CONTAINS HIGH PRESSURE GAS AND ELECTICITY

A. INTRODUCTION

Thank you for selecting an HX series refrigerated air dryer from MACAIR INC.
The refrigerated air dryer is specifically designed and manufactured for drying and purifying compressed air generated by an air compressor. Please read this instruction manual carefully before using the air dryer.
Please pay attention to the precautions in transportation, installation and operation that are listed in this manual.
Please use the dryer according to our application guide and be sure to perform the proper preventative maintenance as recommended in this manual. Failure to perform the preventative maintenance will void the air dryer warranty.
Refrigeration used in this air dryer is environmentally friendly R134a or R404a and is available at local refrigeration wholesalers.
Direct any questions not covered in this manual to your distributor or call MACAIR INC. @ 248-624-6300. Before calling with questions always have the air dryer model #, serial # and pressure gauge readings.
Service and maintenance can be obtained from your distributor. If you do not know your distributor please contact the factory.
Authorization # must be obtained from MACAIR INC. before any parts or dryers are returned to the factory. MACAIR INC. will not be responsible for anything returned without authorization.

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RECEIVING AND INSPECTION

1. The dryer cannot be tilted on its side or upside down during shipping.
2. Use forklift from the bottom of the dryer when installing or moving.
3. Dryers are shipped F.O.B. factory. Immediately upon arrival check the dryer for possible damage. If damage is found, report it to the carrier and file a damage claim.
4. Check dryer data label to be sure you have the right dryer. Check the data labels voltage and amperage to be sure it is correct and the one you ordered.
5. Check the refrigeration gauges for pressure. **If gauges read 0 PSIG STOP. Do not start dryer. Call your distributor for service. This could mean there is a leak and the refrigerant has leaked out.**

DATA LABEL

The data label is affixed to the outside of the cabinet. This label identifies the air dryer's model and serial number and important technical data. Before installing the dryer check all the information on the data label for the correct model and voltage. If the model number and voltage are incorrect do no install the dryer. Do not put power to the dryer. Call your local distributor.

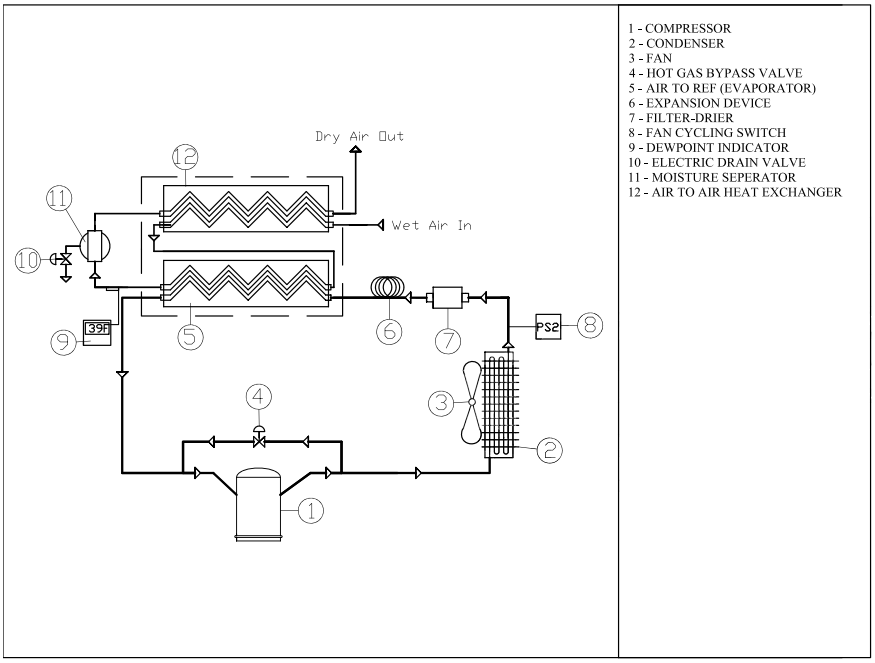
DATA LABEL	
Model	**HX55A-1**
Serial #	**05-12-11095TMZ**
Date of MFG.	**5/30/2012**
Voltage	**115v-1ph-60hz**
Voltage Range	**103 - 126**
RLA	**5.82**
LRA	**32**
Min Circuit Ampacity	**11.51**
Max Fuse Size	**20**
Maximum Inlet Air Temp - F	**110**
Min/Max. Ambient Temp - F	**180/45**
Ref. System Design - PSI	**350/150**
Suction/Discharge - PSI	**30/115**
Maximum Pressure (PSIG)	**232**
Ref. Compressor HP	**1/3**
Refrigerant Type	**R134**
Refrigerant Charge	**10 oz**
MACAIR INC. REFRIGERATED AIR DRYER MADE IN USA	

HOW THE AIR DRYER WORKS

HX Series refrigerated compressed air dryers use refrigeration cooling to condense entrained moisture out of the compressed air stream.

Warm saturated air enters the air-to-air heat exchanger at the dryer inlet.

In the air –to- air heat exchanger the inlet air is pre-cooled by the outgoing cold air. The pre-cooled air then enters the air to refrigerant heat exchanger where it is cooled to its lowest point by the refrigeration in the evaporator. As the air is cooled moisture in the air changes from a vapor to a liquid. The liquid condensate is removed from the airstream by the separator and discharged from the dryer by the automatic drain valve. The cold air is reheated by incoming warm air as it passes back through the air-to-air heat exchanger. Pre-cooling the inlet air reduces the heat load on the refrigerant compressor, permitting the use of a smaller refrigerant compressor. The out going cold air is reheated by the incoming hot air. As a result the outlet air is warmed up as it leaves the dryer. This prevents the outlet pipe from sweating. The air exits the dryer and is now clean and dry, ready for use.



(1) REFRIGERANT COMPRESSOR – The main function of the compressor is to circulate the refrigerant. The compressor pumps refrigerant to the other components in the system so they can perform heat transfer functions. The compressor also separates the high pressure from the low pressure side of the refrigeration system**.**

(2) AIRCOOLED CONDENSER – One of the main functions of the condenser is to condense the high pressure and high temp refrigerant vapor to liquid. A heavy duty fan moves ambient air across the condenser coils removing heat from the refrigerant vapor. As the heat is removed the refrigerant vapor the temperature change causes the refrigerant to change state from a vapor to a liquid. The condenser is made from aluminum fins attached to copper tubes.

(3) CONDENSER FAN MOTOR – Drives ambient air over condenser coils.

(4) HOT GAS BYPASS VALVE – HGBV respond to changes in suction pressure. As the air flow (Or heat load) on the dryer changes the suction pressure will change. An increase in air flow causes an increase in suction pressure a decrease in air flow causes a decrease in suction pressure. During periods of low air flow the HGBV meters hot gas from the hot gas line of the high side to the inlet of the air to ref heat exchanger.

(5) HEAT EXCHANGER MODULE

The compact STAINLESS STEEL module contains the air to air heat exchanger the air to refrigerant heat exchanger.

(6) CAPILLARY TUBE – The metering device meters liquid refrigerant from the liquid line to the evaporator. The capillary tube is a restriction that separates the high pressure side from the low pressure side in the refrigeration system.

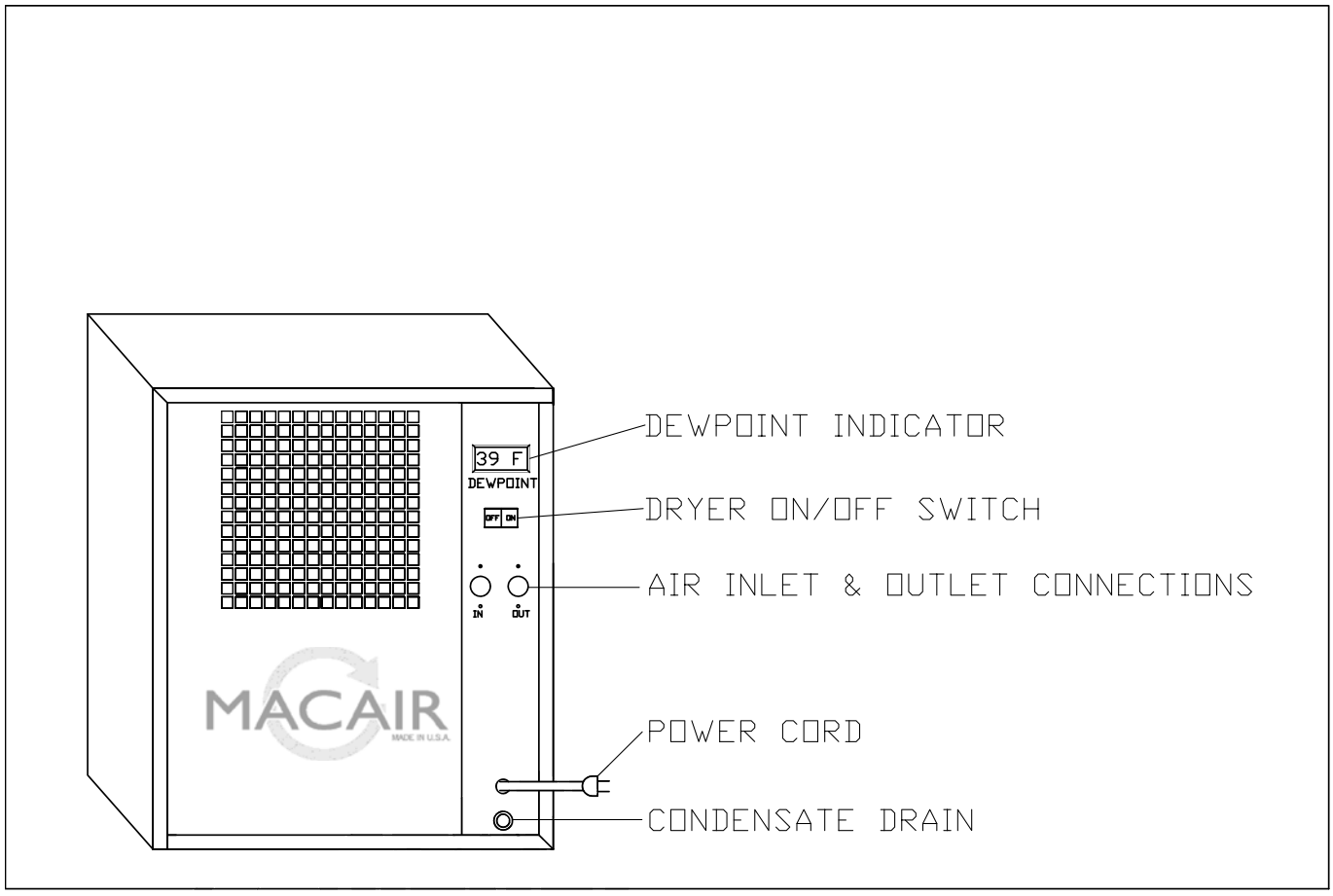
(7) FLTER-DRIER – Adsorbs and filters out any moisture or debris that maybe in the refrigeration system. Moisture can cause freeze ups and dirt particles can plug capillary tubes causing system malfunctions.

(8) PS2 – FAN CYCLING SWITCH – Cycles the condenser fan motor on and off to maintain the proper condensing pressure dryer periods of fluctuating loads and ambient conditions. Fan on 170 psig off at 110 psig

(9) DEWPOINT READOUT – Continually monitors the lowest air temperature or dew point air temperature of the compressed air in the heat exchanger module

(10) ELECTRONIC AUTO-DRAIN – Reliably drains condensate from the dryer.

(11) MOISTURE SEPERATOR – Separates moisture from the air stream.



INSTALLATION and LOCATION

1. Ventilation – Install dryer only in a well-ventilated clean, dry area only and keep at least 3 feet between the dryer, other equipment and the walls.

2. Dryer Location – Make sure there is approximately 3 feet around the dryer for service and maintenance purposes. Do not install the dryer outside. The air dryer must not be exposed to direct sunlight, rain or snow. Do not install the dryer in an environment with fire, high temperatures or low temperatures.
Make sure the dryer is installed in an environment that is clean and dry. Dust and dirt particles will clog the air-cooled condenser. A clogged and dirty condenser will reduce the performance of the dryer and will eventually cause damage to the dryer.

3. Ambient Temperatures – Suitable ambient temperature for the refrigerant dryer is a minimum of 40 F to a maximum of 110 F. The performance of the dryer will be significantly decreased when the air dryer is subject to temperatures higher than 110 F. For installations with ambient temperatures higher than 110 F it is recommended to use a water-cooled condenser on the dryer. Contact your dealer for details.

4. Selecting Proper In and Out Piping and Piping Design – Pipe diameter should be sized according to air flow requirements. Do not mix the air inlet and outlet air flow. ***It is recommended that a vibration absorber be installed on the dryer inlet and outlet to eliminate vibration from the compressor.*** Do not use the inlet and outlet of the air dryer to support the weight of the air piping.

5. Condensate Drains – Condensate drains must be properly piped from the dryer to prevent moisture re-entrainment. The dryer is equipped with an automatic drain valve that controls the discharge of the condensate and a manual valve to manually drain condensate. The user must run a drain line to an environmentally approved condensate collection/disposal system.

6. Electrical Installation – The dryer data label lists the electrical power requirements for the air dryer. The user must confirm that the line voltage matches the voltage listed on the data label. (Warning – Operating the air dryer with improper line voltage will void the warranty.) Provide the proper size wire, disconnect switches and fuses in accordance with applicable codes.

7. Breathing Air Applications - This dryer has not been tested for breathing air applications. The owner is advised to do its own testing and use for breathing air applications at owns risk.

START UP

The following procedure must be followed to start your air dryer. Failure to follow this start up procedure will void your warranty. If problems occur during start up, contact your distributor.

1. Turn off the On/Off switch.
2. Verify the main electrical supply voltage matches the voltage specified on the data label.
3. Check the proper connection and support of the compressed air lines to the dryer:

4. Confirm that the inlet and ambient air temperature, pressure and flow to the dryer meet the specified requirements.
5. Confirm that the condensate drain lines from the separator are properly piped to an environmentally approved disposal system

INITIAL RUN PROCEDURE

After start up and checks are complete and after the main electrical power to the dryer has been turned on for at least 6 hours (only for 230-3-60 dryers), follow the procedure below to put the dryer in operation:

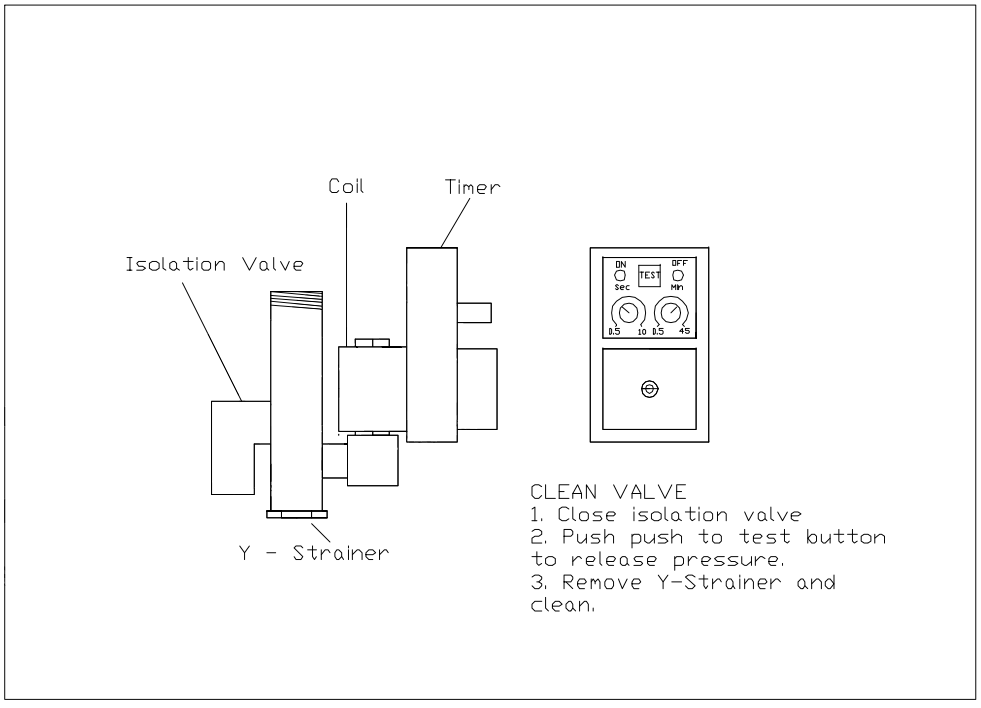
1. Turn ON the dryer ON/OFF switch.
2. Let the dryer run for 15 minutes.
3. Check the **DEWPOINT TEMP INDICATOR**. After about 15 minutes this should read 35 F to 39 F.
4. Verify that the condenser fan motor is operating. The fan will cycle on and off.
5. Allow compressed air to flow through the dryer.
6. Confirm that condensate is discharging from the condensate drain. This may take 30 - 60 minutes.

HOW TO SET THE CONDENSATE DRAIN OPEN & CLOSED TIME

THE CONDENSATE DRAIN IS SET AT THE FACTORY HOWEVER IF YOU WOULD LIKE TO CHANGE THE OPEN AND CLOSE TIME DO THE FOLLOWING:

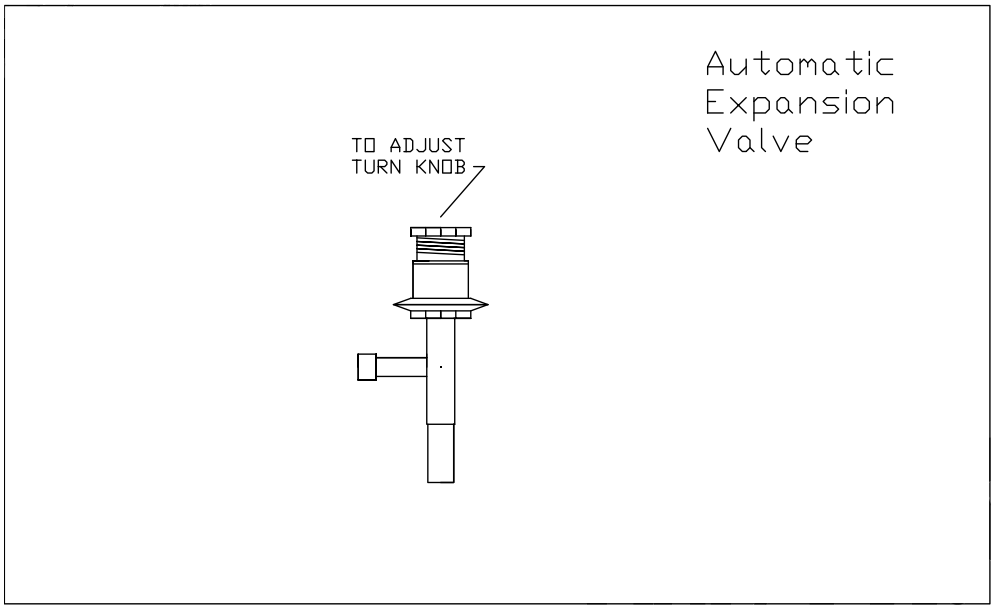
1. Remove the top panel of the dryer cabinet and locate the drain valve.
2. The OPEN (ON) time is adjustable from 0.5 sec to 10 sec. Drains are set at factory to open for 6 sec. When drain opens the on light will light
3. The CLOSED (OFF) time is adjustable 0.5 min to 45 min. Drains are set at factory to stay closed for 10 min. When drain is closed the off light will light.

You may increase or decrease this based on moisture levels in the air.
Push the TEST button to manually open the drain valve.



HOW TO MAKE MINOR REFRIGERANT SUCTION PRESSURE ADJUSTMENTS.

1. Keep dryer running under a no load by turning off or bypassing the compressed air.
2. Remove dryer top and locate the Hot Gas Bypass Valve.
3. Remove cap on Hot Gas Bypass Valve and using an allen wrench turn valve counter clockwise to decrease the suction pressure and clockwise to increase the suction pressure. Make ½ turn adjustments and wait 2 to 3 minutes for suction pressure to stabilize. Make more adjustments if needed.



DANGER

Dismantling or working on any component in the air dryer or the compressed air system under pressure may cause serious personal injury and equipment failure. Before dismantling any part of the air dryer or compressed air system completely vent the internal pressure to the atmosphere. Only qualified service persons should attempt to work on the air dryer.

NORMAL MAINTENANCE PROCEDURES AND CHECKS

1. Daily Maintenance

- Check the operation of the automatic drain valves at least once during each eight hour shift.
- Check Dewpoint Indicator to make sure it is the proper range

- Make sure condenser coil is clean and unobstructed.
- Make sure the high temp warning light is not on.

2. Weekly Maintenance

- Clean Air cooled condenser coils - Blow off all dust and dirt that is on the condenser fins with a compressed air maintenance gun.
- While cleaning the condenser fins do not damage fins.

WARNING - DRYER FAILURE DUE TO A DIRTY CONDENSER IS NOT COVERED UNDER WARRANTY

3. Condensate Drain Maintenance

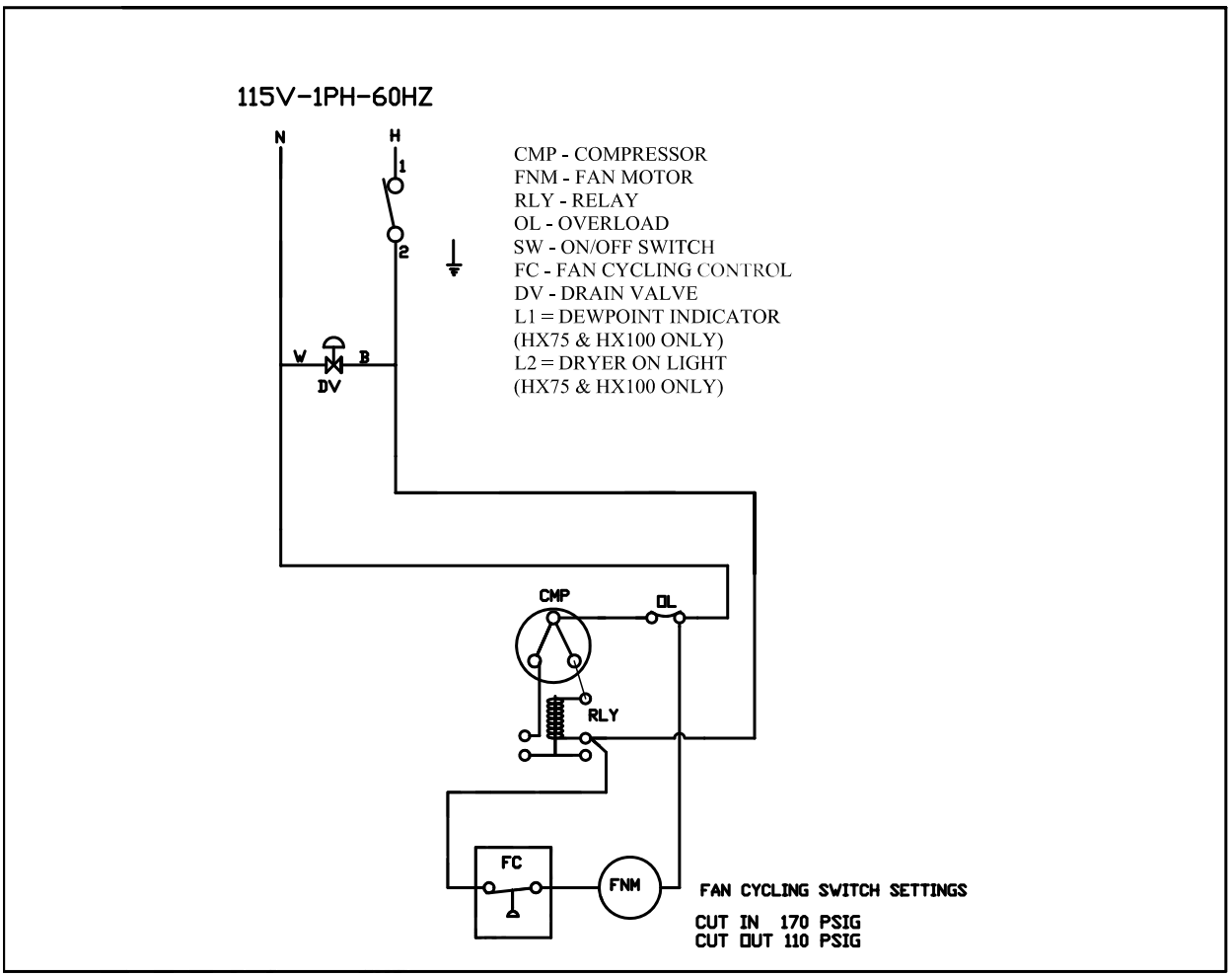
- Push the Push to Test Button to verify drain operation.
- Check the open time.
- Check the closed time.

If drain is not opening the drain should be dis-assembled, cleaned and checked for defects.

DANGER – This should only be done by a qualified service technician.

- Close the isolation valve before the drain.
- Remove the power unit and timer.
- Remove solenoid coil.
- Dis-assemble valve and check for debris and or defective spring or valve parts.
- Clean out any debris and re-assemble the valve.
- If there are defective or broken valve parts contact your distributor for a new drain valve.

Electrical Schematic



TECHNICAL SPECIFICATIONS	DRYER MODEL				
	HX10	**HX20**	**HX25**	**HX40**	**HX55**
RATED CAPACITY IN SCFM @ 100 F, 100 PSIG, 100 F AMB, 38 F PDP	10	20	25	40	55
PRESSURE DROP (PSID)	1.4	1.6	1.75	1.75	1.8
MIN/MAX INLET PRESSURE	20 PSIG / 230 PSIG				
MAX INLET TEMP	180 F (Capacity is reduced as temp goes above 100 F)				
MIN/MAX AMBIENT TEMP	45 F/110 F				
VOLTAGE	115V-1PH-60HZ (100V-1PH-50HZ)				
VOLTAGE RANGE	126 - 103 (110 - 90)				
REF COMPRESOR HP	1/6	1/5	1/4	1/4	1/3
RLA: RUN LOAD AMPS	2.9	3.4	4.91	4.91	5.82
LRA: LOCK ROTOR AMPS	18	22	27.5	27.5	32
MAX FUSE SIZE	15	15	15	15	20
MIN. CIRCUIT AMPACITY	4.035	4.66	6.7	6.7	11.51
WATTS	220	260	389	389	502
REFRIGERANT TYPE	R134A				
REFRIGERANT AMOUNT	(SEE DATA LABEL)				
REFRIG. SUCTION PRESS.	27 TO 34 PSIG				
SHIPPING WGT (LBS)	77	80	85	90	95

PARTS LIST					
MODEL	**HX10**	**HX20**	**HX25**	**HX40**	**HX50**
Compressor	COMP-10-1	COMP-20-2	COMP-25-1	COMP-25-1	COMP-55-1
Fan Motor	FNMT-10-1	FNMT-10-1	FNMT-25-1	FNMT-25-1	FNMT-25-1
Start Capacitor	STCP-10-1	STCP-10-1	STPC-25-1	STPC-25-1	STPC-50-1
OverLaod	OVLD-10-1	OVLD-10-1	OVLD-25-1	OVLD-25-1	OVLD-50-1
Relay	RELY-10-1	RELY-20-1	RELY-25-1	RELY-25-1	RELY-50-1
Heat Exchanger	HEAT-1-10	HEAT-1-10	HEAT-1-25	HEAT-1-40	HEAT-1-55
Expansion Valve	AEXV-1-10	AEXV-1-10	AEXV-1-10	AEXV-1-10	AEXV-1-10
Filter-Drier	FILTD-1-10	FILTD-1-10	FILTD-1-10	FILTD-1-10	FILTD-1-10
Seperator	SEPR-1-10	SEPR-1-10	SEPR-1-10	SEPR-1-10	SEPR-1-10
On/Off Switch	ONOFF-10-1	ONOFF-10-1	ONOFF-10-1	ONOFF-10-1	ONOFF-10-1
Dewpoint Indicator	DWPT-10-1	DWPT-10-1	DWPT-10-1	DWPT-10-1	DWPT-10-1
Elect Cord	ELECT-10-1	ELECT-10-1	ELECT-10-1	ELECT-10-1	ELECT-10-1
Elect. Drain	DRAIN-10-1	DRAIN-10-1	DRAIN-10-1	DRAIN-10-1	DRAIN-10-1

MACAIR LIMITED REFRIGERATED AIR DRYER WARRANTY

MACAIR (herein after referred to as the seller) refrigerated air dryers are warranted to be free of defect in materials and workmanship for a limited period of 2 YEARS from the date of shipment from the sellers warehouse to the distributors warehouse or end user (herein after called the buyer) provided the air dryers are applied, installed and maintained in accordance with sellers recommendations listed in the owner's manual. This warranty applies only to the original owner and is not transferable. The warranty covers materials and labor for the first year and materials only for 2 YEARS from the date of shipment. The air to air, air to refrigerant heat exchangers and the separator on the HX series dryer is warranted to be free of defects for 5 years from the date of shipment from the factory. Normal maintenance items, customer maintained components and labor charges after the first year from the ship date from the seller are not covered by this warranty. The following is not covered by this warranty: Refrigerant leaks after the first 12 months, Condenser cleaning, maintaining the drain valve (Time adjustments and cleaning, auto-drains sticking open or closed due to debris, float drains sticking open or closed) fan motor lubrication, filter element changing and damage in shipping. After the first year from the ship date from the seller, the seller will not be responsible for the following incidental items: service call charges, refrigerant, filter driers, insulation, truck charges, torch charges, recovery/reclaim charges, disposal charges, mileage, miscellaneous fittings, or freight charges. The seller will only allow the amount of labor hours and pay the labor rates that are listed in the MACAIR WARRANTY & SERVICE GUIDELINES. In the event of a warranty issue the buyer must follow the warranty procedures listed in the MACAIR WARRANTY & SERVICE GUIDELINES or the warranty is void. If the buyer purchases replacement parts from a third party, the seller will not be responsible for the cost of the parts. The buyer will be invoiced for the new materials and must return the defective materials to the buyer. Upon inspection of the defective materials and if the materials are deemed defective, the buyer will be credited for the cost of the new materials. The buyer is responsible for all transportation costs of all materials that are shipped to the buyer and to the seller after the initial 12-month period.

The seller will not be responsible for any consequential damage, economic loss, extra expense including payment for the loss of time, pay, inconvenience, storage, removal, reinstallation, loss of dryer use, dryer rental expense, lodging, meals, or other travel.

The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, or statutory, including implied warranties of merchantability or fitness for any particular purpose.

This contract shall constitute the entire agreement between Buyer and Seller. All terms contained herein shall be deemed acceptable by the Buyer and The Seller and shall prevail over the terms of the Buyers purchase order.

The seller's liability is limited solely to the repair or replacement of defective products at seller's option. Under no circumstances shall sell, the sellers distributor or agent be liable for any losses or consequential damages, costs or expenses of any kind incurred by the buyer, whether arising from breach of warranty, negligence or strict liability in tort. The seller makes no warranty or representation of any kind, expressed or implied as to the merchantability or of fitness for a particular purpose with respects to the products. This contract shall be governed and interpreted in accordance with the laws of the State of Michigan.

Warranty only applies to equipment sold in the USA and Canada.

VAN AIR SYSTEMS

April 2012
P/N 432-10016-D

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTION

NITROGEN N2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM

F200 SERIES COMPRESSED AIR FILTERS

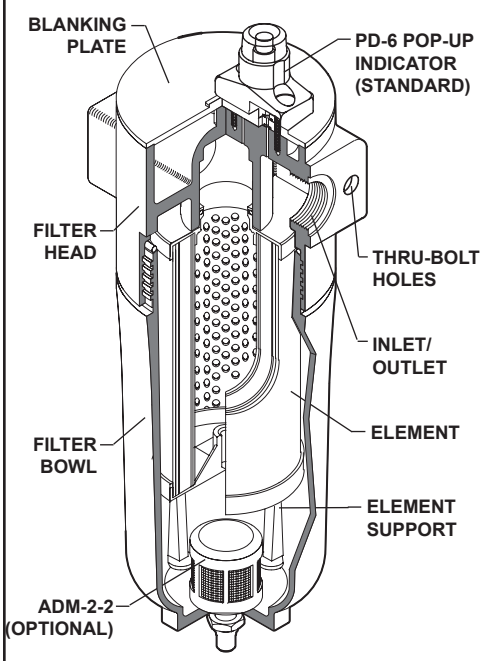
UNITED FIRE SYSTEMS

LOCATED IN NITROGEN GENERATOR MODULE
SERIAL NO. NGM-M-0514-001

PRODUCT PURPOSE & FUNCTION:

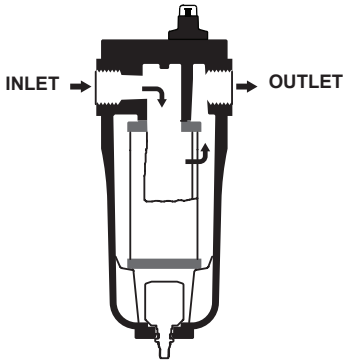
Van Air's F200 series filters are designed to remove contaminants from compressed air systems. Available in 1/4" to 3" connection sizes and flow capacities from 15 to 1250 SCFM (at 100 psig) in 15 housings and 9 filtration grades, the F200 series can remove oil aerosols, oil vapors, water and particulates. Housings are made of cast aluminum and coated with an epoxy powder coating for corrosion resistance. All units include push-on elements with durable polyester drain layer (except RD grade). Accessories include differential pressure indicators, wall mounting kits, connector kits, and automatic drain valves.

FILTER DETAILS

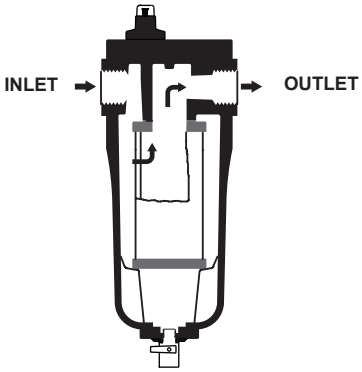


FLOW DIRECTION THROUGH ELEMENT

(COALESCING) IN/OUT



(PARTICULATE) OUT/IN



OPERATING CONDITIONS

MAXIMUM WORKING PRESSURE

All Models	250 PSIG

OPERATING TEMPERATURE

Minimum	35°F
Maximum	225°F

MAXIMUM RECOMMENDED INLET TEMPERATURE

AA, A, RAA, RA, RB, and RC Series	225°F
B Series	175°F
C Series	125°F
RD Series	80°F

FILTRATION GRADES

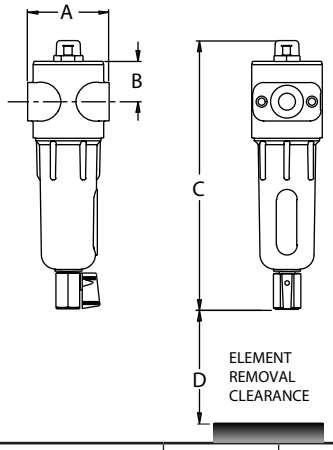
APPLICATION	ELEMENT GRADE	PURPOSE	NOMINAL PARTICULE REMOVAL	ELEMENT FLOW DIRECTION	COLOR CODE
OIL REMOVAL (LIQUIDS)					
	B	General Purpose Coalescing	1.00 µ	IN/OUT	RED
PARTICULATE REMOVAL (SOLIDS)					
	RB	General Purpose Particulate	1.00 µ	OUT/IN	RED

WARNINGS

- **DO NOT REPLACE ANY ITEM ON FILTER WHILE IT IS PRESSURIZED.**
- **DO NOT OPERATE A LEAKING FILTER. TAKE FILTER OUT OF SERVICE IMMEDIATELY.**
- **DO NOT OPERATE ABOVE MAXIMUM WORKING PRESSURE (MWP) AT MAXIMUM OPERATING TEMPERATURE (°F).**

FILTER HOUSING DIMENSIONS & WEIGHTS

DIMENSIONS FOR:
F200-15-1/4
F200-25-3/8
F200-25-1/2



FILTER MODEL	FLOW** (SCFM)	IN/OUT CONN. (NPT)	A (INCHES)	B (INCHES)	C*** (INCHES)	D (INCHES)	HOUSING WEIGHT**** (LBS)	ELEMENT WEIGHT**** (LBS)
F200-25-1/2-(*)	25	1/2"	2-13/16	1-5/8	9-1/4	3	1.3	0.1

*Insert appropriate filtration grades here; for example F200-15-1/4-B.
***Dimensions include filter housing, PD-6 and manual drain.
**Flow is based on SCFM @ 100 PSIG @ 100°F.
****For total filter weight, add element weight to housing weight.

FLOW CAPACITIES AT VARIOUS OPERATING PRESSURES (SCFM)										
FILTER MODEL	25 PSIG	50 PSIG	75 PSIG	100 PSIG	125 PSIG	150 PSIG	175 PSIG	200 PSIG	225 PSIG	250 PSIG
F200-25-1/2	13	18	22	25	28	31	33	35	38	40

INSTALLATION

1. Before installing filter, check operating temperature and pressure conditions to verify that they are within the specified ranges. **(See Operating Conditions on page 1).** Also verify that system flow rate corresponds to the rated capacity of the filter. Operating at flows above rated capacity will result in increased pressure drop.

2. Locate Filter at the point of lowest operating temperature to ensure that water and oil vapor do not condense downstream of the filter. Filter should be installed close to the point of use to minimize the risk of pipe scale, dirt, etc. recontaminating the compressed air. This is particularly important when installing a new filter on an existing system that has not had proper filtration.

3. Install filter vertically. Provide required minimum clearance below filter to allow for replacement of element. **(See Element Removal Clearance on page 2).**

4. Protect filter from reverse flow conditions. Do not install filter downstream of quick opening valves.

5. Remove filter head from the bowl by turning bowl counterclockwise. Pull element from locator. Set bowl and element aside for use later.

6. Install inlet and outlet shutoff valves to facilitate replacement of element. Bypass piping is recommended **(See Figure 1A and 1B). MAKE SURE VALVES ARE CLOSED BEFORE PROCEEDING.**

7. Connect filter head into piping. Avoid reducers or bushings to match inlet size. The resulting restriction will increase pressure drop. Make sure head is installed with flow arrows pointing in proper direction. Use pipe thread compound as required.

IMPORTANT

INSTALL FILTER HEAD INTO THE PIPING WITH ARROWS POINTING IN THE PROPER DIRECTION TO ENSURE PROPER OPERATION. (SEE FLOW DIRECTION DIAGRAM BELOW).

8. Install element by pushing onto element locator on filter head.

9. Check to make sure that the o-ring in the head is in the proper position. Thread filter bowl into filter head and tighten either by hand (models F200-15 through 55) or with strap wrench (models F200-85 through 1250). Do not over tighten. Overtightening could damage filter bowl or make it difficult to remove.

10. Make sure drain valve on bottom of filter is closed. On filters equipped with ADM2-2 auto drain, provide a drain line to remove accumulated water and oil.

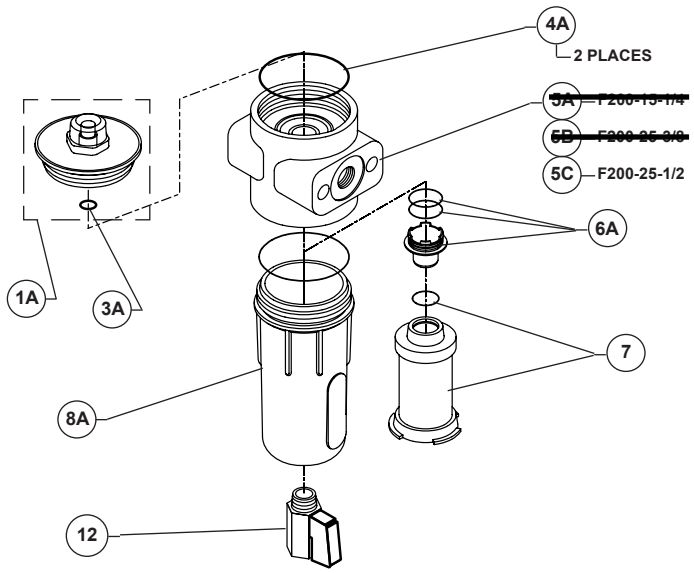
11. Pressurize system and slowly open inlet and outlet shutoff valves.

12. Check piping for leaks. Depressurize system and repair leaks as needed.

13. Re-pressurize system and slowly open inlet and outlet shutoff valves. Close bypass valve if provided.

14. Filter is now in service.

FIGURE 2A F200-15-1/4 THRU 25-1/2 REPLACEMENT PARTS



Finding a part number

1. Find the figure that references your filter.
2. Find the replacement part you need and the item number of that part.
3. Find the item number in the first column of the **Replacement Parts** table.
4. Find the part description that best describes the part.
5. See the last column for the part number.

REPLACEMENT PARTS

ITEM	PART DESCRIPTION	FIG 2-	QTY	PART NO.
1A	PD-6A-C DIFFERENTIAL PRESSURE INDICATOR KIT FOR COALESCING FILTERS	A	1	84-10126
	PD-6A-P DIFFERENTIAL PRESSURE INDICATOR KIT FOR PARTICULATE FILTERS	A	1	84-10127
3A	BLANKING PLATE O-RING FOR F200-15-1/4 THRU 25-1/2	A	1	475-00110
4A	BODY O-RING FOR F200-15-1/4 THRU 25-1/2	A	2	475-01000
5C	1/2" NPT FILTER HEAD FOR F200-25-1/2	A	1	201-00120
6A	EPL1 ELEMENT ADAPTOR FOR F200-15-1/4 THRU 25-1/2	A	1	326-00005
7	REPLACEMENT ELEMENTS (REFER TO PAGE 5)			
8A	FILTER BOWL FOR F200-15-1/4 THRU 25-1/2	A	1	201-01000
12	MANUAL DRAIN 1/4" KIT	A,B, C	1	84-10852

REPLACEMENT ELEMENTS

FILTER MODEL	ELEMENT MODEL	PART NO.
& F200-25-1/2		
COALESCING	E200-15/25-B	26-10404
PARTICULATE	E200-15/25-RB	26-10405

MAINTENANCE

- Drain coalescing filters every shift.
- Check differential pressures weekly on coalescing and particulate filters (AA, A, B, C, RA, RB, and RC grades). When the indicator is red on differential pressure indicator, install clean elements. On adsorbing filters (grade RD), install clean elements when hydrocarbon vapors are first detected downstream or every six months, whichever comes first.
- For correct replacement element model numbers, see label on filter housing, the bottom endcap of the element, or page 5 of this instruction manual.
- When changing out element, inspect housing o-ring for nicks and/or cracks. If nicks and/or cracks are present, replace o-ring.

TROUBLE SHOOTING

CONDITION	POTENTIAL CAUSE	RECOMMENDATION
Initial pressure drop too high	Filter undersized for flow rate.	Install larger filter.
	Filter grade too fine.	Install coarser grade element.
	Filter inlet smaller than pipe size.	Install larger filter.
Oil carryover	Oil present in system before installing filter.	Clean piping.
	Excessive inlet oil >50ppm.	Check compressor and/or gas/oil separator if compressor is rotary vane or screw type. Check lube rate if reciprocating compressor. Install coarse coalescer for prefiltration.
	Filter installed backwards.	Check flow direction (See page 1).
	Filter bowl not being drained.	Drain more frequently.
	High differential pressure.	Check differential pressure indicator, replace element if necessary.
	Defective seal.	Check o-ring in element.
	Incorrect element grade.	Use finer grade.
	By-pass valve leaking or open.	Close valve. Check seals on valve
	Unfiltered gas entering from source down stream of filter.	Relocate filter or install additional filter.
	High operating temperatures.	Install, clean, replace or relocate aftercooler, or relocate filter.
	Cooling by refrigerated dryer.	Install grade C filter downstream of dryer.
Short element life	Excessive contamination.	Install coarse particulate filter immediately upstream of existing filter.
	High compression temperatures causing varnish/ carbon formation.	Use compression lubricant with good temperature stability. Lower lube rates where possible. Use coarser grade filter element.
	Oil/water emulsion overloading element.	Inspect moisture separator. Remove water with better separation.
	High viscosity oil or freeze-up due to low ambient temperature.	Raise ambient temperatures. Heat trace inlet piping and housing.

SAFETY PRECAUTIONS

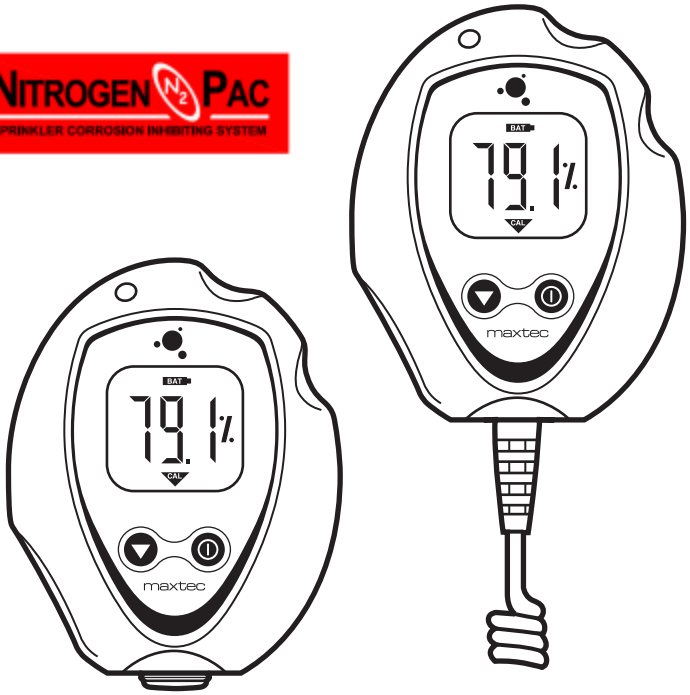
Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious.

VAN AIR SYSTEMS

2950 Mechanic Street
Lake City, PA 16423-2095
Phone: 800-840-9906
Fax: 814-774-3482
www.vanairsystems.com

APPENDIX I

NITROGEN N_2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM



Nitrogen Analyzer

OPERATING MANUAL &
INSTRUCTIONS FOR USE

R217P67

UNITED FIRE SYSTEMS

CONTACT INFORMATION

Manufacturer's Name:	Maxtec, Inc.
Product:	Nitrogen Analyzer
Model	R217P67
Manufacturer's Address:	Maxtec, Inc. 6526 South Cottonwood Street Salt Lake City, Utah 84107
Manufacturer's Telephone:	800.748.5355
Manufacturer's Fax:	(801) 270.5590
Manufacturer's e-mail:	sales@maxtecinc.com
Manufacturer's Web-Site:	www.maxtecinc.com

AUTHORIZED REPRESENTATIVE

EC REP

QNET BV
Hommerterweg 286
6436 AM Amstenrade
The Netherlands

PREFACE

This manual describes the function, operation and maintenance of the N_2 analyzer hand-held and panel mount nitrogen analyzers. The Maxtec N_2 analyzer is engineered for long life, maximum reliability and stable performance.

NOTE: In order to obtain optimum performance from your analyzer, all operation and maintenance must be performed in accordance with this manual. Please read the manual thoroughly before using the analyzer and do not attempt any repair or procedure that is not described herein. Maxtec cannot warrant any damage resulting from misuse, unauthorized repair or improper maintenance of the instrument.

⚠ WARNING:
Never allow an excess length of tubing, lanyard, or sensor cable near a person's head or neck, which may result in strangulation.

Before use, all individuals who will be using the N_2 analyzer must become thoroughly familiar with the information contained in this Operation Manual. Strict adherence to the operating instructions is necessary for safe, effective product performance. This product will perform only as designed if installed and operated in accordance with the manufacturer's operating instructions.

Use only genuine Maxtec accessories and replacement parts. Failure to do so may seriously impair the analyzer's performance. Repair or alteration of the N_2 analyzer beyond the scope of the maintenance instructions, or by anyone other than an authorized Maxtec service person, could cause the product to fail to perform as designed.

Calibrate the N_2 analyzer weekly when in operation, or if environmental conditions change significantly. (ie. Elevation, Temperature, Pressure, Humidity — refer to Section 4.0 of this manual).

Use of the N_2 analyzer near devices that generate electrical fields may cause erratic readings.

If the N_2 analyzer is ever exposed to liquids (from spills or immersion) or to any other physical abuse, turn the instrument OFF and then ON. This will allow the unit to go through its self test to assure everything is operating correctly. You may need to allow the sensor time to dry out.

Never immerse or expose the N_2 analyzer (including sensor) to high temperatures (>70°C). Never expose the device to pressure, irradiation vacuum, steam, or chemicals.

Do not throw away. Dispose of properly in accordance with local regulations.

NOTE: Replace the batteries with recognized high quality AA Alkaline or Lithium batteries.

NOTE: If the unit is going to be stored (not in use for 1 month), we recommend that you remove the batteries to protect the unit from potential battery leakage.

FAILURE TO COMPLY WITH THESE WARNINGS AND CAUTIONS COULD RESULT IN INSTRUMENT DAMAGE AND POSSIBLY JEOPARDIZE THE WELL BEING OF THE USER.

CLASSIFICATION

Protection against electric shock:	Internally powered equipment.
Protection against water:	IPX1
Mode of Operation:	Continuous

SAFETY LABELING

The following symbols and safety labels are found on the N_2 analyzer:

Attention, consult accompanying documents

On/Off

Calibration button

Found to meet the requirements of the U.S. and Canadian nationally recognized codes and standards listed or classified by ETL.

Do not throw away. Dispose of properly in accordance with local regulations.

TABLE OF CONTENTS

1.0 SYSTEM OVERVIEW

1.1 Base Unit Description

The N_2 analyzer provides unparalleled performance and reliability due to an advanced design that includes the following features and operational benefits.

» Extra-life oxygen sensor of approximately 900,000 O_2 percent hours (2-year warranty).

» Durable, compact design that permits comfortable, hand-held operation and easy to clean.

» Operation using only two AA Alkaline batteries (2 x 1.5 Volts) for approximately 5000 hours of performance with continuous use. For extra extended long life, two AA Lithium batteries may be used.

» Oxygen-specific, galvanic sensor that achieves 90% of final value in approximately 15 seconds at room temperature.

» Large, easy-to-read, 3 1/2-digit LCD display for readings in the 0-100% range.

» Simple operation and easy one-key calibration.

» Self-diagnostic check of analog and microprocessor circuitry.

» Low battery indication.

» Calibration reminder timer that alerts the operator, using a calibration icon on the LCD display, to perform a unit calibration.

1.2 Component Identification

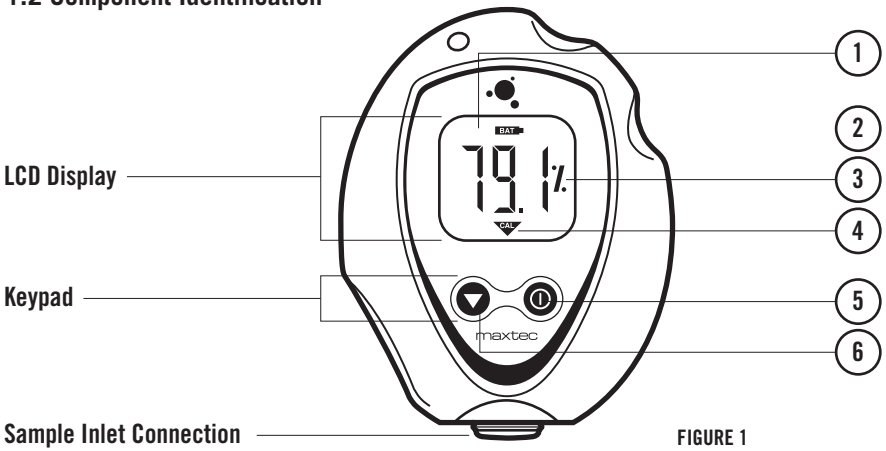


FIGURE 1

1.3 Component Description

1. **3 1/2-Digit Display** - The 3 1/2 digit liquid crystal display (LCD) provides direct readout of nitrogen concentrations in the range of 0 - 105.0% (100.1% - 105.0% used for calibration determination purposes). The digits also display error codes and calibration codes as necessary.
2. **Low Battery Indicator** - The low battery indicator is located at the top of the display and is only activated when the voltage on the batteries is below a normal operating level.
3. **"%" symbol** - The "%" sign is located to the right of the concentration number and is present during normal operation.
4. **Calibration symbol** - The calibration symbol is located at the bottom of the display and is timed to activate when a calibration is necessary.
5. **ON/OFF Key** - This key is used to turn the device on or off.
6. **Calibration Key** - This key is used to calibrate the device. Holding the key for more than three seconds will force the device to enter a calibration mode.

CAUTION: The device will assume a percent oxygen concentration when calibrating. Be sure to apply 100% oxygen, or ambient air concentration to the device during calibration or the device will not calibrate correctly.

Sample Inlet Connection - This is the port at which the device is connected to determine oxygen concentration.

1.4 Oxygen Sensor

The MAX-250 is a galvanic, partial pressure sensor that is specific to oxygen. It consists of two electrodes (a cathode and an anode), a oxygen permeable membrane and an electrolyte. Oxygen diffuses through the teflon membrane and immediately reacts at the cathode. Concurrently, oxidation occurs electrochemically at the lead anode, generating an electrical current and providing a voltage output. Since the sensor is specific to oxygen, the current generated is proportional to the amount of oxygen present in the sample gas. When no oxygen is present, there is no electrochemical reaction and therefore, negligible current is produced. In this sense, the sensor is self-zeroing.

CAUTION: The oxygen sensor is a sealed device containing a mild acid electrolyte, lead (Pb), and lead acetate. Lead and lead acetate are hazardous waste constituents and should be disposed of properly, or returned to Maxtec for proper disposal or recovery.

CAUTION: Do not immerse the sensor in any cleaning solution, autoclave or expose the sensor to high temperatures.

CAUTION: Dropping sensor may adversely affect its performance.

Do not throw away. Dispose of properly in accordance with local regulations.

2.0 OPERATING INSTRUCTIONS

2.1 Getting Started

2.1.1 Protect Tape

Prior to turning on the unit, a protective film covering the threaded sensor face must be removed. After removing the film, wait approximately 20 minutes for the sensor to reach equilibrium.

2.1.2 Remove the Battery Ribbon

A ribbon has been inserted between the two case halves to prevent a battery connection. Remove the ribbon by pulling it completely out of the case.
To energize the unit, tighten all three screws with the included Phillips screwdriver.

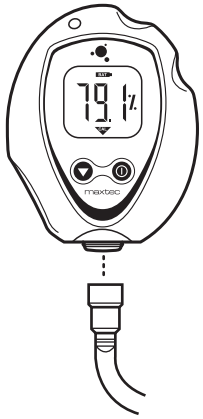
NOTE: If you do not tighten all three screws, the unit may not turn on or it may erratically turn on and off.

2.1.3 Automatic Calibration

After the unit is turned on it will automatically calibrate to room air. The display should be stable and reading 79.1%.

To check the nitrogen concentration of a sample gas: *(after the unit has been calibrated)*

1. Connect the Tygon tubing to the bottom of the analyzer by threading the barbed adapter onto the oxygen sensor. **(Figure 2)**



2. Attach the other end of the sample hose to the sample gas source and initiate flow of the sample to the unit at a rate of 1-10 liters per minute (2 liters per minute is recommended).

3. Using the **"ON/OFF"** key, make sure the unit is in the power **"ON"** mode.

4. Allow the nitrogen reading to stabilize. This will normally take about 30 seconds or more.

2.2 Calibrating the N_2 Analyzer

The N_2 analyzer should be calibrated upon initial power-up. Thereafter, Maxtec recommends calibration on a weekly basis. To serve as a reminder, a one week timer is started with each new calibration. At the end of one week a reminder icon "CAL" will appear on the bottom of the LCD. Calibration is recommended if the user is unsure when the last calibration procedure was performed, or if the measurement value is in question.

Compressed air (79.1% N_2), new calibration is required when:

» The measured N_2 percentage in 79.1% N_2 is above 80.1% N_2
» The measured N_2 percentage in 79.1% N_2 is below 78.1% N_2
» The CAL reminder icon is blinking at the bottom of the LCD
» If you are unsure about the displayed N_2 percentage. *(See factors influencing accureate readings.)*

A simple calibration may be made with the sensor open to static Ambient air. For optimum accuracy Maxtec recommends that the sensor be placed in a closed loop circuit where gas flow is moving across the sensor in a controlled manner.

2.3 Operation with the Flow Restrictor

1. Attach the Barbed Adapter to the N_2 analyzer by threading it on to the bottom of the sensor.

2. Connect the Tygon tube to the barbed adapter.

3. Attach the BC adapter to the other end of the Tygon tube.

4. Connect the inflator hose on the other end of the Tygon tube.

5. If the N_2 analyzer is not already turned on, do so now by pressing the analyzer **"ON"** button.

6. Initiate flow of nitrox to the unit to allow the gas to saturate the sensor. The BC adapter will regulate the optimum flow and pressure. Although a stable value is usually observed within 30 seconds, allow at least two minutes to ensure that the sensor is completely saturated with the gas.

7. The analyzer will now look for a stable sensor signal and a good reading. When obtained, the analyzer will display the oxygen percentage on the LCD.

3.0 FACTORS INFLUENCING ACCURATE READINGS

3.1 Elevation Changes

» Changes in elevation result in a reading error of approximately 1% of reading per 250 feet.

» In general, calibration of the instrument should be performedIn general, calibration of the instrument should be performed

3.2 Temperature Effects

The N_2 analyzer will hold calibration and read correctly within ±3% when in thermal equilibrium within the operating temperature range. The device must be thermally stable when calibrated and allowed to thermally stabilize after experiencing temperature changes before readings are accurate. For these reasons, the following is recommended:

» For best results, perform the calibration procedure at a temperature close to the temperature where analysis will occur.

» Allow adequate time for the sensor to equilibrate to a new ambient temperature.

CAUTION: "CAL Err St" may result from a sensor that has not reached thermal equilibrium.

3.3 Pressure Effects

Readings from the N_2 analyzer are proportional to the partial pressure of oxygen. The partial pressure is equal to the concentration times the absolute pressure. Thus, the readings are proportional to the concentration if the pressure is held constant. Therefore, the following are recommended:

» Calibrate the N_2 analyzer at the same pressure as the sample gas.

» If sample gases flow through tubing, use the same apparatus and flow rates when calibrating as when measuring.

» The N_2 analyzer oxygen sensor has been tested at pressures up to two atmospheres absolute. Calibration or operation above this pressure is beyond the intended use.

3.4 Humidity Effects

Humidity (non-condensing) has no effect on the performance of the N_2 analyzer other than diluting the gas, as long as there is no condensation. Depending on the humidity, the gas may be diluted by as much as 4%, which proportionally reduces the oxygen concentration. The device responds to the actual oxygen concentration rather than the dry concentration. Environments where condensation may occur are to be avoided since moisture may obstruct passage of gas to the sensing surface, resulting in erroneous readings and slower response time. For this reason, the following is recommended:

» Avoid usage in environments greater than 95% relative humidity.

HELPFUL HINT: Dry sensor by lightly shaking moisture out, or flow a dry gas at two liters per minute across the sensor membrane.

4.0 CALIBRATION ERRORS AND ERROR CODES

The N_2 analyzer analyzers have a self test feature built into the software to detect faulty calibrations, oxygen sensor failures, and low operating voltage. These are listed below, and include possible actions to take, if an error code occurs.

E02: No sensor attached
Open the hand held N_2 analyzer and disconnect and reconnect sensor. Unit should perform an auto calibration and should read 79.1%. If not, contact Customer Service for possible sensor replacement.

E02: No valid calibration data available

Make sure unit has reached thermal equilibrium. Press and hold the Calibration Button for three seconds to manually force a new calibration.

E02: Battery below minimum operating voltage

Replace batteries.

CAL Err St: O_2 Sensor reading not stable

Wait for displayed nitrogen reading to stabilize, when calibrating the device at 100% oxygen.

Wait for unit to reach thermal equilibrium (Please note that this can take up to one half hour, if the device is stored in temperatures outside the specified operating temperature range).

CAL Err lo: Sensor voltage too low

Press and hold the Calibration Button for three seconds to manually force a new calibration. If unit repeats this error more than three times, contact Customer Service for possible sensor replacement.

CAL Err hi: Sensor voltage too high

Press and hold the Calibration Button for three seconds to manually force a new calibration. If unit repeats this error more than three times, contact Customer Service for possible sensor replacement.

CAL Err Bat: Battery voltage too low to recalibrate

Replace batteries.

5.0 CHANGING THE BATTERIES

Should the batteries require changing the device will indicate this in one of two ways:

» The battery icon on the bottom of the display will begin to flash. This icon will continue to flash until the batteries are changed. The unit will continue to function normally for approx. 200 hours.

» If the device detects a very low battery level, an error code of “E04” will be present on the display, and the unit will not function until the batteries are changed.

To change the batteries, begin by removing the three screws from the back of the device. A #1 phillips screwdriver is required to remove these screws.

Once the screws are removed, gently separate the two halves of the device.

The batteries can now be replaced from the back half of the case. Be sure to orient the new batteries as indicated in the embossed polarity on the back case.

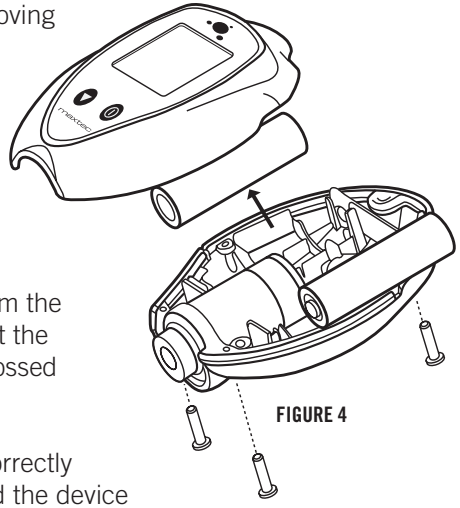


FIGURE 4

NOTE: If the batteries are installed incorrectly the batteries will not make contact and the device will not operate.

Carefully, bring the two halves of the case together while positioning the wires so they are not pinched between the two case halves. The gasket separating the halves will be captured on the back case half.

Reinsert the three screws and tighten until the screws are snug. **(Figure 4)**

The device will automatically perform a calibration and begin displaying % of oxygen.

HELPFUL HINT: If unit does not function, verify that the screws are tight to allow proper electrical connection.

6.0 CHANGING THE OXYGEN SENSOR

6.1 R217P65

Should the oxygen sensor require changing, the device will indicate this by presenting **"Cal Err lo"** on the display after initiating a calibration.

To change the oxygen sensor, begin by removing the three screws from the back of the device. A #1 Phillips screwdriver is required to remove these screws.

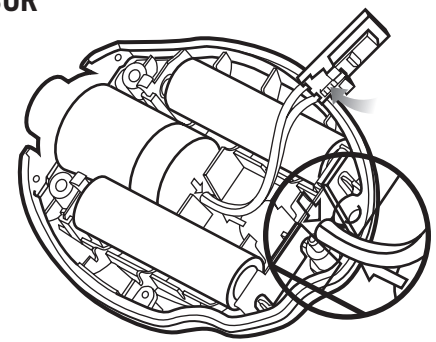


FIGURE 5

Once the screws are removed, gently separate the two halves of the device.

Disconnect the oxygen sensor from the printed circuit board by pressing the unlock lever first and then pulliing the connector out of the receptacle. The oxygen sensor can now be replaced from the back half of the case.

HELPFUL HINT: Be sure to orient the new sensor by aligning the red arrow on the sensor with the arrow in the back case. A small tab is located on the back case that is designed to engage the sensor and prevent it from rotating within the case. **(Figure 5)**

NOTE: If the oxygen sensor is installed incorrectly, the case will not come back together and the unit may be damaged when the screws are reinstalled.

Reconnect the oxygen sensor to the connector on the printed circuit board.

Carefully bring the two halves of the case together while positioning the wires to ensure they are not pinched between the two case halves. Make sure the sensor is fully inserted and in the proper orientation.

Reinsert the three screws and tighten until the screws are snug. Verify the unit operates properly.

The device will automatically perform a calibration and begin displaying % of oxygen.

6.2 R217P66

Should the oxygen sensor require changing, the device will indicate this by presenting **"Cal Err lo"** on the display.

Unthread the sensor from the cable by rotating the thumbscrew connector counterclockwise and pull the sensor from the connection.

Replace the new sensor by inserting the electrical plug from the coiled cord into the receptacle on the oxygen sensor. Rotate the thumbscrew clockwise until snug.

The device will automatically perform a calibration and begin displaying % of nitrogen.

7.0 CLEANING AND MAINTENANCE

Store the N_2 analyzer in a temperature similar to its ambient environment of daily use.

The instruction given below describes the methods to clean and disinfect the instrument sensor and its accessories:

Instrument:

» When cleaning or disinfecting the exterior of the N_2 analyzer, take appropriate care to prevent any solution from entering the instrument. Do not immerse unit in fluids.

Oxygen Sensor:

» Clean the sensor with a cloth moistened with a 65% alcohol/water solution.

» Maxtec does not recommend use of spray disenfectants because they can contain salt, which can accumulate in the sensor membrane and impair readings.

Accessories:

» The threaded barbed adapter may be cleaned by washing them with a 65% alcohol/water solution (per manufacturer's instructions). The parts must be thoroughly dry before they are used.

Because of the variability of the cleaning processes, Maxtec cannot provide specific instructions. Therefore, we highly recommend referring to the manufacturer's instructions on the details of method.

8.0 SPECIFICATIONS

8.1 Base Unit Specifications

Measurement Range: 0-100%
Resolution: 0.1%
Accuracy and Linearity: . . . 1% of full scale at constant temperature, R.H. and pressure when calibrated at full scale
Total Accuracy: . . . . . ±3% actual oxygen level over full operating temp range
Response Time: . . . . . 90% of final value in approximately 15 seconds at 23˚C
Warm-up Time: . . . . . None required
Operating Temperature: . . . . . 15˚C - 40˚C (59°F - 104°F)
Storage Temperature: . . . . . -15˚C - 50˚C (5°F - 122°F)
Humidity: . . . . . 0-95% (non-condensing)
Power Requirements: . . . . . 2, AA Alkaline batteries (2 x 1.5 Volts)
Battery Life: . . . . . approximately 5000 hours with continuous use
Low Battery Indication: . . . . . BAT icon displayed on LCD
Sensor Type: . . . . . Galvanic fuel cell
Expected Sensor Life: . . . . . > 900,000 O_2 percent hours minimum 2-years in typical applications
Model Dimensions: . . . . . 3.0" (W) x 4.0" (H) x 1.5" (D) (76mm x 102mm x 38mm)
Weight: . . . . . 0.4 lbs (170g)

8.2 Sensor Specifications

Type: . . . . . Galvanic fuel sensor (0-100%)
Life: . . . . . 2-years in typical applications for Nitrogen A & AE
1-year in typical applicaitons for Nitrogen A Fast

9.0 WARRANTY

The N_2 analyzer is designed for nitrogen delivery equipment and systems. Under normal operating conditions, Maxtec warrants the N_2 analyzer to be free from defects of workmanship or materials for a period of 2-years from the date of shipment from Maxtec, provided that the unit is properly operated and maintained in accordance with Maxtec's operating instructions. Based on Maxtec's product evaluation, Maxtec's sole obligation under the foregoing warranty is limited to making replacements, repairs, or issuing credit for equipment found to be defective. This warranty extends only to the buyer purchasing the equipment directly. Maxtec's sole obligation under the foregoing warranty is limited to making replacements, repairs, or issuing credit for equipment found to be defective. This warranty extends only to the buyer purchasing the equipment directly from Maxtec through Maxtec's designed distributors and agents as new equipment.

Maxtec warrants the oxygen sensor in the N_2 analyzer to be free from defects in material and workmanship for a period of 2-years for Nitrogen A & AE and 1-year for Nitrogen A Fast from Maxtec's date of shipment in a N_2 analyzer. Should a sensor fail prematurely, the replacement sensor is warranted for the remainder of the original sensor warranty period.

Routine maintenance items, such as batteries, are excluded from warranty. Maxtec and any other subsidiaries shall not be liable to the purchaser or other persons for incidental or consequential damages or equipment that has been subject to abuse, misuse, mis-application, alteration, negligence or accident.

These warranties are exclusive and in lieu of all other warranties, expressed or implied, including warranty of merchantability and fitness for a particular purpose.

APPENDIX J

Nitrogen Maintenance Device

For Dry Pipe Sprinkler Systems, Air Supervised Preaction Systems, & Dry Pilot Actuated Deluge Systems

UL Listed and FM Approved

GENERAL AIR PRODUCTS

Manufactured by: General Air Products, Inc.
118 Summit Drive, Exton, PA 19341

NITROGEN N_2 PAC
SPRINKLER CORROSION INHIBITING SYSTEM

UNITED FIRE SYSTEMS

Product Description

The enclosed Automatic N2 Maintenance Device is a UL Listed and FM Approved assembly of valves, nipples, fittings, and actuators to automatically control the N2 pressure in the piping of dry pipe sprinkler systems, preaction sprinkler systems, or dry pilot actuated deluge systems.

The N2 Maintenance Device is designed to automatically feed N2 into the system piping at the required volume and pressure from an N2 source such as a NITROGEN-PAC sprinkler corrosion inhibiting system.

The pressure regulator in the N2 Maintenance Device AMD-1 automatically regulates the air pressure to the designated level. The outlet pressure of the regulator is field adjustable.

The automatic N2 supply is directed through a restricted orifice in the N2 maintenance device so that upon activation of a sprinkler, the N2 supply will not interfere with the operation of the dry pipe valve, by continuing to supply high volumes of pressurized N2 to the piping system.

It is a recommended safeguard that a low pressure switch and alarm be installed on dry pipe systems or other N2 supervised piping systems. This will cause an alarm to sound if the pressure falls below a predetermined level.

Operation

The N2 Maintenance Device provides a continuous but restricted N2 supply to the piping system.

The activation of only one sprinkler in a dry pipe system, will cause the system pressure to diminish to the point where the dry pipe valve will “trip”, thereby filling the system piping with water.

Small piping system N2 leaks will be compensated for by the automatic N2 feed provided the N2 leaks do not exceed the restricted N2 supply.

Technical Data

Model: AMD-1

Approvals: UL, FM
Factory Operation Test:
100% at 35 psi air

Design Data

An N2 Maintenance Device should be permanently connected to all dry pipe sprinkler systems to avoid the possibility of false valve “trips” which may result from small piping leaks gradually lowering system N2 pressure.

An N2 Maintenance Device may also be utilized to automatically control the N2 supply to the piping system of an N2 supervised preaction system.

Installation

General

The N2 Maintenance Device must be installed in the N2 supply line leading to the dry pipe valve trim, preaction system piping or dry pilot system piping. The N2 flow through the Device must be in the direction shown by the arrows on the units.

Note: The minimum pipe size is 1/2" diameter, although 3/4" diameter piping will provide a more rapid initial system fill.

AMD-1 Includes Non-Listed Pressure Gauge

The AMD-1 includes a non-listed pressure gauge for use with the regulator. Gauge ships uninstalled. To install, remove the 1/8" plug on the regulator and install the pressure gauge into the open port.

Mode AMD-1 (Pressure Regulator) (see Fig. 1)

Step 1. Close the 1/4" ball valves (#8) and open the bypass valve (#7) in the N2 Maintenance Device and open the N2 supply valve in the dry pipe valve trim.

Step 2. Open the N2 supply control valve from the NITROGEN-PAC system to pressurize the system.

Step 3. When the system is pressurized, check the pressure gauge to verify the the pressure is at the design pressure requirement for the system.

Caution: Care must be taken NOT to overpressure the system above the regulator setting when using the quick fill line.

Note: If necessary to adjust the system pressure ensure the pressure gauge is installed in the regulator port. Move the locking nut away from the body of the regulator and turn the adjustment screw IN to increase the system pressure and OUT to reduce system pressure (see Fig. 1).

When reducing from a higher to a lower setting, first reduce to some pressure less than desired, then bring up to the desired point.

After achieving the desired pressure setting, lock the pressure setting by tightening the locking nut.

Step 4. Close the bypass valve (#7) and open the two 1/4" ball valves (#8). The N2 Maintenance Device is now in service.

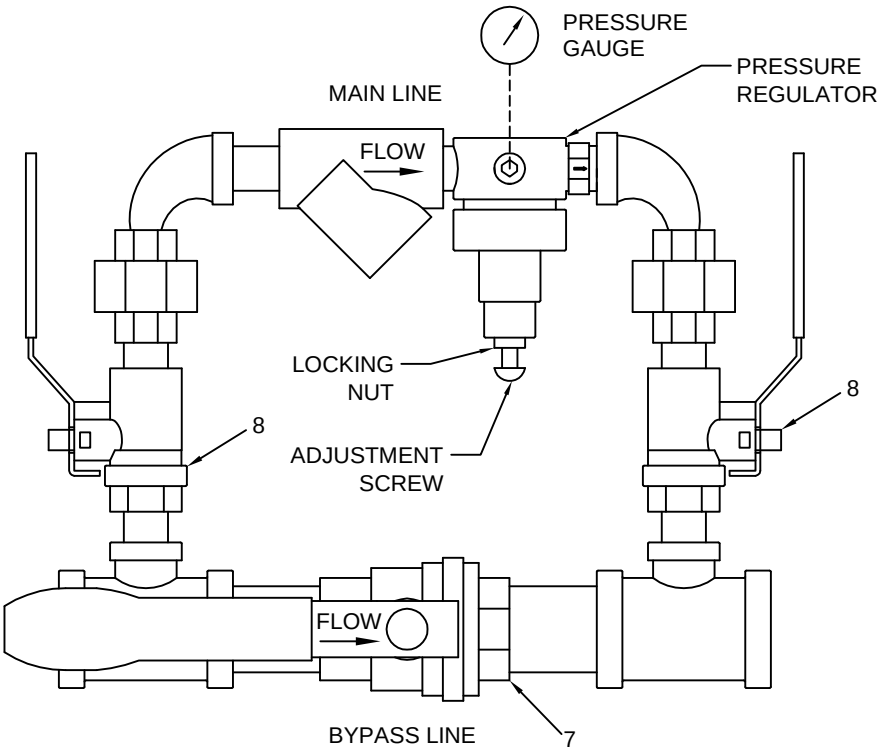
Care and Maintenance

The N2 Maintenance Device does not require any regularly scheduled maintenance. However, it is recommended that proper operation and condition be periodically verified as follows:

1. Verify that the 3/4" bypass valve is closed, the two 1/4" ball valves are open and the N2 supply control valve in the dry pipe valve trim is open.

2. Verify that the regulated pressure is at the proper setting, if applicable.

3. The strainer should be cleaned.



AMD1

FIGURE 1

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UNITED Fire Systems

Division of UNITED Fire Protection Corporation

1 Mark Road

Kenilworth, NJ USA 07033

908-688-0300

www.unitedfiresystems.net