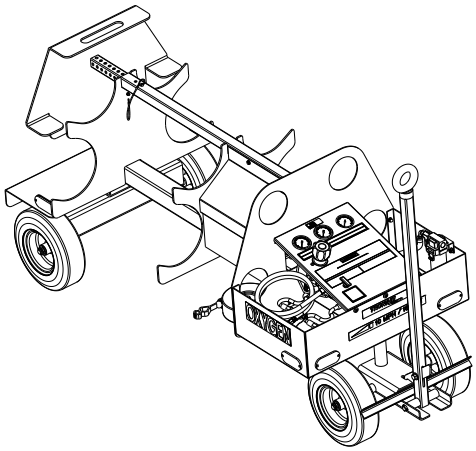
TRONAIR®

OPERATION & SERVICE MANUAL



Models: 20-4505-7000,
20-4509-7000 (includes 4 bottles)
Four Bottle Oxygen Cart with Booster and Manifold/Regulator

CE

11/2018 –Rev. 16

CAUTION! It is mandatory that this instruction manual be read and understood by all persons operating this High Pressure Oxygen Booster.

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
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Email: sales@tronair.com

REVISION	DATE	TEXT AFFECTED
07	04/2004	Major Revision
08	02/2005	Major Revision
09	08/2005	Modified illustration and Parts List
10	04/2006	Major Revision
11	12/2006	Major Revision
12	07/2008	3.1 General Safety Requirements – added oxygen servicing and warning 6.0 Maintenance – added warning, modified 7.0 Troubleshooting Appendix III - added standards
13	02/2009	Major revision
14	07/2009	Revised 4.2 Assembly and Parts List Illustration
16	01/2018	Major revision

TABLE OF CONTENTS

PAGE

Component Illustration

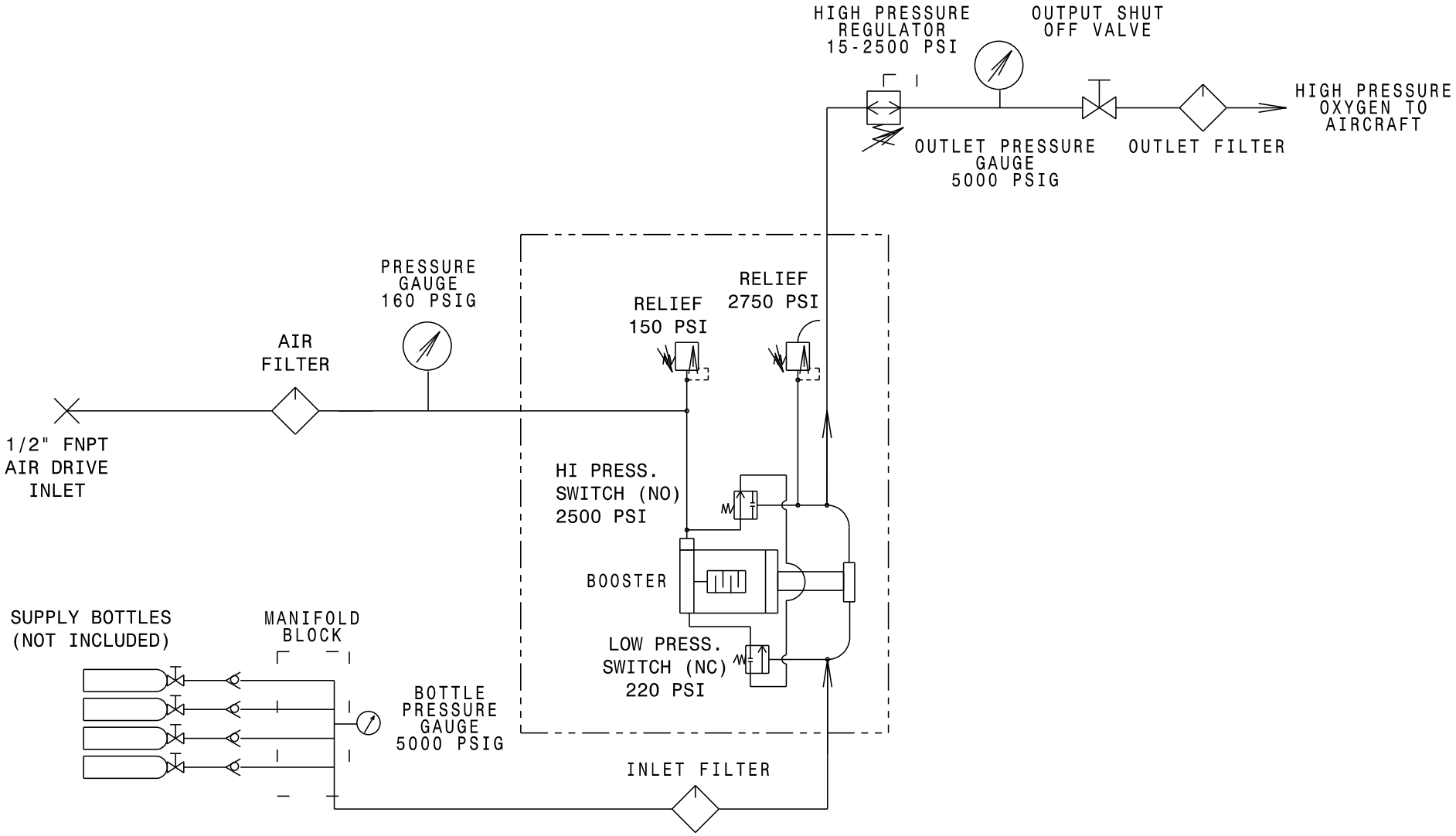

FIGURE 1 – Oxygen Booster Schematic

This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., it suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

CAUTION!

It is mandatory that this instruction manual be read and understood by all persons operating this high pressure oxygen booster.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

The Four Bottle Oxygen Cart with the manifold and regulator allows the operator to manifold together up to four oxygen supply bottles and regulate the outlet pressure. Reverse flow check valves prevent back-flow from one supply bottle to another supply bottle.

The Tronair Oxygen Booster provides the capability of boosting remaining lower pressure oxygen from supply bottles to the required higher aircraft system pressure; up to 2,250 PSIG maximum.

Consumer Requirement: This Oxygen Booster utilizes an air driven pressure amplifier, requiring 145 PSIG maximum air pressure input at 80 SCFM volume.

Cart may be used to supply either internal aircraft systems or portable aircraft bottles.

DANGER!

TO AVOID SERIOUS INJURY, LOSS OF LIMB OR DEATH:

1. **DO NOT use on LOW PRESSURE aircraft systems.**
2. **DO NOT use with ANY GAS OTHER THAN OXYGEN.**
3. **DO NOT exceed 2250 PSIG inlet oxygen bottle pressure into booster.**
4. **All components used in the oxygen system shall be clean, dry and free of all contamination per SAE SPEC. AIR 1176.**
5. **Servicing and/or maintenance of oxygen systems shall be done by trained and qualified personnel using approved procedures per SAE SPEC. ARP 1532.**

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

1.4 SPECIFICATIONS/FEATURES

Dimensions:

- Height: 36-7/16 in (92.5 cm)
- Length: 80 1/8 in (203.5 cm)
- Width: 30 1/8 in (77.5 cm)
- Weight: 360 lbs. (163 kg)

Cart:

- Easy loading
- Use with all standard 9 in (22.9 cm) diameter bottles; CGA 540 connection
- Adjustable bottle stop
- Bottles fully captured
- Pneumatic tires
- Parking brake
- Hose compartment
- Instrument Panel

Booster:

- Output Hose: 15 ft (4.6 m) long with #4 37ºJIC female flare swivel fitting at aircraft hook-up end
- Output Rating: 2250 psi (155 bar) maximum
- Minimum Supply Bottle Pressure: 250 psi (17 bar)
- Input to Booster Pump: 80 SCFM at 150 psi (10.3 bar) maximum
- Booster High Pressure Air Pilot: 2500 psi (172 bar)
- Booster High Pressure Relief: 2750 psi (189.6 bar)
- All plumbing, fittings, and components are oxygen cleaned. The unit and hoses are cleaned and packaged to avoid possible system contamination.

Temperature Range:

- 0º to 200ºF (-17.7º to 93.3º C)

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING!
Warning is used to indicate the presence of a hazard that can cause ***severe personal injury, death, and/or substantial property damage*** if the Warning Notice is ignored.

CAUTION!
Caution is used to indicate the presence of a hazard, which will or can cause ***minor personal injury or property damage*** is the Caution Notice is ignored.

2.2 SAFETY

The operation, maintenance, and trouble shooting of this unit requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be operated and maintained only by qualified persons in accordance with this manual and all applicable local codes.

Safety instructions specifically pertaining to this unit appear throughout this manual highlighted by the signal words WARNING and CAUTION which identify different levels of hazard.

General: Information presented in this manual and on various labels, on this unit pertains to equipment specifications, installation, operation, maintenance and trouble shooting which should be read, understood, and followed for the safe and effective use of this equipment.

Training: Read this entire manual **prior** to operation of the unit. All personnel using this oxygen cart should understand and follow this manual and receive training. We encourage our customers to call Tronair to discuss any operating or testing requirements.

CAUTION!

It is mandatory that this instruction manual be read and understood by all persons operating this high pressure oxygen booster.

WARNING!

TO AVOID SERIOUS INJURY OR DEATH OBSERVE THE FOLLOWING:

1. **All components used in the oxygen system must be clean, dry, and free of all contamination per SAE SPEC AIR 1176.**
2. **DO NOT use this equipment with nitrogen or gas other than oxygen.**
3. **DO NOT exceed 2250 PSIG bottle inlet pressure into booster.**
4. **Servicing and maintenance of the system should only be done by trained and qualified personnel using approved procedures.**
5. **It is mandatory that this instruction manual be read and understood by all persons operating this oxygen manifold.**

2.3 GENERAL SAFETY REQUIREMENTS

Pressures: Gases under pressure are a potential hazard in the form of stored energy. Accidents can occur when this energy is improperly handled. Be sure that all equipment used is compatible and designed to control the pressures encountered.
Oxygen: Oxygen is an oxidizing gas and is chemically stable and nonflammable. However oxygen does support combustion. High concentrations can accelerate the combustion of flammable materials up to and including an explosion. It is important to understand that spontaneous combustion of organic materials can occur in oxygen rich atmospheres.
Handling: Oxygen handling must be done with care to avoid any association with hydro-carbons. Especially where fuels and lubricants are present in aircraft service areas. It is imperative that oxygen systems be handled properly. Be sure to keep all protective caps in position on equipment as long as possible, and replace them as soon as possible.
Velocity: Oxygen flowing at a high velocity in a piping system can propel any foreign material particles with such force that the impact friction can raise the particles temperature to a possible ignition point. It is, therefore, imperative that a high degree of cleanliness be maintained in the oxygen system at all times.
Oxygen Servicing: The following list contains additional general safety precautions that should be adhered to during the servicing process. However, always refer to the manufacturer's procedure for the airplane being serviced.

1. Always ground the system to be serviced and the servicing equipment before connecting the filler adapter.
2. Close the oxygen bottle manual shutoff valve.
3. Ensure that all aircraft electrical power is off. Do not operate electrical switches, or connect or disconnect ground power generators during the oxygen charging operation.
4. Do not service the oxygen system if fueling or other flammable fluid servicing is in process.
5. Do not charge the system too fast. Rapid charging can create a dangerous overheating condition.

2.3 GENERAL SAFETY REQUIREMENTS *(continued)*

SAE AIRCRAFT OXYGEN SPECIFICATION INFORMATION
For more information concerning specific SAE aircraft oxygen equipment specifications, contact:
Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, PA 15096-0001

3.0 PREPARATION FOR USE/ASSEMBLY INSTRUCTIONS

3.1 UNPACKING

The oxygen cart's manifold system and oxygen booster have been thoroughly cleaned and inspected prior to packaging and shipment. After opening the shipping container and removing the unit, inspect it thoroughly for shipping damage.

Though this unit has been functionally and pressure tested prior to leaving out facility, it is possible that some of the installed fittings may have loosened during shipping. It is advised that all connections be checked for tightness as part of the installation process.

Oxygen equipment should be kept clean, dry, and free from contaminants. It is imperative that all installation, inspection, maintenance, testing, and servicing of oxygen system components be done by trained and qualified personnel using approved procedures.

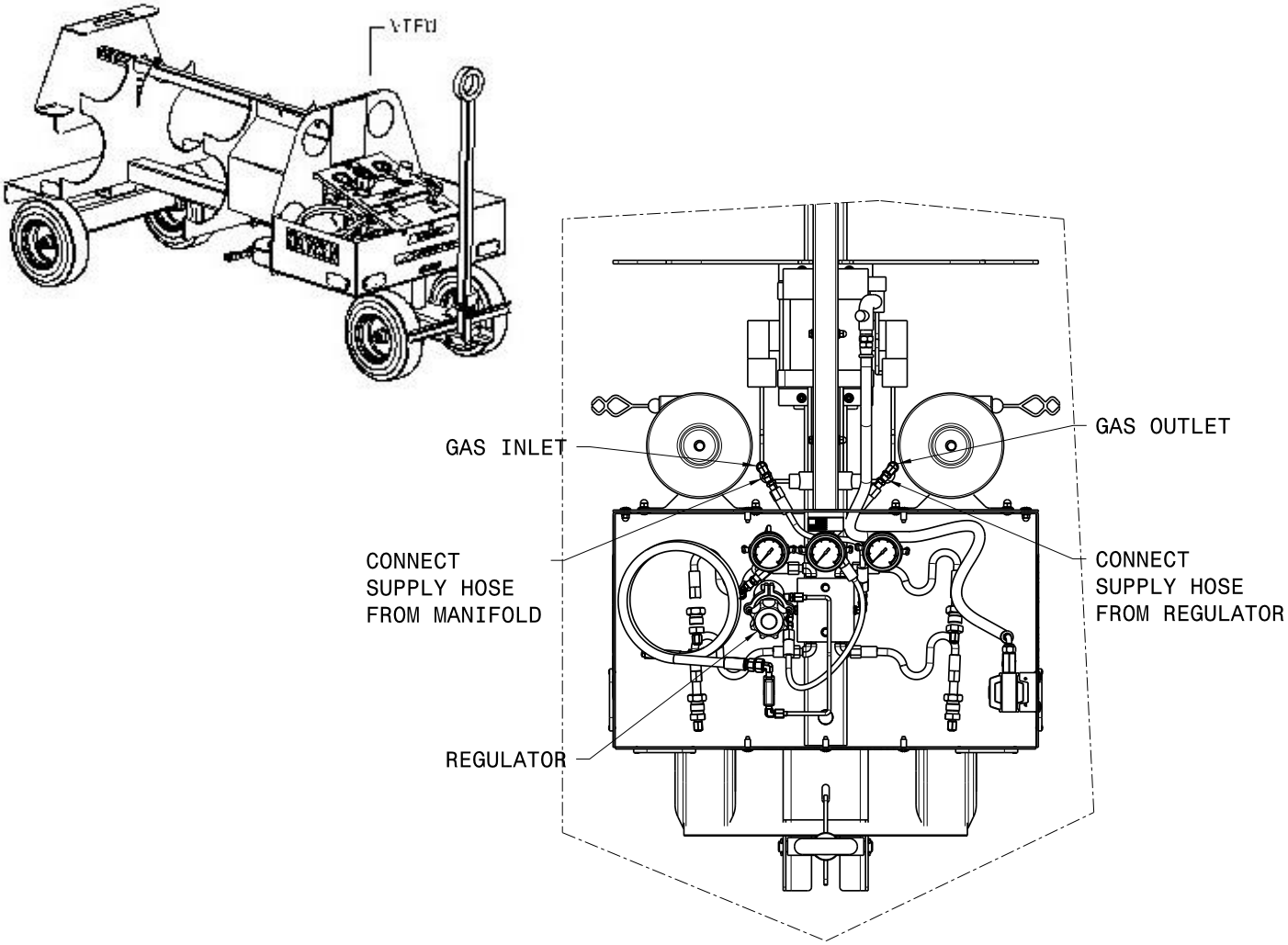

FIGURE 2 – 4 Bottle Cart Instrument Panel

(Shown With Instrument Panel & Various Components Omitted for Clarity)

3.2 ASSEMBLY

1. Inspect all connections for contaminants before installation and tightening. Remove any foreign materials. Be sure all oxygen system components are clean per SAE specification AIR 1176.
2. Install 12 inch oxygen supply hose from regulator assembly to gas outlet on Oxygen Booster per SAE spec. ARP 1532, being careful not to contaminate the system during installation. (See ***Figure 2***).
3. Install 12 inch oxygen supply hose from manifold assembly to gas inlet on Oxygen Booster per SAE specification ARP 1532, being careful not to contaminate the system during installation (See ***Figure 2***).
4. Supply bottles may be loaded by laying bottles down on the ground and lifting, by 2 persons, into place.
5. Rotate the oxygen supply bottles so that the manifold inlet hoses may be easily connected to the bottles. Tighten bottle hoses 2 to 2½ turns after finger tight is reached. Make sure the hoses are not kinked or damaged. Recheck all fittings for tightness. (See ***Figure 2***).
6. If less than four bottles are used, plug or cover unused inlet hoses to ensure cleanliness.
7. Check that outlet shut off valve is closed. Carefully store outlet hose in cart storage tray.

3.3 PREPARATION FOR OPERATION

WARNING!

If there are any differences between the following instructions and the aircraft maintenance manual, the aircraft maintenance manual will take precedence.

1. Attach one static discharge cable clamp to aircraft static ground. (See aircraft maintenance manual if any questions.)
2. Attach other static discharge cable clamp to earth static ground. (See aircraft maintenance manual if any questions.)
3. Be sure all valves and controls are in the closed or “OFF” position.

WARNING!

Be sure fill line is secured prior to purging the unit. This will prevent the hose from “whipping” if too much oxygen is allowed to flow through the unit.

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the unit.

4.2 TRAINING PROGRAM

The employer provided operator training program should cover safety procedures concerning use of the unit in and around the intended aircraft at the intended aircraft servicing location.

4.3 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the unit.

NOTE: Maintenance and Trouble Shooting are to be performed by a skilled and trained technician.

5.0 OPERATION

5.1 FILL PROCEDURE

1. Connect shop air supply (see Figure 3)
2. Close high pressure oxygen gas output valve
3. Reduce output pressure regulator to minimum pressure (counter clockwise)
4. Remove cap from output hose and immediately loosely connect hose to aircraft component
5. **SLOWLY** open shut off valve on the oxygen bottle
6. Adjust output pressure regulator for 50 – 100 psig on output pressure gauge
7. Open high pressure oxygen gas output valve slightly to purge output hose
8. Close high pressure oxygen gas output valve
9. Tighten output hose to aircraft component
10. Read aircraft system oxygen pressure required
11. Adjust output pressure regulator to required pressure
12. Slowly open high pressure oxygen gas output valve to fill aircraft component
13. Close high pressure oxygen gas output valve
14. Allow system to cool and recheck aircraft oxygen pressure prior to disconnecting. Repeat stems 12 & 13 if necessary

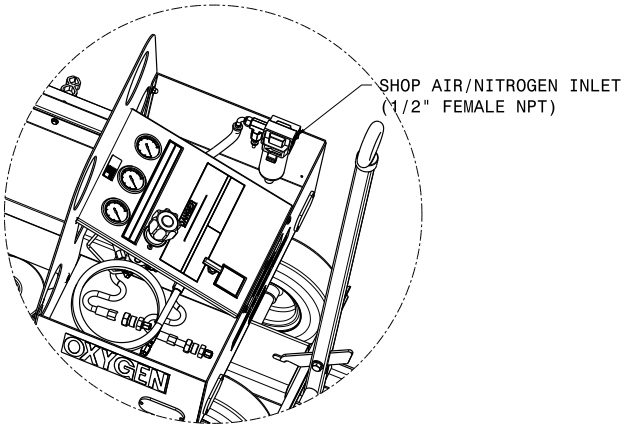

FIGURE 3 – Shop Air Location

If non-standard ambient temperatures are present at the time of oxygen system recharging, refer to Table 1 to determine the proper filling pressure for oxygen cylinders.

TABLE 1

At Temperature Degrees F	Fill to Working Pressure Multiplied by Figure Below
110	1.10
105	1.0875
100	1.075
95	1.0625
90	1.05
85	1.0375
80	1.025
75	1.0125
70	1.000
65	0.9875
60	0.975
55	0.9625
50	0.95
45	0.9375
40	0.925

EXAMPLE: Ambient Temperature = 90° F, Working pressure is 1800 PSIG:
Charge Pressure = (1800) x (1.05) = 1890 PSIG

5.2 DISCONNECT PROCEDURE

WARNING!

When the aircraft fill line is pressurized or when oxygen is flowing through the system, the fill line hose will "whip" if not secured.

1. Close the shut off valves on the oxygen bottle
2. Open high pressure oxygen gas output valve
3. Reduce high pressure output regulator to minimum pressure
4. SLOWLY disconnect the output hose from the aircraft to bleed remaining pressure within the system
5. Immediately reinstall the cap on the output hose
6. Close high pressure oxygen gas output valve
7. Disconnect shop air supply and close shop air shut off valve

5.3 TO READ INDIVIDUAL BOTTLE PRESSURE

1. Close high pressure oxygen gas output valve
2. **SLOWLY** open a bottle shutoff valve
3. Read pressure on bottle supply pressure gauge
4. Close bottle shutoff valve
5. Open high pressure oxygen gas output valve and slightly adjust pressure regulator to bleed off system pressure
6. Repeat procedure for other bottles

5.4 EFFICIENT USE OF SYSTEM

Maximum oxygen may be removed from supply bottles if aircraft are serviced from the lowest pressure bottle first. In this manner, the most oxygen may be removed from each bottle. Even bottles with relatively low pressures may be used to service aircraft if the aircraft has a depleted system (250 psi minimum).

6.0 PACKAGING AND STORAGE

6.1 STORAGE

- Store the unit in a clean, dry area when not in use.
- Be sure that all hoses are capped and the unit is covered with lint free covering for the duration of unit storage to ensure complete oxygen system cleanliness for future aircraft system recharging.

7.0 TROUBLESHOOTING

Refer to Appendix I and Appendix II

8.0 MAINTENANCE

The operation, maintenance, and trouble shooting of this unit require practices and procedures, which ensure personal operator safety and the safety of others. Therefore, this equipment is to be operated and maintained only by qualified persons in accordance with this manual and all applicable local codes. Maintenance is only to be done by qualified persons.

All maintenance personnel must be familiar with the cautions and warnings associated with high pressure oxygen and high pressure oxygen systems as outlined in *Section 3 - Safety* of this manual prior to performing any maintenance on the unit.

TRAILER:

- The inlet shop air filter should be inspected every 300 - 600 hours of service or every two years, whichever comes first. The sintered bronze filter element can be cleaned using soap and water. The element should be dried with shop air blown from the inside out. The element may be cleaned multiple times before replacing, depending on cleanliness of operating environment. The replacement air filter element is available from Tronair, part number PC-1145.
- Maintain pressure listed on tires.
- Grease wheel bearings quarterly.
- Generally keep the entire unit clean and free from contaminants. Visually inspect for any system leaks or damage. Correction of any problems prior to unit operation is imperative for safe operation.

OXYGEN COMPONENTS:

WARNING!

OXYGEN EQUIPMENT IS NOT FIELD OR CUSTOMER SERVICEABLE!

OEM repair or replacement is recommended.

- The gauges on this unit should be inspected and calibrated annually to ANSI grade A accuracy, to maintain and ensure accuracy.
- Manifold inlet hoses should be inspected weekly for signs of cracking or kinking, replace as necessary.
- Inspect oxygen manifold output hose prior to each use for signs of cracking or kinking, replace as necessary.
- Replace inlet and output filters after 2000 hours of use (Z-7011).

9.0 PROVISION OF SPARES

9.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

9.2 RECOMMENDED SPARE PARTS LISTS

Reference the following page(s) for Replacement Parts and Kits available.

10.0 IN SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section 1.3 – Manufacturer.

11.0 GUARANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

a) Parts required for normal maintenance
b) Parts covered by a component manufacturers warranty
c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

a) Product Model Number
b) Product Serial Number
c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately *void any warranty, express or implied* and Tronair *disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse*.**

12.0 APPENDICES

APPENDIX I	Smith Installation & Operator's Guide
APPENDIX II	Haskel Air Driven Gas Booster Compressors Operation & Service Manual
APPENDIX III	Declaration of Conformity

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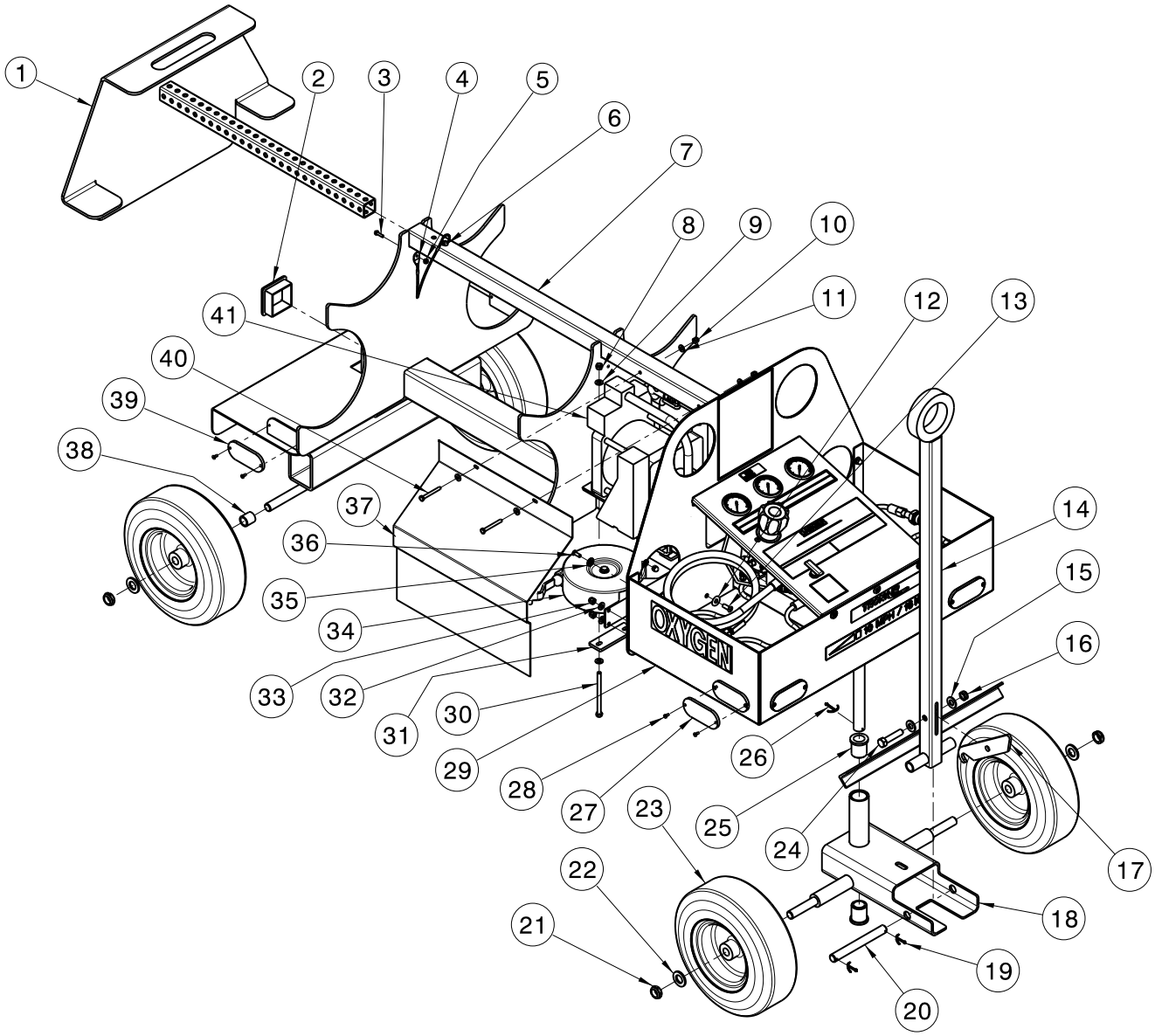
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	Z-5585-01	Weldment, Back Stop	1
2	H-2649-18	Cap	1
3	G-1150-103506	Screw, Hex Head Machine, #10-32 x ¾" long	1
4	H-1026*12.0	Assembly, Lanyard	1
5	G-1202-1035	Elastic Stopnut, #10-32	1
6	G-1307-0618	Pin, Aerofast	1
7	Z-5582-01	Weldment, Bottle Cart	1
8	G-1202-1065	Elastic Stopnut, 5/16 - 24	4
9	G-1250-1060N	Flatwasher, 5/16 narrow	8
10	G-1463-1050	Nut, ¼ - 20 Acorn	6
11	G-1250-1050N	Flatwasher, ¼ narrow	12
12	G-1492	Washer, Finish	8
13	G-1158-107107	Screw, Machine 5/16 – 18 x 7/8” long	8

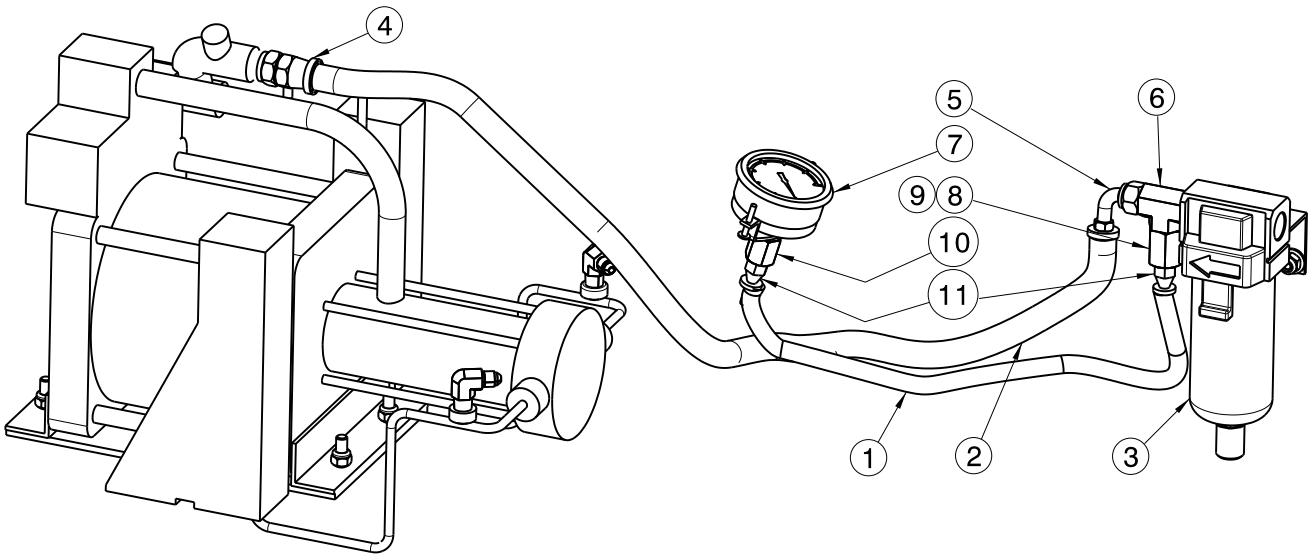
Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

Item	Part Number	Description	Qty
14	Z-5584-01	Weldment, Towbar	1
15	G-1250-1090N	Flatwasher, ½ narrow	2
16	G-1203-1095	Elastic Jamnut, ½ - 20	1
17	J-3427	Lever	1
18	Z-5580-01	Weldment, Front Truck	1
19	G-1301-02	Pin, Cotter	2
20	R-2096	Pin, Towbar	1
21	G-1203-1115	Elastic, Jamnut ¾ - 16	4
22	G-1250-1110N	Flatwasher, ¾ narrow	4
23	U-1041	Wheel, Pneumatic	4
24	G-1100-109522	Bolt, Hex Head Grade 5, ½ - 20 x 2-1/4" long	1
25	H-2019-76	Bearing, Flange	2
26	G-1301-03	Pin, Cotter	1
27	H-1427-02	Reflector, Amber	4
28	G-1352-17	Rivet, Pop	16
29	S-1866-01	Shelf, 4-bottle cart	1
30	G-1100-106544	Bolt, Hex Head Grade 5, 5/16 - 24 x 4 ½ " long	4
31	J-3535-01	Plate, Booster Clamping	2
32	G-1250-1060N	Flatwasher, 5/16 narrow	8
33	G-1463-1060	Nut, Acorn, 5/16 – 18	8
34	H-1186	Reel, Static Discharge	2
35	G-1489	Washer, Finish	4
36	G-1158-106106	Screw, Machine, ¼ - 20 x ¾" long	4
37	S-1907-01	Guard, Booster	2
38	TR-1813	Spacer, Wheel	2
39	H-1427-01	Reflector, Red	4
40	G-1100-105022	Bolt, Hex Head Grade 5, ¼ - 20 x 2- ¼ "	2

Parts List

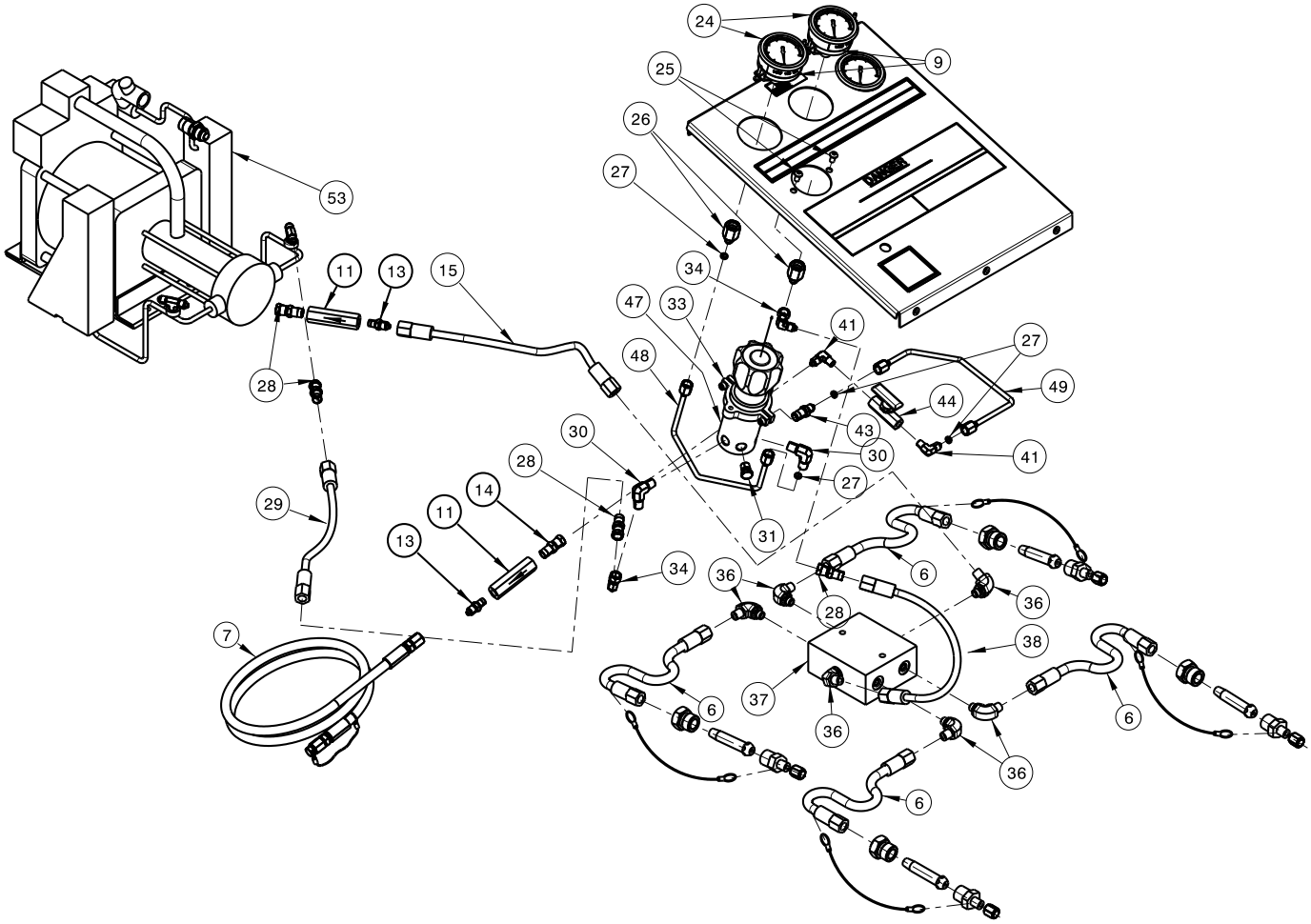
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	TF-1047-01*15.0	Hose, Push On	1
2	TF-1047-05*48.0	Hose, Push On	1
3	PC-1032	Filter Assembly	1
4	N-2026-05-B	Connector, Swivel	1
5	N-2500-03	Elbow, Swivel	1
6	N-2017-14-S	Tee, Male Run	1
7	HC-2278	Gauge	1
8	N-2020-02-S	Reducer, Tube End	1
9	N-2000-06-S	Nut, 37º Flare	1
10	N-2098-04-SS	Connector, Female	1
11	N-2026-01-B	Connector, Swivel	1

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Parts on this page are oxygen cleaned per SAE spec AIR1176 as an assembly; therefore, NO individual parts are sold. Contact your Tronair representative for information regarding repairs.

TRONAIR, Inc.
1740 Eber Road
Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

Parts List

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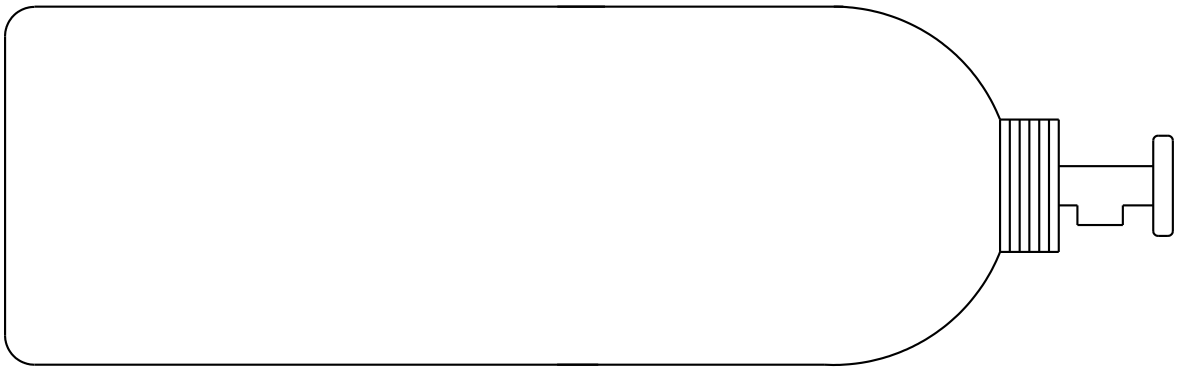

Part Number	Description	Qty
PC-1124	Tank, Oxygen	1

*Tanks are shipped empty and separate from unit.

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APPENDIX I

Smith's
Installation & Operation Guide
Pressure Regulators

SMITH EQUIPMENT

www.smithequipment.com

INSTALLATION & OPERATION GUIDE FOR SMITH PRESSURE REGULATORS

Important safety and operational information contained in this booklet are emphasized by a system of classification using the words: **DANGER, WARNING, CAUTION, NOTICE.**

DANGER!	Danger is used to indicate the presence of a hazard which will cause severe personal injury, death or substantial property damage, if the warning is ignored.
WARNING!	Warning is used to indicate the presence of a hazard which can cause severe personal injury, death or substantial property damage, if the warning is ignored.
⇐CAUTION⇒	Caution is used to indicate the presence of a hazard which will or can cause minor personal injury, death or substantial property damage, if the warning is ignored.
NOTICE!	Notice is used to notify people of installation, operation or maintenance information which is important but not hazard related.

SPECIALTY GASES ~ SAFETY AND TECHNICAL INFORMATION

Gaseous and liquefied compressed gases may be categorized in the following classifications: flammable, oxidant, corrosive, inert or toxic. Because these products may also be gases or liquids under pressure, the hazards accompanying high pressure and low temperature may also be present. The properties of a gas place it in one or a number of categories. Certain basic rules must be followed in order to handle specialty gases safely.

A. Know the hazards associated with the gas.

B. Know and understand the physical and chemical properties of the gas.

C. Observe the necessary general precautions to be taken in the use of specialty gases and the precautions specific to the gas.

In addition to the safe handling and storage procedures presented in this section, the Compressed Gas Association and the Department of Transportation provide detailed gas safety information and regulations.

A. FLAMMABLE

Flammable gases when mixed with air, oxygen or other oxidants burn or explode upon ignition, depending upon the degree of confinement. Each flammable gas has a gas-in-oxidant concentration range within the limits of which the gas may be ignited. Flammable ranges are expressed in terms of air at ambient temperature and atmospheric pressure. A change in temperature, pressure or oxidant concentration may vary the flammable range considerably. Mixtures above and below the flammable range do not ignite. As a precaution in handling flammables, care must be taken to eliminate all possible sources of

ignition through the proper design of facilities, the installation of approved electrical systems, and the restriction of smoking and use of open flames. An explosimeter should be used to determine the existence of a flammable mixture in areas of suspected leakage.

B. OXIDANT
A number of gases, although nonflammable, may initiate and support combustion. Materials that burn in air burn more vigorously or even explosively in oxygen and certain other oxidants. All possible sources of ignition must be eliminated when handling oxidants. Oxidants must not be stored with combustible materials. Oil, grease, or other readily combustible substances must not come in contact with cylinders or equipment used in oxidant service.

C. CORROSIVE
Corrosives are those products that erode and deteriorate materials with which they come in contact; such as metals, fabrics, and human tissue. Some gases, although not corrosive in their anhydrous form, become corrosive in the presence of water. Special Care must be taken when selecting the proper construction materials for equipment in which corrosives are handled. Gases that do not cause deterioration but induce inflammation of human tissue are irritants. Inflammation of the tissue may occur after immediate, prolonged or repeated contact with the irritant. Protective clothing and equipment must be used to minimize exposure to corrosive or irritating materials.

D. INERT
Gases that at ordinary temperatures and pressure do not react with other materials are classified as inert. If released in a confined area, inert gases may displace the oxygen content of the air below the level necessary to sustain life. Asphyxiation, therefore, is the hazard associated with inert products. Adequate ventilation and monitoring of the oxygen content of confined areas minimizes the possibility of asphyxiation.

E. TOXIC
Toxic materials are those substances that may chemically produce injurious or lethal effects. The degree of toxicity and the effects vary with the compound. Some gases are especially nocuous because they do not provide adequate warning of their presence (by color, odor, etc.) at low levels of concentration. Also, some products that are non-toxic in themselves may react with certain chemicals or decompose at elevated temperatures to produce toxic materials. Adequate ventilation, protective clothing, and suitable breathing equipment must be used to minimize exposure.

F. HIGH PRESSURE
Specialty gases are compressed to pressures up to 6000 psig. A sudden release of pressure may cause serious damage to personnel and equipment by propelling a cylinder or whipping a line. Factors that must be considered when choosing construction materials and designing gas-handling systems are the temperature, the pressure of the gas and the possibility of pressure buildup in the system.

NOTICE!

If you have a requirement or concern not covered in the booklet, contact your equipment supplier for assistance.

WARNING!

Read and observe all warnings and instructions before installing or operating any pressure regulating equipment. Improper application and operation of equipment with high pressure media (inerts, flammables, oxidizers or toxics) can result in damage to equipment or severe personal injury.

INTRODUCTION

Prior to installing or operating any pressure regulation equipment, read and follow the information in this booklet. Improper application and operation of regulators can result in damage to equipment or severe personal injury. All possible hazards and precautionary measures are not covered in this booklet. It is recommended that prior to using gas regulation equipment, you fully understand and comply with all established safety regulations.

SECTION I
PRE-INSTALLATION PROCEDURES: COMPRESSED GAS CYLINDERS

WARNING!

Serious accidents can result from improper use and handling of high pressure compressed gas cylinders. Always follow instructions and safety precautions provided by your gas supplier.

WARNING!

Read and observe all warnings and instructions before installing or operating any pressure regulating equipment. Improper application and operation of equipment with high pressure media (inerts, flammables, oxidizers or toxics) can result in damage to equipment or severe personal injury.

Refer to CGA pamphlet page 1 for all regulations which apply to the safe handling and storage of combined gas cylinders.

1. Cylinders should always be kept in the vertical position and secured from falling.
2. Never use compressed gas cylinders without an approved gas pressure reducing regulator attached to the outlet of the cylinders.
3. Do not lubricate compressed gas fittings, gauges, regulators or regulator components.
4. Do not apply sealing tape to cylinder connections.
5. Do not use cylinders with damaged threads. Return the cylinder to your supplier indicating the problem.
6. Do not use cylinder connection adaptors. Use a regulator with the proper compressed gas fitting.

SECTION II PRE-INSTALLATION PROCEDURES: REGULATORS

WARNING!

Regulators must be used only with the gases and pressures for which they are designed. Consult a material safety data sheet (MSDS) for media used to determine compatibility of gases and regulator components (available from your gas supplier). Failure to do this can result in an explosion, damage to equipment or severe personal injury.

1. Check the designed pressure rating of the regulator (stamped on the regulator body) and the scale range of the pressure gauges. They must be adequate for the cylinder pressure and the operating pressure.
2. Check that the materials used in the construction of the regulator are compatible with the intended media service.
3. Check that the regulator inlet connection is compatible with the cylinder outlet valve connections.
4. Fit the operating system with a check valve purge assembly and pressure relief devices as required.
5. Do not interchange pressure regulators or other equipment with different gases unless there is knowledge of the compatibility properties of the gases.
6. Do not use regulator equipment for oxygen service that has been in other gas service.

SECTION III INSTALLATION & OPERATION
TEST FOR LEAKAGE

WARNING!

Check cylinder valve connections and regulator inlet connections for foreign material before connecting. Use a clean dry lint-free cloth to remove contamination. When using oxygen or other oxidizers, it is extremely important that connections are clean and maintained. Failure to do this can result in an explosion, damage to equipment or severe personal injury.

1. Inspect the cylinder valve threads for damage and be sure the cylinder valve is free of oil, grease, dirt or any foreign material.
2. Attach the regulator to the cylinder valve and secure tightly using a wrench.
3. Connect the operation system to the regulator outlet.
4. Turn the regulator adjusting screw counterclockwise until the adjusting screw turns freely (no spring load) or until the adjusting screw is against the mechanical stop. (This allows the regulator valve to close).
5. Close the regulator outlet valve if one is used.

WARNING!

Do not place yourself in front of or behind the regulator when opening the cylinder. Place yourself with the cylinder between you and the regulator.

6. Slowly open the cylinder valve until the full cylinder pressure is indicated on the high pressure regulator gauge. Then, open the cylinder valve all the way. This high pressure gauge should read the cylinder pressure. The delivery gauge should read zero.
7. With the valve at the outlet of the regulator closed and the adjusting screw tension released, leave pressure on the inlet for 5 to 10 minutes. Delivery pressure gauge should not indicate any pressure increase. A pressure increase indicates leakage past the regulator valve seat.

WARNING!

If leakage occurs, do not use the regulator.

8. Turn the adjusting screw clockwise to set a normal delivery pressure. If you are unable to attain a desired pressure or the pressure continues to rise above the setpoint, the regulator should not be used.
9. If the unit functioned properly in the previous step, close the cylinder valve and note the readings of both the inlet and delivery pressure gauges. After 5 to 10 minutes, a drop in the reading of either gauge indicates a leak in the system.

NOTICE!

Use an approved oil-free leak detection fluid to locate possible leaks at the inlet, threaded parts, through the regulator diaphragm or through the outlet valve.

10. If a leak is indicated at the inlet or at a threaded port, relieve all pressures from the regulator and retighten the connections. If a leak continues or is found at the diaphragm or outlet valve, do not use the regulator.
11. If the system is determined to be leak free, turn the adjusting screw clockwise until the desired pressure setting is indicated on the delivery pressure gauge.
12. Open the outlet valve to purge the system. Adjust the regulator adjusting screw to obtain the desired pressure setting at the flow conditions.

⇐CAUTION⇒

A regulator is not intended to be used as a shut-off device. When not in use, the cylinder valve should be closed. A pressure relief device should be installed downstream of the regulator or outlet valve to protect the process equipment in the case of a rise in operating pressures.

SECTION IV SYSTEM SHUTDOWN

1. Close the cylinder valve.
2. Release all media from the regulator and/or system so that both gauges read zero. If the gas is flammable, an oxidant, corrosive, or toxic, take appropriate measures to render it innocuous by employing suitable disposable system before venting the gas to the atmosphere.
3. Turn the adjusting screw counterclockwise until all spring load is released or the adjusting screw reaches the mechanical stop.
4. Close the outlet valve.
5. Disconnect the regulator.
6. If the regulator is to remain out of service, protect the inlet and outlet fittings from dirt, contamination or mechanical damage.
7. Replace the cylinder valve cap.

SECTION V
PERFORMANCE CHARACTERISTICS

The following information is intended to assist you in identifying whether or not your regulator is performing properly.

A. Proper Performance

1. The delivery pressure will drop when flow is started and/or increased.
2. The delivery pressure will rise when flow is stopped. This difference in delivery pressure between flow and no flow condition is called lockup.

3. The delivery pressure of a single stage regulator will increase as the supply/cylinder pressure decays (as the cylinder is emptied). This will not happen with a 2-stage regulator until the supply pressure drops below the first stage set pressure of 250 psig (except 250 psig delivery range regulators, which are set at 400 psig).

B. Improper Performance

1. The delivery pressure continues to rise when flow is stopped (lock-up) without a change in adjusting screw position. This indicates valve seat wear or contamination with foreign materials allowing media to leak to the delivery side. This condition is referred to as "creep". Regulators that creep leakage must not be used until repaired.
2. A significant drop in delivery pressure during normal flow conditions, indicates internal blockage. Check inlet connection filters for contamination. If condition persists, regulator must be repaired.

SECTION VI
CARE AND MAINTENANCE

WARNING!

Periodic inspection and maintenance of your pressure regulator is essential for continued safe and satisfactory operation. The frequency of servicing will depend on duty cycle and type of media.

Equipment should have monthly inspection and annual maintenance (removing any deposits left by media and replacing any worn or damaged parts) under normal non-corrosive use and conditions. It is also recommended that when the system has high duty cycle or is used in corrosive service, more frequent inspection and maintenance may be necessary. Regulators requiring service repair should be sent to your equipment supplier.

A. Inspection

Use the following steps for regulator inspection:

1. Inspect gauges to assure they read zero when all pressure is released from the system.
2. With adjusting screw turned counterclockwise, to release all spring tension, slowly open cylinder valve. The high pressure gauge should read cylinder pressure and the delivery gauge should read zero.
3. With valve at outlet of regulator closed and adjusting screw tension released, leave pressure on inlet for 5 to 10 minutes. The delivery pressure gauge should not indicate any pressure increase. A pressure increase indicates leakage past the regulator valve seat.

WARNING!

If leakage is indicated, the regulator must be repaired and must not be used.

4. Then, turn adjusting screw clockwise to set a nominal delivery pressure. If unable to attain desired pressure setting or if delivery pressure continues to rise above setpoint, regulator should be repaired.
5. If unit functions properly in the previous step, close cylinder valve and note the readings of both the inlet and delivery pressure gauges. After 5 to 10 minutes a drop in reading of either gauge indicates a leak in the system.

NOTICE!

Use an approved oil-free leak detection fluid to locate possible leaks at the inlet, any threaded port, through the regulator diaphragm or through the outlet valve.

6. If leak is at the inlet or at a threaded port, relieve all pressure from the regulator and then tighten. If leak continues or is found at the diaphragm and outlet valve, the regulator must be repaired and must not be used.

B. Storage

1. Regulators taken out of service for extended periods should receive proper care to extend their service life.
2. Regulators used in a non-corrosive media service should be wiped clean with a clean, dry, lint-free cloth and sealed in a plastic bag for storage in a dry area at room temperature.
3. Regulators used in a corrosive media service should be well flushed with dry nitrogen and sealed in a plastic bag. Regulators used for corrosive service may continue to corrode in storage after exposed to atmospheric oxygen and moisture.

C. Repair Service

Any regulator in need of service should be returned to your equipment supplier for evaluation.

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APPENDIX II

Haskel
Air Driven Gas Booster Compressors
Operation & Service Manual

OM-3F

Operating and Maintenance Instructions

Instructions de Fonctionnement et d'Entretien

Betriebs- und Wartungsanleitungen

Istruzioni di Prestazione e Manutenzione

Instruções de Funcionamento e Manutenção

- Air Driven Gas Booster Compressors
  5-3/4" Drive AG Series
- Surpresseurs d'Air Pneumatique à Gaz Entraînement
  5-3/4" Série AG

- Luftdruck Gas-Booster Druckluftzylinder Kompressoren Schalldämpfer
  5-3/4" Antrieb AG Reihe
- Compressori Generatore a Gas Trasmissione ad Aria
  Serie Trasmissione AG 5-3/4
- Compressores de Gás Tipo Gas Booster com Comando Pneumático
  Série AG 5-3/4"

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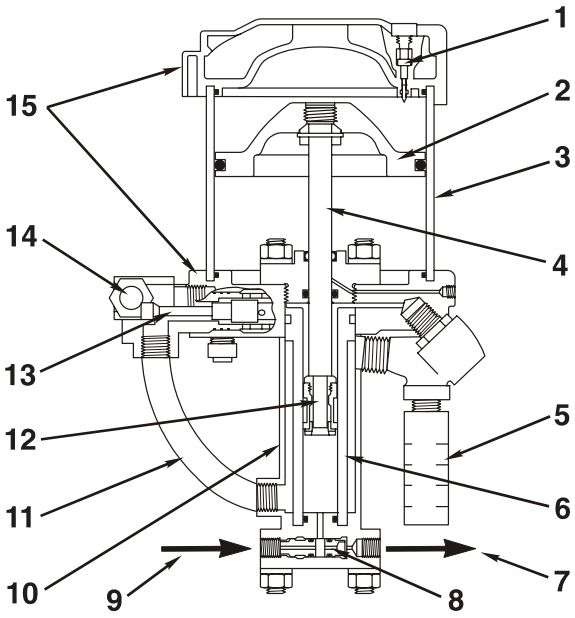


1. Pilot Valve
2. Air Piston
3. Air Drive Barrel
4. Connecting Rod
5. Exhaust Muffler
6. High Pressure Barrel
7. Pump Outlet
8. Check Valves
9. Pump Inlet
10. Cooling Jacket
11. Air Exhaust Tube
12. Pump Piston
13. Air Cycling Valve
14. Air Drive Inlet Port
15. Upper & Lower Caps

1. Robinets Pilotes
2. Piston a Air
3. Colonne du Mecanisme a Entrainement d’Air
4. Axe de Tirette
5. Silencieux d’Echappement
6. Colonne a Haute Pression Igh
7. Sortie de la Pompe
8. Clapets Anti-Retour
9. Entree de la Pompe
10. Enveloppe de Refroidissement
11. Tube d’echappement d’Air
12. Piston de la Pompe
13. Vanne de Cyclage d’Air
14. Orifice d’entree du Mecanisme a Entrainement d’Air
15. Capuchons Superieur et Inferieur

1. Pilotventil
2. Doppelter Druckluftkopf Doppelt Wirkend Oder 2-Stufig
3. Druckluftzylinder
4. Verbindungsstange
5. Schalldämpfer
6. Hochdruckzylinder
7. Pumpenausgang
8. Rückschlagventile
9. Pumpeneingang
10. Kühlmantel
11. Abluftleitung
12. Pumpenkolben
13. Lufttaktventil
14. Luftdruckantr.Eingangsanschl.
15. Obere/Untere Kappen

1. Valvola Pilota
2. Pistone Ad Aria
3. Barrel A Trasmissione Ad Aria
4. Collegamento All’asta
5. .Scarico Marmitta
6. Barrel Ad Alta Pressione
7. Uscita Pompa
8. Valvole Di Controllo
9. Ingresso Pompa
10. Camicia Di Raffredd
11. Tubo Scarico Aria
12. Pistone Pompa
13. Valvola Circolazione Aria
14. Porta Entrata Trasmiss Aria
15. Coperchi Sup. Più Bassi

1. Válvula Piloto
2. Pistão Pneumático
3. Cilindro Pneumático
4. Barra de Ligação
5. Silencioso
6. Cilindro de Alta Pressão
7. Saída da Bomba
8. Válvulas de Retenção
9. Entrada da Bomba
10. Camisa Refrigeração
11. Tubo de Escape de Ar
12. Pistão
13. Válvula de Circulação de Ar
14. Entrada do Comando Pneumático
15. Tampas Inferior e Superior

Introduction

The Haskel “Oil Free” gas booster compressor is an air driven, non-lubricated, reciprocating piston type gas compressor available in single acting single stage, double acting single stage, and two stage configurations. Individual models may also be used in series for multiple staging. The model number is the approximate ratio of the air drive piston(s) area to the gas piston(s) area.

CAUTION: High pressure gas can be dangerous if improperly handled.

Description

General

The air drive piston(s) in all models are automatically cycled by a non-detented, unbalanced air valve spool that is alternately pressurized and vented by the pilot air system. This drive is directly connected to the booster section piston(s) which are designed to run dry without lubrication to supply gas free of hydrocarbon contamination. Exhaust air from the drive is used to cool the gas barrels and in 2 stage units, the gas intercooler. Some models depend on the cold air exhausting from the muffler slots directly against the gas barrel (without benefit of a cooling jacket). Therefore, the position of the exhaust muffler on these models should not be disturbed. Mufflers on models with cooling jackets may be relocated for noise or configuration convenience.

Air Drive Section

Refer to detailed assembly drawing of the air drive section provided with each unit. The air drive section consists of one or more air drive piston assemblies, an unbalanced spool type cycling control valve and pilot valves (one mounted in the valve end cap and one in the opposite end cap), a flow tube to direct drive air flow from the valve end cap to the opposite end cap, and pilot tube to connect the two pilot valves, which are in series. The drive control valve operates without springs or detents and is cycled by the pilot valves alternately pressurizing and venting the large area on the inside end of this spool valve.

The control valve, pilot valves and drive cylinder are lubricated with Haskel air drive grease, part no. 50866, at assembly. Occasional relube of the easily accessible control valve and pilot valves with this grease may be needed depending on the duty cycle of the installation.

It is recommended that only o-rings and seals of proper compounds and hardness for low friction be used in the air drive section. Haskel replacement seals are recommended.

If not otherwise installed by the factory, always install a conventional bowl type shop air filter/water separator of the same or larger pipe size on the incoming air drive plumbing. Drain and maintain it regularly. **Do not use an airline lubricator of any kind.**

Gas Section

Refer to the detailed assembly drawing on the gas section(s) provided with each unit. These sheets cover the individual parts and their installation for the gas section of the individual models. **Note that no lubrication of any kind is ever used on the dynamic seals of the gas pumping sections.** They are designed to run dry supported on the inherent low friction properties of the seal and bearing materials. The life of the gas section also depends on the cleanliness of the gas supply. Therefore, micronic filtration is suggested at the gas inlet port. If compressed air or other moisture containing gas is to be pumped, the initial dew point should be low enough to prevent saturation at booster output pressure, and if any carry over of oil from the compressed air source is evident, special coalescing type filtration may be necessary. Over the life of the moving parts, some migration of inert particles into the gas output should be expected. Therefore, a small particle filter on the high pressure line may be advisable for critical applications.

COMPRESSION RATIO-VOLUMETRIC EFFICIENCY

The compression ratio is the ratio of output pressure to gas supply pressure. (To calculate, use psi absolute values.) The gas pumping sections are designed to have minimum unswept or clearance volume at the end of the compression stroke. On the return (suction) stroke of the piston, output pressure in the

unswept volume expands to inlet pressure. This reduces the amount of potential fresh gas intake on the suction stroke. Volumetric efficiency therefore decreases rapidly with an increase in compression ratio until the volumetric efficiency reaches zero when the unexpelled (expanded) gas completely fills the cylinder at the end of the intake stroke. A cylinder with a 4% unswept volume will reach zero efficiency at a compression ratio of approximately 25:1.

Production models of Haskel gas boosters are tested in the laboratory. Results of these tests indicate that compression ratios of up to 40:1 are possible for some models under ideal conditions. However, for satisfactory operation under production conditions in industrial applications, we recommend compression ratios (per stage) of about 10:1 or less. Operation at higher ratios may not damage the gas booster but because output flow and efficiency will be low, the use should be limited to pressurizing small volumes such as pressure gauge testing, etc.

COOLING

Effective cooling of the gas pumping section is of paramount importance as service life of piston seals, bearings, and static seals are dependent upon proper operating temperatures. Haskel gas boosters use the exhaust air from the driving system to cool the gas barrel (and gas intercooler on the two stage models). Driving air expands during the work cycle with a significant reduction in temperature. Therefore, the exhaust air is a very efficient cooling medium.

In theory, compression ratios above 3:1 with most gases produce temperatures above the allowable limits for the seals. In practice, however, the heat of compression is transferred to the air cooled gas barrel and adjacent metal components during the relatively slow speed of the piston on the compression stroke and these components will stay within allowable temperature limits. Laboratory tests indicate that maximum temperatures occur between compression ratios of 5:1 and 10:1 and have shown that exhaust air cooling is adequate even when the booster is running at full speed.

The gas discharge temperature may run as high as approximately 150°F above ambient temperature. Under certain severe operating conditions, it may be necessary to slow down the cycling of the gas booster to prevent overheating. It is very difficult to predict exactly when overheating may occur. To test, install a thermocouple approximately 1 inch from the discharge port of the gas pumping section. Temperatures above 300°F at this point will shorten piston seal life considerably.

Maintenance

Air Valve Section

Remove spool or sleeve in the following manner:

1. Remove air exhaust fitting located in cycling valve end cap. Pull out spool; inspect 568017 o-rings. **Relube; reinstall; retest before further disassembly.**
2. If necessary, remove sleeve and bumper (rubber faced spacer at inside end of sleeve) with tool P/N 28584 as shown in figures 1, 2, and 3.

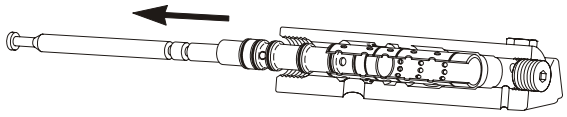


Figure 1: Insert tool in second row of holes in sleeve and if necessary, pry out with screwdriver.

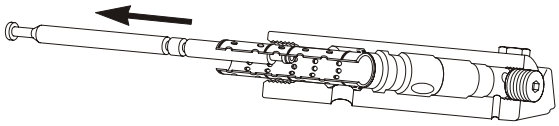


Figure 2: Pull straight out.

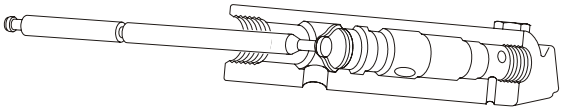


Figure 3: Insert bumper hook through center of bumper and pull straight out.

3. Replace any 568020 o-rings or the bumper/spacer if damaged, worn or swollen.
4. Lubricate o-rings with light coat of Haskel 50866 lubricant.
5. Use lubricant liberally to hold bumper/spacer to sleeve with rubber side facing sleeve.
6. Push lubricated sleeve and bumper into end cap bore, all the way in one quick motion. (If bumper drops off sleeve too soon, remove, regrease and repeat.)
7. Install spool.
8. Replace exhaust fitting.

Pilot System

1. Remove hex o-ring sealed plug.
2. Remove spring and 27375 pilot stem (figure 4).
3. Inspect pilot stem and seat for foreign material. Replace stem if shank is bent or scratched.
4. Replace stem if molded seat is damaged.
5. Apply 50866 lubricant and reassemble in the reverse manner.

NOTE: Unless excessive leakage occurs, it is not advisable to replace the o-ring seal for the shank of the stem. This requires disassembly of the air section. If replacement is required, care must be taken in installing the Tru-Arc retainer concentrically as shown in figure 5. Use the 27375 pilot stem valve as seating tool. Place the rubber valve face against the retainer and tap the top of the valve lightly with a light hammer to **evenly** bend the legs of the retainer.

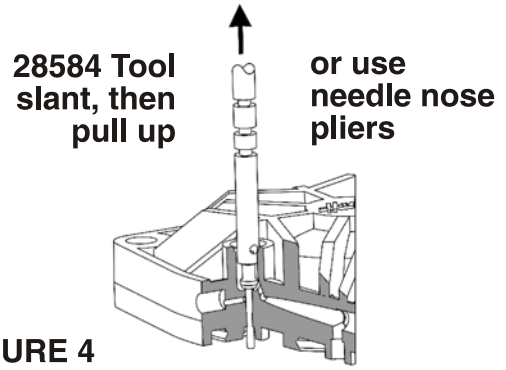
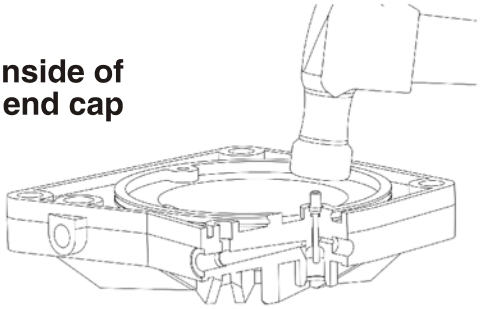


FIGURE 4



Seating the Retainer FIGURE 5

Test Procedure for Pilot Control Valves - 27375:

After relube of the spool and reassembly, if the drive cycles erratically, the following test procedure will determine which of the pilot valves is faulty.

1. Remove the 17658-2 1/8" pipe plug in the upper end cap.
2. Install 0-160 psi pressure gauge.
3. Apply air pressure to the air drive inlet. Gauge will read zero pressure if **lower** pilot valve has not been actuated. Gauge will read full pilot air pressure if **upper** pilot valve has not been actuated. Correct pilot valve action will cause gauge to immediately rise or fall from zero to pilot air pressure. A slow **increase** in gauge reading indicates leakage past the seat of the pilot valve in the valve end cap. A slow **decrease** in pressure indicates leakage past the seat of the opposite pilot valve. Examine and replace as required. Check also for external air leaks at plugs.
4. If drive takes 1 stroke and stops, this is probably due to either pilot valve stem being too short. See the assembly drawing for description of procedure to determine proper stem length.

For Disassembly and Repair of Air Drive Section and Air Piston:

1. Remove (4) tie bolts.
2. Remove air barrel and static seal o-rings.
3. Remove seal on air piston.
4. Remove air piston and rod assembly in air drive section.
5. See applicable assembly drawing. Note that the air drive seals and bearings **for the rods** are part of the **gas section** seal kit.
6. Inspect, replace and install all internal parts in air drive section per assembly drawing.
7. Relubricate air barrel with 50866 Haskel lubricant. Re-assemble drive in reverse order of disassembly instructions. Care must be taken in disassembly and assembly that the flow and pilot tube o-rings be on the flow and pilot tubes prior to assembly. Alternately (crosswise) torque tie rods to a maximum torque of 16-18 ft-lbs.

Introduction

Le surpresseur à gaz Haskel "sans huile" avec un piston pneumatique alternatif, non lubrifié, type compresseur à gaz est également disponible dans les configurations à effet unique et double ainsi qu'étage unique et double. Des modèles individuels peuvent également être utilisés en séries pour de multiples étages. Le numéro du modèle est le rapport approximatif de la zone du (es) piston(s) à injection d'air par rapport à la zone du (es) piston(s) à gaz.

ATTENTION: Les gas a haute pression peuvent etre dangereux si mal utilises.

Description

General

Les pistons à injection d'air dans tous les modèles sont automatiquement cyclés par un tiroir de commande autonome, non équilibré qui est alternativement pressurisé et aéré par un système d'air pilote. Cet entraînement est directement connecté aux pistons du bâtit-accélérateur conçu pour fonctionner à sec sans lubrification de l'apport de gaz sans contamination d'hydrocarbure. L'échappement d'air depuis le mécanisme à entraînement est utilisé pour refroidir les colonnes de gaz et dans les unités à 2 étages, le refroidisseur intermédiaire à gaz. Certains modèles dépendent de l'échappement d'air froid des orifices des silencieux directement contre la colonne de gaz (sans bénéficier d'une enveloppe réfrigérante). Cependant, la position du silencieux d'échappement de ces modèles ne devra pas être changée. Les silencieux des modèles avec enveloppes refroidissantes peuvent être replacés selon le niveau de bruit ou ce qui vous convient.

Section du Mécanisme a Entrainement d'Air

Se référer au schéma de montage détaillé de la section du mécanisme à entraînement d'air fourni avec chaque unité. La section du mécanisme à entraînement d'air se compose d'un ou de plusieurs assemblages de piston d'injection d'air, d'une vanne de régulation de cycle de type manchette non équilibrée et de robinets pilotes (une montée dans le capuchon de protection de la vanne dans le capuchon de protection opposé), d'un tube de courant pour diriger le débit d'injection d'air depuis le capuchon de protection de la vanne jusqu'au capuchon de protection opposé, et d'un tube pilote pour connecter les deux robinets pilotes, qui sont en série. La vanne de régulation du mécanisme à entraînement fonctionne sans ressorts ou détentes et est cyclée alternativement par les robinets pilotes pressurisant et aérant la vaste zone à l'extrémité interne de ce distributeur à tiroir cylindrique.

La vanne de régulation, les robinets pilotes et le cylindre du mécanisme à entraînement sont lubrifiés avec une graisse pour mécanisme à entraînement d'air no. 28442, lors du montage. Relubrifier occasionnellement la vanne de régulation facilement accessible et les robinets pilotes avec cette graisse pouvant être requise selon le cycle de résistance de l'installation.

Il est recommandé que seul les anneaux toriques et les joints des composants appropriés et la dureté du faible frottement soient utilisés dans la section du mécanisme à entraînement d'air. Les joints de rechange Haskel sont recommandés.

Si non installé préalablement par l'usine, toujours installer une cuvette conventionnelle de type filtre à air d'atelier/séparateur d'eau de la même taille ou plus gros que la largeur du tuyau dans le tuyau du mécanisme à entraînement d'air entrant et le drainer et l'entretenir régulièrement. **Ne pas utiliser de lubrificateur de conduite d'air.**

Section a Gaz

Se référer au schéma de montage détaillé de la section à gaz fourni avec chaque unité. Ces schémas couvrent les parties individuelles et l'installation de la section à gaz des modèles individuels. Noter qu'aucune **lubrification n'est jamais utilisée dans les sections de pompage à gaz**. Elles sont conçues pour fonctionner à sec selon les propriétés de faible frottement inhérent des matériaux de scellage et de support. La durée de vie de la section à gaz dépend également de la propreté de l'apport de gaz. Cependant, La filtration micronique est suggérée pour l'orifice d'entrée du gaz. Si de l'air comprimé ou de l'humidité contenant du gaz est pompée, le point de rosée initial devra être assez bas

pour éviter la saturation dans la pression de sortie du surpresseur, et en cas de surcharge d'huile évidente dans la source d'air comprimé, un coalescent spécial type filtration peut être nécessaire.

Selon la durée de vie des parties mouvantes, certaines migrations des particules inertes dans la sortie de gaz pourraient être présentes. Cependant, un filtre de petites particules sur la conduite à haute pression peut être conseillée pour les applications critiques.

RAPPORT DE COMPRESSION —RENDEMENT VOLUMÉTRIQUE

Le rapport de compression est le rapport de pression de sortie par rapport à la pression d'apport de gaz. (Pour calculer, utiliser des valeurs absolues en psi.) Les sections de pompage à gaz sont conçues pour avoir un balayage minimum ou un volume de clarté au bout de la course de compression. Dans la course de retour (succion) du piston, la pression de sortie du volume non balayé s'étend à la pression d'entrée. Ceci réduit la quantité de prise d'entrée de gaz frais potentielle dans la course de la section. Ainsi le rendement volumétrique diminue rapidement avec une augmentation du rapport de compression jusqu'à ce que le rendement volumétrique atteigne zéro lorsque le gaz non expulsé (étendu) remplit complètement le cylindre au bout de la course d'entrée. Un cylindre avec un volume non balayé de 4% atteindra zéro rendement à un rapport de compression d'environ 25:1.

Les modèles de production des surpresseurs à gaz Haskel sont testés en laboratoires. Les résultats de ces tests indiquent que les rapports de compression jusqu'à 40:1 sont possibles pour certains modèles en conditions idéales. Cependant, pour une satisfaction de fonctionnement en condition de production dans des applications industrielles, nous recommandons des rapports de compression (par étage) d'environ 10:1 ou moins. Le fonctionnement à des rapports élevés n'endommagera pas le surpresseur à gaz mais parce que le débit de sortie et le rendement ne seront pas faibles, l'utilisation doit être limitée à des petits volumes pressurisés comme le test de la jauge de pression, etc.

REFROIDISSEMENT

Le refroidissement efficace de la section de pompage à gaz est d'une importance prépondérante pour la durée de vie de fonctionnement des joints du piston, des supports, des joints statiques qui dépendent des bonnes températures de fonctionnement. Les surpresseurs à gaz Haskel utilisent l'air évacué du système d'injection pour refroidir la colonne d'air (et le refroidisseur intermédiaire de gaz des modèles à deux étages). L'air de l'injection s'étend lors de la fonction de cyclage avec une réduction significative de la température. Cependant, l'air évacué est un moyen de refroidissement très efficace.

En théorie, les rapports de compression au dessus de 3:1 avec plus de gaz produisent des températures au dessus des limites tolérées pour les joints. En pratique, cependant, la chaleur de la compression est transférée à la colonne de gaz de l'air refroidi et aux composants métalliques proches à une vitesse relativement lente du piston sur la course de compression et ces composants resteront à une température limite acceptable. Les tests en laboratoires indiquent que les températures sont au maximum entre les rapports de compression de 5:1 et 10:1 et ont montré que le refroidissement de l'air évacué est adéquat même lorsque le surpresseur fonctionne à grande vitesse.

La température de la décharge gazeuse doit être aussi haute qu'environ 150°F au dessus des températures ambiantes. Sous certaines conditions de fonctionnement critiques, il peut être nécessaire de ralentir le cyclage du surpresseur à gaz pour éviter une surchauffe. Il est très difficile de prédire exactement à quel moment la surchauffe aura lieu. Pour tester, installer un thermocouple d'environ 1 pouce depuis l'orifice de refoulement de la section de pompage de gaz. Les températures au dessus de 300°F à ce point, mettront à rude épreuve la durée de vie du joint du piston.

Entretien

Section de la Vanne d'Air

Enlever la manchette ou le gainage de la manière suivante:

1. Enlever le raccord d'échappement d'air situé sur le capuchon de protection de la vanne de cyclage. Tirer la manchette; inspecter les anneaux toriques 568017. **Relubrifier; réinstaller; refaire un test avec un autre démontage.**

2. Si nécessaire, enlever le gainage et le pare-chocs (l'entretoise en caoutchouc à l'extrémité intérieur du gainage) avec l'outil P/N 28584 comme montré dans les schémas 1, 2, et 3.
3. Remplacer chaque anneau torique 568020 ou le pare-chocs/entretoise si endommagé, usé ou brisé.
4. Lubrifier les anneaux toriques avec une légère couche de lubrifiant Haskel 28442.
5. Utiliser librement un lubrifiant pour maintenir le pare-chocs/entretoise contre le gainage avec le côté en caoutchouc contre le gainage.
6. Enfoncer le gainage lubrifié et le pare-chocs dans l'orifice de passage du capuchon de protection, en un seul geste rapide. (Si le pare-chocs tombe du gainage trop tôt, enlever, regraisser et répéter.)
7. Installer la manchette.
8. Remplacer le raccord d'échappement.

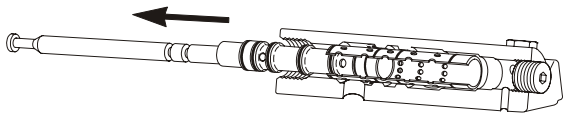


Schéma 1. Insérer un outil dans le seconde rangée de trous du gainage et si nécessaire, écarter avec un tournevis.

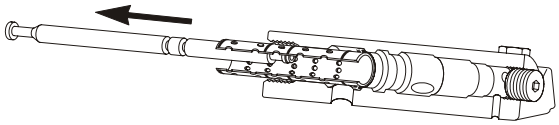


Schéma 2. Tirer.

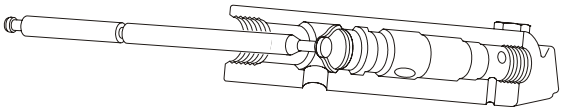


Schéma 3. Insérer le crochet du pare-chocs au centre du pare-chocs et tirer.

Système Pilote

1. Enlever le raccord d'étanchéité de l'anneau torique hex.
2. Enlever le ressort et la tige de manoeuvre pilote 27375 (schéma 4).
3. Inspecter la tige de manœuvre pilote et installer les matériaux étrangers. Remplacer la tige si le rivet est plié ou rugueux.
4. Remplacer la tige si le siège moulé est endommagé.
5. Appliquer du lubrifiant 28442 et remonter dans l'ordre inverse.

NOTE: Sauf en cas de grosse fuite, il n'est pas conseillé de remplacer l'anneau torique étanche par le rivet de la tige. Ceci nécessite un démontage de la section d'air. Si un remplacement est nécessaire, bien installer l'arrêtoir Tru-Arc concentriquement comme montré dans le schéma 5. Utiliser la tige de manoeuvre pilote 27375 en tant qu'outil d'étanchéité. Placer le côté en caoutchouc de la vanne contre l'arrêtoir et boucher légèrement le haut de la vanne avec un léger coup de marteau pour sceller les jambages de l'arrêtoir de manière homogène.

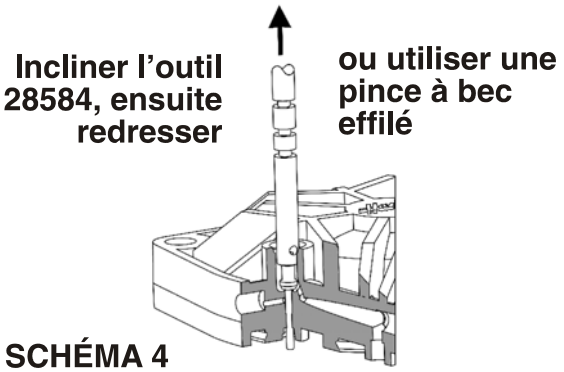
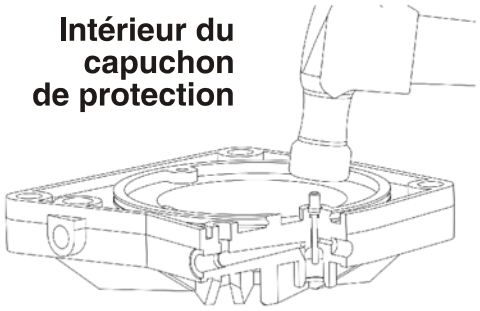


SCHÉMA 4



Asseoir l'arrêtoir SCHÉMA 5

Test des vannes de régulation pilotes - 27375:

Après la relubrification de la manchette et le remontage, si le mécanisme à entraînement cycle irrégulièrement, le test suivant déterminera quel robinet pilote est défectueux.

1. Enlever le bouchon du tuyau 17658-2 1/8" du capuchon de protection supérieur.
2. Installer une jauge de pression de 0-160 psi.
3. Appliquer une pression d'air à l'entrée du mécanisme à entraînement. La jauge affichera une pression de zéro si le robinet pilote inférieur n'est pas actionné. La jauge affichera une pression d'air pilote maximum si le robinet pilote supérieur n'est pas actionné. Un fonctionnement correct du robinet pilote fera immédiatement augmenter le jauge ou la fera chuter à une pression d'air pilote de zéro. Une légère augmentation indique une fuite passée du siège au robinet pilote du capuchon de protection de la vanne. Une légère diminution de la pression indique une fuite passée du siège du robinet pilote opposé. Examiner et remplacer si nécessaire. Vérifier également les fuites d'air externes des bouchons.
4. Si le mécanisme à entraînement effectue 1 course et s'arrête, ceci est probablement dû à la tige de manoeuvre pilote étant trop courte. Voir le schéma de montage pour une description de la procédure pour déterminer la bonne longueur de la tige de manoeuvre.

Pour le démontage et la réparation de la section du mécanisme à entraînement d'air et du piston à air:

1. Enlever les quatre boulons d'assemblage.
2. Enlever la colonne d'air et les anneaux toriques d'étanchéité statiques.
3. Enlever le joint du piston à air.
4. Enlever le piston à air et l'assemblage de la tige dans la section du mécanisme à entraînement d'air.
5. Voir le schéma de montage applicable. Noter que les joints du mécanisme à entraînement d'air et les supports pour les tiges font partie du jeu de joints de la section à gaz.
6. Inspecter, remplacer et installer toutes les parties internes dans la section du mécanisme à entraînement d'air suivant le schéma de montage.
7. Relubrifier la colonne d'air avec du lubrifiant Haskel 28442. Remonter le mécanisme à entraînement dans l'ordre inverse des instructions de démontage. Bien démonter et monter pour que les anneaux toriques des tubes de courant et pilotes soient sur les tubes de courant et pilotes avant le montage. Alternativement (coupe) coupler les tirants à un couple maximum de 16-18 pieds livre seconde.

Einleitung

Bei dem “ölfreien” Gas-Booster-Verdichter von Haskel handelt es sich um einen nicht geschmierten, Hubkolbengaskompressor, der in den Ausführungen einfach wirkend 1-Phase, zweifach wirkend 1-Phase und 2-Phasen angeboten wird. Individuelle Modelle können in Reihe geschaltet werden. Die Modellnummer ist das Übersetzungsverhältnis des Druckluftkolbenbereichs zum Gaskolbenbereich.

VORSICHT: Der umgang mit hochdruckflüssigkeit ist gefährlich!

Beschreibung

Allgemein

Die Druckluftkolben in allen Modellen werden automatisch von einer unausgewogenen Luft¬ventilspule betrieben, die abwechselnd von einem Steuerluftventil mit Druck versorgt und entlüftet werden. Der Antrieb ist direkt an die Kolben des Verstärkerabschnitts angeschlossen, die ohne Schmierung trocken laufen, um sauberes Gas ohne Kohlenwasserstoffverschmutzung zu liefern. Mit der Abluft aus dem Antrieb werden die Gaszylinder und in 2-Phasen-Einheiten die Gaszwischenkühlung gekühlt. Bei einigen Modellen muss die kalte Abluft direkt von den Schalldämpferschlitzen zum Gas¬zylinder geführt werden (ohne Kühlmantel). Daher darf die Position der Schalldämpfer an diesen Modellen nicht verändert werden. Die Schalldämpfer an Modellen mit Kühlmantel können u. a. aus Gründen der Geräuschdämpfung umgesetzt werden.

Luftdruckabschnitt

Wir verweisen auf die der Druckluftantriebseinheit beiliegende Montagezeichnung. Der Antriebsabschnitt besteht auf einer oder mehreren Antriebskolbenbaugruppe, einer unausgewogenen Spule als Taktsteuerventil und Steuerventile (eines auf der Ventilendkappe und eines auf der gegenüber liegenden Endkappe), einer Durchflussleitung mit der die Luft von der Ventilendkappe zur gegenüber liegenden Endkappe geleitet wird sowie einer Steuerleitung für den Anschluss der beiden in Reihe geschalteten Steuerventile. Das Antriebssteuerventil arbeitet ohne Federn und Sperren und wird über das Steuerventil getaktet, das abwechselnd die große Fläche am inneren Ende dieses Spulventils mit Druck versorgt und entlüftet.

Das Regelventil, die Steuerventile und der Antriebszylinder werden mit Haskel-Schmiermittel, Teile-Nr. 28442, auf der Baugruppe geschmiert. Gelegentlich müssen das einfach zugängliche Regelventil und die Steuerventile mit diesem Schmiermittel erneut geschmiert werden; dies ist abhängig vom Arbeitszyklus der Anlage:

Wir empfehlen, dass nur die O-Ringe und Dichtungen aus den korrekten Verbundstoffen und in den entsprechenden Härten im Luftantrieb verwendet werden, damit so wenig wie möglich Reibung erzeugt wird. Wir empfehlen für den Austausch Haskel-Dichtungen zu verwenden.

Sofern nicht bereits ab Werk installiert, bauen Sie stets einen konventionellen Luftfilter/Wasserabscheider an der Zuleitung zum Antrieb ein. **Warten Sie Filter/Abscheider regelmäßig. Verwenden Sie keine Luftleitungsschmiervorrichtung.**

Gasabschnitt

Wir verweisen auf die der Gasantriebseinheit beiliegende Montagezeichnung. Auf diesen Blättern werden die Einzelteile und deren Installation im Gasabschnitt der einzelnen Modelle angegeben. **Beachten Sie bitte, dass die Gaspumpenabschnitte niemals geschmiert werden.** Aufgrund des niedrigen Abriebs der Dichtungs- und Lagermaterialien laufen diese trocken. Die Haltbarkeitsdauer des Gasabschnitts hängt von der Sauberkeit der Gaszuleitung ab. Daher muss am Gasanschluss ein Mikron-Filter installiert werden. Wenn Druckluft oder anderes Gas, das Feuchtigkeit enthält, gepumpt wird, muss der Eingangstaupunkt so gering sein, dass keine Sättigung am Booster-Eingangsdruck auftritt. Wenn Öl an der Druckluftquelle auftritt, muss eventuell ein spezieller sich vereinigender Filter verwendet werden.

Im Laufe der Zeit können Verschleißerscheinungen an den beweglichen Teilen des Flüssigkeitsausgangs auftreten. Daher ist es sinnvoll bei kritischen Anwendungen einen kleinen Partikelfilter in der Hochdruckleitung einzusetzen.

VERDICHTUNGSVERHÄLTNIS - VOLUMENLEISTUNG

Das Verdichtungsverhältnis ist das Verhältnis von Ausgangsdruck und Gasversorgungsdruck. (Zu Berechnungszwecken ziehen Sie die absoluten psi-Werte heran). Die Gaspumpenabschnitte wurden so entwickelt, dass Sie am Ende der Verdichtungshubbewegung über ein Toleranzvolumen verfügen oder unswept sind. Beim Rück-Hub (Ansaugung) des Kolbens überschreitet der Ausgangsdruck im Volumen den Einlassdruck. Auf diese Weise wird die mögliche Frischgas¬aufnahmemenge am Ansaug-Hub reduziert. Daher sinkt die Volumetrieleistung schnell bei einem erhöhten Verdichtungsverhältnis, bis die Volumetrie¬leistung Null erreicht, wenn das vorhandene (ausgeweitete) Gas den Zylinder am Ende des Ansaug-Takts vollständig füllt. Ein Zylinder mit einem unswept Volumen von 4 % erreicht Nullwirkung bei einem Verdichtungsverhältnis von circa 25:1.

Alle Haskel-Gas-Booster-Modelle werden im Test¬labor getestet. Die Testergebnisse zeigen, dass bei einigen Modellen unter idealen Bedingungen Verdichtungsverhältnisse von 40:1 erreicht werden können. Allerdings empfehlen wir für den fehlerfreien Betrieb unter normalen Produktionsbedingungen in Industrieanlagen Verdichtungsverhältnisse (je Phase) von max. 10:1. Der Betrieb bei höheren Verhältnissen beschädigt den Gas-Booster jedoch nicht, da die Ausgangsleistung und Wirkung niedrig sind, allerdings sollte der Booster mit geringen Druckvolumen entsprechend der Druckmessung usw. betrieben werden.

KÜHLUNG

Die effektive Kühlung des Gaspumpenabschnitts ist von größter Wichtigkeit, da die Haltbarkeit der Kolbendichtungen, Lager und statischen Dichtungen von den richtigen Betriebstemperaturen abhängt. Haskel Gasverstärker arbeiten mit der Abluft aus dem Antriebssystem, um den Gaszylinder zu kühlen (und die Gaszwischenkühlung auf den 2-Phasen-Modellen). Die Antriebsluft weitet sich während des Arbeitstakts aus und die Temperatur fällt stark ab. Daher ist die Abluft ein überaus geeignetes Kühlmedium.

In der Theorie erzeugen Verdichtungsverhältnisse über 3:1 bei den meisten Gasen Temperaturen, die die Grenzwerte für die Dichtungen überschreiten. In der Praxis wird die Wärme der Verdichtung während relativ geringer Kolbendrehzahlen an den luftgekühlten Gaszylinder und die benachbarten Metallkomponenten übertragen, daher werden die zulässigen Temperaturgrenzwerte eingehalten. Labortests ergeben, dass Höchsttemperaturen bei Verdichtungsverhältnissen 5:1 und 10:1 auftreten und dass die Kühlung durch Abluft ausreichend ist, auch wenn der Booster mit voller Drehzahl läuft.

Die Gasverdichtungstemperatur kann bis circa 150°F über der Umgebungstemperatur liegen. Unter bestimmten Bedingungen muss der Takt des Gasverstärkers verringert werden, um Überhitzung zu vermeiden. Es ist sehr schwierig, exakte Werte für die Überhitzung anzugeben. Installieren Sie zu Testzwecken circa 1 Inch entfernt vom Verdichtungsanschluss des Gaspumpenabschnitts eine Thermokupplung. Temperaturen über 300°F an diesem Punkt verkürzen das Leben der Kolbendichtung beträchtlich.

WARTUNG

Luftventilabschnitt

Nehmen Sie Spule oder Manschette wie folgt ab:

1. Nehmen Sie die Abluftbefestigung aus der Endkappe des Taktventils heraus. Ziehen Sie die Spule heraus; prüfen Sie die O-Ringe 568017. **Schmieren Sie sie erneut und überprüfen Sie sie vor dem Wiedereinbau.**
2. Entfernen Sie gegebenenfalls die Manschette und den Bumper (Distanzstück mit Gummibeschichtung am internen Ende der Manschette) mit Werkzeug P/N 28584 gemäß den Abbildungen 1 bis 3.
3. Tauschen Sie beschädigte, verschlissene oder aufgeblähte 568020 O-Ringe oder Bumper/Distanzstücke gegebenenfalls aus.
4. Schmieren Sie die O-Ringe leicht mit Haskel 28442 Schmiermittel.

5. Verwenden Sie das Schmiermittel, um den Bumper/das Distanzstück mit der Gummiseite gegen die Manschette einzusetzen.
6. Schieben Sie die geschmierte Manschette und den Bumper mit einer schnellen Bewegung vollständig in die Bohrung der Endkappe. (Wenn die Manschette zu früh vom Bumper fällt, nehmen Sie sie auf, schmieren Sie sie und setzen Sie sie wieder ein).
7. Setzen Sie die Spule ein.
8. Setzen Sie das Abluftfitting wieder ein.

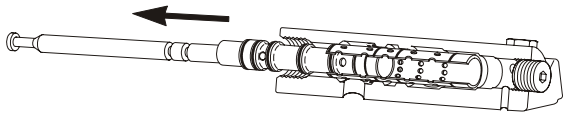


Abb.1: Setzen Sie das Werkzug in die zweite Lochreihe in der Manschette und ziehen Sie sie ggfs. mit einem Schraubenzieher heraus..

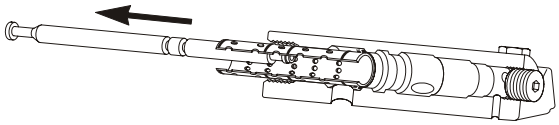


Abb. 2 Gerade heraus ziehen.

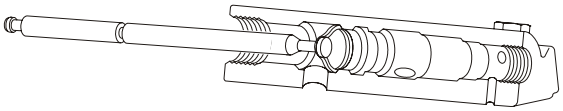


Abb. 3 Setzen Sie den Pufferhaken durch den mittleren Bumper ein und ziehen Sie diesen gerade heraus.

Steuersystem

1. Nehmen Sie den mit dem Sechskantstopfen abgedichteten O-Ring heraus.
2. Bauen Sie die Federn und die 27375 Pilotsplinte aus (Abb. 4).
3. Prüfen Sie den Schaft des Steuerventils und den Sitz auf Fremdmaterial. Tauschen Sie das Ventil aus, wenn der Schaft verbogen oder zerkratzt ist.
4. Ersetzen Sie den Schaft, falls die Dichtung beschädigt sein sollte.
5. Tragen Sie Schmiermittel 28442 auf und nehmen Sie den Einbau in umgekehrter Reihenfolge vor.

HINWEIS: Sofern keine übermäßigen Lecks auftreten, muss der O-Ring am Schaft nicht ausgetauscht werden. Sonst muss der Luftabschnitt auseinander gebaut werden. Sofern ein Austausch vorgenommen werden muss, achten Sie bitte darauf, dass der Tru-Arc-Bügel konzentrisch, wie in Abb. 5 dargestellt, eingesetzt werden muss. Verwenden Sie das 27375 Pilotventil mit Schaft als Einpasswerkzeug. Setzen Sie die Gummiseite des Ventils auf den Halter und ziehen Sie leicht am Ventil, um die Schenkel der Halterung leicht zu biegen.

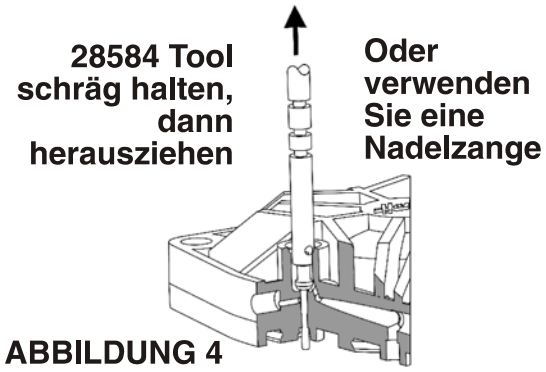


ABBILDUNG 4

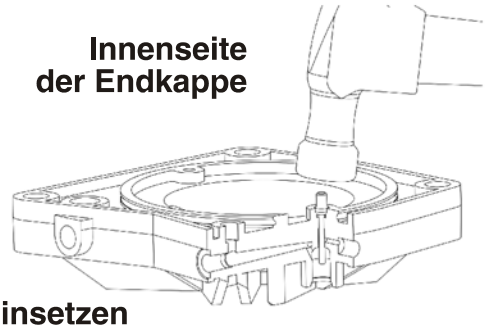


ABBILDUNG 5

Testverfahren für Steuerregelventile – 27375:

Wenn der Takt nach Schmierung der Spule und Wiedereinbau fehlerhaft ist, ermitteln Sie mit folgendem Testverfahren, welches Steuerventil defekt ist:

1. Nehmen Sie den Leitungsstopfen 17658-2 1/8” aus der unteren Endkappe heraus.
2. Setzen Sie ein 0-160 psi Druckmessgerät ein.
3. Führen Sie dem Drucklufteinlass Druckluft zu. Sofern das untere Pilotventil nicht auslöst, zeigt das Messgerät Null an. Sofern das obere Pilotventil nicht auslöst, zeigt das Messgerät den vollständigen Druck an. Wenn Sie Änderung am Pilotventil vornehmen, steigt der Messwert sofort bzw. er fällt von Null auf den Antriebsdruck. Ein geringfügiger Anstieg des Messwerts ist ein Anzeichen für ein Leck vor dem Sitz des Steuerventils in der Ventil-Endkappe. Ein geringfügiger Abfalls des Messwerts ist ein Anzeichen für ein Leck vor dem Sitz des Steuerventils des entgegen gesetzten Steuerventils. Überprüfen Sie das Ventil und tauschen Sie es ggfs. aus. Prüfen Sie die Stopfen ebenfalls auf Luftaustritt.
4. Wenn der Antrieb 1 Mal taktet und stoppt, ist der Schaft des Steuerventils eventuell zu kurz. Ziehen Sie die Montagezeichnung heran, um die korrekte Schaftlänge zu ermitteln.

Ausbau und Reparatur des Luftdruckabschnitts und des Druckluftkolbens:

1. Entfernen Sie die vier Spannschrauben.
2. Entfernen Sie den Luftzylinder und statischen O-Ringdichtungen.
3. Entfernen Sie die Dichtungen vom Luftkolben.
4. Bauen Sie den Luftdruckkolben und die Stangenbaugruppe im Luftantriebsabschnitt aus.
5. Siehe entsprechende Montagezeichnung. Beachten Sie, dass die Luftdruckdichtungen und Lager für die Stangen Bestandteil des Dichtungssets für den Gasabschnitt sind.
6. Prüfen Sie die Innenteile im Luftdruckantriebsabschnitt entsprechend der Montagezeichnung, wechseln Sie defekt Teile aus.
7. Schmieren Sie den Luftzylinder mit 28442 Haskel-Schmiermittel. Bauen Sie die Teile in der umgekehrten Reihenfolge des Ausbaus wieder ein. Achten Sie während Wiedereinbau und Ausbau darauf, dass die Durchfluss- und Pilotleitungs-O-Ringe und Pilotleitungen sich in Fliessrichtung befinden. Ziehen Sie die Zugstangen (kreuzweise) auf ein max. Drehmoment von 16-18 ft. lbs. an.

Introduzione

Il compressore a gas “senza olio” Haskel è del tipo ad aria non lubrificato, con pistoni alternati del tipo compressore a gas, disponibile a funzione singola e doppia, e due stadi di configurazione. É anche possible utilizzare modelli individuali per stadi multipli Il numero di modello è il rapporto approssimativo della zona della conduzione del/ pistone(i) verso la zona del pistone/i a gas.

ATTENZIONE: L'alta Pressione Del Gas Può Essere Pericolosa Se Gestita In Modo Improprio.

Descrizione

Generale

I pistoni ad aria in tutti I modelli sono automaticamente messi in ciclo per mezzo di una tamburo con valvola ad aria non tesa, non bilanciata ventilata dal sistema ad aria pilota. Questa trasmissione è direttamente collegata al pistone/I della sezione del generatore, progettati per scorrere a secco senza lubrificazione per poter fornire gas senza contaminazione da idrocarburi L’aria emessa dalla trasmissione è utilizzata per raffreddare il gas e in due unità di stadio, l'intercooler del gas Alcuni modelli, a seconda dell’aria fredda emessa dalla marmitta si inseriscono direttamente contro la canna del gas (senza trarre vantaggio da una camicia di raffreddamento. Di conseguenza la posizione della marmitta di scarico su questi modelli non dovrebbe essere modificata. Le marmitte sui modelli con camicia di raffreddamento possono essere ricollocati per motive di rumore o configurazione.

Sezione Trasmissione Ad Aria

Riferirsi al disegno dettagliato di assemblaggio della sezione trasmissione ad aria con ciascuna unità. La sezione a trasmissione ad aria consiste di una o più assemblaggi di pistoni a trasmissione ad aria un tamburo non bilanciato del tipo a valvola di controllo ciclico e valvole pilota (una montata nel terminale della calotta e una nella calotta opposta) un tubo di flusso per dirigere il flusso d’aria dalla calotta finale della valvola al terminale della calotta opposto ,e un tubo pilota per collegare le due valvole pilota, che sono in serie. La valvola di controllo di trasmissione opera senza molle o fermi ed è operata in cicli per mezzo delle valvole pilota pressurizzando alternativamente e ventilando la zona ampia sulla fine interna di tale valvola a tamburo.

la valvola di controllo, le valvole pilota e il clindro di trasmissione sono lubrificato con grasso Haskel trasmissione ad aria, parte n. 28442, assemblaggio. Rilubrificazione occasionale della valvola di controllo di più facile accessibilità e delle valvole pilota con tale grasso, può essere necessaria a seconda del ciclo dell'installazione.

Si raccomanda di utilizzare solo anelli ad o e sigilli di adeguata durezza e composizione per l’utilizzo di bassa frizione nella sezione della trasmissione. Si raccomanda di utilizzare sigilli sostitutivi Haskel.

Se non altrimenti installati dalla fabbrica, installare sempre una vaschetta del tipo convenzionale, aria filtro/acqua separatore della stessa dimensione o più grande nel tubo della trasmissione ad aria impianto idraulico e drenaggio e provvedere a regolare manutenzione. Non utilizzare lubrificanti ad aria di nessun tipo.

Sezione Gas

Riferirsi al disegno dettagliato di assemblaggio della sezione/i fornito con ciascuna unità. Queste pagine riguardano i singoli pezzi di ricambio e la loro installazione per la sezione gas dei singoli modelli. Notare che non è mai usato nessun tipo di lubrificazione nelle sezioni di pompaggio di gas. Esse sono progettate per funzionare a secco sulle proprietà della frizione bassa del sigillo e dei materiali e materiali di supporto. la durata della sezione gas dipende anche dalla pulizia del gas fornito. Do conseguenza è consigliata la microfiltratura alla porta d'ingresso del gas. Se l’aria compressa od altre sostanze umide contenenti gas vengono pompate, il punto di rugiada iniziale dovrebbe essere abbastanza basso da prevenire la saturazione all’uscita della pressione del generatore, e se nessun trascinamento d’olio dalla fonte di aria compressa è evidente, può essere necessaria una filtratura del tipo coalescente.

Per quanto riguarda la durata dei pezzi di ricambio spostabili, alcune migrazioni di particelle inerti nell’uscita dal gas sono da ritenersi possibili. Di conseguenza una piccola particella di filtro può essere opportuna in caso di applicazioni critiche.

RAPPORTO DI COMPRESSIONE- EFFICIENZA VOLUMETRICA

Il rapporto di compressione è il rapporto di uscita della pressione alla pressione di gas fornita. (per calcolarlo, utilizzare i valori assoluti psi) le sezioni di pompaggio del gas sono progettate per avere un volume minimo di assenza di spinta o spazio morto alla fine della corsa di compressione. Sul ritorno (aspirazione) di scarico del pistone, la pressione di uscita nel volume senza spinta si espande verso la pressione di uscita. Questo riduce la componente di potenziale immissione di gas freschi sulla corsa di aspirazione. Di conseguenza l'efficienza volumetrica diminuisce rapidamente con un aumento del rapporto di compressione fino a che l’efficienza volumetrica raggiunge lo zero quando il gas non espulso (espanso) riempie completamente il cilindro alla fine della corsa di immissione. Un cilindro con un volume del 4% di non spinta raggiunge un efficienza di zero ad un rapporto di compressione di circa 25.1.

I modelli di produzione di generatori di gas di produzione Haskel sono testati in laboratorio. I risultati di questi test indicano che i rapporti di compressione superiori a 40:1 sono possibili per alcuni modelli in condizioni ideali. Tuttavia, per operatività soddisfacente in condizioni di produzione per applicazioni industriali, si raccomandano rapporti di compressione (per stadio) di circa 10:1 o inferiori. Operatività a rapporti superiori può non danneggiare il generatore di gas ma siccome il flusso di uscita e l'efficienza saranno bassi, l'utilizzo deve essere limitato alla pressurizzazione di volumi di ridotte dimensioni come verifica di misura della pressione, ecc.

RAFFREDDAMENTO

Il raffreddamento effettivo della sezione del gas pompato è di somma importanza per la durata dei sigilli dei pistoni, della direzione e i sigilli statici dipendono dalla giusta temperatura di operatività. I generatori di gas Haskel utilizzano lo scarico dell'aria dal sistema di trasmissione per raffreddare il gas (e l'intercooler du gas sui due stadi di modelli). L’aria di trasmissione si espande durante il ciclo di lavoro con un'importante diminuzione della temperatura. Di conseguenza l’aria è un mezzo di raffreddamento molto efficiente.

In teoria, il rapporto di compressione sopra 3:1 con la maggior parte dei gas produce temperatura sopra i limiti consentiti per i sigilli. In pratica, tuttavia, il calore di compressione è trasferito alla canna del gas aria raffreddata e i componenti dei metalli adiacenti durante la velocità relativamente lenta del pistone sulla corsa di compressione per cui questi componenti staranno entro i limiti di temperatura consentiti. Test di laboratorio indicano che la massima temperature si trova tra i rapporti di 5:1 e 10:1 ed hanno mostrato che l’aria di scarico raffreddata è adeguata anche quando il generatore funziona a piena velocità.

La temperatura del gas di scarico può funzionare ad una temperatura fino a 150°F. (65,5°C) oltre la temperatura ambiente Sotto certe estreme condizioni di operatività, può essere necessario rallentare il ciclo del generatore del gas per prevenire il surriscaldamento. É molto difficile prevedere esattamente in caso di surriscaldamento. Per la verifica, installare una termocoppia a circa 1 pollice (2,5 cm) dalla porta di scarico della sezione pompaggio gas Temperature sopra I 300 ° F (148.8°C) a questo punto diminuirà sensibilmente la durata del sigillo del pistone.

Manutenzione

Valvola dell' Aria

Rimuovere la bobina o i manicotti nel seguente modo:

1. Rimuovere gli accessori di scarico aria posizionati alla fine del coperchio nella valvola a ciclo.Tirare fuori il tamburo, ispezionare l'anello ad O 568017. **Rilubrificare, reinstallare, riverificare prima di Ulteriore assemblaggio.**
2. Se necessario rimuovere il tamburo e il respingente separatore se danneggiato, usurato o gonfio.

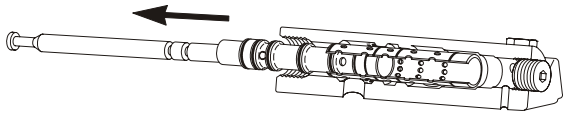


Figura 1. Inserire lo strumento nella seconda fila dei fori del manicotti e se necessario stringerli con un cacciavite.

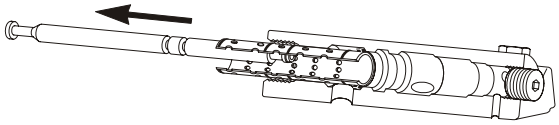


Figura 2. tirare fuori.

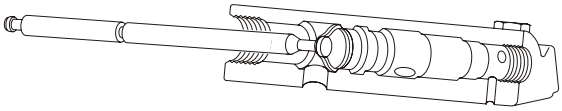


Figura 3. Inserire il respingente di collegamento verso il centro del respingente e sfilare.

3. Sostituite tutti gli anelli ad o 568020 o il basamento – distanziatore se danneggiato, usurato o rigonfio.
4. Lubrificare gli anelli as O con sigillante leggero lubrificante Haskel 28442 anelli ad o con leggera patina di lubrificante 28442.
5. Usare lubrificante liberamente per isgrassare il manicotto con la gomma di fronte al manicotti.
6. Spingere il manicotti lubrificato al terminale del foro del coperchio, con una sola operazione veloce. (Se il respingente scende troppo velocemente sotto il manicotti, rimuovere, rilubrificare e ripetere).
7. Installare il tamburo.
8. Sostituire gli accessori di scarico.

Sistema Pilota

1. Rimuovere l'anello ad o esagonale
2. Rimuovere la molla e l'asta pilota 27375(figura 4).
3. Ispezionare l'asta pilota e controllare che non vi siano corpi estranei. Sostituire l'asta pesante se il codolo è piegato o scalfito.
4. Sostituire l'asta se la zona di modanatura è danneggiata.
5. Applicare lubrificante 28442 e Riassemblare in modo contrario

NOTA: salvo che non ci siano perdite eccessive, non è consigliabile sostituire il sigillo con l'anello ad o per il codolo dell'asta. Questo richiede il disassemblaggio della sezione ad aria. nel caso in cui la sostituzione si renda necessaria, prestare attenzione ad installare il Truarc in modo concentrico come mostrato in figura 5. Utilizzare la valvola pilota dell'asta 27375 come alloggiamento dell'utensile. Posizionare la valvola in gomma contro il fermo e tappare lievemente la cima della valvola con un martellino per piegare in modo **uniforme** il montante del fermo.

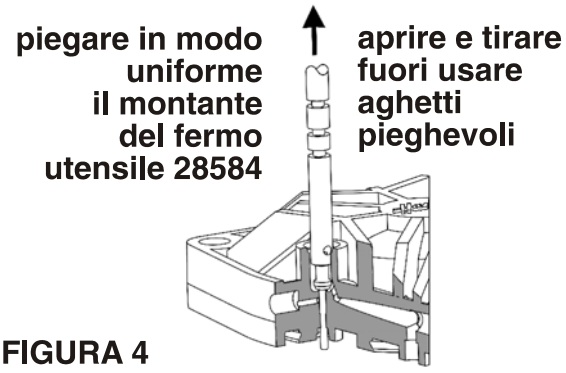


FIGURA 4

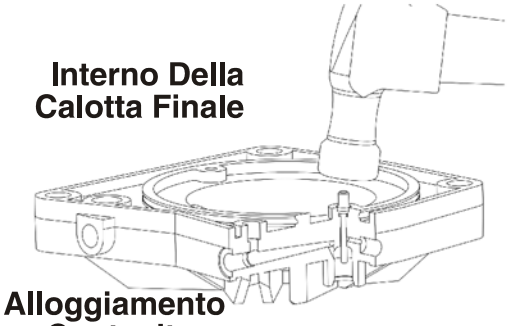


FIGURA 5

Test di procedura per Valvole controllo Pilota 27375:

Dopo la rilubrificazione della bobina e il riassemblaggio, se il ciclo di trasmissione è incostante, le seguenti verifiche di procedura determineranno quale delle valvole pilota è difettosa.

1. Rimuovere il tubo 17658-2 1/8 nel coperchio terminale superiore
2. Installare psi s pressione 0-160
3. Applicare la pressione dell'aria all'entrata di trasmissione dell'aria. Il calibro segnerà una pressione a zero se la valvola pilota **più bassa** non è stata attualizzata. Il calibro segnerà piena pressione aria pilota se la valvola pilota **superiore** non è stata attualizzata. La correzione dell'azione della valvola pilota provocherà l'immediato aumento del calibro o la caduta a zero della pressione dell'aria d'lla valvola pilota Un leggero **aumento** nella lettura del calibre indica perdita precedente della sede della valvola pilota nel coperchio terminale della valvola. Una lenta **diminuzione** della pressione indica perdita precedente nella sede della valvola pilota opposta. Esaminare e sostituire come richiesto Controllare anche le perdite d'aria esterne negli scarichi.
4. Se la trasmissione viene colpita e si arresta, il fatto è probabilmente dovuto allo stelo troppo corto della valvola pilota. Vedere I disegni di assemblaggio per la descrizione della procedura per determinare la giusta lunghezza dello stelo.

Per disassemblaggio e riparazione della sezione trasmissione dell'aria e pistone dell'aria:

1. Rimuovere i quattro bulloni collegati.
2. Rimuovere i barrel ad aria e gli anelli ad o statici
3. Rimuovere il sigillo dal pistone ad aria
4. Rimuovere il pistone ad aria e l'assemblaggio della bacchetta nella sezione trasmissione ad aria.
5. Vedere i disegni di assemblaggio applicabili Notare che I sigilli della trasmissione ad aria e le direzioni **delle bacchette** sono parte del kit sigillo della sezione **gas**.
6. Ispezionare, sostituire e installare tutte le parti interne nella sezione trasmissione ad aria per i disegni d'assemblaggio.
7. Rilubrificare il barrel ad aria con lubrificante Haskel 28442 Riassemblare la trasmissione nell'ordine contrario alle istruzione di assemblaggio. Durante la fase di assemblaggio e disassemblaggio fare attenzione che il flusso e il tubo degli anelli ad o siano sul flusso e sui tubi pilota prima di assemblare Alternativamente(ad incrocio) stringere le bacchette a forza di torsione massima di 16-18 libbre.

Introdução

O compressor de gás (booster), sem óleo, Haskel é um compressor pneumático de pistões que dispensa lubrificação, oferecido nas configurações simple efecto-monoetapa, dupla ação-monoestágio e modelos duplo estágio. Também pode-se usar unidades em série para configurações de múltiplo estágio. O número de modelo representa a relação aproximada entre a área dos pistões pneumáticos e a área dos pistões a gás.

CUIDADO: Líquidos sob alta pressão, quando indevidamente manipulados, podem ser perigosos.

Descrição

Geral

Os pistões pneumáticos, de todos os modelos, são acionados por uma válvula carretel pneumática não balanceada e sem trava de segurança que é pressurizada e ventilada alternadamente pelo sistema pneumático piloto. O comando está conectado diretamente aos pistãos da seção de compressão (booster), que foi projetada para trabalhar a seco, sem lubrificação, com o objetivo de fornecer gás sem nenhuma contaminação por hidrocarbonetos. O ar que sai do comando é usado para refrigerar os cilindros de gás e, em unidades de 2 estágios, o intercooler de gás. Alguns modelos dependem do ar frio que sai das ranhuras do silencioso para o cilindro de gás (sem as vantagens de uma camisa de refrigeração). Por isso, a posição do silencioso destes modelos não deve ser alterada. Se for o caso, os silenciosos dos modelos com camisa de refrigeração podem ser mudados de lugar por questão de ruído ou configuração.

Seção do Comando Pneumático

Consulte o desenho do conjunto com os detalhes da seção do comando pneumático fornecido com cada unidade. A seção do comando pneumático consiste em no mínimo um conjunto de pistão de ação pneumática, uma válvula de controle de circulação do tipo carretel, não balanceada e válvulas piloto (uma instalada na tampa terminal da válvula e a outra na tampa do lado oposto), um tubo de escoamento para conduzir o fluxo de ar da tampa terminal da válvula até a tampa oposta e um tubo piloto para para conectar as duas válvulas piloto instaladas em série. A válvula de controle pneumática funciona sem molas ou limitadores e é acionada ciclicamente pelas válvulas piloto que alternadamente pressurizam e ventilam a ampla zona que se encontra no extremo interno da válvula carretel.

A válvula de controle, válvulas piloto e cilindro pneumático são lubrificados com graxa para comandos pneumáticos Haskel, PN 28442, no momento em que são instalados. Dependendo do ciclo de trabalho da instalação, poderá haver necessidade de uma relubrificação periódica, com esta mesma graxa, da válvula de controle e das válvulas piloto, que são facilmente acessíveis.

Recomenda-se utilizar na seção do comando pneumático somente o-rings e vedações de composição e dureza adequadas para baixo atrito. Recomendamos utilizar as vedações Haskel.

Caso não tenha sido instalado na fábrica, providencie a instalação de um filtro de ar / separador de água convencional, tipo copo, com as mesmas medidas da tubulação, ou maior, na tubulação de entrada e dreno do comando pneumático e mantenha-o regularmente. **Em hipótese alguma use lubrificador de ar.**

Seção de Gás

Consulte o desenho de conjunto com os detalhes da seção de gás fornecido com cada unidade. A seguir descrevemos cada componente e sua instalação na seção de gás de cada modelo. **Observe que não se utiliza nenhum tipo de lubrificação na seção de compressão de gás.** A referida seção foi projetada para trabalhar a seco graças às propriedades inerentes de baixo atrito dos materiais das vedações e mancais. A durabilidade da seção de gás depende também da limpeza do gás fornecido; por isso sugere-se filtração micrônica na entrada do gás. Se for necessário bombear ar comprimido ou outro gás úmido qualquer, o ponto de orvalho inicial deve ser suficientemente baixo para evitar a saturação à pressão de saída do compressor (booster) e, se for notada a saída de óleo da fonte de ar comprimido, poderá ser necessário instalar um filtro especial coalescente.

Durante a vida útil dos componentes móveis, é de se esperar a migração partículas inertes para a saída do gás. Por isso, seria bom instalar um filtro de partículas no circuito de alta pressão.

RELAÇÃO DE COMPRESSÃO - EFICIÊNCIA VOLUMÉTRICA

A relação de compressão é a relação entre a pressão de saída e a pressão de entrada do gás (para calculá-la, use valores absolutos de pressão). A seção de compressão de gás foi projetada para que se tenha o menor volume possível na câmara de compressão no final do curso do pistão. Durante o tempo de retorno (admissão), este gás residual se expande desde a pressão de descarga até a pressão de admissão. Assim, reduz-se a quantidade de gás fresco que pode entrar durante o tempo de admissão. Conseqüentemente a eficiência volumétrica diminui rapidamente ao aumentar a relação de compressão, até atingir o valor zero, quando o gás não expelido (expandido) enche completamente o cilindro no final do tempo de admissão. Um cilindro com um volume não utilizado de 4% terá a eficiência zero a uma relação de compressão de 25:1 aproximadamente.

Os modelos comerciais de compressores (booster) de gás Haskel foram testados em laboratório. Os resultados destes testes indicam que se pode chegar a relações de compressão de até 40:1 em alguns modelos sob condições ideais. Entretanto, para um funcionamento satisfatório, em condições de produção em aplicações industriais, recomendamos relações de compressão (por etapa) de no máximo 10:1. O funcionamento com relações mais elevadas pode não danificar o equipamento, mas como o fluxo de saída e a eficiência são muito baixas, seu uso deveria se limitar à compressão de volumes reduzidos, como os necessários para testes de manômetros, etc.

Refrigeração

Uma refrigeração eficaz do circuito de compressão de gás é de vital importância, pois a durabilidade das vedações do pistão, mancais e selos estáticos depende de se opere a temperaturas adequadas. Os compressores (booster) de gás Haskel utilizam o ar de escape do sistema propulsor para refrigerar o cilindro de gás (e o intercooler de gás nos modelos de dois estágios). O ar propulsor se expande durante o ciclo de operação, com uma conseqüente grande redução da temperatura. Por isso, o ar de escape torna-se um refrigerante muito eficaz.

Teoricamente, as relações de compressão acima de 3:1 produzem, na maioria dos gases, temperaturas acima dos limites recomendados para as vedações. Entretanto, na prática, o calor de compressão passa para o cilindro refrigerado pelo ar e para os componentes metálicos adjacentes durante o tempo de compressão do pistão, a uma velocidade relativamente baixa, e tais elementos se mantêm dentro de uma faixa de temperatura permitida. Os testes de laboratório indicam que as temperaturas máximas aparecem entre as relações de compressão 5:1 e 10:1 e ficou comprovado que a refrigeração com o ar de escape é adequada, inclusive quando o compressor (booster) está funcionando em máxima rotação.

A temperatura de descarga do gás pode estar até cerca de 150 ºF acima da temperatura ambiente. Sob certas condições críticas de funcionamiento, poderá ser necessário reduzir o ciclo de operação do compressor (booster) para evitar superaquecimento. É muito difícil prever com exatidão quando poderá ocorrer um superaquecimento. Para fazer um teste, instale um termopar a cerca de 25 mm (1 pol.) do tubo de descarga do circuito de compressão de gás. Se a temperatura neste ponto for superior a 300 ºF, a vida útil das vedações do pistão poderá diminuir consideravelmente.

Manutenção

Seção da Válvula Pneumática

Remova o carretel ou camisa da seguinte maneira:

1. Remova a conexão de saída de ar que se encontra na tampa terminal da válvula. Remova o carretel; inspecione os anéis de vedação (o-rings) PN 568017. **Relubrifique, reinstale e teste novamente antes de continuar a desmontagem.**
2. Se for necessário, remova a camisa e o amortecedor (espaçador com faces de borracha no lado interno da camisa) com a ferramenta PN 28584, como mostrado nas Figuras 1, 2 e 3.

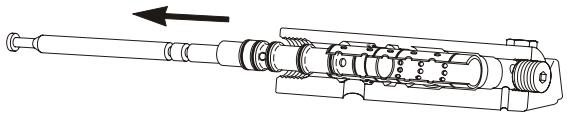


Figura 1: Introduza a ferramenta na segunda fileiras de furos da camisa e, se necessário, force com uma chave de fenda.

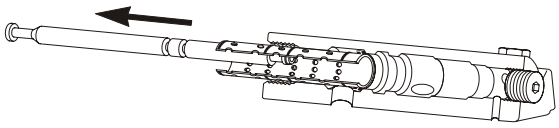


Figura 2: Remova em linha reta.

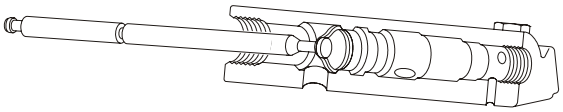


Figura 3: Introduza o gancho no centro do amortecedor e puxe em linha reta.

3. Substitua os anéis de vedação (o-rings) PN 568020 ou o amortecedor/espaçador, casos estejam danificados, gastos ou deformados.
4. Lubrifique os anéis de vedação (o-rings) com uma fina camada de lubrificante Haskel PN 28442.
5. Utilize uma boa quantidade de graxa para manter o amortecedor/espaçador na camisa com a face de borracha virada para o lado da camisa.
6. Empurre a camisa lubrificada e o amortecedor para dentro do furo da tampa terminal, em toda a extensão com um rápido movimento (se o amortecedor se soltar da camisa rápido demais, remova-o, lubrifique novamente e repita o processo).
7. Instale o carretel.
8. Recoloque a conexão do tubo de escape.

Sistema Piloto

1. Remova o bujão sextavado vedado com anel o-ring.
2. Remova a mola e a haste da válvula piloto PN 27375 (Figura 4).
3. Inspecione a haste e a sede para ver se há material estranho. Substitua a haste caso o cabo esteja torto ou riscado.
4. Substitua a haste caso a sede moldada esteja danificada.
5. Aplique lubrificante PN 28442 e monte novamente seguindo o procedimento inverso.

NOTA: Exceto no caso de vazamentos excessivo, não é recomendável substituir o anel de vedação (o-ring) do cabo da haste. Para isto, é necessário desmontar a seção pneumática completamente. Se for necessária sua substituição, deve-se cuidar para que o retentor Tru-Arc seja instalado concentricamente como mostrado na Figura 5. Utilize a válvula piloto PN 27375 como ferramenta de assento. Coloque a face de borracha da válvula virada para o retentor e bata levemente na parte de cima da válvula com um martelo para dobrar uniformemente as patas do retentor.

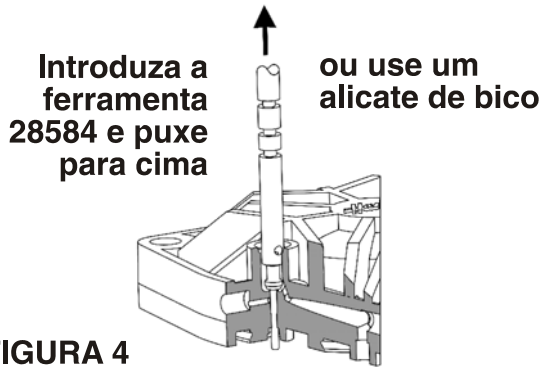
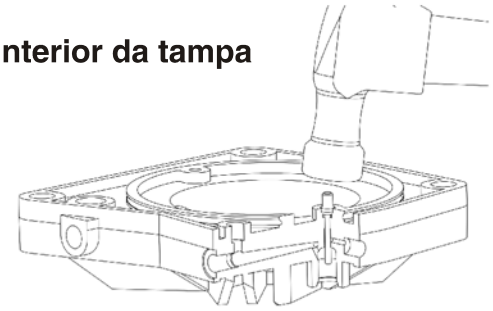


FIGURA 4



Colocação do retentor FIGURA 5

Procedimento de Teste para as Válvulas Piloto PN 27375:

Depois de relubrificar o carretel e tornar montá-lo, se a máquina não funcionar normalmente, faça o seguinte teste para verificar qual das válvulas piloto está com defeito.

1. Remova o bujão PN 17658-2 1/8" da tampa superior.
2. Instale um manômetro de 0-160 psi.
3. Aplique uma pressão de ar na entrada do sistema de acionamento. O manômetro indicará zero caso a válvula com defeito seja a **inferior**. O manômetro indicará uma pressão de ar máxima caso a válvula com defeito seja a **superior**. Se as duas válvulas funcionarem corretamente, a pressão aumentará de zero até a pressão de pilotagem e vice-versa. Um lento **aumento** do valor indicado no manômetro indica que há um vazamento na tampa terminal após a sede da válvula piloto. Por outro lado, uma lenta **redução** de pressão indica que há um vazamento após a sede da válvula piloto oposta. Inspecione-a e substitua-a, se necessário. Verifique também se há vazamentos externos nos bujões.
4. Se a máquina executa um só tempo e pára, é provavelmente porque a haste de alguma das válvulas piloto é muito curta. Consulte o procedimento de determinação do comprimento correto da haste no desenho de conjunto.

Para Desmontagem e Reparo da Seção do Comando Pneumático e do Pistão:

1. Remova os quatro tirantes.
2. Remova o cilindro pneumático e os anéis de vedação (o-rings) estáticos.
3. Remova a vedação do pistão pneumático.
4. Remova o pistão pneumático e o conjunto haste da seção do comando pneumático.
5. Consulte o desenho de conjunto correspondente. Observe que as juntas do comando pneumático e os mancais **das hastes** fazem parte do jogo de juntas do kit de vedação da **seção de gás**.
6. Inspecione, substitua e instale todos os componentes internos da seção do comando pneumático de acordo com o desenho de conjunto.
7. Lubrifique novamente o cilindro pneumático com o lubrificante Haskel PN 28442. Monte novamente o cilindro seguindo o procedimento inverso ao da desmontagem. Durante a desmontagem e montagem, deve-se ter cuidado para que os anéis de vedação dos tubos de escoamento e piloto sejam montados antes da montagem. Aperte os tirantes alternadamente (cruzado) com um torque máximo de 16 a 18 ft.lb.

Operating and Maintenance Instructions

CE Compliance Supplement

SAFETY ISSUES

a. Please refer to the main section of this instruction manual for general handling, assembly and disassembly instructions.

b. Storage temperatures are 25°F – 130°F (-3.9°C – 53.1°C).

c. Lockout/tagout is the responsibility of the end user.

d. If the machine weighs more than 39 lbs (18 kg), use a hoist or get assistance for lifting.

e. Safety labels on the machines and meanings are as follows:

General Danger

Read Operator’s Manual

f. In an emergency, turn off the air supply.

g. Warning: If the pump(s) were not approved to ATEX, it must NOT be used in a potentially explosive atmosphere.

h. Pressure relief devices must be installed as close as practical to the system.

i. Before maintenance, liquid section(s) should be purged if hazard liquid was transferred.

j. The end user must provide pressure indicators at the inlet and final outlet of the pump.

k. Please refer to the drawings in the main instruction manual for spare parts list and recommended spare parts list.

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APPENDIX III

Declaration of Conformity

DECLARATION of CONFORMITY

The design, development and manufacture is in accordance with European Community guidelines

20-4505-7000
20-4509-7000

Relevant provisions complied with by the machinery:
2006/42/EC

Relevant standards complied with by the machinery:
EN ISO 12100-1
CGA G-4.1 - 2004
SAE ARP 1176
SAE ARP 1532

Identification of person empowered to sign on behalf of the Manufacturer:

Patrick Finch

Quality Assurance Representative

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