JANUARY 10, 1996

APV Crepaco Inc
100 South CP Avenue
Lake Mills, WI 53551-1799
Tel.: (414) 648-8311

APV Crepaco
Instruction Manual

CONTINUOUS ICE CREAM FREEZER

Model Number:	"WS-212GS"
Serial Number:	N-1307
Order Number:	32-03079
Drawing Number:	07B-P-482339

RICHMOND ICE CREAM

When requesting information about your machine, always state serial number, name of machine, and model number, or any other pertinent information that might apply.

Keep this manual in a safe place for future reference.

Additional copies may be ordered through your local APV Crepaco Sales Representative.

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Introduction

Congratulations, you are the owner of a quality built item of APV Crepaco. This equipment was manufactured by the skilled personnel of a company which has served the needs of the dairy, food, and process industries for more than 100 years.

The purpose of this manual is to provide instructions for the safe installation, operation, and maintenance of your APV Crepaco equipment.

Read and understand the entire manual before removing from the crate and installing the equipment.

APV Crepaco is committed to provide quality equipment and customer satisfaction. We have a unique network of sales and service support throughout the world, which are listed on the following page. Note the office nearest you. Should you have any questions concerning any information contained in this manual, contact the nearest office or our Lake Mills, Wisconsin office for assistance.

APV Crepaco Offices

Engineering and Manufacturing Facilities

100 S. CP Ave.
Lake Mills, WI 53551
Tel: (414) 648-8311
Fax: (414) 648-3418

Factory Direct Service Parts Sales, Toll Free (800) 358-4100

Regional Sales Offices

Central Region
9525 West Bryn Mawr Ave.
Rosemont, IL 60018
Tel: (708) 678-4300
Fax: (708) 678-5037

6663 Huntley Rd.
Suite L
Columbus, OH 43229
Tel: (614) 846-8503
Fax: (614) 846-4932

4226 Park Glen Rd.
St. Louis Park, MN 55416
Tel: (612) 927-4910
Fax: (612) 927-6895

Western Region
16641 Valley View Ave.
Cerritos, CA 90701
Tel: (310) 926-9700
Fax: (310) 926-1179

4380 S. 500 West
Salt Lake City, UT 84123
Tel: (801) 262-8494
Fax: (801) 262-9467

1138 Industry Drive
Seattle, WA 98188
Tel: (206) 575-8900
Fax: (206) 575-1221

Southern Region
P.O. Box 166199
2920 Skyway Circle N.
Irving, TX 75038
Tel: (214) 257-3455
Fax: (214) 594-1339

Eastern Region
330 Franklin Turnpike
Mahwah, NJ 07430
Tel: (201) 529-5959
Fax: (201) 529-2676

2252 Northwest Parkway
Suite B
Marietta, GA 30067
Tel: (404) 956-9110
Fax: (404) 956-8993

Canada

APV Canada, Inc.
Central Region-Toronto
30 Whitmore Rd.
Woodbridge, Ont. L4L 7Z4
Tel: (905) 850-1852
Fax: (905) 850-1863

APV Canada, Inc.
Eastern Region-Montreal
6555 Cote De Liesse
Montreal, Quebec H4T 1E6
Tel: (514) 737-0006
Fax: (514) 737-1310

APV Canada, Inc.
Western Region-Vancouver
Unit #10-8075 Enterprise Street
Burnaby, B.C. V5A 1V5
Tel: (604) 420-4344
Fax: (604) 420-2419

International

APV Crepaco (Far East) Inc.
Hoko Bldg., Ginza 1-18-19
Chuo-Ku, Tokyo 104, Japan
Tel: 03-562-3921
Fax: 03-561-1719
Telex: 02523295

APV de Mexico
Periferico Sur 4225-106
Colonia Jardines en la Montana
CP 14210, Mexico, D.F., Mexico
Tel: 52(5)-644-2439
Fax: 52(5)-644-2730

APV Crepaco Service GmbH
Spinnereistrasse 11
D-88239 Wangen/Allgau
Germany
Tel: 07522-80024
Fax: 07522-80010

STANDARD WARRANTY

Obligations of Seller

During the warranty period, Seller shall repair, or at Seller's option, replace parts determined by Seller to be defective in material or workmanship. The warranty period is one (1) year from the date of delivery to Buyer F.O.B. point of manufacture. The foregoing shall be the sole obligation of Seller under this warranty with respect to the equipment and other property included in this Agreement. With respect to equipment, materials, parts and accessories manufactured by others, Seller's sole obligation shall be to use reasonable efforts to obtain for Buyer the full benefit of the manufacturers' warranties.

Warranty Exclusions

Repair or replacement of parts required because of misuse, improper care or storage, negligence, alteration, accident, use of incompatible supplies or lack of specified maintenance are excluded from Seller's warranty obligations.

DISCLAIMER OF WARRANTIES

THE FOREGOING WARRANTY EXPRESSIONS ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND EXISTENCE OF ANY SUCH OTHER WARRANTY IS HEREBY DENIED.

Limitation of Liability and Remedies

The liability of Seller for breach of any warranty obligation hereunder is limited to:

1. The repair or replacement of the equipment on which the liability is based; or,

2. At Sellers option, the refund to Buyer of the amount paid by Buyer to Seller for said equipment.

All other liability of Seller with respect to this Agreement, or from the manufacture, installation, maintenance, repair or use of any equipment covered by or furnished under this Agreement, whether in contract or in tort, or otherwise, is limited to the amount paid by Buyer to Seller pursuant to the terms hereon: SELLER SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

Breach

Any breach by Seller with respect to any items or unit of equipment shall be deemed a breach with respect to that item or unit only.

Infringement

Seller will not be liable for the infringement of any patent by the Buyer's use of any equipment or materials delivered hereunder.

POLICY REGARDING AVAILABILITY OF SERVICE PARTS

APV Crepaco will attempt to remain in a position to supply replaceable service parts during the normal life of any item of APV Crepaco equipment. This will be contingent upon availability of tools, material, and facilities of our own as well as of our suppliers.

After expiration of this period, supply of service parts will be limited to available stock of completed parts. If unable to supply the service part, drawings will be furnished when available to permit local manufacturing, if desired.

APV Crepaco reserves the right to improve, change or modify the construction of its equipment or any parts thereof without incurring any obligation to provide like changes to equipment previously sold.

A Word About APV Crepaco Service Parts

We want to raise your awareness to the problem associated with purchase of parts not manufactured to the high quality specifications of APV Crepaco, INC.

In addition to our high quality, APV Crepaco parts are manufactured to meet regulatory agency authorizations, approvals and certification (3-A Sanitary Standards, USDA, ASME, BISSC and OSHA). Where applicable, materials used in construction of APV parts conform to FDA regulations.

WARNING

PARTS NOT MANUFACTURED TO OUR SPECIFICATIONS MAY CAUSE DAMAGES TO YOUR APV CREPACO EQUIPMENT AND VOID ALL WARRANTIES. USE OF PARTS THAT DO NOT MEET APV CREPACO, INC. SPECIFICATIONS MAY CAUSE PROPERTY DAMAGES AND SERIOUS BODILY INJURY.

Types of equipment include, but are not limited to, rotary pumps, centrifugal pumps, homogenizers, ice cream freezers, scrape surface heat exchangers, plate heat exchangers, ingredient feeders, process tank and contact plate freezers.

We bring this potentially serious problem to your attention in order to safeguard your best interest and those of your employees.

If you have any questions, please feel free to call 1-800-358-4100 or your local APV Crepaco Regional Sales Office.

APV Crepaco Troubleshooting Guide

100 South CP Avenue
Lake Mills, Wisconsin 53551
USA

Phone: (414 648-8311
Fax: (414) 648-1390

If you are experiencing difficulty with the operation of your APV Crepaco freezer, please answer the questions given in this guide before contacting us by phone or facsimile. This will greatly reduce the time required to identify and respond to the problem.

- What is the model of the freezer?* (Ex: KM318, W-112GA, WS-206G*)
- What is the serial number of the freezer?* (Ex: A-1008, G-2170, N-0345*)
- When did the problem start?
- Have you isolated the problem to a particular system? (electrical, mechanical, refrigeration, air, automation, etc.)
- Have you checked the blades for wear? (Worn blades can cause capacity, temperature and product consistency problems.)
- Have you inspected the rotors for wear? (Worn rotors can cause capacity and cylinder pressure problems.)
- Have you drained the refrigerant oil from the cylinder? (Oil will affect the refrigeration efficiency of the freezer and affect capacity.)
- Is the problem isolated to one freezer, or is it happening to other cylinders?
- Has the problem occurred abruptly or has the freezer been slowly deteriorating over time?
- Does the problem occur with one particular mix or all mixes?
- Had anything changed before the problem occurred?

Please explain anything else in detail which may help us understand the problem!

* For WS Model Freezers, fax a copy of the "Customer Specification Sheet", located in the rear electrical panel, or from the Service Parts Manual. An example of this sheet is found on the following page.

CUSTOMER SPECIFICATION SHEET (EXAMPLE)

Serial Number:

Model:

Order Number:

Drawing Number:

Controls

- Automatic
- Semi-Automatic
- Manual
- Mass Flow Air Controller

Dasher Type

- Series #30 (Open)
- Series # 80 (Solid)

Accumulator

Inner Cylinder

Refrigeration Type

- Ammonia
- Freon
- Back Pressure Regulator
- Float Valve

Rear Right Hand Plate

Mix Gear Motor

- Horse Power
- Motor Voltage
- Inverter
- Pump Size:

Product Gear Motor

- Horse Power
- Motor Voltage
- Inverter
- Pump Size:

Dasher Motor

- Horse Power
- Motor Voltage
- Sheave
- Hub

Belt Selection

Reducer

- Sheave
- Hub

Special Options

WSF00184

Standard Features

- All stainless steel frame.
- Cylinders - Chrome plated nickel polished to a mirror like finish.
- Dashers - Stainless steel with hardened stainless steel scraper blades.
- Pumps are rotary lobe type with rubber covered rotors and CIP bypass covers.
- Pump Drive(s) - Electric variable frequency with TEFC gear head drives.
- Refrigeration - Full flooded system with float valve, back pressure regulator valve and solenoid valves. Ammonia refrigerant is standard.
- Dasher Motors - Supplied - TEFC.
- Constant cylinder pressure control.
- Pressure vessel cylinder certification.
- Built in viscosity control.
- Companion sanitary ferrules and clamp kit(s).
- Vent valves.
- Extra parts.
  - Seal inserter.
  - Dasher puller and holder.
  - Cylinder protector.
  - Dasher removal key.
  - Instruction drawing.
  - Instruction and Parts manuals.
  - Blade sharpening fixture.
- Safety Lock Out switches on the front and rear of units.
- Weld and half nipples for utility connections.
- Dasher coupling guards.

Specifications

	WS-06	WS-08	WS-12	WS-15
Basic Dimensions				
Width	29 in. (74 cm)	29 in. (74 cm)	29 in. (74 cm)	29 in. (74 cm)
Length	88 in. (224 cm)	90 in. (229 cm)	109 in. (277 cm)	128 in. (325 cm)
Height	92 in. (234 cm)	92 in. (234 cm)	92 in. (234 cm)	92 in. (234 cm)
Pumps				
Pump Model (R Series)	0.5	2.0	2.5	2.5
Mix Pump Drive hp	2 hp (1.5 kw)	2 hp (1.5 kw)	2 hp (1.5 kw)	2 hp (1.5 kw)
I.C. Pump Drive hp	2 hp (1.5 kw)	2 hp (1.5 kw)	3 hp (2.2 kw)	3 hp (2.2 kw)
Mix Inlet Connection	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)
I.C. Outlet Connection	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)	2.0 in. (5.08 cm)	2.0 in. (5.08 cm)
Dasher Drive hp				
Type G	20 hp (15 kw)	20 hp (15 kw)	30 hp (32 kw)	30 hp (32 kw)
Type E	20 hp (15 kw)	25 hp (19 kw)	30 hp (32 kw)	
Cylinder				
Material	chrome nickel	chrome nickel	chrome nickel	chrome nickel
Diameter	6 in. (15 cm)	8 in. (20 cm)	8 in. (20 cm)	8 in. (20 cm)
Length	47 in. (119 cm)	44 in. (112 cm)	63 in. (160 cm)	82 in. (208 cm)
Capacity Mix				
Minimum USgph	26 (98 lph)	40 (151 lph)	60 (227 lph)	80 (303 lph)
Maximum USgph	132 (500 lph)	200 (757 lph)	300 (1136 lph)	400 (1514 lph)
Capacity Ice Cream Overrrun @ 100%				
Minimum USgph	52 (197 lph)	80 (302 lph)	120 (454 lph)	160 (606 lph)
Maximum USgph	264 (999 lph)	400 (1514 lph)	600 (2271 lph)	800 (3028 lph)

Nominal rated capacity is based on an ice cream mix containing 10.5% butterfat, 37.5% total solids, 15.5% sugar (of which 85% is sucrose), and 0.3% stabilizer. The mix enters the unit at 40.0 F and is drawn at 22.0 F.

Refrigeration Requirement				
@ -28.0 F (-33 C)	8.8 tr (26,611 kcal)	13.3 tr (40,320 kcal)	20 tr (60,480 kcal)	26.7 tr 80,640 kcal)

tr = tons of refrigeration (1 tr = 3024 kcal)
kcal = kilogram calories

Specifications

	WS-06	WS-08	WS-12	WS-15
Refrigeration Connections				
(Weld Flange)				
Suction Line	2.0 in. (5.08 cm)	2.0 in. (5.08 cm)	3.0 in. (7.62 cm)	3.0 in. (7.62 cm)
Liquid Line	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)
Safety Relief Valve Line	1.0 in. (2.54 cm)	1.0 in. (2.54 cm)	1.0 in. (2.54 cm)	1.0 in. (2.54 cm)
Hot Gas Line	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)
Air Requirements				
Scfh @ 90 psi	75 (22.8 cmh)	100 (30.5 cmh)	150 (45.7 cmh)	200 (60.9 cmh)
Air Connection	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)
Control Power Requirement				
110 V	8 amps	8 amps	8 amps	8 amps
220 V	4 amps	4 amps	4 amps	4 amps

Lubrication	Type of Lubrication	Interval
Dasher Drive Gear Box	See Vendors insert at end of manual.	See Vendors insert at end of manual.
Dasher Support Bearings	Orange #390	Grease daily.
Pump Drive Gear Motor	See Vendors insert at end of manual.	See Vendors insert at end of manual.
Rotary Pump Gearcase	CP Homolube-APV Part No. 902-S-1456	Check weekly, change every 500 hours.

Acceptable Substitutes for CP Homolube (High Quality Non-Emulsifying Oil)	
Humble Oil and Refining Co. (Esso)	Teresstic or Teresso 65
America Indiana Oil Company	America Indiana Oil #51
Texaco	Texaco Regal Oil PER&O
Mobile Oil Company	Mobile DTE Oil - Heavy
Shell Oil Company	Tellus #41
British Petroleum	BP Energol HL 150

Acceptable Substitutes for Orange #390	
Mobile Oil Company	Mobile EP #1
Texaco	Texaco Novatex #1
Shell Oil Company	Alvania

Safety Information

Definitions

DANGER

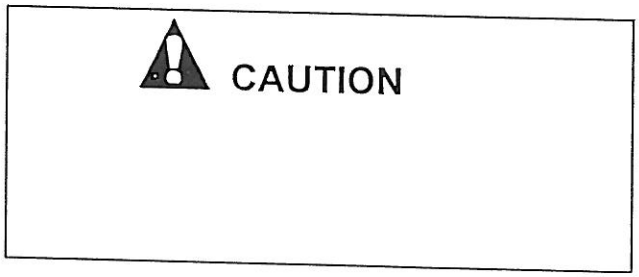
An immediate hazard with a possibility of severe personal injury or death if instructions, including recommended precautions, are not followed.

WARNING

Hazards or unsafe practices which could result in severe personal injury or death if instructions, including recommended precautions, are not followed.

CAUTION

Possible hazards or unsafe practices which could result in minor injury or damage to product or property if instructions, including recommended precautions, are not followed.



Lock Out

A positive means of securing the main electrical disconnect in the Off position, where only the person involved in the maintenance procedure has possession of the key.

DANGER **WARNING** **CAUTION**

DO NOT OPERATE OR SERVICE YOUR APV CREPACO MACHINE UNTIL YOU HAVE READ THESE SAFETY RULES AND THE INSTRUCTIONS MANUAL FOR THE MACHINE

SAFETY INSTRUCTIONS

THINK SAFETY

1. Do not operate this equipment (machine) with safety devices bypassed or guards removed.
2. Only qualified personnel should operate this machine.
3. Do not start the machine until all personnel are clear.
4. Never perform service or maintenance procedures on a machine in motion.
5. Most equipment requires a high voltage electrical system. To avoid shock or serious injury, only qualified personnel should perform maintenance on the electrical system.
6. All air hydraulic and electric power must be OFF before servicing the machine.

   For maximum protection the power source should be locked out using a lock for which only you have the key. This prevents anyone from accidentally turning on the power while you are servicing the machine.

APV

100 South CP Ave., Lake Mills, WI 53551
Tel: (414) 648-8311, Fax: (414) 648-3418

HAZARD SERIOUSNESS LEVEL IDENTIFICATION

Definitions for identifying the various hazard levels shown on warning labels or to indicate proper safety procedures in the instruction manual are provided below with their respective signal words.

The use of the word "Danger" always signifies an immediate hazard with a high likelihood of severe personal injury or death if instructions, including recommended precautions, are not followed.

The use of the word "Warning" signifies the presence of hazards or unsafe practices which could result in severe personal injury or death if instructions, including recommended precautions, are not followed.

The use of the word "Caution" signifies possible hazards or unsafe practices which could result in minor injury or damage to product or property if instructions, including recommended precautions, are not followed.

The use of the wording "Safety Instructions" signifies that the guidelines provided will assist in the safe operation of the machine or system.

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USER'S RESPONSIBILITY

The basic rules of safety set forth in this booklet are intended as a guide for the safe operation of APV machines. This general safety information, along with explicit service, maintenance and operational materials for each specific machine, make up the complete instruction manual. All personnel who will operate, service or be involved with this equipment in any way should become totally familiar with this information prior to start-up.

It is the buyer's responsibility to make certain that the procedures set forth are followed and should any major deviation or change in use from the original specifications be required, appropriate procedures should be established for the continued safe operation of the machine. It is strongly recommended that you contact APV to make certain that the machine can be converted to the new use and continue to function in a reasonably safe manner.

All installation, service, maintenance and operations must be performed in strict accordance with all applicable codes and standards, including those established by OSHA.

SAFETY FIRST

APV equipment is designed and manufactured with due consideration and care for generally accepted safety standards. However, like any mechanical device, the proper and safe performance of this equipment depends upon using sound and prudent operating, maintenance and servicing procedures under properly trained supervision.

For your protection, and the protection of others, learn and always follow the safety rules outlined in this booklet. Observe warning signs on machines and act accordingly. Form safe working habits by reading the rules and abiding by them. Keep this booklet handy and review it from time to time to refresh your understanding of the rules.

Do not take chances. The odds are stacked against you!

OPERATING ZONE

An operating zone should be established around all machines. A brightly painted guard rail or warning stripe should define the zone. Only the operator or other authorized personnel should be within the operating zone when machine control circuits are energized or the machine is running. No tools or other equipment should be kept within the operating zone.

INSTALLATION

SPECIAL NOTE - All installation, service, maintenance and operations must be performed in strict accordance with OSHA's Standard for Control of Hazardous Energy (lockout/tagout) 29 CFR 1910.147.

Power sources, such as electric, air and hydraulic, should be installed by trained and authorized personnel only. Installations must comply with all applicable codes and standards, including those established by OSHA.*

SAFETY INSPECTION

Before Starting A Machine:

1. Be absolutely positive all guards and safety devices are installed and operative.
2. Be sure all personnel are clear of the machine.
3. Remove (from the operating zone) any materials, tools or other foreign objects that could cause injury to personnel or damage the machine.
4. Make certain the machine is in operating condition.
5. Make certain all indicating lights, horns, pressure gauges or other safety devices or indicators are in working order.

After Shutdown:

Make certain all air, hydraulic and electrical power is turned off.

*OSHA is the United States Occupational Safety and Health Administration, 200 Constitution Avenue NW, Washington, DC 20001.

GENERAL OPERATING SAFETY

1. Do not operate this machine until you read and understand the operating instructions and become thoroughly familiar with the machine and its controls.
2. Never operate a machine while a safety device or guard is removed or disconnected.
3. Always wear safety glasses, hats, shoes, ear protection or any other required safety equipment.
4. Never remove "Warnings" that are displayed on the machine. Torn or worn labels should be replaced.
5. Do not start the machine until all other personnel in the area have been warned and have moved outside the operating zone.
6. Remove any tools or other foreign objects from the operating zone before starting.
7. Absolutely do not have loose clothing, neckties, necklaces or unrestrained long hair near an operating machine.
8. Do not wear gloves, rings, watches, bracelets or other jewelry near an operating machine.
9. Keep the operating zone free of obstacles that could cause a person to trip or fall towards an operating machine.
10. Never sit or stand on anything that might cause you to fall against the machine.
11. "Horseplay" around a machine at any time is dangerous and prohibited.
12. Know the EMERGENCY STOP procedure for the machine.
13. Air, hydraulic and electrical power must be off when the machine is not in use. **Note: For maximum protection, the power source should be locked out using a lock for which only you have the key. This prevents anyone from accidentally turning on the power while you are servicing the machine.**
14. Never operate the machine above specified speeds, pressures or temperatures.
15. Never manually operate limit switches with power on.
16. Keep alert and observe indicator lights and warnings that are displayed on the machine.
17. Never leave the machine unattended while in operation.
18. Do not operate faulty or damaged equipment. Make certain proper service and maintenance procedures have been performed.
19. Avoid placing fingers, hands, or any part of your body into the machine or near moving parts when control circuits are energized.
20. A safe work surface should be provided, including proper guarding of platform areas and the design and use of ladders.

SPECIAL NOTE - All installation, service, maintenance and operations must be performed in strict accordance with OSHA's Standard for Control of Hazardous Energy (lockout/tagout) 29 CFR 1910.147.

SERVICE AND MAINTENANCE SAFETY

1. Do not service a machine until you are thoroughly qualified and familiar with the tasks to be performed.
2. Never operate any controls while other persons are performing maintenance on the machine.
3. Do not bypass a safety device.
4. Always use the proper tool for the job.
5. Never open covers that house electrical components when power is on.
6. Only perform maintenance on a machine in motion when properly trained and required to do so. When directed to make adjustments on machines in motion, extreme care must be taken.
7. All air and hydraulic pressure must be relieved before performing maintenance or loosening connection on any pressurized system.
8. Air, hydraulic and electrical power are to be turned off unless they are absolutely required for the specific servicing being performed. **Note: For maximum protection the power source should be locked out using a lock for which only you have the key. This prevents anyone from accidentally turning on the power while you are servicing the machine.**
9. Replace fuses only when electrical power is off (locked out).
10. Do not enter a confined space without first checking for toxic fumes and providing standby personnel on the site.

ELECTRICAL SAFETY

1. All electrical/electronic maintenance and service should be performed by trained and authorized electricians only.
2. Always assume that power is on and treat all conditions as live. This practice assures a cautious approach which may prevent an accident or injury.
3. To remove the load from circuit or equipment, open disconnect or breaker and lock in open position. **Note: For maximum protection the power source should be locked out using a lock for which only you have the key. This prevents anyone from accidentally turning on the power while you are servicing the machine.**
4. Make certain that the circuit is open by using the proper test equipment. **Note:** Test equipment must be checked at regular intervals.
5. Capacitors must be given time to discharge, otherwise it should be done manually with care.
6. There may be circumstances where "trouble-shooting" on live equipment may be required. Under such conditions, special precautions must be taken as follows:
   - Make certain your tools and body are clear of the ground.
   - Extra safety measures should be taken in damp areas.
   - Be alert and avoid any outside distractions.
7. Before applying power to any equipment, make certain that all personnel are clear of the machine.
8. Control panel doors should be open only when checking out the electrical equipment or wiring. After closing the panel door, make certain that (on those panels where applicable) the disconnect handle mechanism is operating properly.
9. All covers on junction panels should be closed before leaving any job.
10. All electrical apparatus must be properly grounded and overload protected.
11. All electrical connections should be protected by confining them within a sealed junction box.

SPECIAL NOTE - All installation, service, maintenance and operations must be performed in strict accordance with OSHA's Standard for Control of Hazardous Energy (lockout/tagout) 29 CFR 1910.147.

HYDRAULIC SYSTEM SAFETY

1. Never operate a hydraulic system unless covers, safety devices and indicators are operating and in place.
2. Never operate a hydraulic system above the pressure specified.
3. Hydraulic fluid should never be allowed to collect on floors or equipment.
4. Skin contact with hydraulic fluid should be avoided. Always wear proper protective clothing when handling hydraulic fluid.
5. Never loosen any hydraulic connection when the system is under pressure.
6. Never operate a machine that has leaks in the hydraulic system. Most hydraulic fluids are flammable and constitute a fire hazard.
7. A hydraulic system retains the power to complete its intended motion even after the power is off. Care is required to avoid injury.

AIR SYSTEM SAFETY

1. Never operate an air system unless covers, safety devices and controls are operating and in place.
2. Compressed air retains the power to complete its intended motion even after the power is off. Care is required to avoid injury.

CLEANING SAFETY

Manual Cleaning Procedures:

1. Do not use toxic and/or flammable solvents to clean a machine.
2. Turn off air, hydraulic and electrical power (lock out) prior to cleaning a machine.
3. Keep electrical panel covers closed and power off when washing a machine. Note: For maximum protection the power source should be locked out using a lock for which only you have the key. This prevents anyone from accidentally turning on the power while you are servicing the machine.
4. Always clean up spills around machine as soon as possible.
5. Never attempt to clean a machine while it is operating.

Cleaning-In-Place Procedures:

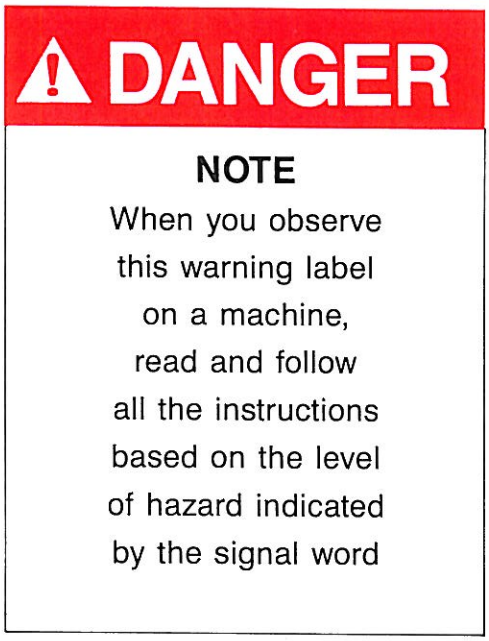
1. Make certain that all connections in the cleaning circuit are tight to avoid contact with hot water or cleaning solutions.
2. When the cleaning cycle is controlled from a remote or automated control center, establish fail-safe procedures to avoid automatic start-up while servicing equipment in the circuit.
3. On equipment which includes manways, make certain covers are closed and latched prior to starting the cleaning cycle.

CONFINED SPACE SAFETY

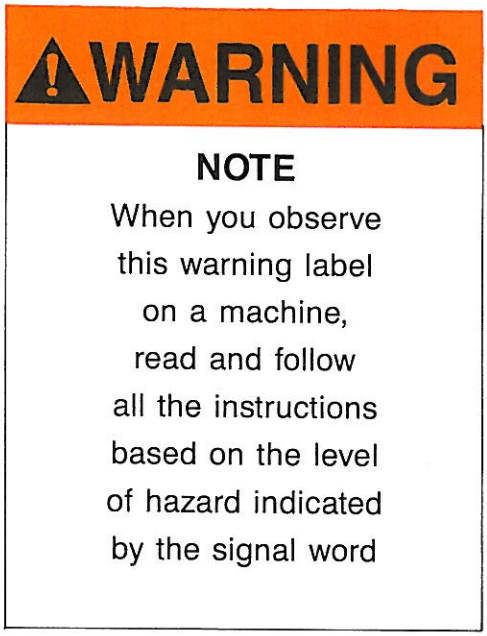
1. Entering any area which meets the definition of a confined space may create a serious hazard for a worker.
2. All maintenance and service procedures must be performed in strict accordance with OSHA standard #1910.146 (permit required confined space).

SPECIAL NOTE - All installation, service, maintenance and operations must be performed in strict accordance with OSHA's Standard for Control of Hazardous Energy (lockout/tagout) 29 CFR 1910.147.

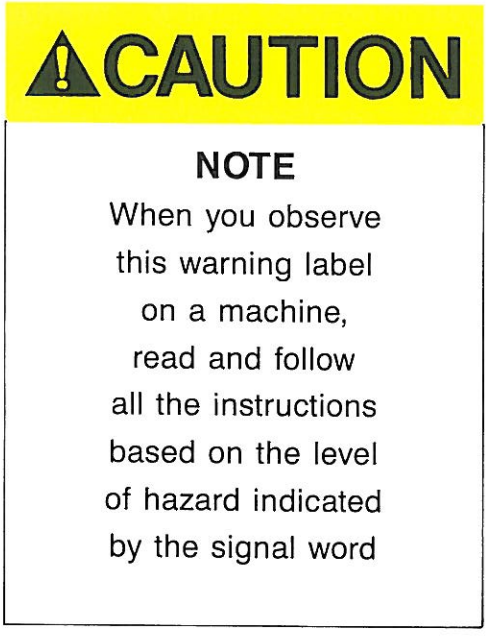
Warning labels with the following signal words will be appropriately located on APV machines. It is important that all personnel working on each machine read and understand the instructions on those labels and follow them for their own protection and safety. We are repeating the definitions of the various hazard levels as a reminder of the potential danger involved.



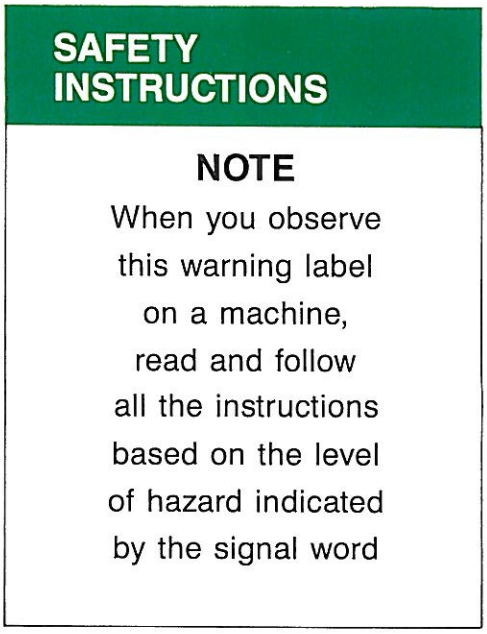
The use of the word "Danger" always signifies an immediate hazard with a high likelihood of severe personal injury or death if instructions, including recommended precautions, are not followed.



The use of the word "Warning" always signifies the presence of hazards or unsafe practices which could result in severe personal injury or death if instructions, including recommended precautions, are not followed.



The use of the word "Caution" signifies possible hazards or unsafe practices which could result in minor injury or damage to product or property if instructions, including recommended precautions, are not followed.



The use of the wording "Safety Instructions" signifies that the guidelines provided will assist in the safe operation of the machine or system.

Safety Information

The following information supplements the preceding GENERAL SAFETY INSTRUCTIONS and provides specific safety information on hazardous conditions which are inherent in the unit.

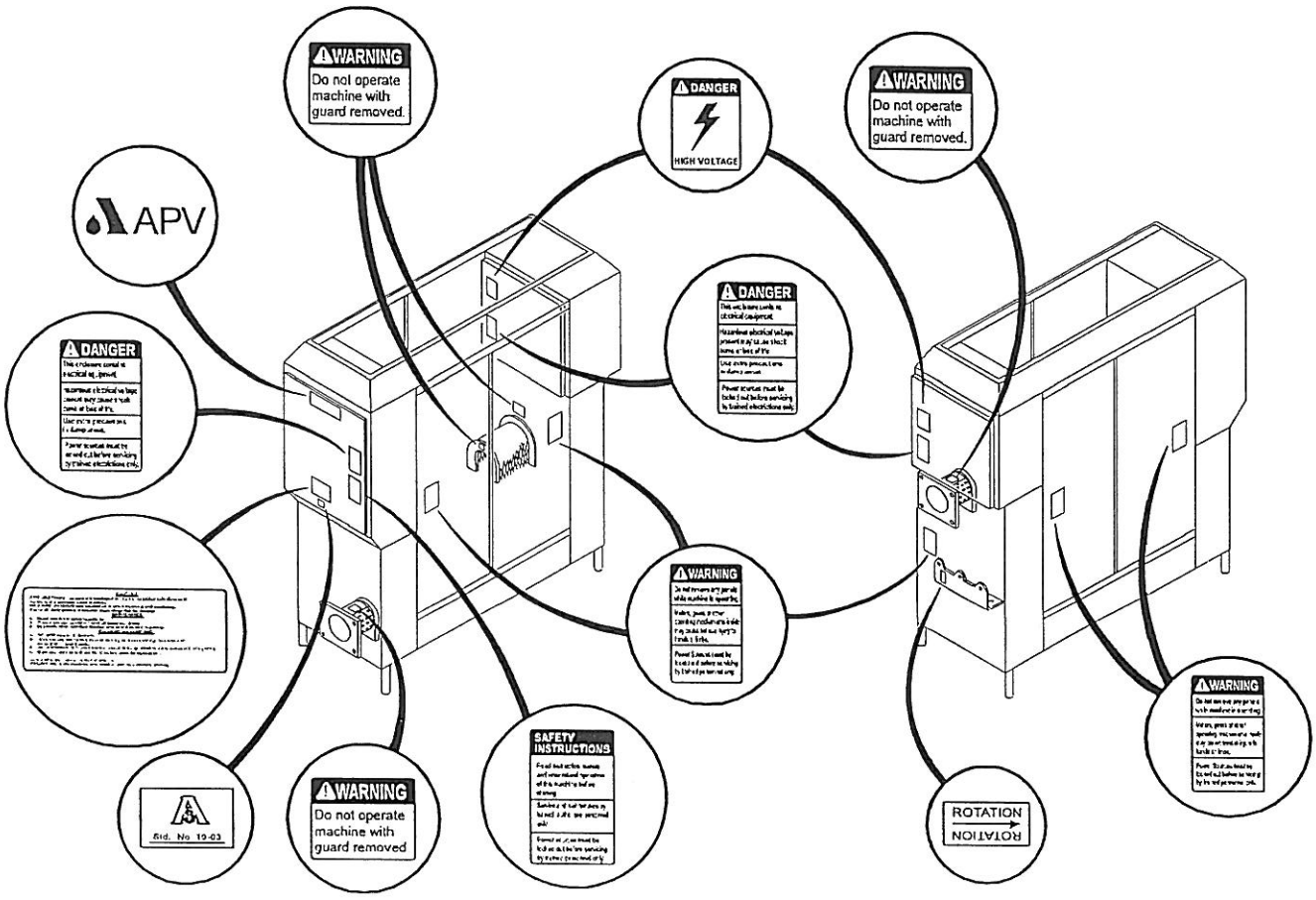
The unit is a mechanical freezing machine which by the very nature of its design creates certain unavoidable hazards. Safe installation, operation, and maintenance requires proper training of all personnel and their supervisors.

Our objective in providing instructions and warnings is to identify each area of potential hazards and its level of severity and to guide each worker for safe operation, service and maintenance procedures.

APV Crepaco equipment is designed to provide minimum operator access to hazardous areas while providing adequate access for service by trained personnel. Hazardous areas are provided with guards. Various types of fasteners may be used for the guards depending on how frequently routine access is required. Regardless of the type of fastener used, the mere existence of a guard should alert the worker to the presence of a hazard. Never operate or test run the equipment with a guard removed, unless under the supervision of properly trained and authorized personnel. Then use extreme caution to avoid the hazard.

Safety Decal Location

The illustration below shows the typical location of safety information decals attached to the unit. If any decal is removed or becomes unreadable, replace it immediately with a new decal.



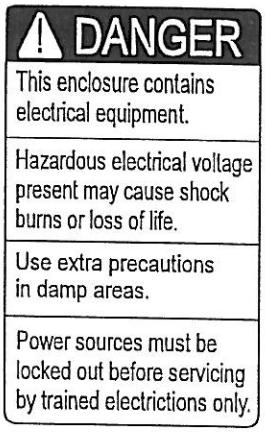
Typical Safety Decal Location

Safety Information

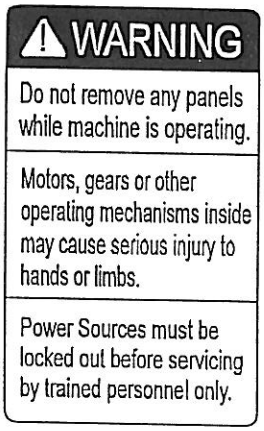
Safety Decals

The wording of the safety decals is shown below. If any decal is removed or becomes unreadable, replace immediately with a new decal.

681-P-419854



681-P-431691



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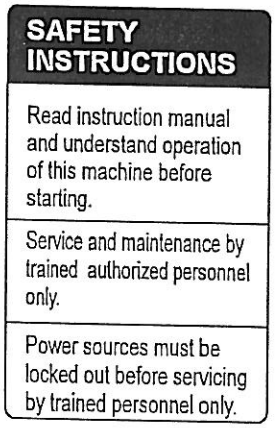

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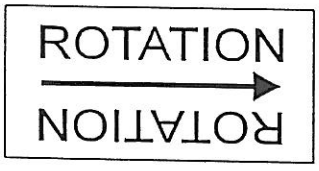
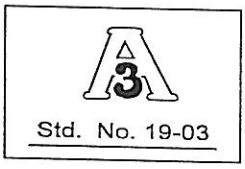


681-P-288335

681-P-151170



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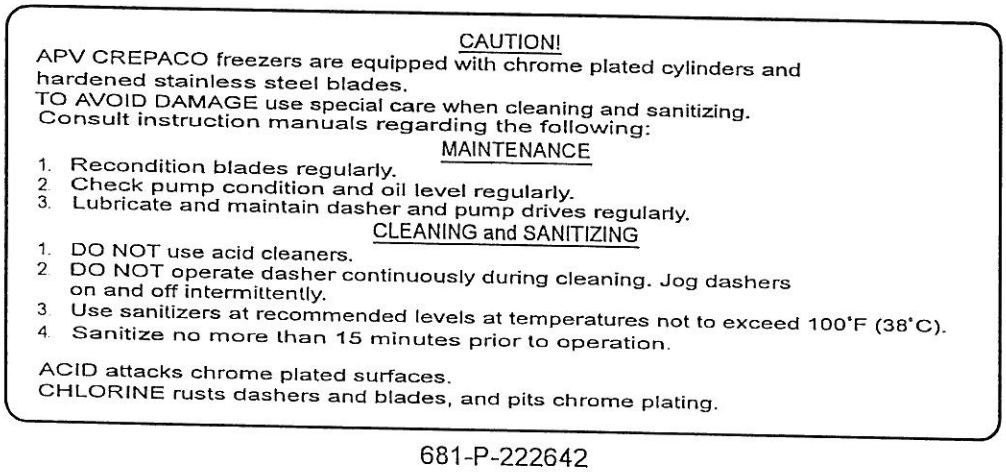

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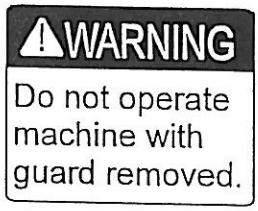


681-P-431689

Safety Decals

Safety Information

DANGER

Electrical Hazard

DANGER

DO NOT perform any maintenance or service on the unit unless the main and control power sources have been turned off and Locked Out using a locking device for which only the person performing the work has the key.

The unit is normally powered by electric motor(s) and have many other electronic controls and devices. In addition, electronic controls or devices may be added either at the APV Crepaco factory or at the installation site. This creates a hazard of electrical shock which could cause severe injury or even loss of life.

To minimize the risk of this hazard:

1. All electric/electronic installation must comply with all applicable codes and standards including those established by the Occupational Safety and Health Administration (OSHA).
2. All electric/electronic installation, maintenance, and service, must be performed by trained and authorized electricians only.
3. Install a main power disconnect On-Off switch that can be locked in the power-off position and the key removed. This will allow maintenance or service to be performed with no possibility of the power being accidentally turned on.
4. Check motor nameplate data to be certain that it matches the electrical supply, and that all wiring, switches, starters, and overload protections are correctly sized.
5. Thoroughly read the motor manufacturer's instructions before making installation.
6. Install an emergency shutoff switch within easy reach of the operator.
7. Make the installation suitable for a wet environment, including:
   a. Protection from flooding. Do not install in an area which could fill with water to a level which would contact the motor.
   b. Protection of all electric connections within a sealed junction box.
   c. Proper grounding of the motor.

DANGER

Mechanical Hazard

DANGER

DO NOT perform any maintenance or service on the unit unless the main and control power sources have been turned off and Locked Out using a locking device for which only the person performing the work has the key.

The unit has mechanical drive components which operates the dasher and pumps (belts, pulleys and couplings). All of these components are guarded and/or enclosed. However, it is necessary to remove the guards/enclosures to perform routine maintenance, cleaning or service procedures. These components are powered by electric motors which may start unexpectedly from a remote control signal. Should the unit start unexpectedly during these procedures severe injury or even loss of life could result.

DANGER

ALWAYS turn off the electrical power supply and Lock Out using a locking device for which only the person doing the work has the key before performing service or maintenance. Should the dasher start rotating unexpectedly during service and maintenance procedures severe injury or loss of life could result.

Rotating Coupling: Never remove the coupling guard(s) or service the coupling assembly without Locking Out the drive power source such that only the person involved has the key. Reaching in or around the coupling while the unit is running could cause severe injury or loss of life.

Safety Information

Dasher and Coupling

In order to assure maximum sanitary operating conditions or for certain maintenance and servicing procedures it is necessary to disassemble and assemble the dasher. The dasher assembly is large and heavy.

This creates a hazard of severe injury for anyone handling it incorrectly. Provide enough workers or mechanical lifting assistance to enable removing, installing, and servicing the dasher safely.

To minimize the risk of this hazard:

1. Only trained and authorized mechanics should perform maintenance or service work on the unit.
2. An emergency shutoff switch is installed within easy reach of the operator.
3. Always turn off the electrical power supply and Lock Out using a locking device for which only the person doing the work has the key before performing any of the following;
    a. Removing the stainless steel panels which protect the dasher and pump drive areas.
    b. Removing the guards from the motor coupling or from the front bearing.
    c. Performing any maintenance or service on the motor(s).
    d. Removing the front door, front bearing, or the dasher.
    e. Disassembling the pump cover or rotors.
    f. Assembling or disassembling the dasher.

Scraper Blades

The scraper blades assembled on the dasher must be sharp to work correctly. This creates a hazard of severe cuts for anyone handling the scraper blades incorrectly. Wear protective clothing for the hands and arms when handling the dasher assembly or the scraper blades. Avoid contacting the cutting edge of the scraper blades.

DANGER

All dashers have removable scraper blades. These blades can be very sharp and cause severe injury if not handled properly.

To minimize the risk of cuts from these sharp blades when removing and installing the dasher:

1. When removing the dasher by hand, always use heavy protective gloves (such as welders gloves) that reach to the elbows.
2. Always work with at least one other trained person when removing or installing the dasher.
3. Remove each blade from the dasher as soon as possible to remove the danger from others in the immediate area.
4. Always store the blades together in a labeled container when not in use.

DANGER

Ammonia Hazard

DANGER

Your unit uses ammonia as the refrigerant for freezing the product. Ammonia is a hazardous chemical which, when used incorrectly, can cause severe injury or even loss of life. Some specific hazards of ammonia are listed below.

1. Breathing of ammonia gas (concentration over 400 ppm, exposure time over 1 hour) can injure the respiratory system or, in severe cases, cause suffocation.
2. Extremely high concentrations of ammonia gas (over 4% by volume) are flammable by spark ignition and may explode.
3. Direct contact to eyes with ammonia liquid can cause blindness.
4. Direct contact to skin with ammonia liquid can cause severe burns.

Safety Information

Do not open any connection into the refrigeration system until all refrigerant is evacuated and the unit is isolated by closing the hand valves in the liquid and suction lines.

WARNING

A sudden release of refrigerant liquid sprayed on the skin can cause serious damage to skin tissue. Keep eyes and exposed skin areas away from any potential refrigerant discharge. If such a refrigerant burn occurs, flush immediately with cold water, apply ice packs if severe and see a physician at once.

Pressurized gas can be hazardous because of the energy latent in the pressure alone. Never fill any refrigerant gas cylinder completely with liquid. Always limit to approximately 80% liquid full. This will allow for normal expansion.

To minimize the risk of this hazard:

1. The refrigeration installation should comply with all applicable codes and standards including those established by OSHA.
2. The refrigeration installations must be performed only by pipe fitters trained and authorized for ammonia refrigeration systems.
3. Maintenance and service of the refrigeration system must be performed only by trained and authorized service personnel.
4. Install a hand operated shutoff valve in the line to each service connection to allow isolation of components during service or maintenance.
5. Thoroughly train all operating and maintenance personnel in the areas of:
   a. Use and care of personal protective equipment.
   b. The hazardous effects of ammonia.
   c. First aid procedures.

WARNING

When evacuating or purging any ammonia system always ventilate the area immediately. Concentrations of ammonia can cause severe injury or even loss of life. Extremely high concentrations of ammonia gas are flammable by spark ignition and may explode.

6. Develop and use a plant-wide program for the safe operation and maintenance of the ammonia refrigeration system and all associated equipment.
7. Provide personal protective equipment including protective clothing, eye protection, and respiratory protection.
8. Provide adequate ventilation for the processing area.
9. Provide first aid supplies.

Safety Information

WARNING

Cleaning Chemical Hazard

To properly clean and sanitize the unit for use with food products it may be necessary to use chemical solutions. Many of the commonly used chemical solutions could cause severe injury to personnel if contacted. The hazard is especially severe for eyes, skin, or inhalation.

To minimize the risk of this hazard:

1. Thoroughly train all personnel working with cleaning/sanitizing chemicals in their safe handling and disposal following use as required by OSHA's "Hazardous Materials Standard."

   Additional precautions are required during the use of cleaning or sanitizing chemical solutions to minimize the risk of personnel contact which could cause an injury.

2. During automatic cleaning/sanitizing:

   a. Check all line connections in the cleaning circuit to be certain they are connected and tightened before starting.

   b. Never disconnect any lines or fittings until it is known that the automatic cleaning sequence is completed and there is no chemical solutions or high temperature fluids present.

3. When using manual cleaning methods:

   a. Turn off the dasher power source and Lock Out before disassembling the unit.

   b. Equip all personnel using cleaning/sanitizing solutions with protective clothing including eye protection.

   c. Thoroughly train all personnel using cleaning/sanitizing in their safe handling and disposal after use.

   d. Never use toxic and/or flammable solvents for cleaning.

WARNING

Compressed Air Hazard

The unit uses compressed air for the following functions:

1. Added to the product to produce "overrun."

2. Operate the bypass covers on the product pumps.

3. Operate parts of the control system of the unit.

Compressed air creates certain unavoidable hazards. Compressed air may retain the power to move objects even after the supply is turned off. Air operated mechanical devices may operate unexpectedly from a remote control signal. If the air supply pressure exceeds design limits, plastic line connections could come apart and move around uncontrolled. These create a hazard of severe injury to personnel working in the area.

To minimize the risk of this hazard:

1. An installation of compressed air service must be performed by trained and authorized pipe fitters only.

2. All compressed air installations must comply with all applicable codes and standards including those established by OSHA.

3. Install a 150 psig safety relief valve in the compressed air supply.

4. Install a hand operated shutoff valve in the supply line to allow isolation of components before service or maintenance.

5. DO NOT perform any maintenance or service on the compressed air system components unless the supply valve to the system has been closed and locked or tagged.

Safety Information

DANGER

Halocarbon Hazard

DANGER

Your unit may use halocarbon as the refrigerant for freezing the product. Halocarbon is a hazardous chemical which, when used incorrectly, can cause severe injury or even loss of life.

If your unit uses halocarbon (freon) as a refrigerant for freezing the product, the following precautions are important. Halocarbon (R-12, R-22, or R-502) is colorless and clear in appearance with only a slight ethereal odor. It is heavier than air and thus displaces much oxygen needed for breathing. Thus it has the potential hazard of producing unconsciousness and even loss of life.

Do not open any connection into the refrigeration system until all refrigerant is evacuated and the unit is isolated by closing the hand valve in the liquid and suction line.

WARNING

A sudden release of refrigerant liquid sprayed on the skin can cause serious damage to skin tissue. Keep eyes and exposed skin areas away from potential refrigerant discharge. If such a refrigerant burn occurs, flush immediately with cold water, apply ice packs if severe and see a physician at once.

Refrigerants R-12, R-22, and R-502 are generally considered to be chemically nontoxic and nonflammable; however, any gas under pressure can be hazardous because of the energy latent in the pressure alone. Never fill any refrigerant gas cylinder completely with liquid. Always limit to approximately 80% liquid full, this will allow for normal expansion.

Used freon and other fluorocarbons (CFC's) should be recovered and recycled. CFC's are known to harm the ozone layer of the Earth's atmosphere.

To minimize the risk of this hazard:

1. The refrigeration installation must comply with all applicable codes and standards including those established by OSHA.
2. The refrigeration installation must be performed only by pipe fitter trained and authorized for halocarbon refrigeration systems.
3. Maintenance and service of the refrigeration system must be performed only by trained and authorized personnel.
4. Install a hand shutoff valve in the line to each service connection to allow isolation of components during service or maintenance.
5. Thoroughly train all operating and maintenance personnel in the areas of:
   a. Use and care of personnel protective equipment.
   b. The hazardous effects of halocarbons.
   c. First aid procedures.

WARNING

When evacuating or purging any system containing R-12, R-22, or R-502 always ventilate the area immediately.

6. Develop and use plant-wide program for the safe operation and maintenance of the halocarbon refrigeration system and all associated equipment.
7. Provide personnel protective equipment including protective clothing, eye protection, and respiratory protection.
8. Provide adequate ventilation from the processing area.
9. Provide first aid supplies.

Important Cautions

The following important cautions describe ways to avoid incorrect operating procedures which will cause serious damage to the unit.

CAUTION

Protect Chrome Cylinders

The inside surface of the freezing cylinder is chrome plated. Incorrect operating procedures may cause severe damage or rapid wear of the chrome surface and require an expensive cylinder replacement.

1. DO NOT operate dasher without product or water in the cylinder.
2. DO NOT operate dasher with worn scraper blades at less than the recommended width dimension.
3. DO NOT use any type of acid rinse. Acid attacks chrome.
4. DO use the cylinder protector whenever removing or installing the dasher.

CAUTION

Avoid Freeze-up

A freeze-up occurs when the product becomes too cold and too stiff. The resulting load on the dasher motor and drive components may cause severe damage to the dasher, belts, motor, and other drive components. If the dasher stops, the product inside the cylinder will freeze further, requiring defrosting procedure before production can resume.

In addition to the operation instructions to prevent freeze up:

1. DO NOT turn on the refrigeration without the dasher running.
2. DO NOT allow the supply of mix to the unit to stop during freezing operations.
3. DO NOT operate with product stiffness at greater than 100% motor load.
4. DO NOT turn on the refrigeration when water is present in the cylinder.
5. DO NOT leave the refrigeration on when flushing out with water.
6. DO NOT obstruct the unit outlet.

CAUTION

Beware of Sanitizing Solutions

Sanitizing solutions are extremely corrosive, especially those which contain halogen compounds (chlorine, bromine, iodine). Solutions of these chemicals, will attack the chrome surface of the freezing cylinder and the special hard alloy stainless steel scraper blades. To prevent serious damage:

1. DO NOT sanitize the unit sooner than 15 minutes immediately prior to starting production.
2. DO NOT leave sanitizing solutions in prolonged contact with any surface-product contact or exterior. As droplets dry out they become more concentrated and will cause corrosion pitting.
3. DO NOT use any type of acid sanitizer. Acid attacks chrome.

Important Cautions

CAUTION

Prevent Pump Damage

Incorrect operating procedures may cause damage or rapid wear to pump parts, especially the rotors and shafts. To obtain maximum service life of pump parts:

1. DO NOT operate the pumps dry (without water or product present).
2. DO NOT use a screwdriver or any other prying type tools when removing rotors. Use the rotor removal tool provided.
3. DO NOT operate product pump against excessive discharge pressure.
    a. Keep discharge lines short as possible.
    b. Use large as possible discharge lines.
    c. Use few as possible elbows, tees, and/or valves in the discharge line.
    d. Use wide sweep elbows wherever possible in the discharge line.

CAUTION

Prevent Dasher Damage

Incorrect operating and/or maintenance procedures may cause severe damage to the dasher, which is expensive to replace.

General Information

The unit is a heat exchanger designed for the commercial production of frozen dessert food products with added air (overrun). It includes highly engineered control systems for the control of air incorporation, frozen product stiffness, and product throughput.

Sanitary Design

Units are designed and constructed to meet the requirements of the 3-A Sanitary Standards for cleanability of dairy processing equipment.

Meeting these standards requires, in part, that materials of construction in product contract areas be stainless steel or other materials approved for food contact. All product contact surfaces must be smooth, free draining, and accessible for cleaning. The mechanical product components must be easy to disassemble for cleaning and/or inspection for cleanliness. The outer construction must prevent outside contaminants from draining or dripping into the product area.

Customer Furnished Components Services

The following summarizes the services required to install and operate the unit.

Electrical Service

Provide correctly sized electrical service including overload protection and Lock Out capability. Check the nameplate on the unit for specifications. Electrical service is required to operate the dasher drive motor(s), the pump drive motor(s), and the control panel(s), whether they are factory installed or customer supplied and mounted.

Refrigerant Service

Either ammonia (R-717) or halocarbon (R-22 or R-502) is required including liquid supply, suction return, and hot gas supply (to provide a means of defrosting).

Compressed Air

Instrument quality sanitary compressed air is required for addition to protect (overrun) and to operate certain components.

Product Supply

A supply of product mix is required under pressure to the unit's inlet.

Product Packing

Frozen product discharged from the unit is not packaged.

Piping

Piping must be well supported near the unit and in line with connection fittings so that no strain is put on the fittings. The use of large diameter lines and wide sweep elbows is recommended to keep discharge pressures to a minimum level.

The purchase and installation of all piping is the responsibility of the purchaser. This includes any valves, booster pumps, ingredients, cleaning solutions, and refrigerant which are routed to and from the unit.

Piping, valves, pumps, etc., may be purchased through the APV Crepaco sales offices serving you.

Cleaning Equipment

The unit is designed for mechanical cleaning. A pressurized supply of controlled temperature rinse water and cleaning chemical is required. A nearby hose station and floor drain is also recommended to aid cleaning.

The dasher must be removed routinely for cleaning and/or service. The dasher is heavy and is assembled with sharp scraper blades. Mechanical lifting equipment is recommended to assist dasher removal and installation for the larger models.

General Information

Receiving and Inspection

1. APV Crepaco equipment is run tested or inspected prior to shipment. When leaving the factory, it is well crated for normal transportation procedures. APV Crepaco cannot, however, guarantee safe arrival. Therefore, upon receipt of this equipment, check the received items against the packing list for damage or missing parts. Check the packing material thoroughly for small parts.

2. Visually inspect for damage or loss. Damage or loss should be reported immediately to the delivery carrier while present. Following the immediate notification of the lost or damaged parts, a detailed description including quantity, description of the loss or damage, and a cash value should be claimed against the carrier with respect to the guidelines set forth by the responsible carrier's policies. APV Crepaco's responsibility terminates F.O.B. point of manufacture unless otherwise specified per the General Terms and Conditions of Sale as published by APV Crepaco and amended from time to time. Contact APV Crepaco Order Services if shipping information is required for handling claims.

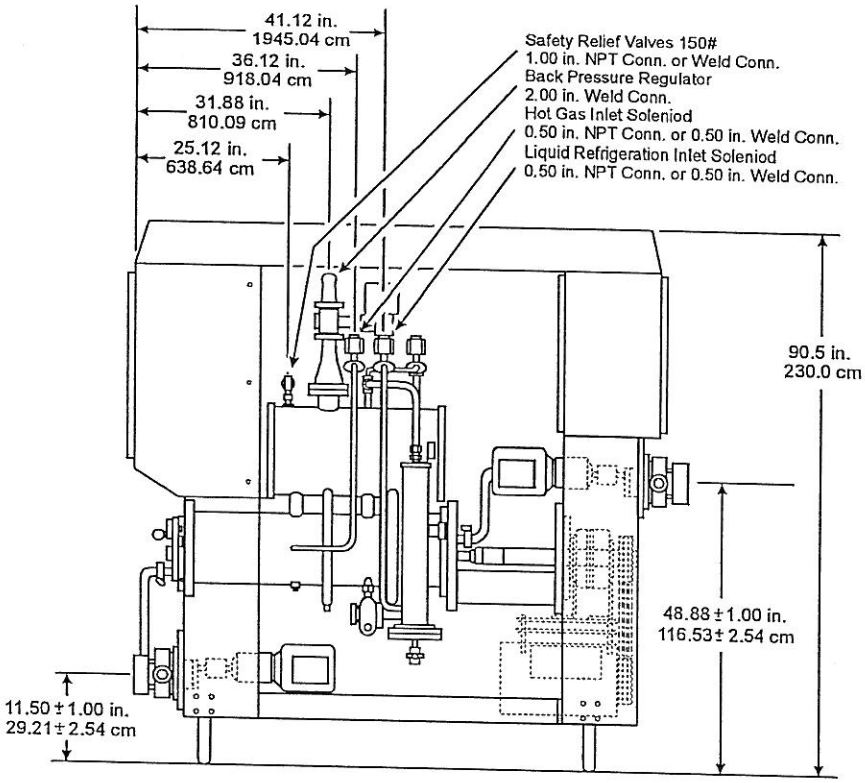
3. In the case of damage or loss to the equipment, APV Crepaco may perform three major functions:

   a. **Manufacturer Function** - APV Crepaco manufactures quality equipment and stands behind the APV Crepaco Standard Warranty. Refer to the Standard Warranty.

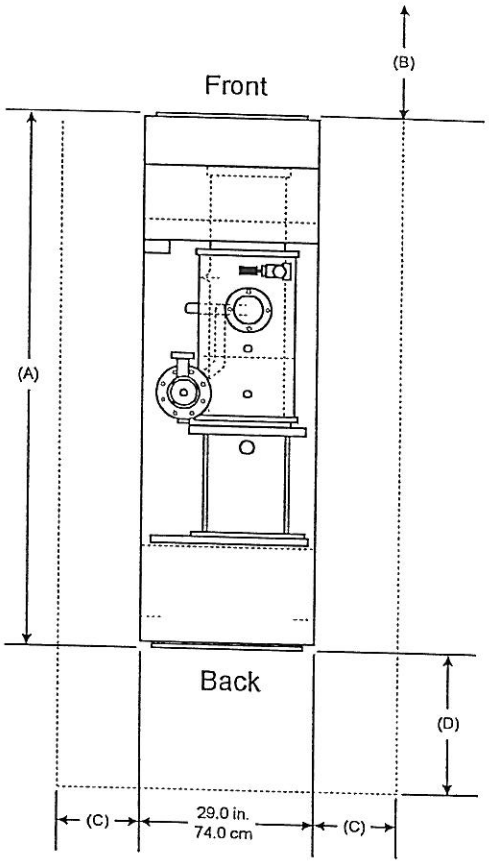
   b. **Assessor Function** - APV Crepaco offers assessment services for filing claims. The APV Crepaco assessor will accurately determine the extent of the damage (or loss), and cost of repairs to the equipment. Reimbursement for this service will be agreed upon prior to the assessment.

   c. **Repair House Function** - APV Crepaco offers services for repairing the damage(s) or replacement of loss(es) to the equipment. APV Crepaco has the option to alter the Standard Warranty on refurbished or replacement parts. The cost of this service will be dependent upon the assessment that is made.

WS Series Ice Cream Freezer Installation Prerequisites



Side View



Top View

Overall Dimensions of Freezer

Model		WS-06	WS-08	WS-12	WS-15
Length	(A)	88 in. (224 cm)	90 in. (229 cm)	109 in. (277 cm)	128 in. (325 cm)
Height		90.5 in. (230 cm)	90.5 in. (230 cm)	90.5 in. (230 cm)	90.5 in. (230 cm)
Width		**1 Cylinder**	**2 Cylinder**	**3 Cylinder**	
		29 in. (74 cm)	58 in. (147 cm)	87 in. (221 cm)	

Minimum Clearance Around Freezer for Servicing

Front	(B)	47 in. (119 cm)	44 in. (112 cm)	63 in. (160 cm)	82 in. (208 cm)
Side	(C)	18 in. (45.72 cm)	18 in. (45.72 cm)	18 in. (45.72 cm)	18 in. (45.72 cm)
Back	(D)	30 in. (76.2 cm)	30 in. (76.2 cm)	30 in. (76.2 cm)	30 in. (76.2 cm)

Electrical Considerations

Pumps

"R" Series	0.5	2.0	2.5	2.5
Mix Pump	2 hp (1.5 kw)	2 hp (1.5 kw)	2 hp (1.5 kw)	2 hp (1.5 kw)
Product Pump	2 hp (1.5 kw)	2 hp (1.5 kw)	3 hp (2.2 kw)	3 hp (2.2 kw)

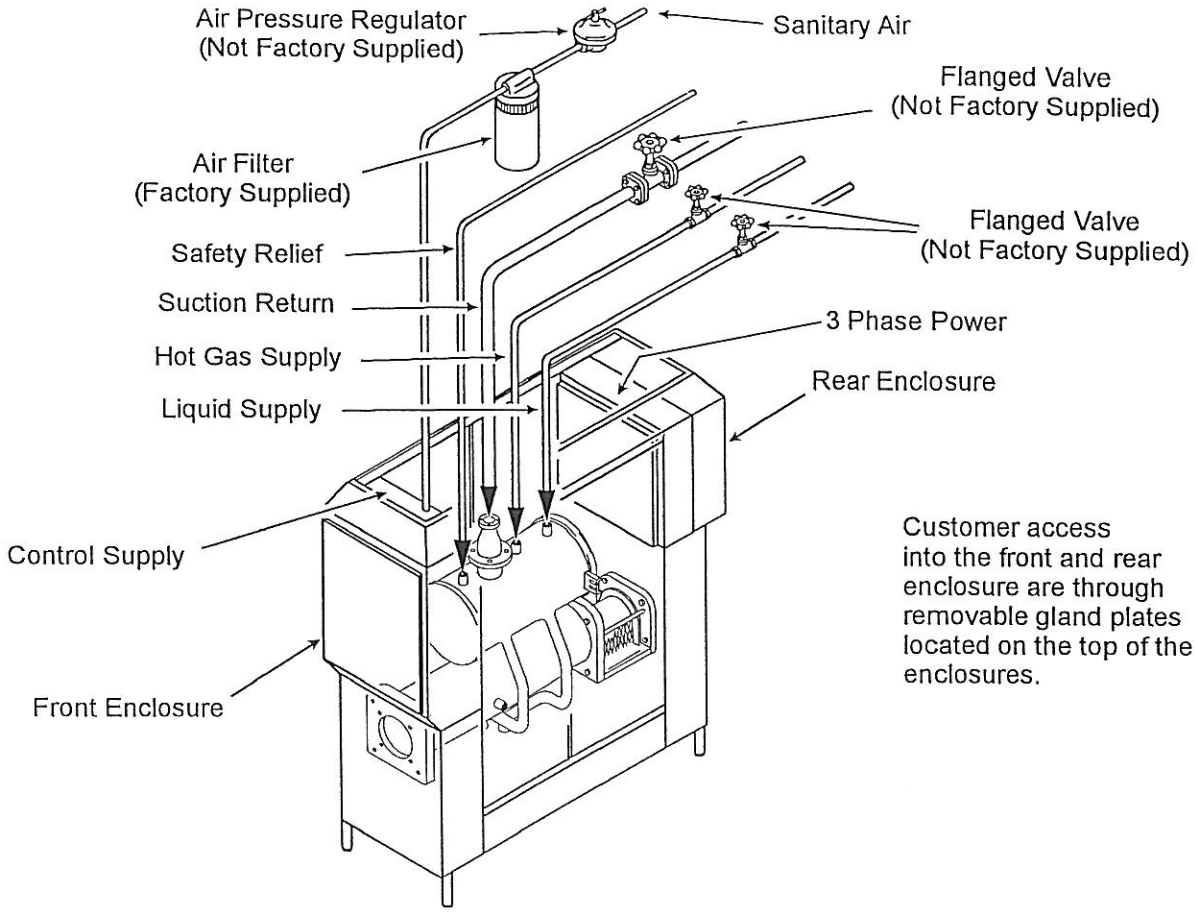
Dasher Drive

#30 Type G	20 hp (15 kw)	20 hp (15 kw)	30 hp (32 kw)	30 hp (32 kw)
#80 Type E	20 hp (15 kw)	25 hp (19 kw)	30 hp (32 kw)	

Control Power Required: 110 Vac @ 8 amps or 220 Vac @ 4 amps single phase 50/60 Hz

Motor Starters Required (Not Factory Supplied): (1) Dasher drive, (2) Pump drives, (1) Booster pump, (1) Pre-aerator (optional)

WS Series Ice Cream Freezer Installation Prerequisites



Customer access into the front and rear enclosure are through removable gland plates located on the top of the enclosures.

Piping Considerations

Model	WS-06	WS-08	WS-12	WS-15
Product				
Mix Inlet	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)
Product Outlet	1.5 in. (3.81 cm)	1.5 in. (3.81 cm)	2.0 in. (5.08 cm)	2.0 in. (5.08 cm)
Mix to be supplied to unit at 35 psig. (Inlet/Outlet=APC PV weld and fittings supplied)				
Sanitary Air				
Air Supply	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)
Refrigerant				
Liquid Line	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)
Suction Line	2.0 in. (5.08 cm)	2.0 in. (5.08 cm)	3.0 in. (7.62 cm)	3.0 in. (7.62 cm)
Hot Gas	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)	0.5 in. (1.27 cm)
Relief Valve	1.0 in. (2.54 cm)	1.0 in. (2.54 cm)	1.0 in. (2.54 cm)	1.0 in. (2.54 cm)
Refrigerant and air supply line connections are NPT (National Pipe Threads) or weld.				

Refrigeration (Ammonia/Freon)

-28 F	8.8 tr	13.3 tr	20 tr	26.7 tr
(-33 C)	(26,611 kcal)	(40,320 kcal)	(60,480 kcal)	(80,640 kcal)

tr=tons of refrigeration **kcal=kilo calories**

Sanitary Air Supply Considerations

Pressure	90 psig	90 psig	90 psig	90 psig
	75 scfh	100 scfh	150 scfh	200 scfh
	2123 slph	2832 slph	4247 slph	5663 slph

psig=pounds per square inch gauge **scfh=cubic feet/hour** **slph=liters/hour**

Other Considerations

Warm water supply near the unit for cleaning purposes, and adequate floor drain near the unit.

Installation

DANGER

Install the unit in an area with good ventilation. The possibility of leaking refrigerant liquid or gas creates a hazard of severe injury or loss of life when installed in areas with poor ventilation, see Ammonia Hazard section.

When installing the unit, consider these items before locating the unit:

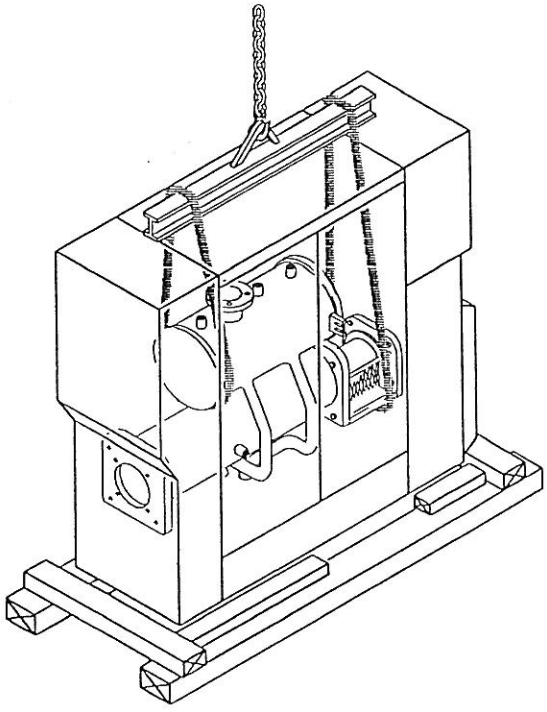
1. Install the unit in a location with good lighting and clearance around it for maintenance and operation.
2. Locate with consideration for required service connections. Keep service supply lines as short and direct as possible for optimum operating efficiency.
3. Locate close to associated process equipment to minimize piping between equipment and minimize pressure build up through lines.
4. Locate near floor drains with a hose station nearby.

Uncrating and Leveling

1. Remove the crating, but leave the unit on the skid.
2. Move to plant installation site and place in position.
3. Remove stainless steel panels from the sides of the unit.
4. Removed lag bolts which hold the unit onto the skid.

When installing multiple units, refer to the Merging Procedure for Units, found at the end of the Installation section. Then continue with step 5.

5. Raise the unit by lifting at the proper locations.



Lifting Equipment Lift Point

WARNING

If the lifting equipment slips or breaks, severe injury may result. Make sure lifting equipment is rated for the weight of the unit. Only trained personnel should operate the lifting equipment.

CAUTION

Do not place the lifting straps outside of the shroud. The lifting straps must be placed inside of the shroud to prevent damaging the shroud when lifting.

Installation

CAUTION

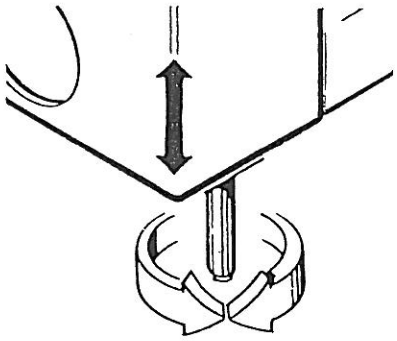
Dropping the unit or twisting the frame by uneven lifting may cause misalignment of critical parts or otherwise damage the unit. Lift carefully and evenly at all locations.

6. Remove the skid from under the unit.

7. Lower the unit slowly until the adjustable legs just touch the floor.

CAUTION

The weight of the unit must still be supported by the lifting equipment when proceeding to the next step.



Turn Leg Clockwise or Counterclockwise

Adjustable Leg

8. Level the unit by turning the leg clockwise or counterclockwise. When correctly positioned, the unit should be level from side to side and have a slight pitch end to end so that water drains out the front of each cylinder. This is an approximate 1/16 inch per foot slope. The bottom tubular frame members are the same level as the unit cylinder(s) and may be used for leveling.

9. Check each adjustable leg. Make sure they are all firmly against the floor when leveling is finished.

Sanitary Compressed Air Service

WARNING

Incorrect compressed air service installation may cause system components to fail or come apart with explosive force and result in severe injury to personnel working in the area, see Compressed Air Hazard section.

The following must be considered during installation:

1. All installation must be by trained and authorized pipe fitters only.

2. The installation must comply with all applicable codes and standards including those established by OSHA.

3. Install a hand operated shutoff valve in the supply line to allow isolation and depressurization of components before service or maintenance.

Uses For Sanitary Air

Sanitary compressed air is required for addition to the product (overrun) and to operate certain mechanical devices on the unit. One common connection point supplies air for all the various uses even on multiple cylinder units.

Sanitary Air Required

Air supply intended for direct addition to products for human consumption must be "sanitary quality." If milk or milk products are being processed, the air must be oil, dirt, and moisture free.

Installation

An air filter with automatic drain is supplied with the unit. It does not remove oil, dirt and moisture to the extent required by the above standards. Its purpose is to provide back-up protection in the event of a failure in the system.

Sanitary disposable media discs (filter discs) and a sanitary product check valve, as required by the standards, are supplied as part of the unit.

Regardless of the product, the air must be "instrument quality" to ensure trouble free operation of the controls on the unit.

Basically this standard requires:

1. Maximum particle size of 3 microns.

2. Dew point at line pressure-minimum of 18.0 F below the lowest expected temperature in process area, and under no circumstances higher than 36.0 F.

3. Maximum oil/hydrocarbon content (exclusive of noncondensibles) 1 ppm.

An excellent way to improve the air supply and reduce the load on the filters is to use compressor source air from a cold storage room at approximately -20.0 F.

Required Pressure/Volume

Recommended supply pressure is 90 psig at the inlet connection to the unit.

Required Connection

Connect the sanitary compressed air supply to the inlet connection of the filter/trap provided.

Refrigerant Service Connections

Line Sizes and Location

Use line sizes equal to or larger than the connection size provided. Do not use smaller line sizes, which will restrict flow and cause inefficient operation. Supply headers for units with more than one cylinder must be larger.

DANGER

Incorrect refrigerant service installation may cause leaks which could result in severe injury or loss of life. All refrigerant service installation (Ammonia Hazard section) must be performed by trained and authorized trades-persons only. The installation must comply with all applicable codes and standards including those established by OSHA.

Each connection is labeled with a tag. If the tags are missing or if you are uncertain of the correct connections, contact your nearest APV Crepaco sales office or the APV Crepaco Sales and Services at the manufacturing facility for assistance.

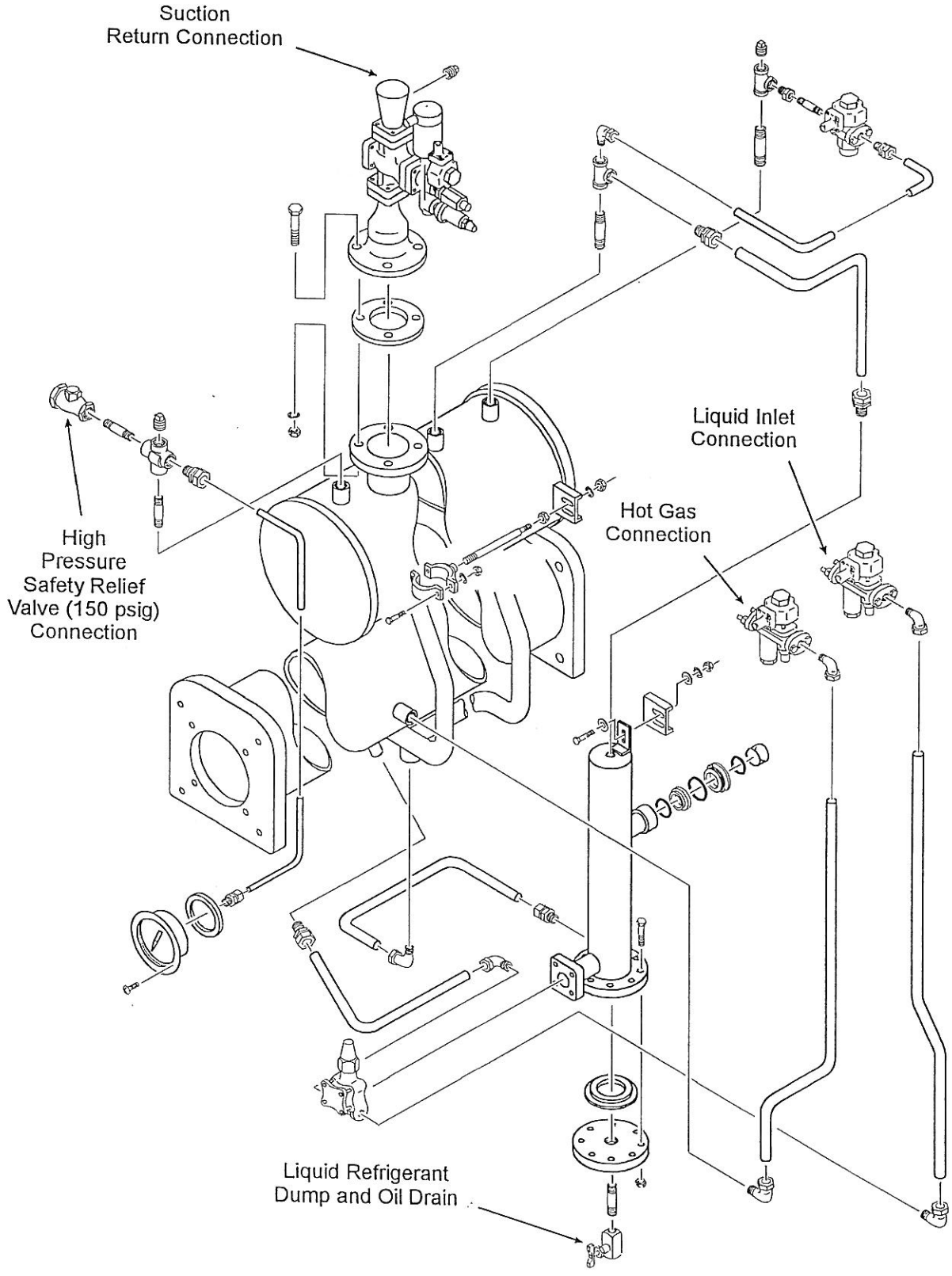
Required Connections

Liquid Supply

1. Connect the liquid refrigerant supply to the liquid inlet connection of the unit as shown on the next page.

2. The in-line filter is factory installed on the unit. The hand shutoff valves and piping are not supplied.

Installation



Refrigerant Supply Connections

Installation

Suction Supply

1. Attach the refrigerant suction supply to the weld flange connection bolted to the back-pressure valve. See illustration on the previous page.

2. Install a hand shutoff valve and compound pressure gauge (supplied by the customer) in the line near the back-pressure valve. As a safety measure, remove the handle of the hand shutoff valve to prevent accidental line blockage.

3. Recommended suction pressure is 0 psig.

Safety Relief Valve

Connect the safety relief valve to the outside atmosphere using an unobstructed, separate line with no shutoff valves. The valve has a 150 psig rating.

DANGER

Failure to connect the safety relief valve or incorrect installation may cause release of refrigerant and severe injury or loss of life.

When installing piping to the Safety Relief Valve:

1. DO NOT connect the relief line to the suction supply header.

2. DO NOT vent the relief valve inside any building.

3. DO NOT manifold more than one relief line together.

Hot Gas Defrost

Connect the hot gas supply inlet to a source of high pressure refrigerant gas-typically from the compressor discharge line. A 100 psig supply is recommended.

A solenoid valve and throttling valve are supplied with the unit. They control the flow of hot gas which is used to defrost the unit in the event of a freeze-up. The needle valve should be adjusted to provide minimum flow necessary to accomplish defrost.

Liquid Refrigerant Dump Line and Oil Drain

This connection is provided as a purge point to allow the removal of oil and/or water contamination from the system evaporator (freezing cylinder). It is located at the lower end of the float chamber. It may be connected to a permanently installed "supplementary oil pot system" or left unconnected for intermittent use with temporary connection.

DANGER

Incorrect use of the liquid refrigerant dump line and oil drain could release hazardous quantities of liquid refrigerant or gas and cause severe injury or loss of life. Only trained and authorized service or maintenance personnel should use this connection.

Test For Leaks

Following installation of refrigeration service, check system for leaks before starting production with the unit.

Installation

Electrical Connections

DANGER

Incorrect electrical installation can cause an electrical shock which may result in severe injury or loss of life. All electrical/electronic installation must be performed by trained and authorized electricians only. All electrical/electronic installation must comply with all applicable codes and standards including those established by OSHA.

Wiring Diagrams

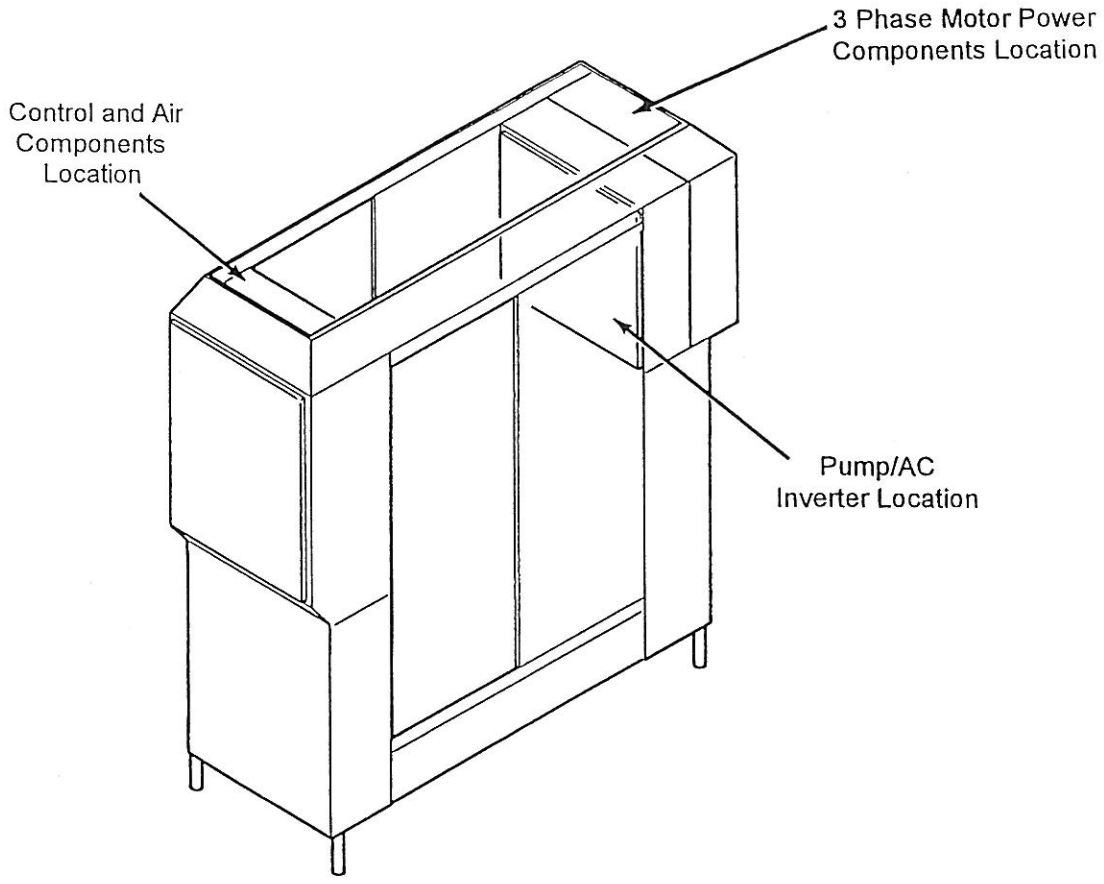
Wiring diagrams are included at the end of this manual. In addition, an electrical information plate is attached to the unit. This plate shows the electrical specifications for the motors and the control system.

Main Power Disconnect/Lock Out

Provide a main power disconnect with Lock Out capability. That is a disconnect which can be locked in the power off position and the key is removed. This will allow service and maintenance to be performed with no possibility of someone accidentally starting the unit.

Wet Environment

Make sure installation is suitable for wet environment.



Location of Electrical Enclosures

Installation

Required Connections

The following electrical installation connections are required for each cylinder of the unit:

1. Main Power Supply: Required for the dasher drive motor and the pump drive motors. Motors starters are optionally supplied with the unit. If not, they must be supplied and mounted by the customer in a location apart from the unit, or in the rear enclosure. Switching circuits for the motor starters (24 Vdc) are included in the unit control panel.

    a. Thoroughly read the motor manufacturer's instructions (shipped with the unit) before making installation.

    b. Check motor nameplate data and the electrical information plate.

The electrical specifications shown must match the electrical supply. If not, contact your nearest APV Crepaco sales office or the APV Crepaco manufacturing facility.

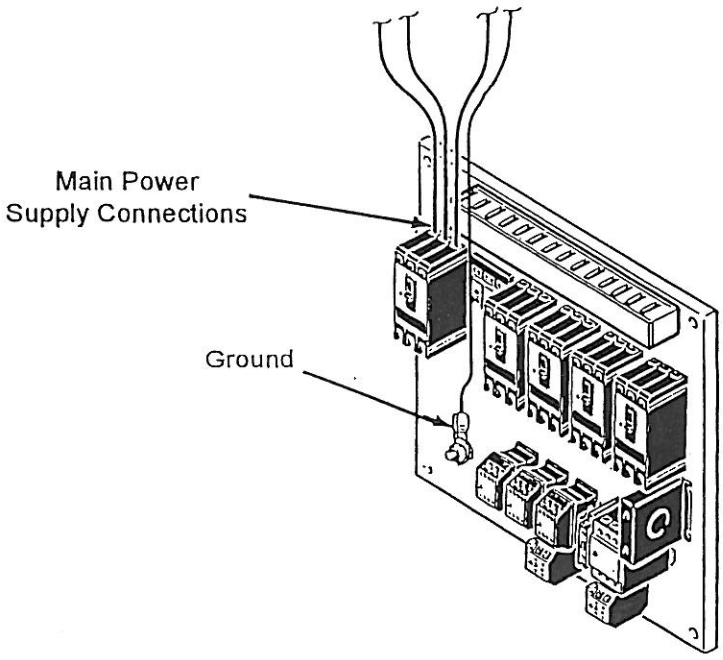
c. All wiring, switches, starters, and overload protection must be correctly sized for the power supply and the nameplate rating of the motors.

d. Connect main power for the motors to the terminals provided in the rear wiring enclosure (left side of unit, at rear). Cut holes in the enclosure at the removable gland plate for the power supplies, use watertight connectors.

e. Correct dasher drive motor rotation is counterclockwise facing the motor shaft. (See Unit Preparation for checking rotation.)

f. Control power supply (220 Vac or 110 Vac) is required to be installed through the removable gland plate, into the front electrical enclosure. See electrical drawings.

g. Correct mix pump motor rotation is counterclockwise facing the motor shaft. Correct product pump motor rotation is clockwise facing the motor shaft. (See the Unit Preparation section for checking rotation.)



Main Power Supply Connections
(Factory Supplied Starters Optional)

Installation

Control Power Supply-Instrumentation

1. Check power supply. It must match the specifications shown on the wiring diagrams and the electrical information plate. If not, contact your nearest APV Crepaco sales office or the APV Crepaco manufacturing facility.

2. Install a fuse in the power supply with a maximum size as shown on the wiring diagram.

3. Connect control power wiring as shown on the field installation diagrams located in the back of this manual.

4. A 24 Vdc signal is provided for the motor starters which is included in the unit controls. An output is supplied for the dasher motor, pump motors and for a mix booster pump which is not part of the unit.

The following table lists the maximum length and cross sections for ground cable.

Length Of Ground Cable	Minimum Wire Sizes	Resistance at Minimum Cross Section
10 ft.	8 Awg	0.006 ohms
100 ft.	8 Awg	0.06 ohms
1,000 ft.	6 Awg	0.4 ohms
2,000 ft.	4 Awg	0.51 ohms

Ground Cable Resistance and Wire Size

5. Connect wires from the motor starter coils to the terminal strip locations as shown on the wiring diagram.

Units Shipped Without Motors

If the unit is shipped without the dasher drive motor and the pump drive motor, additional installation wiring is required as follows:

1. Connect the wires provided to the motors and to the terminal strips in the rear wiring enclosure as shown in the electrical wiring diagram.

2. Connect the motor lead wire for the dasher motor through the current transducer/transformer located in the rear wiring enclosure as shown in the electrical wiring diagram. For the correct wiring procedure, refer to the Current Transducer Winding and Calibration section.

Current Transducer Winding

A current transducer is used to continuously measure the amount of current load being used by the dasher motor. The amount is displayed on the control panel.

For the instruments to work correctly, the current transducer must be connected as described in the Current Transducer Winding and Calibration section. Correct connection varies depending on the full load current rating of the motor, and the type of motor starter used (whether or not a wye [star] delta type).

If the unit is supplied from the factory with the dasher drive motor(s) installed, this wiring has already been installed. If the unit is supplied from the factory without the dasher drive motor(s) the wiring must be field installed.

Also use this procedure any time the transducer is replaced or any time the dasher drive motor is replaced with one which has a full load current rating different from the replaced motor.

Installation

Current Transducer (0-100 Amp) Winding and Calibration Instructions

The following procedure is only used when a current transducer is present.

1. The calibration value for the ZERO point (4 mA) is labelled Z. Z = 0% motor load.
2. Determine the full load current rating (amps) of the motor. This can be found on the motor name plate. Label this value I_M.
3. Divide 100 by I_M and drop any fractional part to determine the number of turns of wire that must pass through the opening of the transducer. Label this value T.
4. Divide 10,000 by (I_M x T) to determine the calibration value for the span point (20 mA) rounding off to the nearest whole number. Label this value S.
5. Value S = % motor load.

Example 1

1. Z = 0% motor load.
2. I_M = 32.2 amps.
3. $$\frac{100}{I_M} = \frac{100}{32.2} = 3.1$$

   T = 3 Turns
4. $$\frac{10{,}000}{I_M \times T} = \frac{10{,}000}{32.2 \times 3} = 103.52$$

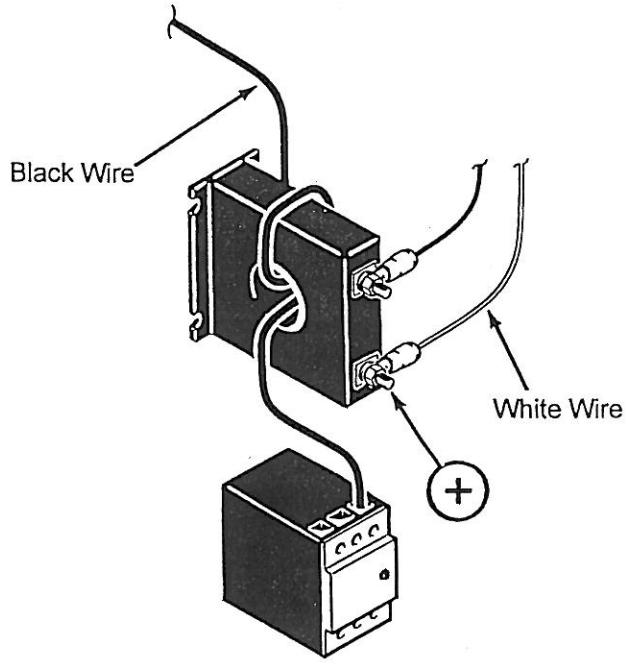
   S = 104% Motor Load

Example 2

1. Z = 0% motor load.
2. I_M = 25.4 amps.
3. $$\frac{100}{I_M} = \frac{100}{25.4} = 3.9$$

   T = 3 Turns
4. $$\frac{10{,}000}{I_M \times T} = \frac{10{,}000}{25.4 \times 3} = 131.2$$

   S = 131% Motor Load



Dasher Motor Starter Optional

Current Transducer (0-100 Amp)

Installation

Product Piping

The following items should be considered when installing any piping to and from the unit:

1. Independently support and align the mix supply and product pump piping. Do not support piping from pump connections.

2. Use mix supply line size equal to or larger than the connection size on the mix pump.

3. Install the discharge piping to keep the discharge pressure as low as possible.

4. Arrange piping to provide clearance for maintenance procedures.

CAUTION

High discharge pressure for the unit product pump will decrease service life of pump parts. Keep the discharge pressure as low as possible by using short direct lines, large as possible line size, and few as possible elbows, tees, and valves in discharge line. Use sweep els in place of narrow radius els.

5. Use the table below as a guide for selection of discharge line size based on the highest expected flow rate. For line lengths and flow rates between listed values, use the next higher value.

Recommended Minimum Size for Discharge Line			
Product Flow Rate - up to -	Line Length (with three els)		
	10 ft.	20 ft.	30 ft.
130 gph	1.5 in.	1.5 in.	1.5 in.
260 gph	1.5 in.	1.5 in.	2.0 in.
400 gph	2.0 in.	2.0 in.	2.5 in.
530 gph	2.0 in.	2.5 in.	2.5 in.
660 gph	2.5 in.	2.5 in.	3.0 in.
800 gph	2.5 in.	3.0 in.	3.0 in.

Product Discharge Line Size

Installation (Merging Procedure for Units)

1. Remove both the left and the right units from the their shipping crates. The proper uncrating procedure can be found in the instructions included with each unit.

2. Lift the left unit so that the legs are approximately one inch off the floor.

3. Place two wooden blocks under the front and rear frame supports on the merging side of the left unit. The blocks should be placed in such a way, that when the unit is lowered, the legs on the merging side are a maximum of 1/2 inch off the floor.

4. Remove both leg blocks and legs on the merging side of the left unit.

5. Remove the front-to-rear support bar from the merging side of the left unit and leave it off permanently.

6. Install the spacer blocks (using the double sided adhesive tape, taped side) on the merging side of the left unit. Make sure the holes on the spacers are directly aligned with the holes in the unit.

   a. The round spacers should be placed on the top-front and top-rear of the unit.

   b. The rectangular spacers should be placed on the bottom-front and bottom-rear of the unit.

7. Lift the right unit just high enough to enable temporary removal of the front and rear leg blocks from the merging side of the unit.

8. Remove the leg blocks and legs from the merging side of the right unit.

When the leg blocks are removed, the support bar will remain attached to the rear frame support, however the support bar will no longer be attached to the front frame support at this time.

Do Not remove the support bar from the right unit. It will remain on this unit.

9. With the left unit still on blocks, position the right unit next to the left unit.

DANGER

Do Not place fingers in holes or use fingers for aligning purposes. Severe injury may result.

10. From inside the left unit, place a 16 mm hex head bolt (with flat washer on bolt) through the **top-rear** hole in the frame support. Align the right unit with the left unit so that the bolt protrudes through:

    a. The **top-rear** left unit frame support.

    b. The **top-rear** spacer.

    c. The **top-rear** right unit frame support.

    When the bolts protrude through the right unit, install flat washers, lock washers and nuts, on the bolts. Secure the nuts hand tight only.

11. From inside the left unit, place four 12 mm hex head bolts (with flat washer on bolts) through the **bottom-rear** holes in the frame support. Align the right unit with the left unit so that the bolts protrude through:

    a. The **bottom-rear** left unit frame support.

    b. The **bottom-rear** spacer.

    c. The **bottom-rear** right unit frame support.

    d. The right unit replaced rear leg block.

    When bolts protrude through the right unit leg block, install flat washers, lock washers and nuts, on the bolts. Secure the nuts hand tight only.

Installation (Merging Procedure for Units)

DANGER

Do Not place fingers in holes or use fingers for aligning purposes. Severe injury may result.

12. From inside the left unit, place a 16 mm hex head bolt (with flat washer on bolt) through the **top-front** hole in the frame support. Align the right unit with the left unit so that the bolt protrudes through:

    a. The **top-front** left unit frame support.

    b. The **top-front** spacer.

    c. The **top-front** right unit frame support.

    When the bolts protrude through the right unit, install flat washers, lock washers and nuts, on the bolts. Secure the nuts hand tight only.

13. From inside the left unit, place four 12 mm hex head bolts (with flat washer on bolts) through the **bottom-front** holes on the frame support. Align the right unit with the left unit so that the bolts protrude through:

    a. The **bottom-front** left unit frame support.

    b. The **bottom-front** spacer.

    c. The **bottom-front** right unit frame support.

    d. The **bottom-front** right unit front-to-rear support.

    e. The right unit replaced front leg block.

    When bolts protrude through the right unit leg block, install flat washers, lock washers and nuts, on the bolts. Secure the nuts hand tight only.

14. Shift the right unit until the front of both units are parallel and flush.

15. Tighten the top 16 mm bolts (2) to a torque of 135 lbs./sq ft.

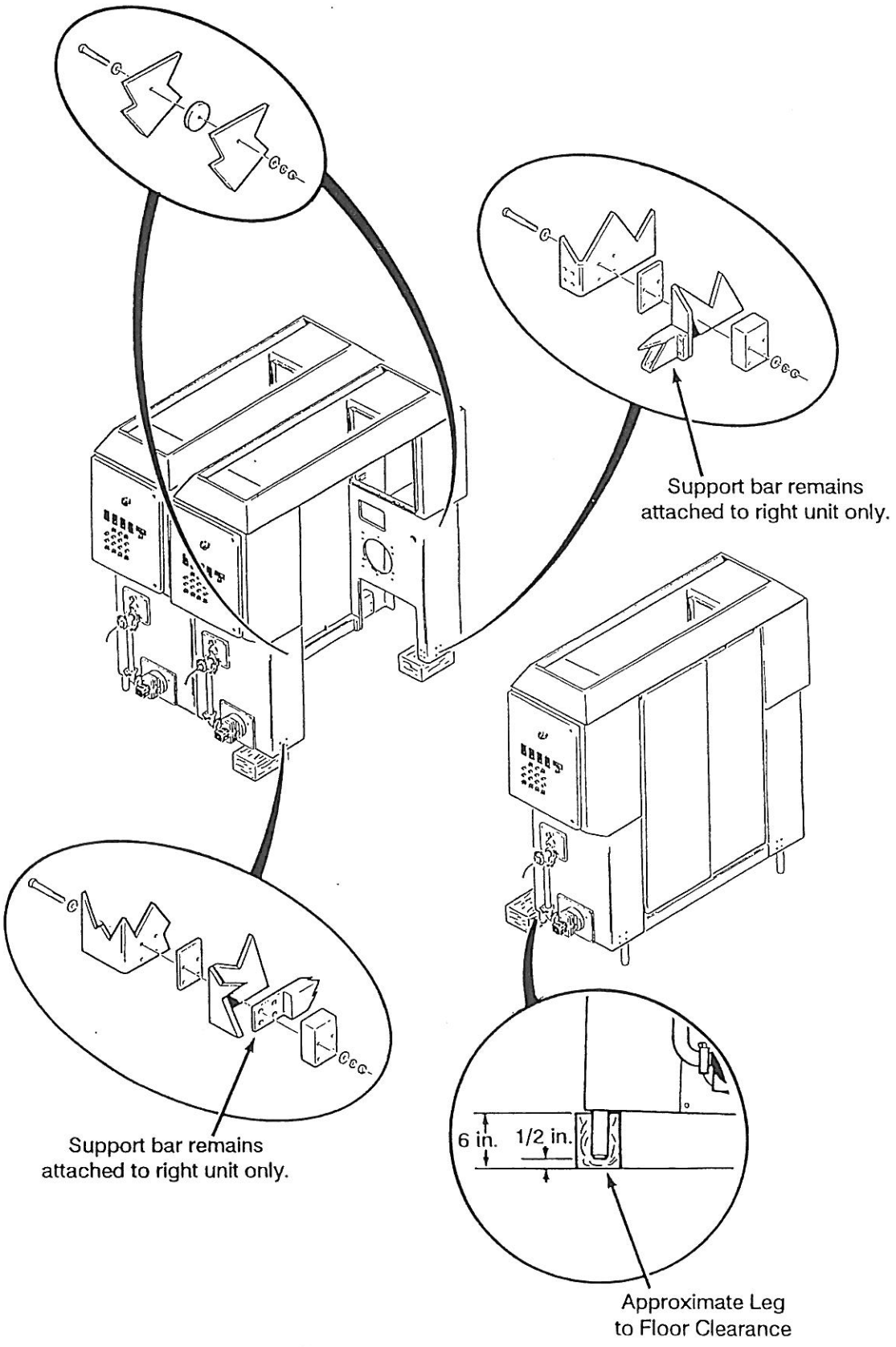
16. Tighten the bottom 12 mm bolts (8) to a torque of 55 lbs./sq ft.

17. When all bolts are tightened securely, raise the entire unit just enough to allow removal of the two wooden blocks.

18. The left unit and the right unit are now merged into one unit.

Repeat this procedure when merging any multiples of units together.

Installation (Merging Procedure for Units)



Unit Preparation

Sensor Mounting

Some units are shipped from the factory with the tee and the product temperature sensor rotated on the unit. Units shipped with rotated sensors include WS-06 and WS-08 models. Models WS-12 and WS-15 have the sensor and tee mounted in the proper location for operation at time of shipping.

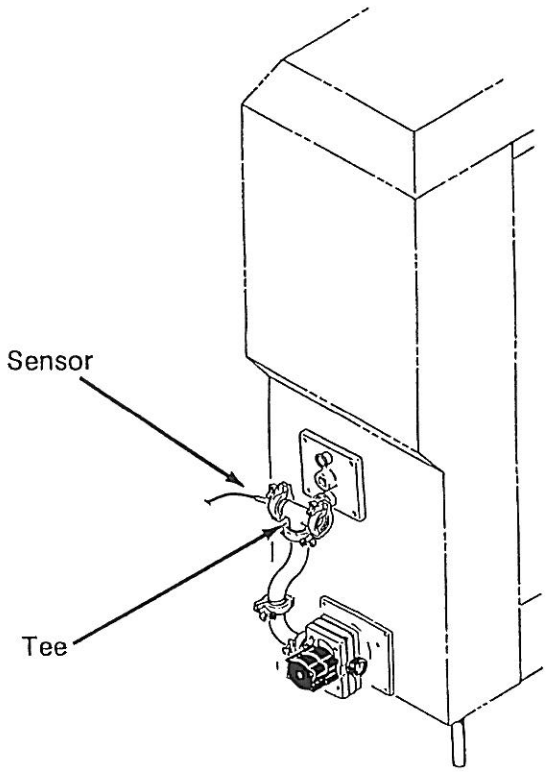
Rotating the sensor tee prevents damage to the sensor during shipping.

One plug is installed in the front door and another is installed in the tee. The plugs keep dirt and contaminates out during shipping.

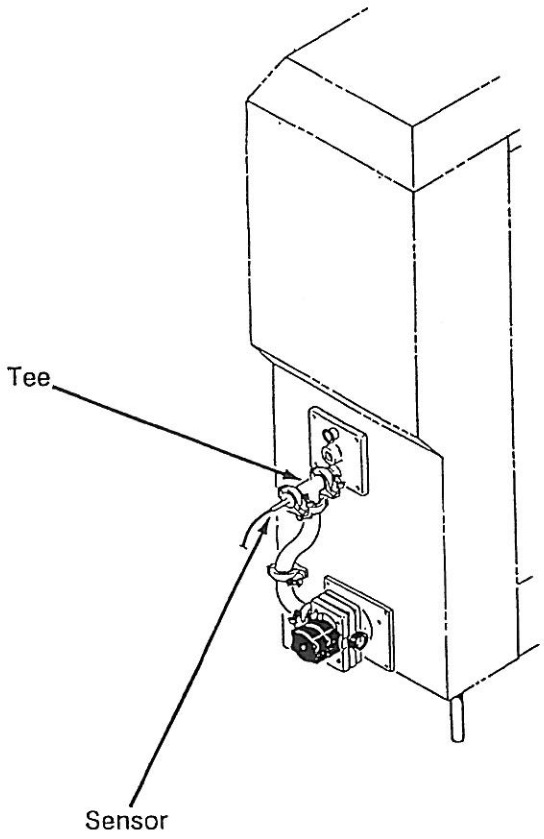
Prior to operating the unit, the tee and product sensor must be mounted in a horizontal position at a 90° angle to the unit.

To change the sensor position:

1. Remove the clamp that holds the sensor tee in place.
2. Remove the plugs in the front door and the tee.
3. Rotate the tee until the sensor is in the correct position as shown below.
4. Install and tighten the clamps.



Sensor Mounting During Shipping



Proper Sensor Mounting for Operation

Unit Preparation

Unit preparation requires disassembly of the unit and exposure of certain hazardous areas. Read the Safety Information section thoroughly.

DANGER

Turn off electric supply and Lock Out before removing the protective stainless steel panels around the dasher drive or before handling any electric wiring. Unexpected starting of the dasher drive or pump drive may cause severe injury or loss of life for personnel in contact with drive components. Changing drive rotation direction requires handling of electric wires which, when energized, could cause severe injury or loss of life.

Dasher and Dasher Drive Preparation

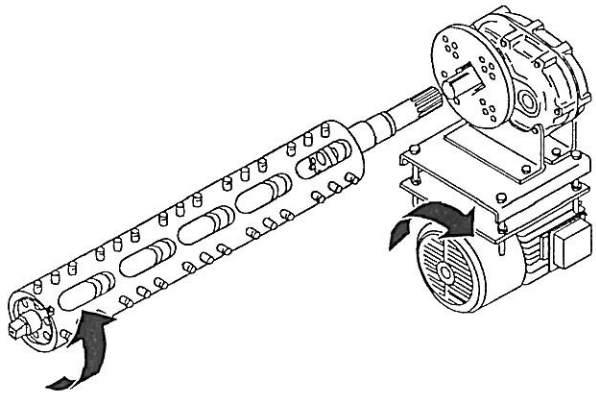
1. Remove stainless steel panels to access the dasher drive area.

2. Read the motor manufacturer's instructions. Lubricate the motor as recommended by the manufacturer.

3. The dasher drive gear box is normally filled to the proper level with lubricant, however, the lubricant level should be checked prior to operation. Fill or add lubricant if required.

4. Jog the dasher drive motor to check for correct dasher drive motor rotation.

   Refer to the Input/Output Test screen.



Correct Dasher Drive Rotation

Correct dasher drive motor rotation is counterclockwise facing the motor shaft.

5. Install the V-belts.

If the customer is supplying the motor, the V-belts are shipped loose with the unit and are required to be installed on site. If APV Crepaco supplies the motor, the belts will be installed prior to shipping. Follow procedure for Belt Replacement in the Maintenance section.

6. Check V-belt tension.

7. Lubricate the dasher bearings using the grease zerk provided on the bearing.

8. Reassemble stainless steel panels around the dasher drive area.

WARNING

Scraper blades are sharp and can cause cuts when handled incorrectly. Wear protective gloves, handle with care and avoid contacting the sharp edge.

9. Remove the freezing cylinder front door(s) and dasher(s) by following the instructions in the Dasher and Dasher Drive section.

See instructions in the First Cleaning section before assembling the dasher.

10. Assemble the scraper blades onto the dasher per instructions in the Scraper Blades section.

11. Assemble the dasher assembly into the unit and reassemble the door using the cylinder protector as shown in the Dasher Installation section.

Unit Preparation

Pumps and Pump Drive Preparation

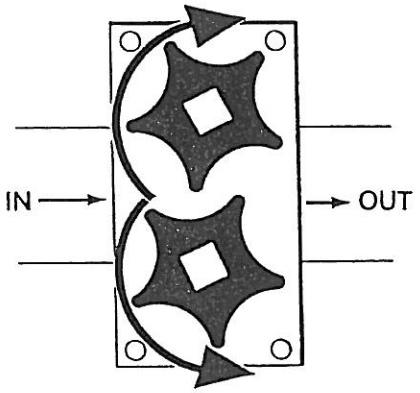
1. Disassemble the rotary pumps on the front and rear of the unit per instructions in the Rotary Pump Maintenance section. Disconnect piping, and remove the cover, rotor, and body.

2. Check oil level in the pump gearcase. If necessary, add oil per instructions in the Lubrication section and inspect per instructions in the Inspection of Pump section.

3. Jog the pump drive motors to check for correct mix and product pump motor rotation.

   Refer to the Input/Output Test screen.

Correct mix pump motor rotation is counterclockwise facing the motor shaft. Correct product pump motor rotation is clockwise facing the motor shaft.



Mix Pump and Product Pump

Correct Pump Rotations

4. Reassemble pumps and piping per instructions in the Reassembly section.

First Cleaning

Carefully clean all product contact surfaces prior to use to eliminate all possible foreign material which may have accumulated during manufacture, shipment, and installation. In addition, this gives personnel an opportunity to become familiar with the unit. Read the Cleaning Chemical Hazard section and the Beware of Sanitizing Solutions section.

1. Use a detergent solution as described in the Cleaning and Sanitizing section.

2. Disassemble all of the product contact areas of the unit including:

   a. Freezing cylinder front door.

   b. Dasher assembly.

   c. Freezing cylinder rear door.

   d. Rotary pumps - covers, rotors, and bodies.

3. Scrub the interior surface of the cylinder and all the removed product contact parts using a brush and detergent until completely clean.

4. Thoroughly rinse away all traces of detergent solution with clean water and allow the cylinder to drain.

5. Reassemble all of the product contact parts.

6. Clean the exterior surfaces of the unit by wiping methods only.

DANGER

The use of water around electronic equipment enclosures creates a hazard of electric shock which could cause severe injury or loss of life. Turn off the electric power supply and Lock Out before using any water for cleaning or rinsing around the electrical enclosures. Make sure the doors on all electrical enclosures are closed and the fasteners are tightened. Never spray water directly onto any electric controls or enclosures.

CAUTION

The presence of any water inside electrical control enclosures may damage the controls. Make sure the doors on all electric enclosures are closed and the fasteners tightened. Never spray water directly onto any electric controls or enclosures.

Cleaning and Sanitizing

DANGER

ALWAYS turn off the electrical power supply and Lock Out, using a locking device for which only the person doing the work has the key, before performing service or maintenance.

WARNING

Using unclean or unsanitary equipment could produce contaminated food products. Always clean and sanitize equipment before producing product for human consumption. See the Beware of Sanitizing Solutions section.

Cleaning and sanitizing of equipment is necessary on a routine basis whenever processing food products. The frequency of cleaning and the chemicals and procedures used will vary depending on the product. It is the responsibility of the user to establish procedures which are suitable for the product.

Users should develop a well defined cleaning and sanitizing program. This program must take into consideration all applicable laws, regulations, and standards relative to the protection of public health and the safe use and disposal of chemicals. See Cleaning Chemical Hazard section.

The following information is presented as general guidelines only. For additional help contact your local health authority and a reputable supplier of cleaning and sanitizing chemicals for the food processing industry. You may also contact your local APV Crepaco sales representative for recommendations.

WARNING

During automated Clean-In-Place (CIP) procedures the dasher or pumps may start unexpectedly from a remote signal. This may cause severe injury to anyone in contact with these parts. See Mechanical Hazard section. Do not contact any part of the dasher or rotary pumps during automated cleaning procedures.

WARNING

Direct contact with cleaning and sanitizing solutions may cause chemical or high temperature burns. Equip all personnel performing cleaning/sanitizing operations with protective clothing (including eye protection). Thoroughly train these personnel in the safe handling and disposal of the chemical and high temperature solutions they are using. See Cleaning Chemical Hazard section.

CAUTION

Many of the chemical solutions used for cleaning and sanitizing are corrosive, especially to the chrome inner cylinder lining and the hardened stainless steel scraper blades. Do not use higher than recommended concentrations, or longer then recommended exposure times with cleaning/sanitizing solutions. Always rinse thoroughly immediately following the use of chemical solutions. As droplets dry out the become more concentrated and more corrosive. See Beware of Sanitizing Solutions section.

Acid attacks the chrome inner lining of the freezing cylinder. Never use any type of acid in cleaning, sanitizing or rinse solutions. See Beware of Sanitizing Solutions section.

Methods for Cleaning and Sanitizing

The general sequence of steps for cleaning and sanitizing includes the following steps:

1. Rinse - Preliminary removal of excess residual product.
2. Wash - Use of detergent solution to remove residual product.
3. Rinse - Removal of residual detergent solution.
4. Sanitize - Treatment with heat or chemical solution prior to product processing to kill bacteria.

Cleaning and Sanitizing

Definitions

Rinse

The purpose of rinsing is to remove excess residual product and reduce the load required for detergent removal. At the end of washing, rinsing removes residual chemical solutions. Without the rinse, the chemicals could be corrosive or react unfavorably with other chemical solutions.

Use a rinse water temperature which readily removes the excess product or residual chemical solutions. Generally, this means warm water near 100 F. Use potable water for final rinse.

Detergent Solution

The customer is responsible for using chemical solutions compatible with the chrome inner lining of the cylinder. Your supplier of cleaning chemicals should recommend the type of chemical, concentration, temperature, and time of exposure for cleaning with your conditions.

Acid Rinse

Do not use any type of acid in the final rinse water. Acid attacks the chrome inner cylinder lining.

Sanitizing

Sanitizing is used to kill bacteria on product contact surfaces of the unit. When using chemical solutions, sanitizing should be performed no earlier than 15 minutes prior to processing product. The chemicals commonly used for sanitizing (chlorine or iodine containing compounds) are extremely corrosive.

Solution strength and exposure time must be closely regulated.

Hot water may be used for sanitizing to avoid the corrosive effect of chemical solutions.

CIP Cleaning

CIP (Clean-In-Place) means cleaning solely by flowing rinse, detergent, and sanitizing solutions, pumped through the product contact areas at high velocity. Parts of the unit such as the dasher and pumps are turned on and off to provide additional turbulence and more rapid cleaning. The solutions must be supplied from a separate source such as a central CIP system.

Recommended flow rate for effective CIP cleaning is 50 US gpm, per cylinder. At this flow rate the expected pressure drop through the unit (per cylinder) is 20 psig.

The unit is designed to be cleaned using CIP methods. Units with Kwik-Clean Kwik-Fill design pumps permit pump cleaning without disassembly. Units without the Kwik-Clean Kwik-Fill design pumps require that the pumps be disassembled, the rotors removed, and the covers reinstalled prior to each CIP cleaning.

With CIP methods, it is necessary to periodically disassemble the unit to check for cleanliness and the effectiveness of the CIP cleaning. Hand clean if necessary at this time. Checking once per month is recommended.

Hand Cleaning

Hand cleaning means that the application of rinses, detergents, and sanitizers is done by hand. For example, rinse water may be sprayed over product contact surfaces with a hose and detergent solution may be scrubbed on with a brush.

CAUTION

Using the wrong cleaning tools will damage product contact surfaces. Never use steel wool or a wire brush. Use a nonmetallic brush.

Theory of Operation

Principles of Operation

The unit is a combination of various systems working together to:

1. Pump the product through the freezing cylinder.
2. Add air at a controlled rate.
3. Incorporate air uniformly into the product.
4. Freeze the product to the correct stiffness.
5. Pump the frozen product to the next process step.

The principle of operation is best understood if each system is considered separately.

Product Flow System

Mix Booster Pump

The mix booster pump is not part of the unit. It supplies the liquid product mix to the inlet of the mix pump on the unit.

Mix Pump

The mix pump is mounted on the back of the unit. It pumps the liquid product mix into the rear of the freezing cylinder at a controlled flow rate.

Sanitary Air Inlet

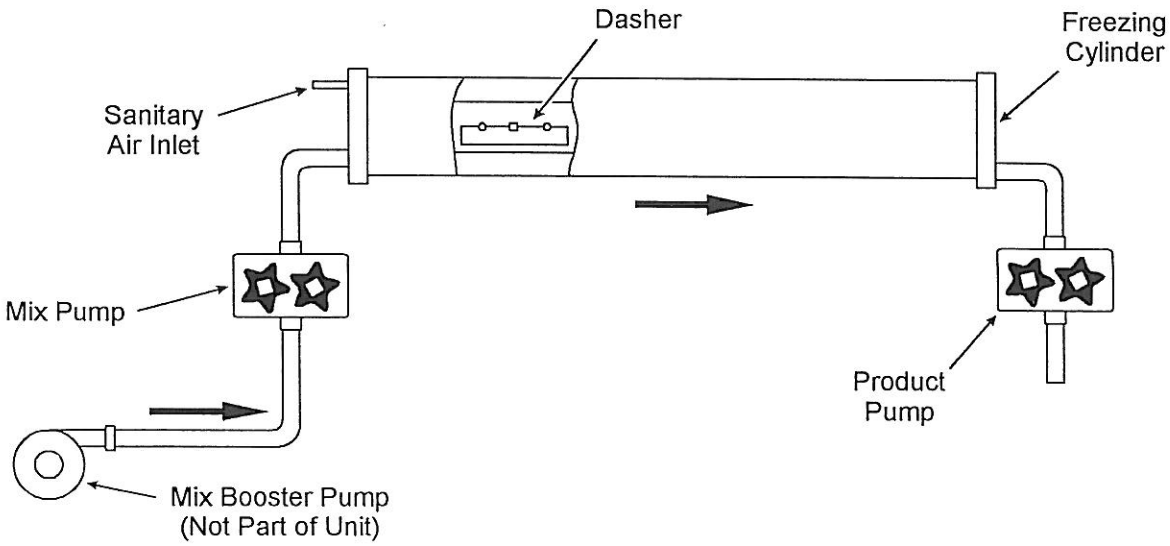
Sanitary air is added to the liquid product mix at a controlled rate through an air inlet located at the rear of the freezing cylinder. Air added to frozen dessert products is known as "overrun" and is necessary to give the product a desirable body and texture.

Dasher Assembly

A dasher with attached scraper blades rotates inside the freezing cylinder. As metered mix and air enter the cylinder, the mix freezes on the cold cylinder wall and is continuously scraped off by the scraper blades. The rotating dasher incorporates the air and mix into a homogeneous semi-frozen product.

Product Pump

The semi-frozen ice cream discharges from the front of the freezing cylinder and through the product pump. The speed of this pump is controlled to maintain a constant pressure inside the freezing cylinder. The ice cream is pumped to the next processing step; usually forming and/or packaging equipment, (not part of the unit.)



Product Flow System

Theory of Operation

Pump Drive and Speed Control System

The mix and the product pumps are directly driven by two separate, variable speed, three phase, electric motors.

The speed of either motor can be increased or decreased through the use of an AC inverter. The programmable controller gives an input signal to the AC inverter. The AC inverter then increases or decreases the electrical frequency.

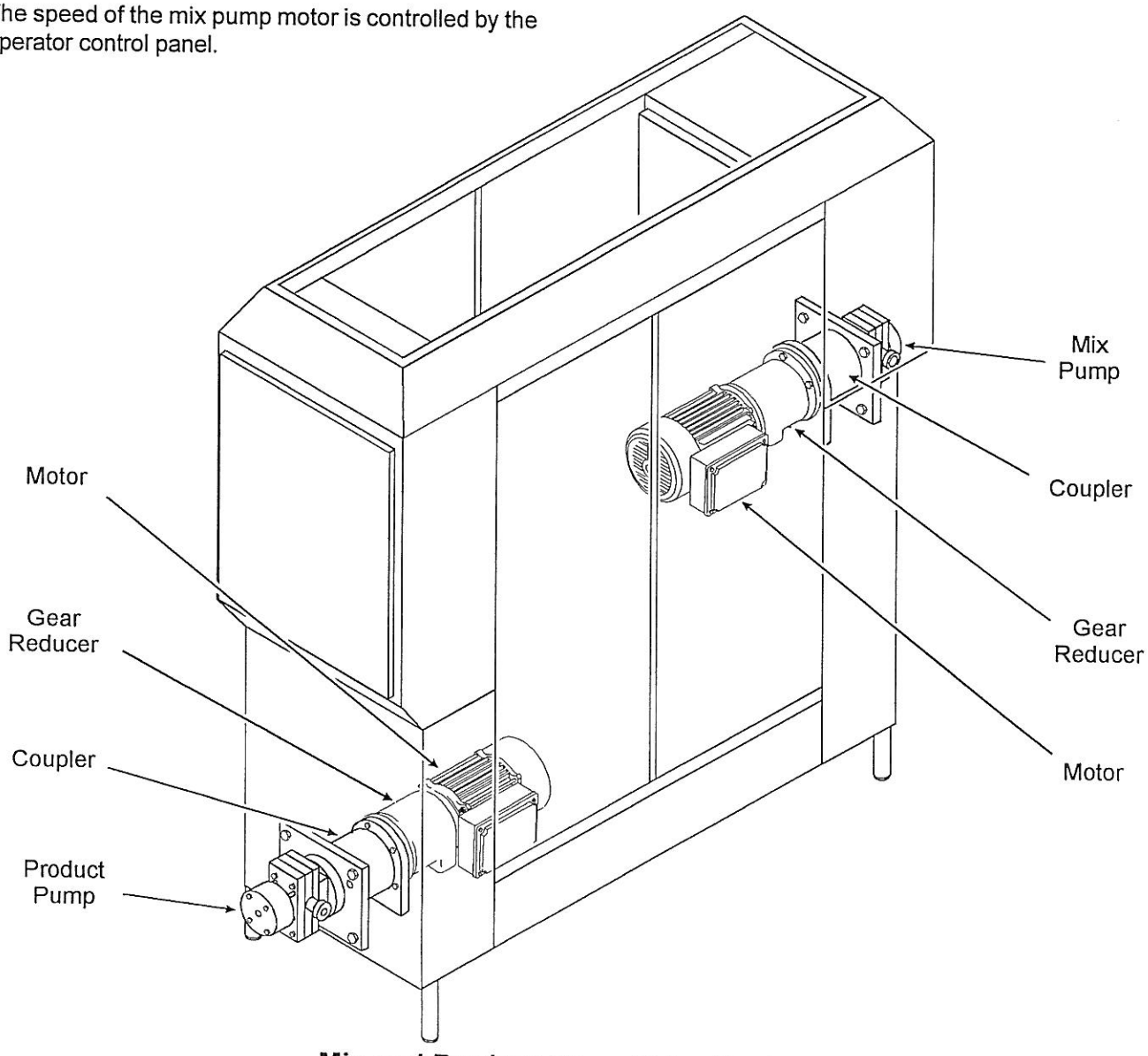
Mix Pump

The speed of the mix pump motor is controlled by the operator control panel.

Product Pump

The speed of the product pump is also controlled by the operator control panel. The speed of the product pump will maintain a constant pressure inside the barrel.

The mix pump and the product pump may or may not operate at the same rpm.



Mix and Product Pump Drive Systems

Theory of Operation

Air System

Sanitary air, under pressure, is metered into the product to provide overrun. The following controls are used to meter the air:

Control Panel

The operator controls all unit functions at the control panel.

Check Valve

The check valve allows air to flow into the freezing cylinder but will not allow flow in the other direction.

Hand Needle Valve

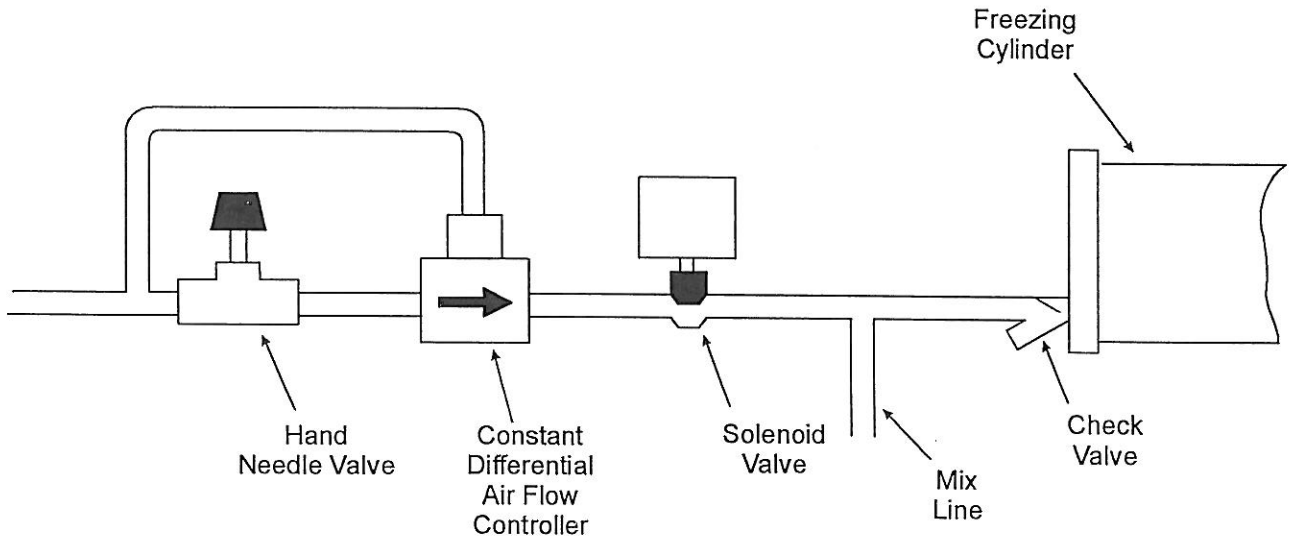
A manually adjusted, hand needle valve, delivers a metered flow of air into the product.

Solenoid Valve

The solenoid valve is an electrically controlled valve that when energized, the solenoid is open and air may flow through it. When de-energized, the valve remains closed. Some valves however, are normally open.

Constant Differential Air Flow Controller

The purpose of the constant differential air flow controller is to maintain a constant volume of air into the freezing cylinder as the cylinder pressure fluctuates. This reduces the need to adjust the hand needle valve once proper overrun has been established during production.



Air System

Theory of Operation

Refrigeration System

The unit is supplied with liquid from the in-plant refrigeration system, through a separate liquid line. One end is connected to the liquid line of the in-plant refrigeration system and the other end is connected to the liquid inlet of the unit. The in-plant refrigeration system must be capable of supplying the unit with liquid refrigerant at a pressure of 50 psig minimum continuously.

The liquid refrigerant in the freezing cylinder absorbs the heat from the product. This causes the refrigerant to boil (vaporize). The vaporized refrigerant then flows through a suction line back to the main suction line of the in-plant refrigeration system. The process is controlled by the back pressure regulator valve.

The following describes the function of each component contained in the unit:

Liquid Line Solenoid Valve

The liquid line solenoid valve is an electrically controlled, normally closed valve. When de-energized, the valve is closed, therefore, liquid refrigerant is not allowed to flow through it. When energized, the valve is open and the liquid refrigerant may flow through it to the float valve.

Float Valve

The float valve maintains the proper refrigerant level inside the freezing cylinder. If the refrigerant level inside the freezing cylinder drops, the float valve opens, allowing liquid refrigerant to flow into the freezing cylinder. When the refrigerant is at the correct level, the float valve begins modulating to control a constant flow of refrigerant into the freezing cylinder.

Freezing Cylinder

The freezing cylinder is flooded with liquid refrigerant. The heat from the product is absorbed into the refrigerant causing the refrigerant to boil (vaporize). This vaporized refrigerant then flows to the accumulator.

Accumulator

The accumulator is located above the freezing cylinder.

The accumulator has a plate welded internally, dividing the accumulator into two vessels, a large vessel and a small vessel.

The function of the large vessel is to separate any remaining liquid that may exist from the vaporized refrigerant. This is to be sure that no liquid refrigerant is allowed to flow to the suction line.

The smaller vessel functions as a storage tank for liquid refrigerant when the unit is not in operation. The liquid refrigerant in the freezing cylinder is drawn into the small vessel of the accumulator at shutdown.

Theory of Operation

Equalizer Solenoid Valve

The equalizer solenoid valve is an electrically controlled, normally closed valve. When the valve is open, it allows pressure in the small and large vessels of the accumulator to equalize.

When the valve is de-energized (closed), it isolates the large vessel of the accumulator from small vessel so that the liquid refrigerant from the freezing cylinder can be drawn into the small vessel only at shutdown.

Hot Gas Solenoid Valve

The hot gas solenoid valve is an electrically controlled, normally closed valve. When the valve is de-energized (closed), it isolates the freezing cylinder from the hot gas line.

When the valve is energized (open), it allows hot gas to flow directly into the freezing cylinder for defrosting.

High Pressure Safety Relief Valve

The high pressure safety relief valve is a normally closed valve. If the pressure in the accumulator rises above a predetermined pressure, the high pressure safety relief valve will open, allowing the excessive pressure to be released to the atmosphere. The valve will automatically close when the pressure in the accumulator has decreased to an acceptable pressure.

DANGER

The high pressure safety relief valve must never be removed, tampered with, or plugged off. Serious injury or loss of life may result.

Back Pressure Regulator Valve

The back pressure regulator valve is located in the suction line above the accumulator. Its purpose is to control the freezing process (viscosity of the product), by maintaining a constant pressure in the accumulator.

Low Pressure Relief Valve

The low pressure relief valve is placed in a parallel circuit with the back pressure regulator. Its purpose is to allow refrigerant vapor to flow from the accumulator to the suction line if the pressure in the accumulator exceeds the relief valve setting. The relief valve will not allow refrigerant to flow in the reverse direction.

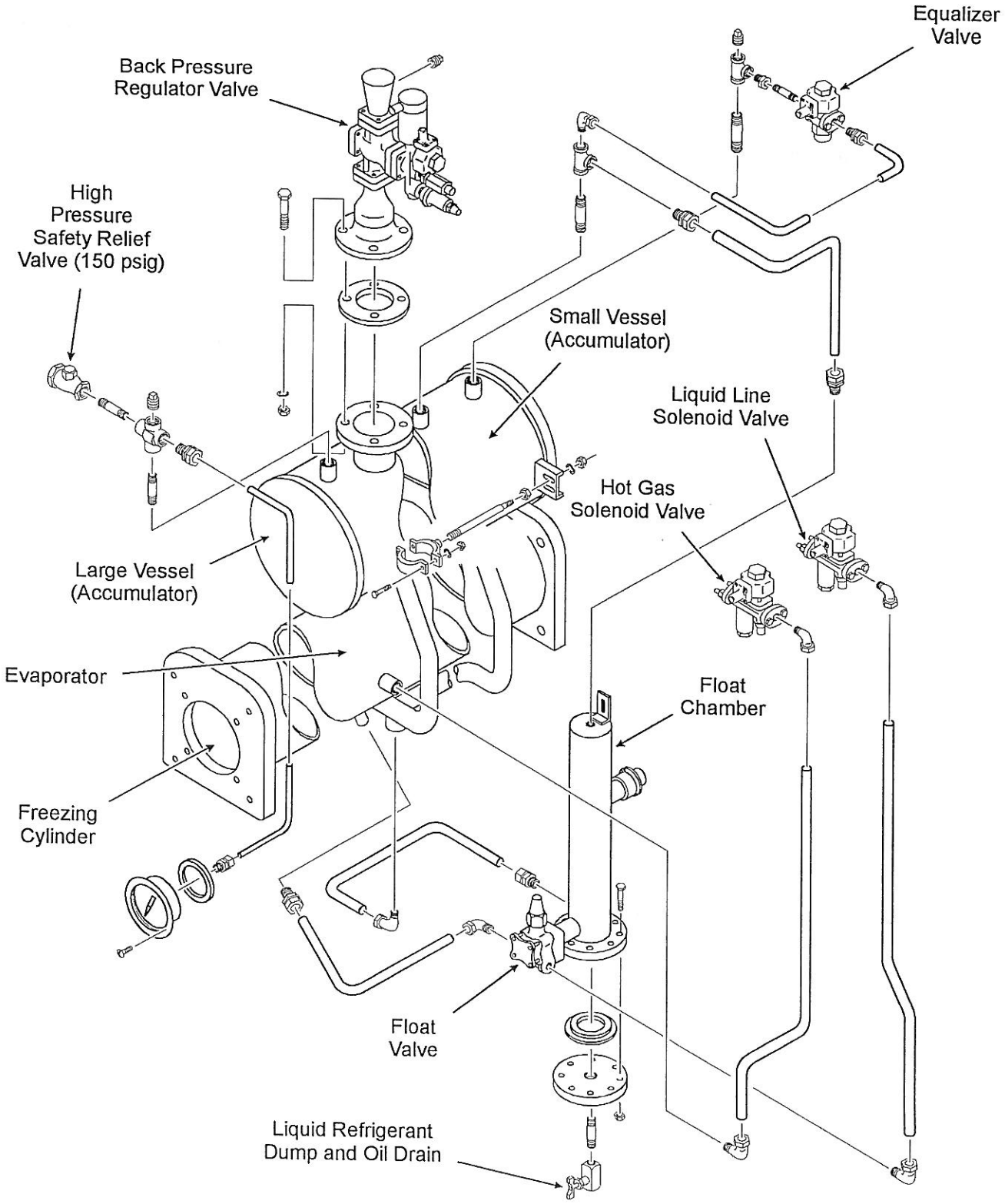
Oil Drain Valve

The oil drain valve is a hand operated valve used to manually drain refrigerant oil out of the float valve cylinder.

Hot Gas Pressure Switch (Optional)

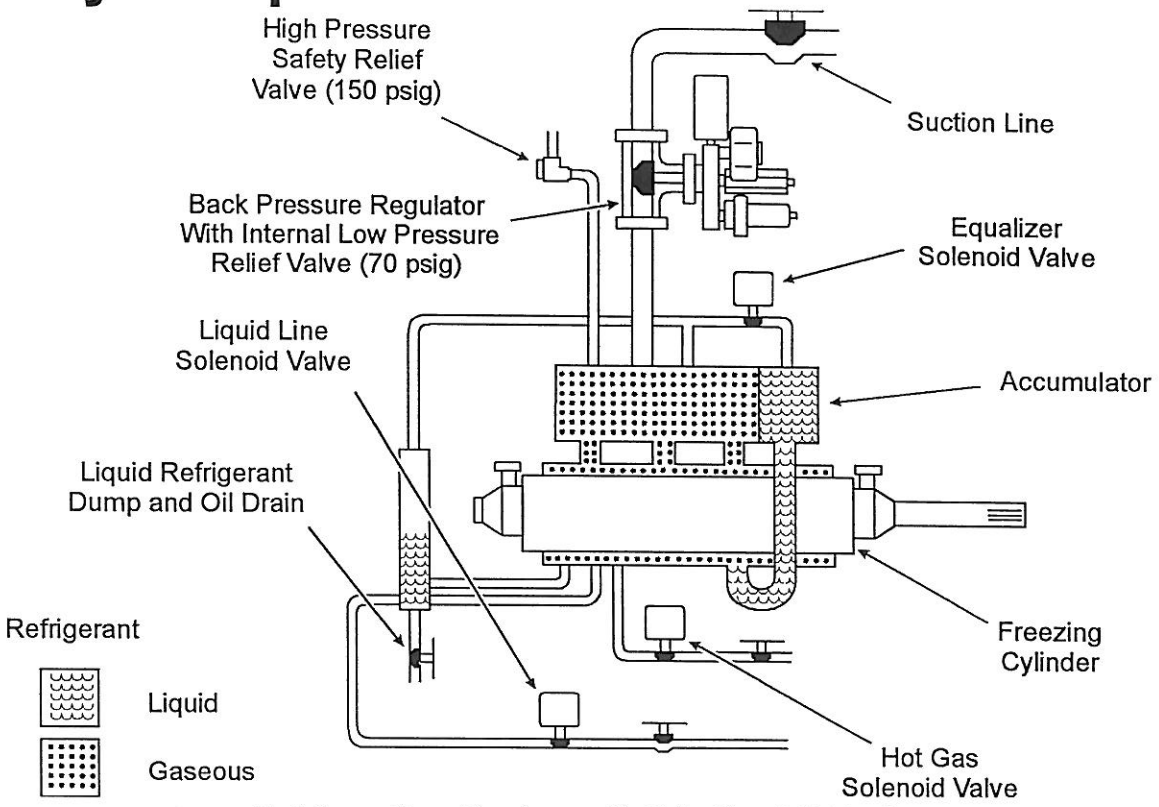
See the Options section.

Theory of Operation

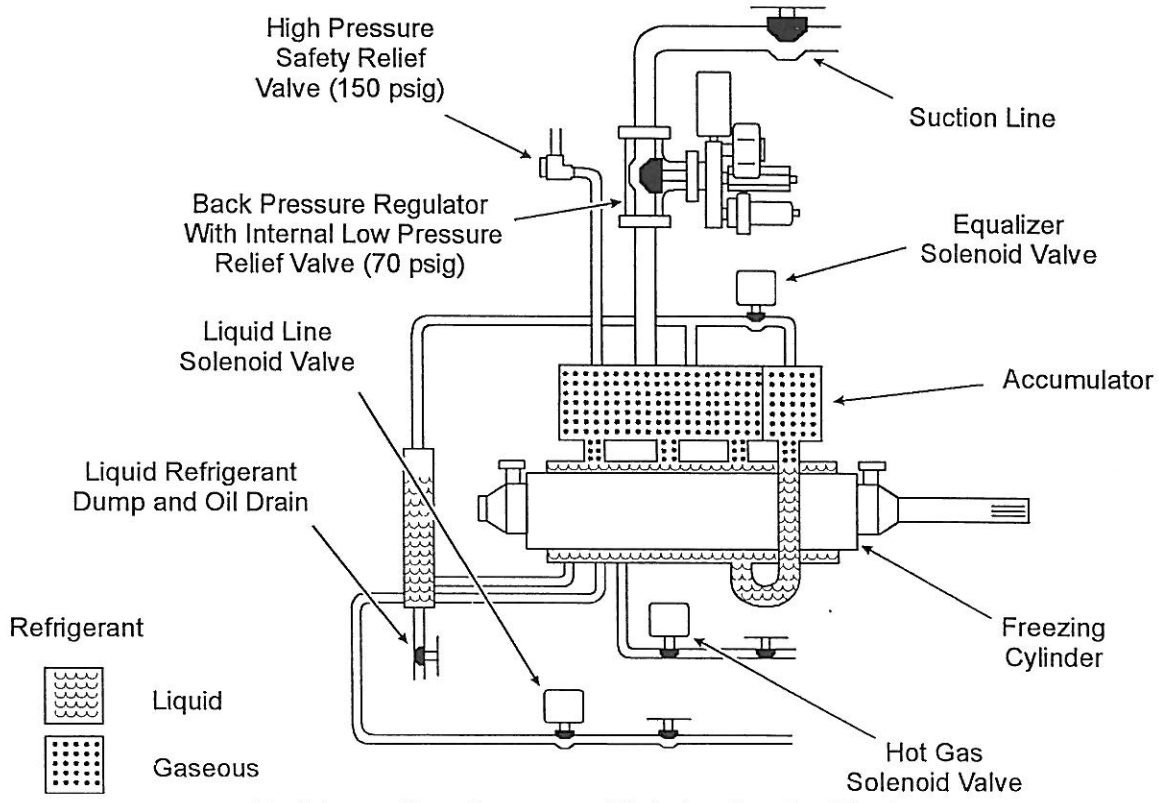


Refrigeration Component Location

Theory of Operation

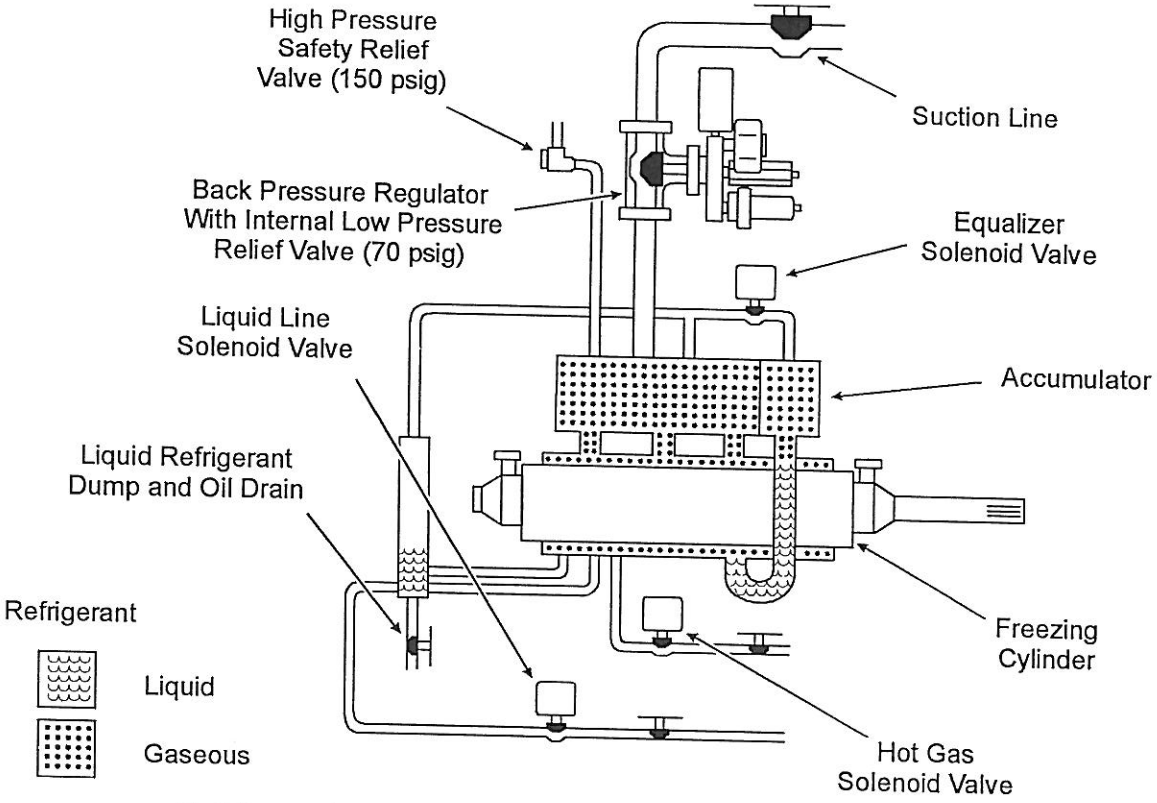


Refrigeration System - Unit in the Off Mode



Refrigeration System - Unit in the On Mode

Theory of Operation



Refrigeration System - Unit in the Pump Down Mode

Semi-Automatic Controller

Control Functions

1. **Pump Speed.** Turn clockwise to increase speed; turn counterclockwise to decrease speed.

2. **Premixer On-Off.** When this switch is in the Off position, the optional premixer is deactivated. When the switch is in the On position, the premixer is activated.

3. **Recirculation On-Off.** When this switch is in the Off position, the optional recirculation pump will be de-energized. When the switch is in the On position, the recirculation pump will be energized.

4. **Hot Gas.** When this button is pressed and held, the hot gas solenoid is energized (opened). When the button is released, the hot gas solenoid is de-energized (closed).

5. **Refrigeration Dump.** This switch is used to perform a refrigeration pump down. The switch must be in the Run position during normal operation. (Freon units only.)

6. **Pumps Start.** When this button is pressed, the mix and product pumps are energized.

7. **Dasher Start.** When this button is pressed, the dasher motor is energized and the dasher will begin to turn.

8. **Refrigeration Start.** When this button is pressed, the liquid line solenoid valve and the back pressure regulator valve are activated allowing the refrigeration cycle to begin.

If the unit is equipped with a Camflex back pressure valve, Refrigeration On=Valve opens.

If the unit is equipped with a Danfoss back pressure valve, Refrigeration On=Output to pilot operated valve is turned on and BPR valve opens to the previous setpoint.

9. **Booster Start.** When this button is pressed, the mix booster pump will be energized.

10. **Pumps Stop.** When this button is pressed, the mix and product pumps will be de-energized.

11. **Dasher Stop.** When this button is pressed, The dasher motor will be de-energized and the dasher will stop turning.

12. **Refrigeration Stop.** When this button is pressed, the liquid line solenoid and the back pressure regulator valve are deactivated and the freezing will stop.

If the unit is equipped with a Camflex back pressure valve, Refrigeration Off=Valve closes completely.

If the unit is equipped with a Danfoss back pressure valve, Refrigeration Off=Valve setpoint remains the same but the output to the pilot operated valve is turned off.

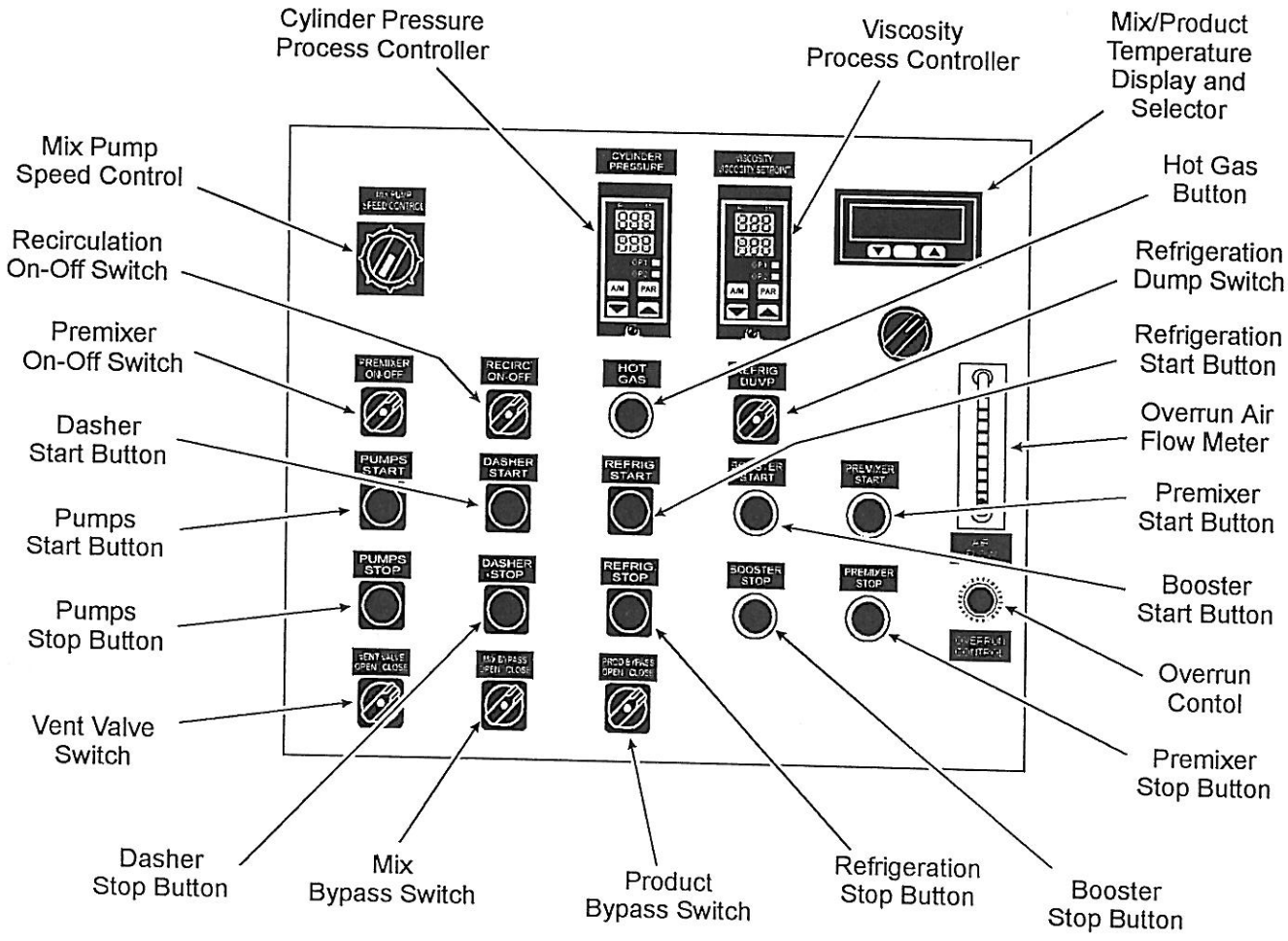
13. **Booster Stop.** When this button is pressed, the mix booster pump will be de-energized.

14. **Vent Valve Open/Close.** When this switch is in the Open position, the vent valve will be open. When the switch is in the Closed position, the vent valve will be closed.

15. **Mix Bypass Open/Close.** When this switch is in the Open position, the mix pump bypass cover will be open. When the switch is in the Closed position, the mix pump bypass cover will be closed.

16. **Product Bypass Open/Close.** When this switch is in the Open position, the product pump bypass cover will be open. When the switch is in the Closed position, the product pump bypass cover will be closed.

Semi-Automatic Controller



Semi-Automatic Control Panel

Semi-Automatic Controller

17. **Mix/Product Temperature.** When this switch is in the Mix position, the temperature of the mix will be displayed on the Temperature Indicator. When the switch is in the Product position, the temperature of the product will be displayed on the Temperature Indicator in degrees F or C.

The top display on the Overrun Process Controller reads the mix flow.

18. **Viscosity Process Controller.** This control allows the operator to adjust the product viscosity setpoint. When the unit is in operation, this control will monitor and maintain the product viscosity at the required level.

    The Viscosity Process Controller also acts as a stall monitor. When the high alarm setpoint is reached, the liquid line solenoid valve and the back pressure regulator valve is turned off.

19. **Cylinder Pressure Process Controller.** This control allows the operator to adjust the cylinder pressure setpoint. When the unit is in operation, this control will monitor and maintain the cylinder pressure at the required level. Normally this controller is Locked Out so only a setpoint of 55 psi is allowed.

20. **Temperature Indicator.** When the switch is in the Mix position, the temperature of the mix will be displayed on the Temperature Indicator. When the switch is in the Product position, the temperature of the product will be displayed on the Temperature Indicator in degrees F or C.

21. **Refrigeration Run-Pumpdown Switch.** (The Refrigeration Run-Pumpdown switch is located inside the front control panel.) The Refrigeration Run-Pumpdown switch must be in the Run position during production. When placed in the Pumpdown position, the liquid line solenoid will close allowing the refrigeration system to be pumped down.

Process Controllers

Process Controllers

The process controllers are identical instruments, but are programmed differently at the APV Crepaco factory for the two different unit applications. They are stand alone controllers, which operate with a 4-20 mA input and output. The basic function varies with application.

There are two process controllers on the Semi-Automatic control system.

- Viscosity Process Controller.
- Cylinder Pressure Process Controller.

Each of these controllers are preset at the factory with typical operating values. These factory installed values will remain in the controllers until a new value is entered.

Increase/Decrease Keys

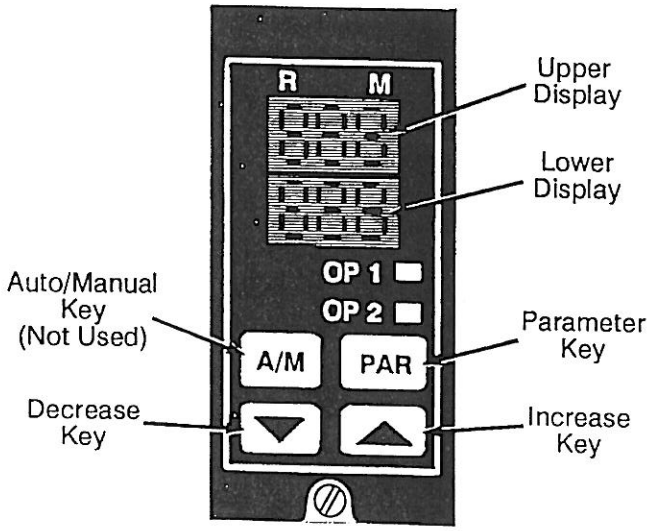
The Increase/Decrease keys are pressed by the operator to adjust each operating setpoint (overrun, viscosity, and cylinder pressure). Pressing a key one time will change the current value by one. Pressing and holding a key changes the value with increasing speed the longer the key is held.

Parameter Key

The Parameter key is pressed to access the set-up parameter display.

Displays

Each process controller has two readout displays, an upper display and a lower display. These readouts indicate to the operator specific operating data.



Process Controller

Process Controllers

Viscosity Process Controller

This controller adjusts the amount of product viscosity (stiffness) by controlling the refrigeration system. The required level of product viscosity is entered by the operator pressing the Increase or Decrease keys.

The upper display indicates the measured value of the dasher motor load. (0% to 100%).

The lower display indicates the present motor load setpoint. (25% to 75%).

The viscosity process controller compares the measured value of the dasher motor load to the setpoint motor load and adjust the refrigeration system as necessary to maintain the setpoint viscosity.

An alarm relay has been provided with the viscosity process controller. The alarm relay will implement a stall monitor function. When the motor load exceeds the high alarm setpoint, the back pressure regulator valve and the liquid line solenoid valve will close. Valves will remain closed until the motor load decreases to less than the high alarm setpoint.

Cylinder Pressure Process Controller

This controller adjusts the cylinder pressure during operation. The required cylinder pressure is entered by the operator pressing the Increase or Decrease keys.

The upper display indicates the actual cylinder pressure.

The lower display indicates the present cylinder pressure setpoint.

The cylinder pressure process controller compares the measured value of the cylinder pressure to the setpoint cylinder pressure and adjust the ice cream pump speed as necessary to maintain the setpoint cylinder pressure.

Process Controllers

Viscotrol Process Controller

As product temperature decreases viscosity increases. Higher viscosity requires more horsepower to turn the dasher and higher amperage to the motor.

The 4-20 mA signal sent to the Viscosity controller appears as percent of scale (0-100%), or the actual viscosity, in the top display of Viscotrol process controller. The bottom display equals the viscosity setpoint (25%-75%).

This process controller regulates product viscosity (stiffness). Control of product viscosity is based on the dasher motor load. The motor current is converted to 4-20 mA by the current transducer. This 4-20 mA output is routed to the input of the Viscosity controller. The controller is reverse acting.

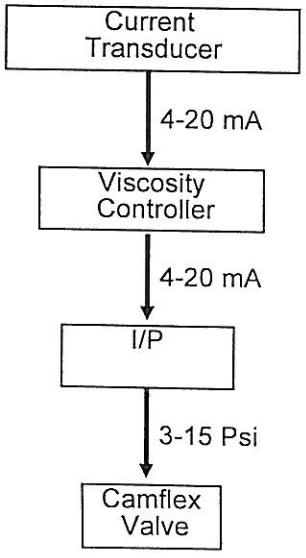
Camflex BPR. The 4-20 mA output of the Viscosity controller is routed to the I/P transducer. It converts the 4-20 mA to a 3-15 psi output. The 3-15 psi controls the position of the Camflex valve.

4 mA = 3 psi = Camflex Fully Closed
20 mA = 15 psi = Camflex Fully Open

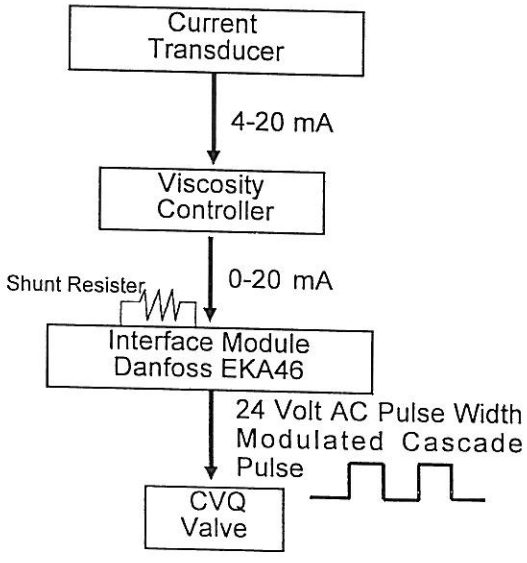
Danfoss BPR (CVQ Valve). The 0-20 mA output of the Viscosity controller is converted to 0-10 Vdc via a shunt resister then routed to the EKA46 module. The EKA46 will then open or close the pilot of the CVQ valve. The EKA46 output energizes a heater inside the CVQ valve within a sealed chamber. This acts as a gas spring. The more pressure applied, the harder it is for the valve to come off of it's seat. As the heater is cooled, the valve opens.

The LED on the EKA46 module corresponds to the output from the EKA46 module to the heater of the CVQ valve.

0 Vdc = Danfoss Fully Closed
10 Vdc = Danfoss Fully Open



Block Diagram - Viscotrol Process Controller with Camflex BPR



Block Diagram - Viscotrol Process Controller with Danfoss BPR

Process Controllers

The unit is programmed at the factory with the standard PID software. The Viscotrol process controller is also a stand alone unit, operating all the time with the PID loop enabled (the M indicator switched off).

When the refrigeration is switched off the Camflex valve will close and the output is inhibited. A time delayed relay inhibits the output of the viscosity controller and prevents its alarm when the dasher is restarted. The delay is factory set at 10 seconds and adjustable from 0.3 to 30 seconds.

When power to refrigeration is resumed after a delay time, then the output to the Camflex valve is resumed. The Camflex valve will position itself in proportion the air pressure being sent to it.

Description & Specifications

A/M Key

The process controller parameters are set so that the A/M key is disabled.

PAR Key

The PAR key is used to access the parameter list. It may be used to read various parameter settings of the process controller. The parameters cannot be changed unless a jumper switch inside the controller is closed. See Final Setup section.

This key also acknowledges an alarm condition. Pushing the key once stops the alarm message from flashing. If the condition still exists the alarm message will reoccur.

Alarm

The process controllers have programmed high and low level alarm setpoints. Only the alarms of the Viscotrol process controller are used. When the level of actual viscosity is above or below alarm setpoints, the top display will flash Hi AL or Lo AL respectively. If the condition continues a defrost cycle should be started.

OP1 Indicator Light

The intensity of the OP1 indicator light indicates the level of the process controller's 4-20 mA output signal. At 4 mA the light is very weak, at 20 mA it is very bright.

OP2 Indicator Light

The OP2 indicator light indicates the alarm channel is active for refrigeration shut-off.

R Indicator Light

Normally, the R indicator light is not on. When ramping is selected, the light indicates that "ramp to setpoint" is in progress.

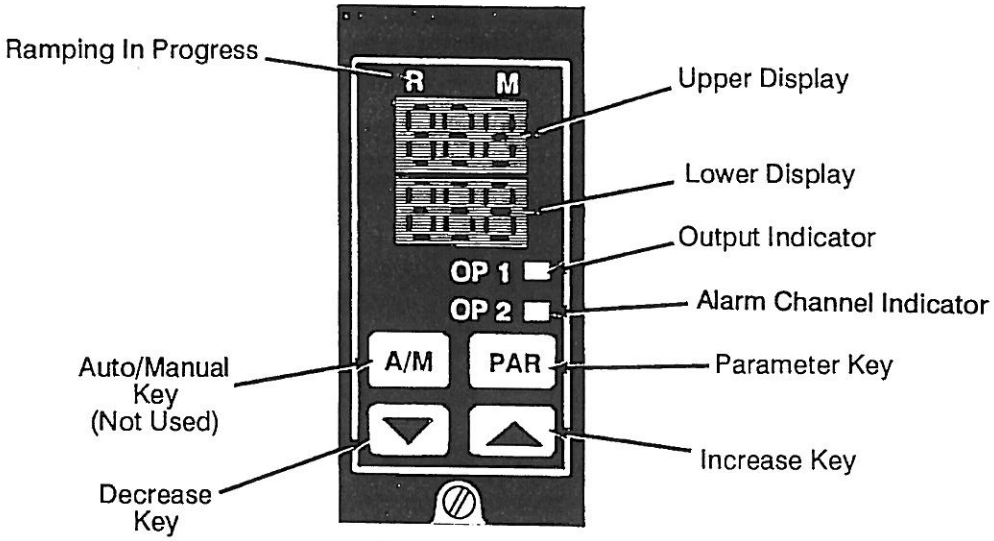
Air Selector

The air selector determines whether the manual needle valve or the Overrun process controller is used.

Temperature Selector

The temperature selector determines display of mix inlet temperature or of ice cream temperature in degrees centigrade.

Process Controllers



Process Controller Operator Keys and Indicators

Operation Checks

Self Diagnostic

During power up the process controller performs an internal check. If an error is found, the message CErr appears in the lower display. If this message appears, replace the process controller.

Interlocks

The dasher must be running, or by using the run/pump down selector, for refrigeration to come on. Emergency Stop drops out all 120 Vac power to the unit.

Refrigeration must be on for the viscosity controllers output to occur.

Input/Output Current

The control supply voltage requirement is 90-130 Vac, 50/60 Hz single phase. All pushbutton circuits latch with exception of the emergency stop and hot gas, which are momentary.

Process Controllers

A 20 amp circuit breaker limits 120 Vac power entering into the unit control circuit. Each cylinder has a 10 amp circuit breaker for the control circuit and instrumentation. It is recommended to externally fuse the unit per wiring and connection diagram, in the back of this manual.

Open the front control panel door to access the connection terminals at the rear of the process controllers.

DANGER

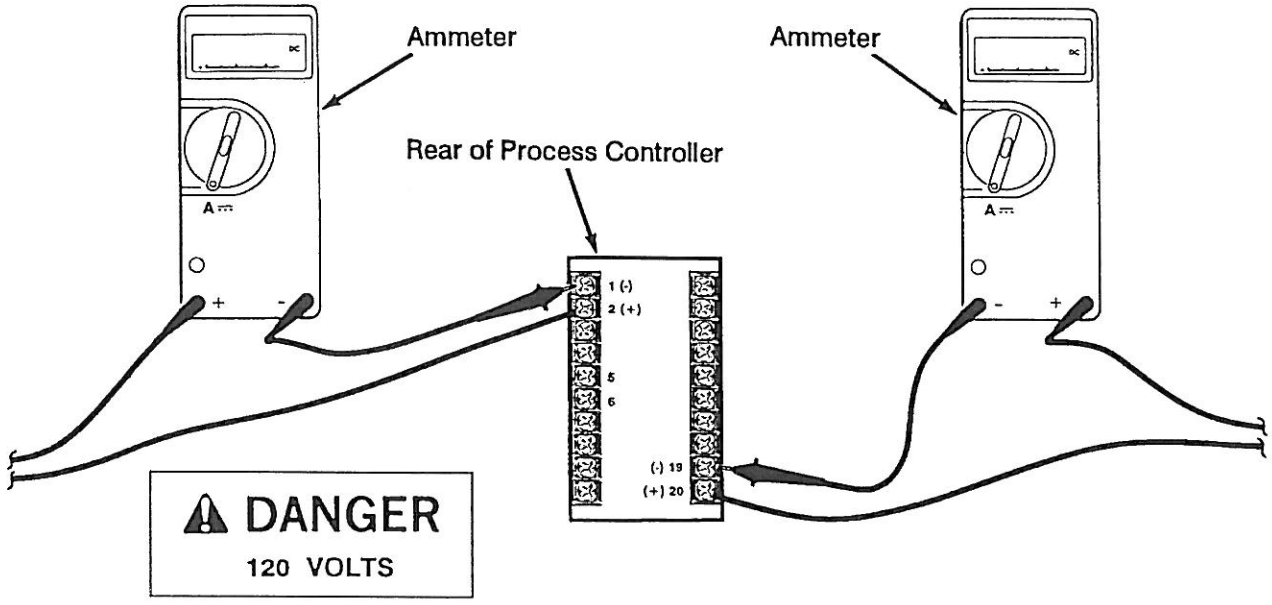
Terminal numbers 5 & 6 on the process controller are at 120 volts. Checking operation requires access near these and other exposed high voltage connections. Contact with them could cause electric shock and severe injury or loss of life. Only trained and authorized electricians must make this check. Use wiring diagram to identify these and other high voltage points in the enclosure before starting. Do not contact high voltage points. Use nonconducting or insulated tools.

Check the input and output current using a digital volt meter. The input is connected to process controller terminal numbers 19 (-) and 20 (+). The output is connected to terminal numbers 1 (-) and 2 (+). Connect the current meter in series in the (-) line.

Both input and output current should range from 4 to 20 milliamps DC. The current should correspond to the values listed in the following table and be proportional for points in between. If incorrect, check process controller parameter settings.

Current Reading	Viscotrol
Min. Input = 4 mA	Dasher Motor Not Running
Max. Input = 20 mA	100 - Top Display, 80 - High Alarm Setting
Output = 4 mA	Camflex Closed; 3 psi or Less
Output = 20 mA	Manual Mode - Setting = 100%; Camflex Open; 15 psi

Process Controller Input/Output Current Chart



Checking Process Controller Input and Output

Process Controllers

Replacement

When installing a replacement process controller perform the following final setup procedure before operating. This procedure is for new process controllers, supplied from the APV Crepaco factory. These controllers have been programmed at the APV Crepaco factory. The final setup procedure enables the process controller to work by entering the correct address and identification number for the appropriate unit cylinder.

If new unprogrammed controllers are used or if a controller for a different application is used (e.g. Viscotrol for Overrun), the entire program must be entered.

Special ratio control software is used for the Overrun process controller.

Final Setup

1. Remove the previous controller from the housing by loosening the screw at bottom of the controller and pulling it out.

2. Remove the new controller from the housing it was shipped in. Connect the internal jumper switch WB1 on the new controller. Install the new controller. Slide into the housing and secure with a screw while pushing in at the top of the controller.

3. Press the PAR key repeatedly until PROP appears in the top display. Use the Increase or Decrease key to set the value in the lower display.

4. Calibrate per instructions in Process Controller Calibration section.

5. Do not change any other setting. If one is unintentionally changed, return it to the original setting. See Complete Programming instructions for complete list of settings.

6. Remove the controller from the housing. Disconnect the internal jumper switch WB1. Reinstall the controller into the housing.

If a setting is not changed within 5 seconds after pressing the PAR key, the controller resets to the beginning.

Adjusting Parameter Settings

Some parameter settings of the Viscotrol process controller can be changed to adjust refrigeration system performance. The best settings for a unit will vary depending on product flow rate, product composition, and product viscosity. The original settings are average values which will give satisfactory performance under most operating conditions. The parameter settings which may be adjusted are marked (***).

> **CAUTION**
>
> *Do not change any other parameter settings for the Overrun, or Viscotrol process controllers. Changing other parameters may cause incorrect unit operation and serious damage.*

The High alarm setting controls motor load level at which the High Dasher Motor Load indicator light comes on. Raising the setting above the recommended 80 allows operation at higher motor load, but also increases the risk of a freeze up and/or a motor overload.

The Proportional band and integral time settings control response to changing conditions. Increasing the settings generally increases the speed of response, but also increases the possibility of instability.

Proportional band settings below 20 or above 75 are not recommended. Only for the Viscotrol process controller are integral time settings below 5 or above 45 not recommended.

Process Controllers

Complete Programming

Follow the procedure described for Final Setup except set every parameter as listed in the following tables. The program has two parts, parameter setting and parameter access. The parameter setting establishes the operating values used by the process controllers. The parameter access code controls which parameter settings can be read by the operator.

If the setting is not changed within 5 seconds after pressing the PAR key, the controller resets to the beginning.

General Parameter Settings			
Description	**Display**	**Viscotrol Process Controller**	**Mix Flow Process Controller**
Setpoint	S P	25	
High Alarm	Hi AL	***80	9999
Low Alarm	Lo AL	Pump Start Setpoint	-999
Deviation Alarm	d AL	9999	9999
Proportional Band	ProP	***30	300

Process Controller Complete Programming

Process Controllers

General Parameters Settings			
Description	**Display**	**Viscotrol Process Controller**	**Mix Flow Process Controller**
Integral Time	Int.t	***15	5
Derivative Time	dEr.t	OFF	OFF
Setpoint High	SP H	75	600
Setpoint Low	SP L	25	100
High Alarm	H AO	LAt	OFF
Low Alarm	L AO	nLAt	OFF
Deviation Alarm	d AO	OFF	OFF
High Power Limit	H PL	100.0	100.0
Sensor Break	SnbP	0	100.0
Sensor	Sn	Lin	Lin
Address	Addr	**	**
Baud Rate	bAud	9600	9600
Identification	idno	**	**
Control Mode	Ctrl	PID	PID
Output 1	OP 1	4-20	4-20
Output 2	OP 2	L Hi	Off
Auto/Hand	A H	Auto	Auto
	t Su		
Proportional Band	Pb d	Lin	Lin
	Cb o	Auto	Auto
Control Action	Act	rev	rev
High Limit	Hi L	150	9999
Low Limit	Lo L	-10	-10
Filter	Fil	1.00	1.00

Process Controller Complete Programming

Process Controllers

Access Parameters Settings			
Description	**Display**	**Viscotrol Process Controller**	**Mix Flow Process Controller**
	Prog	HidE	HidE
	tunE	HidE	HidE
	L C	HidE	HidE
	r 1	HidE	HidE
	L 1	HidE	HidE
	d 1	HidE	HidE
	r 2	HidE	HidE
High Alarm	Hi AL	rEad	rEad
Low Alarm	Lo AL	rEad	rEad
Deviation Alarm	d AL	HidE	HidE
Proportional Band	ProP	rEad	rEad
Integral Time	Int.t	rEad	rEad
Derivative Time	dEr.t	HidE	HidE
Setpoint High	SP H	rEad	rEad
Setpoint Low	SP L	rEad	rEad
High Alarm	H AO	HidE	HidE
Low Alarm	L AO	HidE	HidE
Deviation Alarm	d AO	HidE	HidE
	H PL	HidE	HidE
Sensor Break	SnbP	HidE	HidE
Input Sensor	Sn	HidE	HidE
Address	Addr	rEad	HidE
Baud Rate	bAud	rEad	HidE
Identification	idno	rEad	HidE
Control Type	Ctrl	rEad	rEad
	SPrr	****Acc/Cal	
Output 1	OP 1	rEad	rEad
Output 2	OP 2	rEad	rEad
A-H	CJC	rEad	rEad
Proportional Band	Pb d	rEad	rEad
	t Su	rEad	rEad
	Cb o	rEad	rEad
Control Action	Act	rEad	rEad
High Limit	Hi L	rEad	rEad
Low Limit	Lo L	rEad	rEad
Filter	Fil	rEad	rEad

Process Controller Complete Programming

Process Controllers

Access Parameter Settings			
Description	**Display**	**Viscotrol Process Controller**	**Mix Flow Process Controller**
Process Scale	Proc	HidE	HidE
* Setting varies with unit model. ** Setting varies with cylinder number. *** See "Adjusting Parameters Settings". **** Acc = Access, Cal = Calibrate			

Process Controller Complete Programming

Operation

Semi-Automatic Controller Operation

To Start Unit

Start the unit in the following sequence from a shut-down condition.

1. Clear the inner cylinder of cleaning and sanitizing solutions.
2. Open the liquid refrigerant supply valve to the unit.
3. Place the Product Bypass switch in the Close position. This will close the bypass cover on the product pump.
4. Place the Vent Valve switch in the Open position.
5. Place the Mix Bypass switch in the Open position. This will open the bypass cover on the mix pump.
6. Press the Booster Start button. This will fill the inner cylinder with mix.
7. Wait until the mix starts coming out of the vent, then:
   a. Place the Vent Valve switch in the Close position.
   b. Place the Mix Bypass switch in the Close position.
   c. Press the Booster Stop button.

   Units with 80 Dashers

   a. Press the Dasher Start button.
   b. Press the Booster Start button.
   c. Press the Pumps Start button.
   d. Wait 5 seconds, press the Premixer Start button.
   e. Press the Refrigeration Start button.
   f. Adjust the Viscosity Process Controller so that the accumulator pressure gauge indicates a suction pressure of 10-15 psig (for ammonia units). Monitor the motor load as it rises and adjust the Viscosity Process Controller to obtain the appropriate motor load.

Top Display = Actual Viscosity
Lower Display = Setpoint

   Units with 30 Dashers

   a. Press the Dasher Start button.
   b. Press the Refrigeration Start button.
   c. Adjust the Viscosity Process Controller so that the accumulator pressure gauge indicates a suction pressure of 10-15 psig (for ammonia units). Monitor the motor load as it rises and adjust the Viscosity Process Controller to obtain the appropriate motor load.

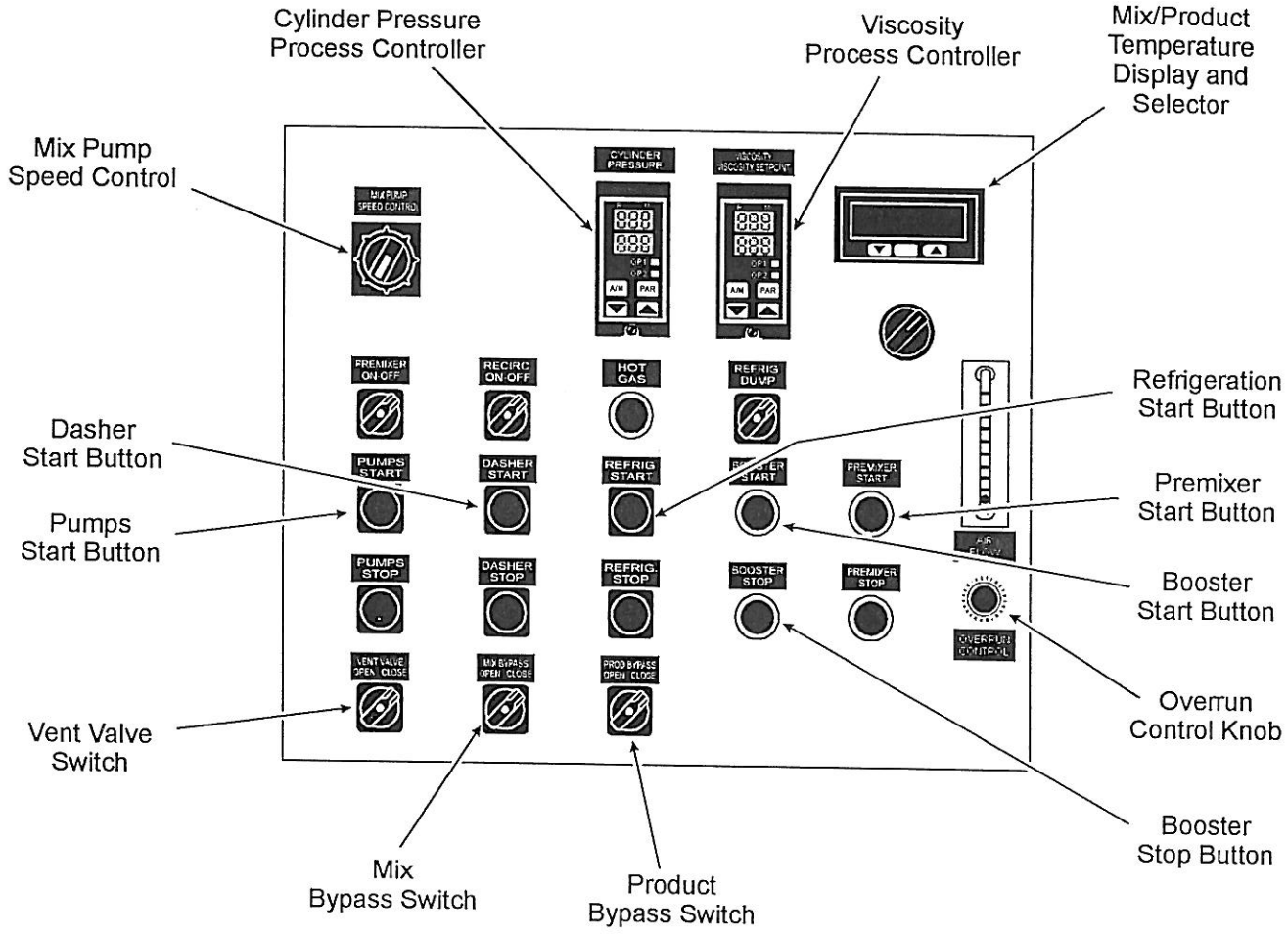
Top Display = Actual Viscosity
Lower Display = Setpoint

   d. Press the Booster Start button.
   e. Press the Pumps Start button.
8. Adjust the mix flow rate by turning the Mix Pump Speed Control. Turning clockwise increases mix flow rate; turning counterclockwise decreases mix flow rate.
9. Adjust the product overrun by adjusting the Overrun Control knob.
10. Adjust cylinder pressure by adjusting the Cylinder Pressure Process Controller.

Cylinder pressure is not adjustable unless reconfigured by authorized personnel.

During production, adjustment to the mix flow rate, overrun, product viscosity, and cylinder pressure may be necessary.

Operation



Controls Used to Start and Operate Unit

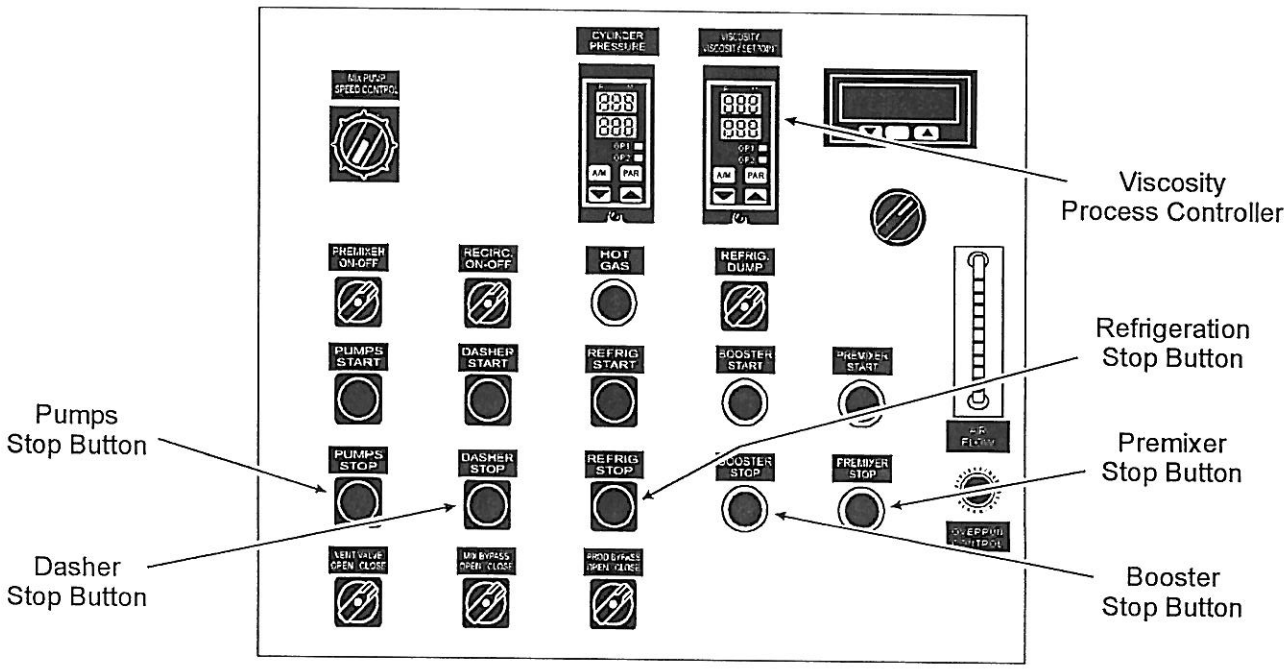
Operation

To Shut Down From Production

1. Set the Viscosity Process Controller to 25.

25 is minimum setting.

2. Shut off the liquid refrigerant supply 3 to 5 minutes before the anticipated end of the run. When the mix tank is nearly empty, add warm water.
3. Press the Refrigeration Stop button immediately.
4. Wait 5 minutes to let the water mix with the product and soften, becoming less viscous.
5. Press the Premixer Stop button.
6. Press the Booster Stop button.
7. Press the Dasher Stop button.
8. Press the Pumps Stop button.



Controls Used to Shut Down From Production

Operation Problem Solving Guide

1. **Product Too Soft**
   a. Low liquid refrigerant level.
      1. Liquid refrigerant filter clogged.
      2. Liquid refrigerant pressure too low.
      3. Liquid refrigerant supply line too small.
      4. No liquid refrigerant available (plant receiver level low).
      5. Water contamination.
      6. Unit float not working or not adjusted correctly.
   b. Suction pressure high.
      1. Refrigerant compressor not developing capacity.
      2. Refrigerant suction lines too small.
      3. Back pressure regulator valve not working correctly.
   c. Exterior of freezing cylinder contaminated with compressor oil.
   d. Scraper blades need reconditioning.
   e. Operating above rated unit capacity.
      1. Mix flow rate too high.
      2. Product temperature too low for flow rate.
   f. Mix supply too warm.
   g. Mix formulation incorrect.

2. **Product Too Stiff (High Discharge Pressure)**
   Unit's accumulator refrigerant pressure too low.

3. **Overrun Too Low**
   a. Leaking air connections.
   b. Air supply pressure too low.
   c. Freezing cylinder pressure too high.
   d. Needle valve or controller not working correctly.
   e. Mix formulation incorrect.
   f. Product too soft or too stiff.

4. **Overrun Too High**
   a. Air supply pressure too high.
   b. Rerun added to mix supply.
   c. Mix pump worn.
   d. Low booster pump pressure.
   e. Needle valve or controller not working correctly.
   f. Air in mix supply.
      1. Tank agitator incorporating air.
      2. Leak at booster pump seal or inlet connection.
      3. Leak in supply line to booster pump.

5. **Varying Overrun**
   a. Changing air supply pressure.
   b. Mass flow meter or controller not working correctly.
   c. Borderline high cylinder pressure.
   d. Changing cylinder pressure.
   e. Rerun added to mix supply.
   f. Air in mix supply.
      1. Tank agitator incorporating air.
      2. Leak at booster pump seal or inlet connection.
      3. Leak in supply line to booster pump.
   g. Changing product stiffness.
   h. Changing quality of mix supply.
   i. Premixer not working correctly.

6. **Air Pockets In Product**
   a. Rerun added to mix supply.
   b. Freezing cylinder not full.
   c. Mix formulation incorrect.
   d. Product too cold or too warm.

Maintenance

The unit contains highly engineered systems and controls. To keep your unit operating trouble free and at peak efficiency establish a schedule of routine maintenance for the unit components.

DANGER

Maintenance personnel will be exposed to hazardous areas of the unit while performing the recommended procedures in this manual. Individual hazard areas are described in the front of this manual. In addition, DANGER and WARNING statements appear where appropriate throughout the manual. Instruct all maintenance personnel of these hazards and the recommended procedures before they perform any maintenance. All maintenance must be performed by trained and authorized maintenance personnel only.

DANGER

The dasher may start unexpectedly from someone else using the controls or from a remote control signal. This creates a hazard of severe injury or loss of life to persons in contact with the dasher or dasher drive components. Before disassembling any parts, protective guards, or enclosures, turn off the electric power supply and Lock Out using a locking device for which only the person doing the work has the key.

WARNING

Removal of the dasher should be done by two people to prevent damage to the cylinder or dasher. The dasher should always be pulled out or inserted in a true plane with the cylinder. Do not allow the dasher or blades to rest on or bump the lip of the cylinder. Abuse will require the cylinder or dasher to be repaired.

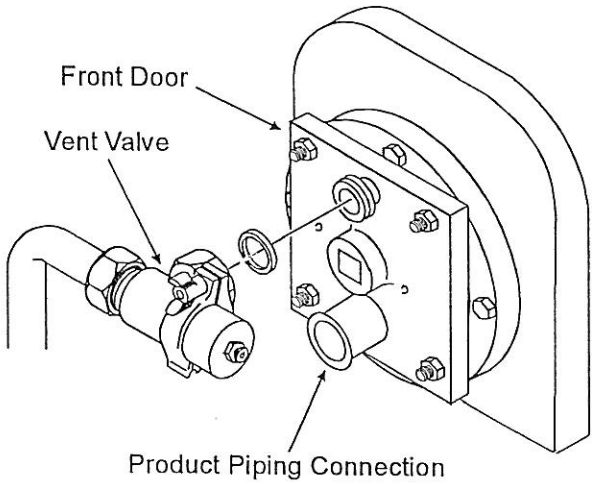
Dasher (Type 30)

Removal

The following procedure pertains to WS-08, WS-12, and WS-15 units.

Dasher removal requires the use of a cylinder protector and dasher holder.

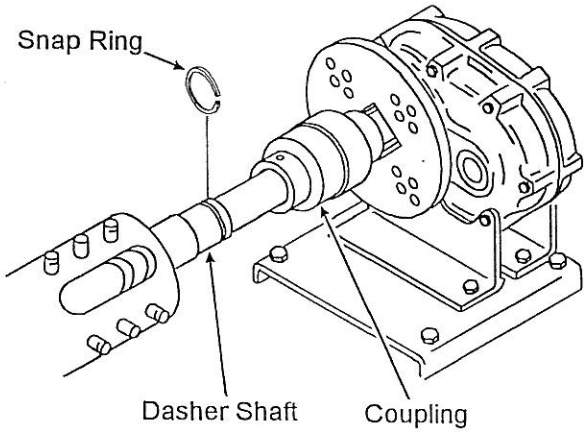
1. Turn off and Lock Out power supply.
2. Disconnect the air supply to the vent valve, at the point where the air line protrudes through the frame. Check the vent valve to see that it is open. If any air or liquids come out of the valve, wait until it stops.
3. Remove the vent valve.
4. Disconnect the product piping at the outlet from the front door.



Removing the Vent Valve and Product Piping

Maintenance

5. Remove the snap ring from its groove in the rear of the dasher shaft.

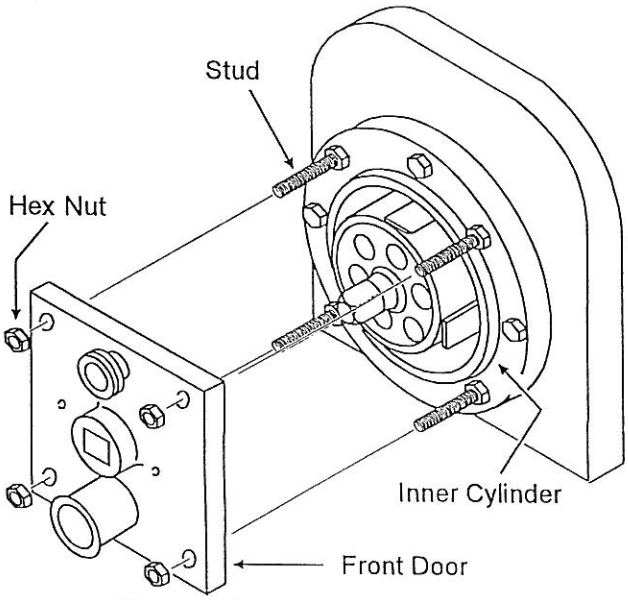


Removing the Snap Ring

6. Remove the hex nuts from the front door.

7. Pull the front door slowly off the studs. Then pull the door off of the dasher.

Do not let the dasher fall on the inner cylinder. Damage may occur to the dasher, blades or cylinder.



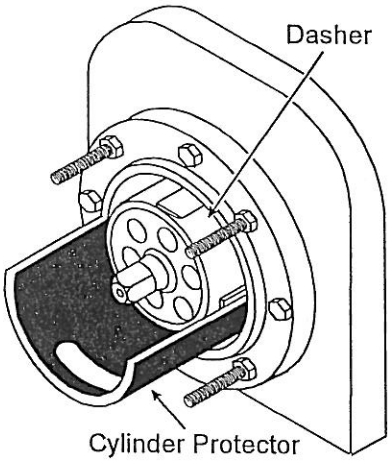
Removing the Front Door

8. Install the dasher puller into the dasher.

9. Lift the front of the dasher and insert the cylinder protector under the dasher.

   a. Slide the cylinder protector in as far as possible.

   b. Position the dasher on the cylinder protector by rotating the dasher so that the weight of the dasher is evenly supported in the curved area of the cylinder protector.



Dasher with Cylinder Protector Installed

WARNING

The dasher has sharp scraper blades that could cause severe cuts. Wear protective clothing for hands and arms whenever handling the dasher. Two workers are required to remove the dasher.

10. Carefully remove the dasher.

    a. Slowly pull the dasher and cylinder protector out of the cylinder, while supporting the dasher and cylinder protector from underneath. Be sure not to scratch the cylinder wall. Watch for the end of the cylinder protector so that the dasher does not drop onto the cylinder.

> **CAUTION**
>
> *Do not hold the dasher from the front only. This could cause the rear of the dasher to drop down and the rear shaft to hit the inner chrome surface causing serious damage. Lift the dasher from the center, supporting the entire weight as it is removed.*

    b. Place the dasher on the dasher holder.

    c. After the dasher and cylinder protector have been removed, look inside the cylinder and remove any seal parts that may have dropped off of the dasher during removal. Remove the seal from the rear door. Keep the front and back end seal parts marked, and separate them from each other for reassembly.

11. Remove the scraper blades. Refer to the Scraper Blades section.

12. When the dasher is out of the unit, certain items should be checked for wear. Refer to Inspection in this section.

Installation

1. Install the scraper blades onto the dasher. Refer to the Scraper Blades section.

> **WARNING**
>
> *The dasher has sharp scraper blades that could cause severe cuts. Wear protective clothing for hands and arms whenever handling the dasher. Two workers are required to install the dasher.*

2. Lubricate the dasher spline shaft.

3. Place the cylinder protector under the dasher. Lift the dasher and cylinder protector together and carefully slide them into the cylinder until the shaft extends approximately 2 in. through the rear door.

Hold the scraper blades to prevent them from contacting the sides of the cylinder.

4. Install the rear seal and follower loosely onto the dasher shaft. Push the dasher shaft through the rear bearing.

5. Install the snap ring loosely onto the dasher shaft.

6. Rotate the dasher as needed to engage the shaft splines and the coupling.

7. With the bearing locating pin aligned with the slot in the rear bearing, slide the dasher toward the rear until the locating pin is fully engaged in the bearing slot.

8. Lift the front of the dasher and remove the cylinder protector.

9. Install the front door.

    a. Inspect the O-rings for the door and dasher shaft. Replace if there is any deterioration. Use sanitary lubricant on O-rings and install them in the door.

    b. Install the door over the dasher shaft. Lift slightly and install over the four studs. Install and tighten the four nuts onto the studs. Always tighten alternately and evenly.

10. Install the snap ring into the groove on the rear of the dasher shaft.

11. Install the rear seal and follower into the rear door.

12. Reconnect the product piping at the outlet of the front door.

13. Install the vent valve and connect the air supply.

Maintenance

Inspection

Type 30 dasher have a rotating beater inside the dasher. The bearing for the front and rear of the beater requires routine inspection for wear.

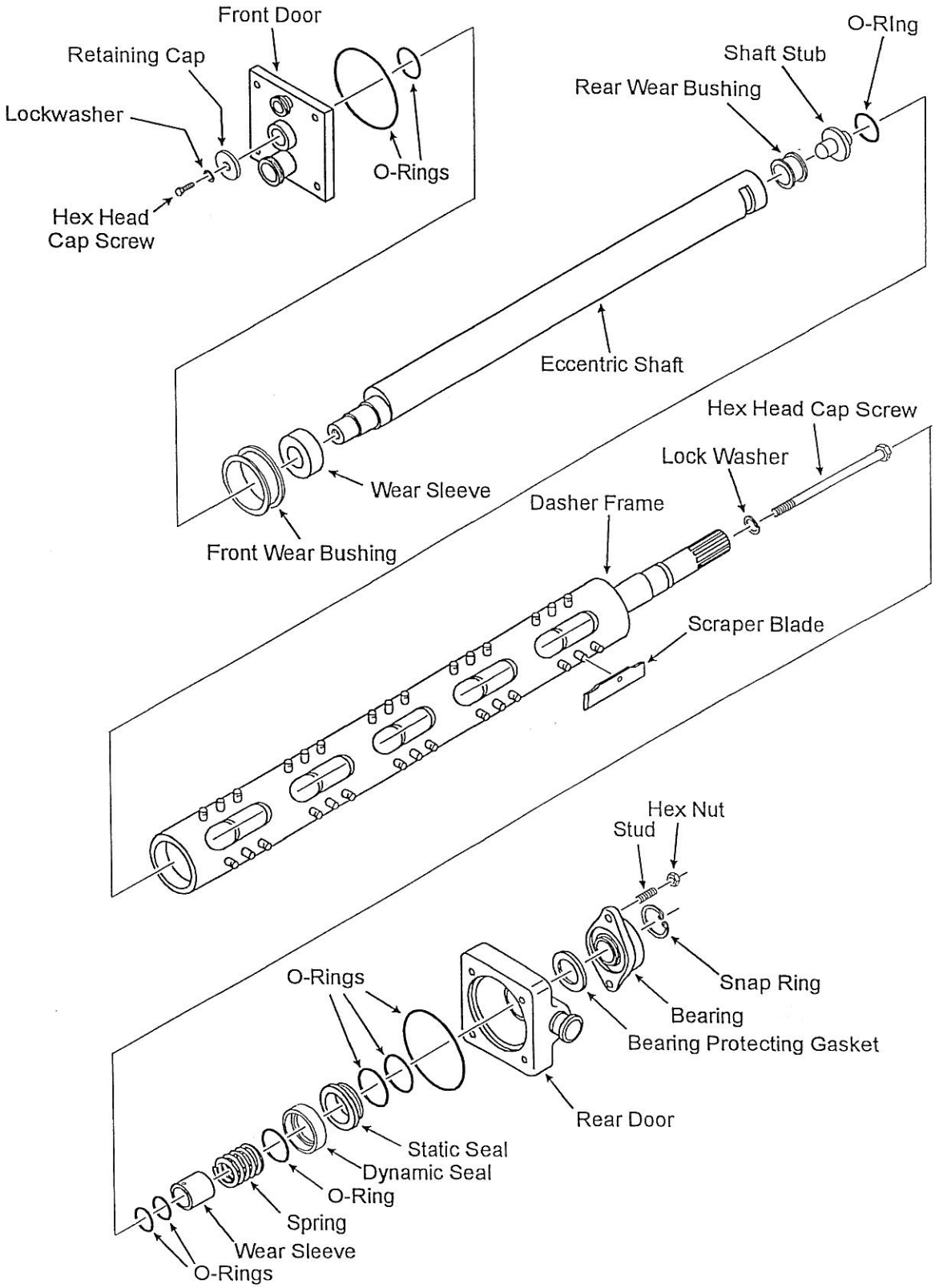
Check for bearing wear by moving the beater side to side within the dasher. If looseness is evident, disassemble the dasher components to measure the bearing parts.

The following parts require routine inspection for wear and/or damage.

- Dasher Head Bushing (if applicable)
- Wear Bushings (if applicable)
- Beater Bushings (if applicable)
- Rear Beater Bearing (if applicable)
- Thrust Disc (if applicable)
- Scraper Blades
- Wear Sleeves
- Shaft Stub (if applicable)

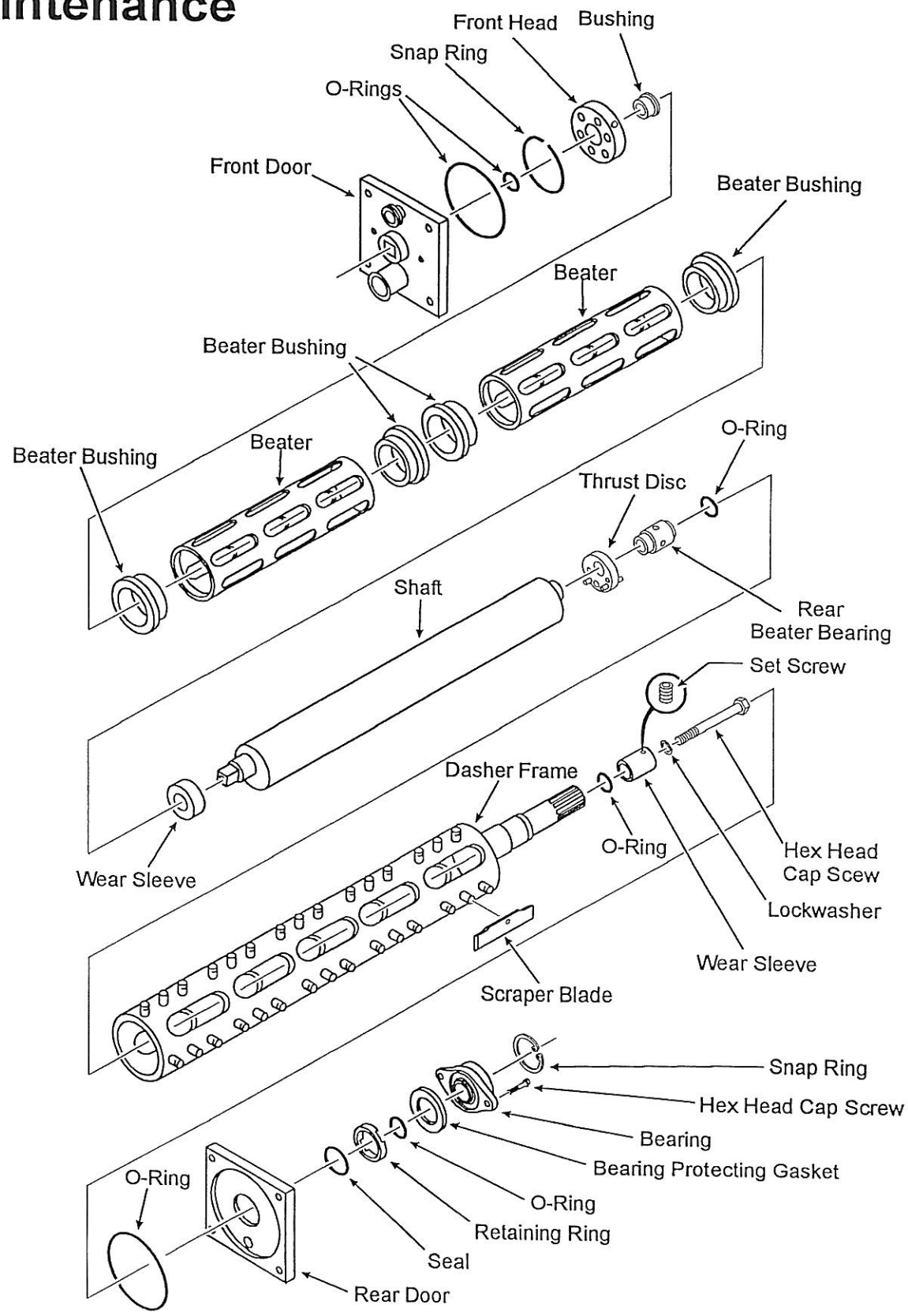
Refer to the illustrations on the following pages for the location of individual components.

Maintenance



Dasher (Type 30), WS-06 Typical Components

Maintenance



Dasher (Type 30), WS-08, WS-12, WS-15 Typical Components

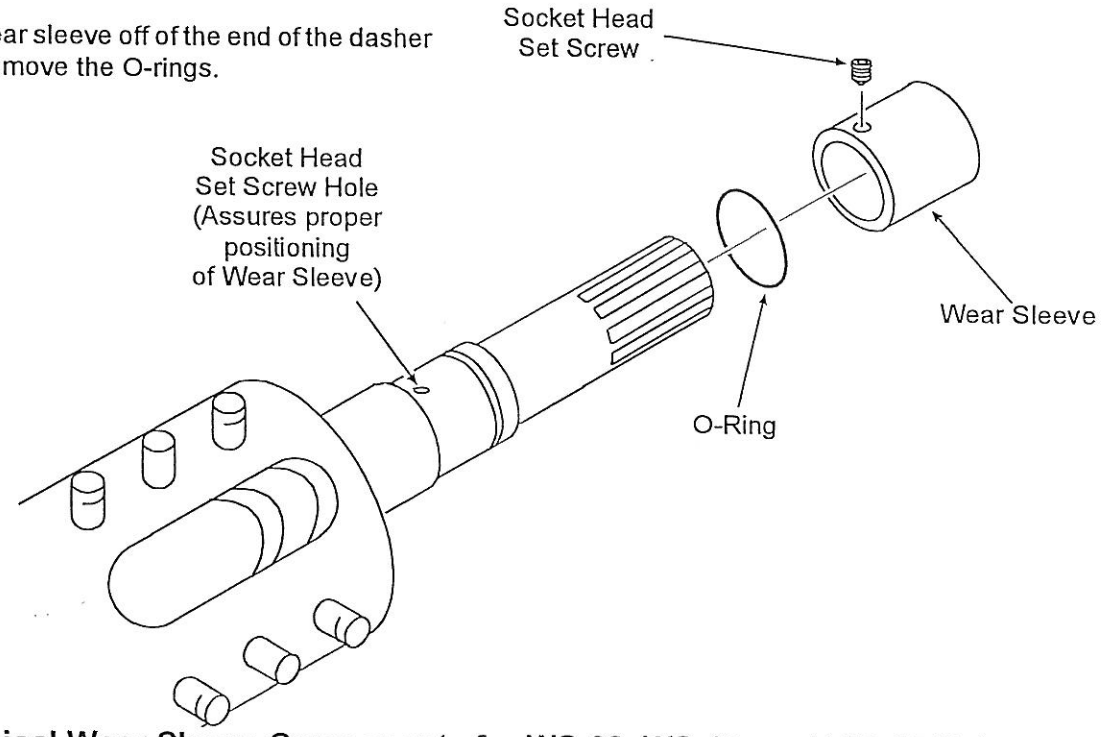
Maintenance

Wear Sleeves

The wear sleeves can be difficult to remove after an extended period of time between service. Wear chemical resistant gloves to get a good grip.

Removal

1. Remove the socket head set screw that holds the wear sleeve to the dasher shaft.
2. Slide the wear sleeve off of the end of the dasher shaft and remove the O-rings.



Typical Wear Sleeve Components for WS-08, WS-12, and WS-15 Units

Installation

1. Inspect the O-ring and replace if necessary.
2. Lubricate the new wear sleeve and O-ring with sanitary lubricant.
3. Slide the wear sleeve and O-ring onto the dasher shaft.
4. Turn the wear sleeve until the hole in the wear sleeve, lines up with the hole in the dasher shaft.
5. Install the set screw.

CAUTION

Make sure the socket head set screw is below the surface of the wear sleeve. It can cause irreparable damage to the bearing surface.

Maintenance

Front Head

The front head has a bushing contained inside. This bushing must be inspected for wear and/or damage with the front head removed.

Removal

1. Remove the snap ring.
2. Remove the front head from the dasher frame.

Installation

1. Install the front head into the dasher frame.
2. Install the snap ring.

Inspection

Measure the inside diameter of the bushing (installed in the front head). Replace if the inside diameter is greater than the value listed in the following tables. (Refer to Front Head Bushing for removal and installation.)

Rear Beater Bearing

Removal

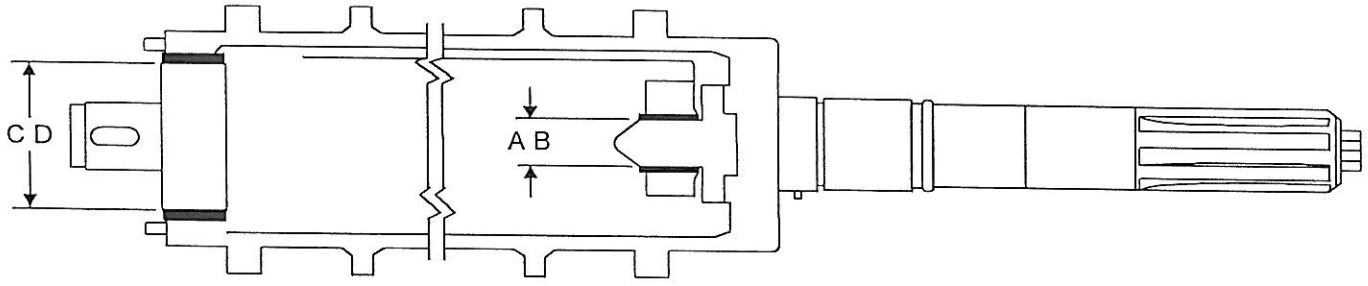
1. Carefully slide the beater out of the dasher.
2. Remove the rear beater bearing by loosening the hex head cap screw from the splined end of the dasher shaft.

Installation

1. Reassemble the rear beater components in the reverse order of disassembly.
2. Apply sanitary lubricant to all bearing locations.
3. Install a new gasket or O-ring in the rear beater bearing.
4. If the rear beater bearing has a locating pin, position the pin in the hole provided.
5. Firmly tighten the hex head cap screw, on the splined end of the dasher.
6. Install the beater, head, and snap ring.

Inspection

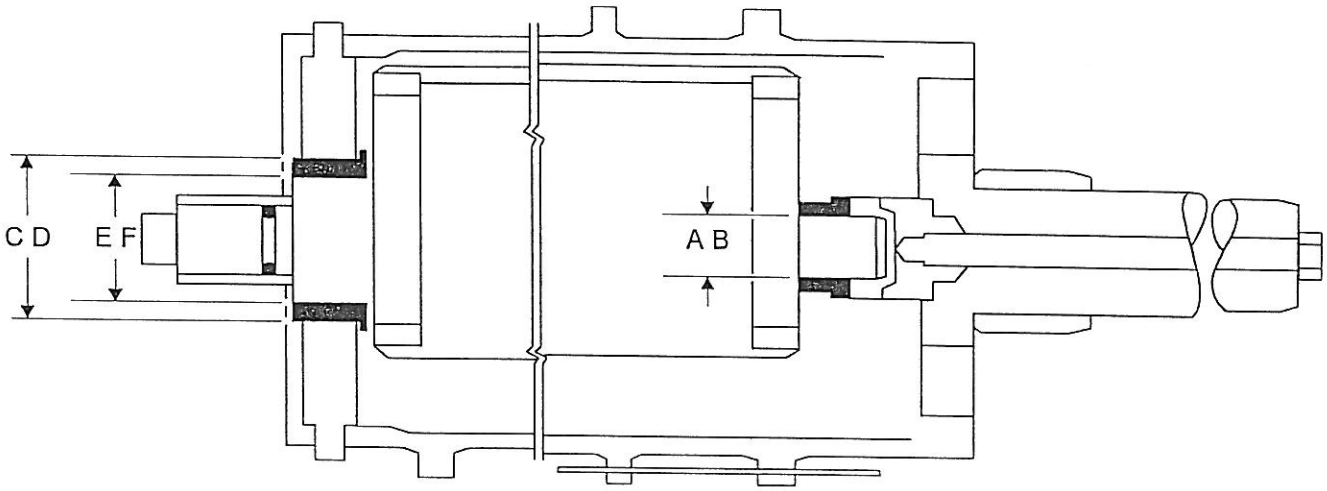
1. Measure the inside diameter of the bearing and the outside diameter of the beater shaft. Compare the dimensions with the maximum and minimum values listed in the tables.
2. Inspect the thrust disc, and replace if necessary. (If applicable.)
3. Replace any parts showing excess wear.



A	B	C	D
Minimum O.D. of Shaft Stub	Maximum I.D. of Bushing Checked in Place	Minimum O.D. of Sleeve	Maximum I.D. of Bushing Checked in Place
.990 in.	1.040 in.	3.240 in.	3.300 in.

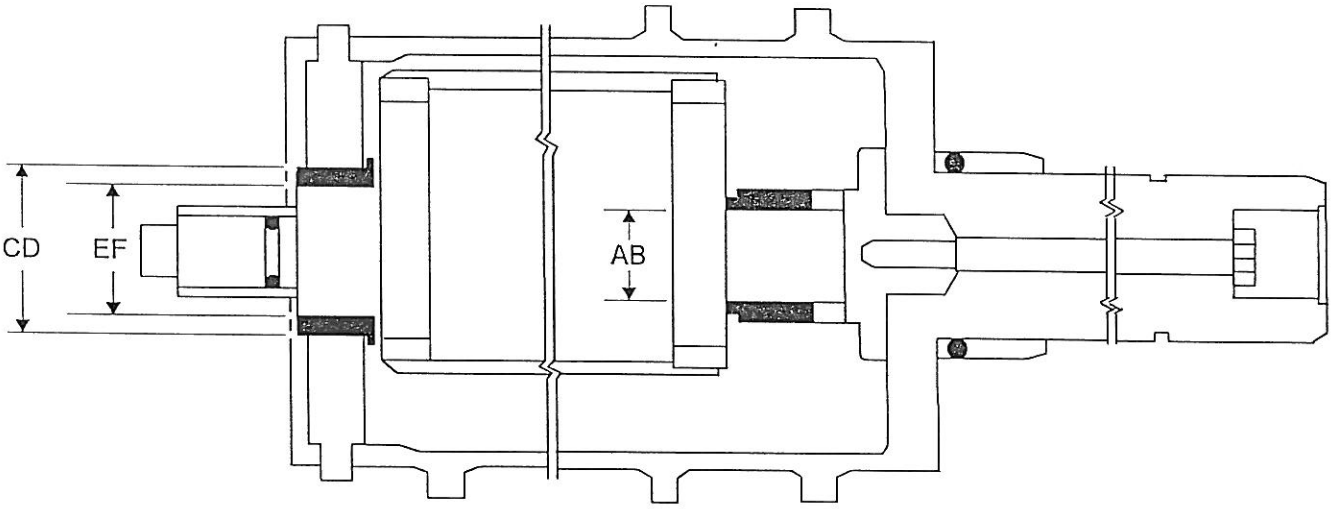
Dasher (Type 30), WS-06 Dasher Component Dimensions

Maintenance



A	B	C	D	E	F
Maximum I.D. of Bearing	Minimum O.D. of Shaft	Maximum I.D. of Head	Minimum O.D. of Bushing	Minimum O.D. of Sleeve	Maximum I.D. of Bushing
1.030 in.	.986 in.	2.385 in.	2.336 in.	2.106 in.	2.160 in.

Dasher (Type 30), WS-08 Component Dimensions



A	B	C	D	E	F
Maximum I.D. of Bearing	Minimum O.D. of Shaft	Maximum I.D. of Head	Minimum O.D. of Bushing	Minimum O.D. of Sleeve	Maximum I.D. of Bushing
1.402 in.	1.357 in.	2.385 in.	2.336 in.	2.106 in.	2.160 in.

Dasher (Type 30), WS-12 and WS-15 Component Dimensions

Maintenance

Front Head Bushing

The bushing is pressed into the head bore. Field replacement requires the use of a light press. (The use of a light press is not necessary when replacing plastic bushings.)

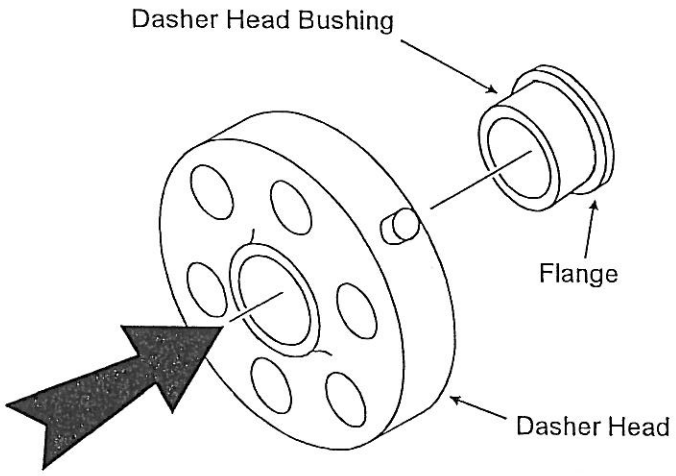
Removal

1. Note the position of the old bushing flange. (The new bushing should be installed so that the flange is on the same side of the head as the old one was.)

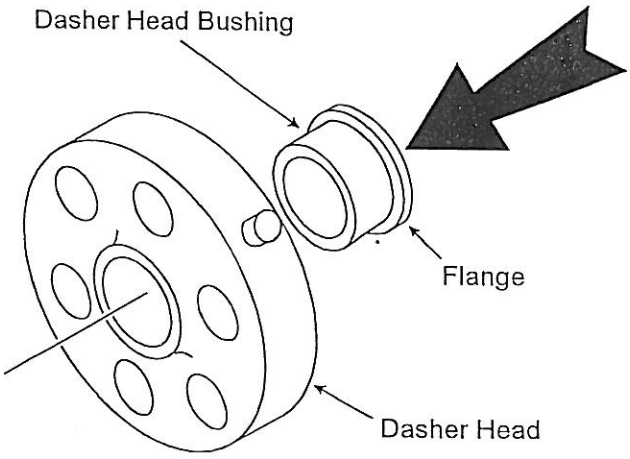
2. Press the old dasher head bushing out of the head bore. (As shown below.)

Installation

Press the new dasher head bushing into place in the head bore.



Front Head Bushing Removal



Front Head Bushing Installation

Maintenance

Dasher (Type 80)

WARNING

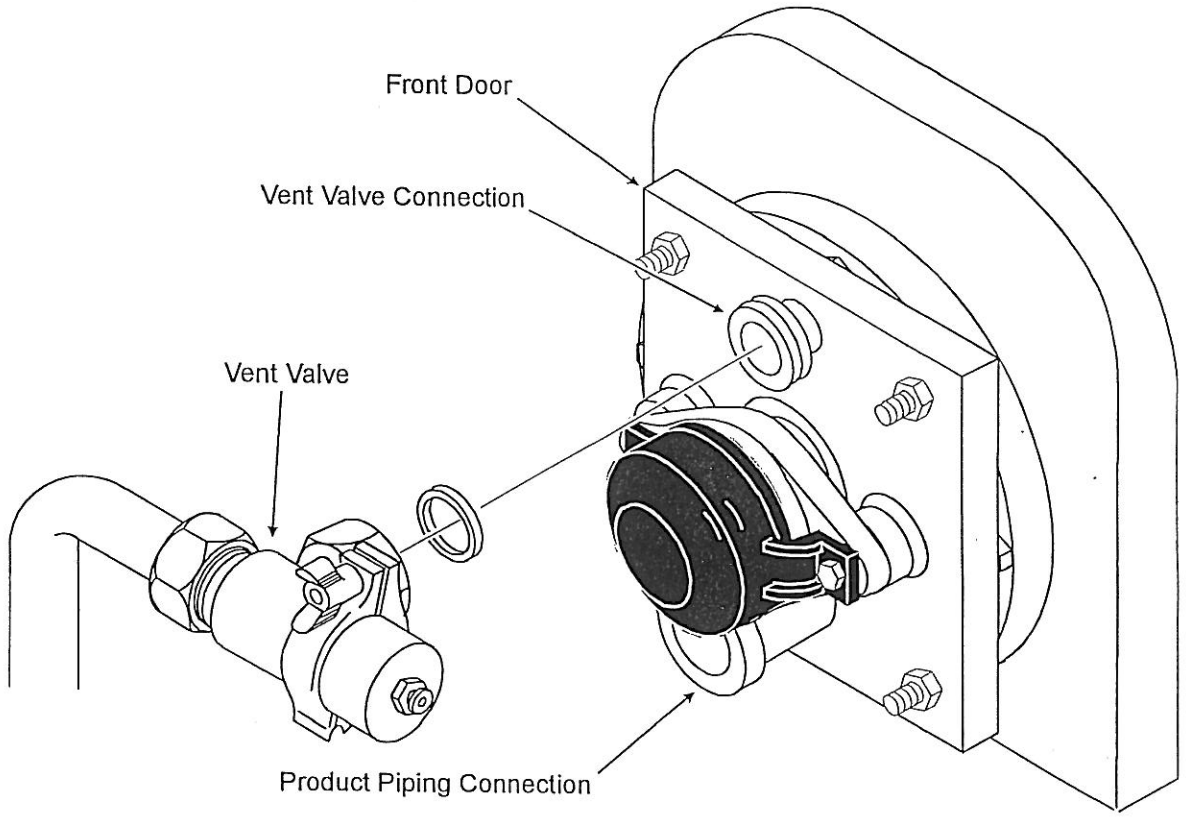
Removal of the dasher should be done by two people to prevent damage to the cylinder or dasher. The dasher should always be pulled out or inserted in a true plane with the cylinder. Do not allow the dasher or blades to rest on or bump the lip of the cylinder. Abuse will require the cylinder or dasher to be repaired.

Removal

The following procedure pertains to WS-08, and WS-12 units.

Dasher removal requires the use of a cylinder protector and dasher holder.

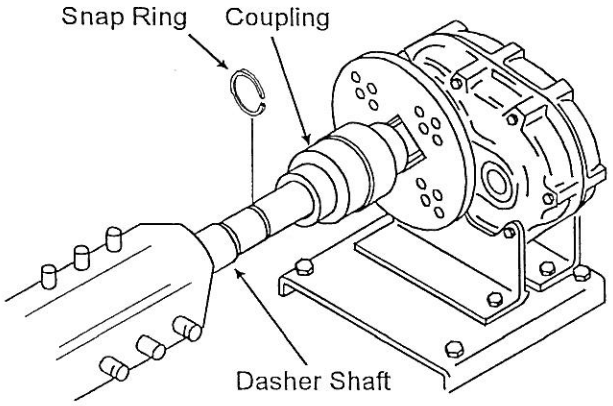
1. Turn off and Lock Out power supply.
2. Disconnect the air supply to the vent valve, at the point where the air line protrudes through the frame. Check the vent valve to see that it is open. If any air or liquids come out of the valve, wait until it stops.
3. Remove the vent valve.
4. Disconnect product piping at the outlet from the front door.



Removing the Vent Valve and Product Piping

Maintenance

5. Remove the snap ring from its groove in the rear of the dasher shaft.

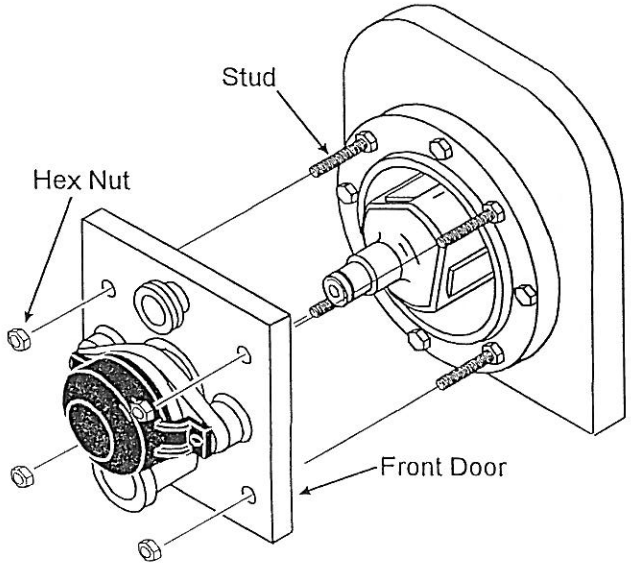


Removing the Snap Ring

6. Remove the hex nuts from the front door.

7. Pull the front door slowly off the studs.

Do not let the dasher fall on the inner cylinder. Damage may occur to the dasher, blades or cylinder.



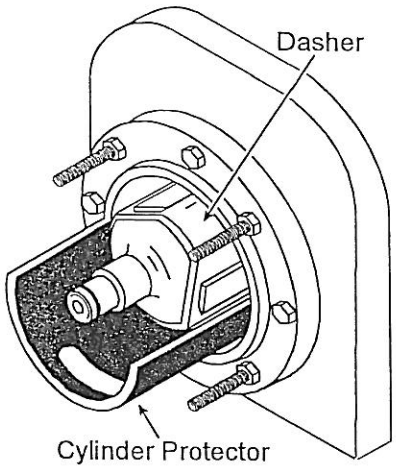
Removing the Front Door

8. Install the dasher puller into the dasher.

9. Lift the front of the dasher and insert the cylinder protector under the dasher.

   a. Slide the cylinder protector all the way in until it stops against the back door.

   b. Position the dasher on the cylinder protector by rotating the dasher so that the weight of the dasher is evenly supported in the curved area of the cylinder protector.



Dasher with Cylinder Protector Installed

WARNING

The dasher has sharp scraper blades that could cause severe cuts. Wear protective clothing for hands and arms whenever handling the dasher. Two workers are required to remove the dasher.

Maintenance

10. Carefully remove the dasher.

    a. Slowly pull the dasher and cylinder protector out of the cylinder, while supporting the dasher and cylinder protector from underneath. Be sure not to scratch the cylinder wall. Watch for the end of the cylinder protector so that the dasher does not drop onto the cylinder.

> **CAUTION**
>
> *Do not hold the dasher from the front only. This could cause the rear of the dasher to drop down and the rear shaft to hit the inner chrome surface causing serious damage. Lift the dasher from the center, supporting the entire weight as it is removed.*

    b. Place the dasher on the dasher holder.

    c. After the dasher and cylinder protector have been removed, look inside the cylinder and remove any seal parts that may have dropped off of the dasher during removal. Remove the seal from the rear door. Keep the front and back end seal parts marked, and separate them from each other for reassembly.

11. Remove the scraper blades. Refer to the Scraper Blade section.

12. When the dasher is out of the unit, certain items should be checked for wear. Refer to Inspection in this section.

Installation

1. Install the scraper blades onto the dasher. Refer to the Scraper Blade section.

> **WARNING**
>
> *The dasher has sharp scraper blades that could cause severe cuts. Wear protective clothing for hands and arms whenever handling the dasher. Two workers are required to install the dasher.*

2. Lubricate the dasher spline shaft.

3. Place the cylinder protector under the dasher. Lift the dasher and cylinder protector together and carefully slide them into the cylinder until the shaft extends approximately 2 in. through the rear door.

Hold the scraper blades to prevent them from contacting the sides of the cylinder.

4. Install the rear seal and follower loosely onto the dasher shaft. Push the dasher shaft through the rear bearing.

5. Install the snap ring loosely onto the dasher shaft.

6. Rotate the dasher as needed to engage the shaft splines and the coupling.

7. With the bearing locating pin aligned with the slot in the rear bearing, slide the dasher toward the rear until the locating pin is fully engaged in the bearing slot.

8. Lift the front of the dasher and remove the cylinder protector.

9. Install the front door.

    a. Inspect the O-rings for the door and dasher shaft. Replace if there is any deterioration. Use sanitary lubricant on O-rings and install them in the door.

    b. Lubricate the front door seal and install the seal and follower loosely over the dasher shaft.

    c. Install the door over the dasher shaft. Lift slightly and install over the four studs. Install the seal and follower into the front door. Line up the slot in the front bearing, with the bearing locating pin (on the front of the dasher). Install and tighten the four nuts onto the studs. Always tighten alternately and evenly.

10. Install the snap ring into the groove on the rear of the dasher shaft.

11. Install the rear seal and follower into the rear door.

12. Reconnect the product piping at the outlet of the front door.

13. Install the vent valve and connect the air supply.

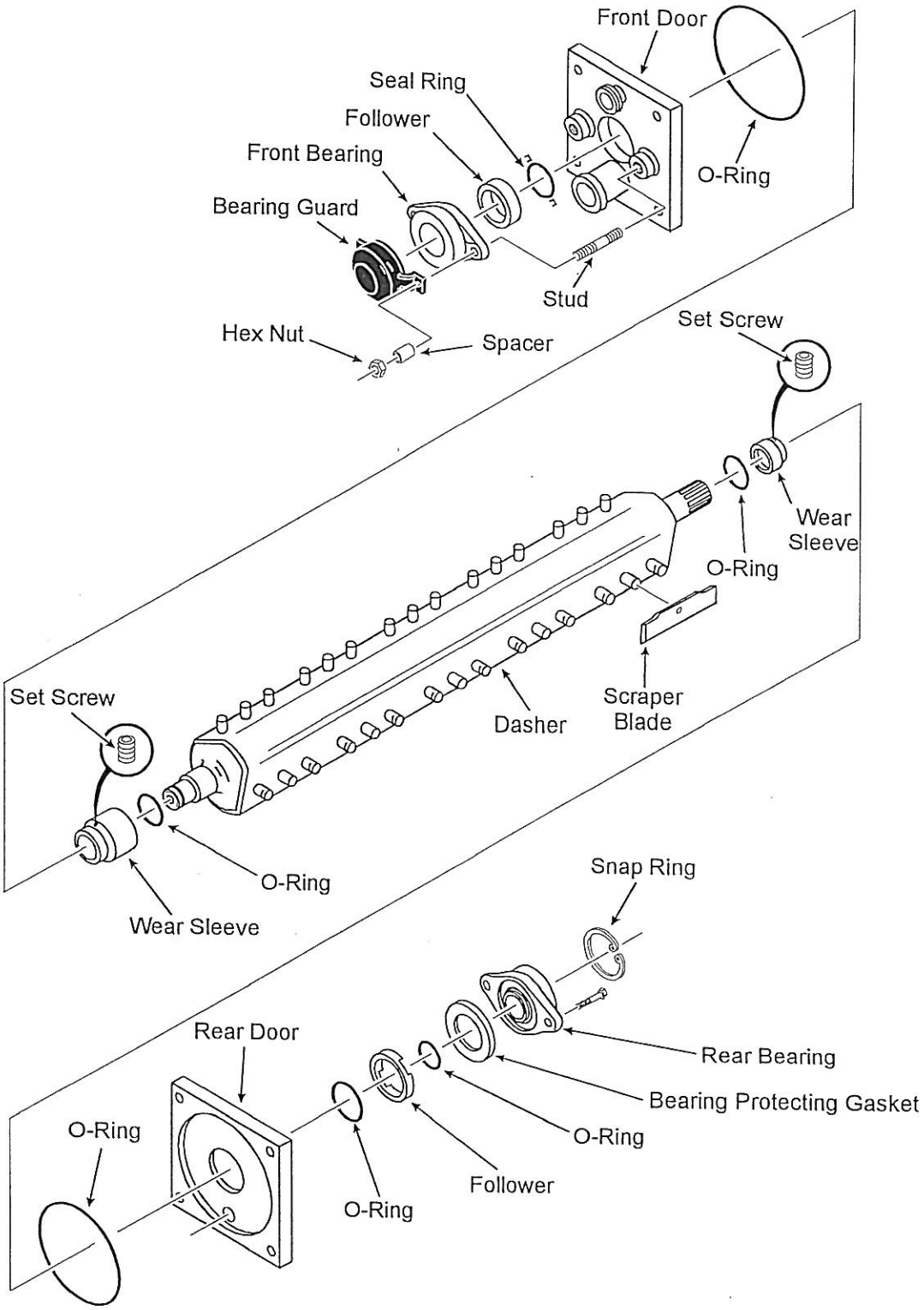
Inspection

The following parts require routine inspection for wear and/or damage.

- Front Bearing
- Rear Bearing
- Seal Ring
- Wear Sleeves
- O-Rings
- Dasher Shaft
- Scraper Blades
- Retaining Ring
- Bearing Protecting Gasket

Refer to the illustration on the following page for the location of individual components.

Maintenance



Dasher (Type 80), WS-08 and WS-12 Typical Components

Maintenance

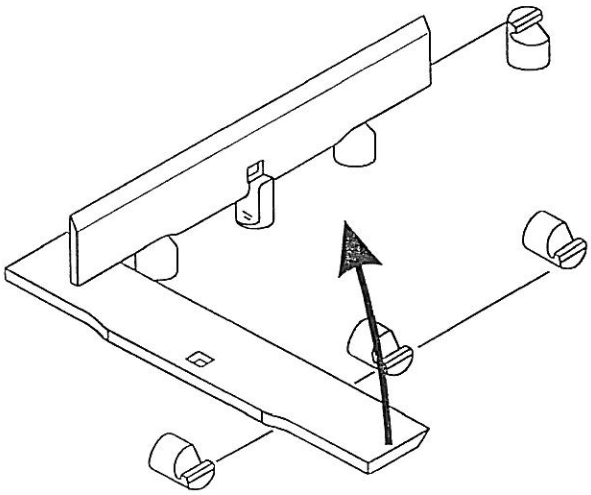
Scraper Blades

WARNING

Scraper blades are sharp and can cause severe cuts. Wear protective clothing and gloves to avoid contacting sharp edges.

Removal

Position the blade so that the scraping edge points directly away from the dasher. Remove by lifting up under one end. Use another blade as a prying tool.



Scraper Blade Removal

Inspection

Scraper blades are made from stainless steel which is hardened by heat treating for extended life. Even so, routine inspection and reconditioning (reconditioning pertains to stainless steel scraper blades only) is required to maintain a correct scraping edge to ensure good scraping of the inner cylinder wall and efficient unit operation.

To prevent unnecessary down time while scraper blades are being reconditioned, maintain a second set and routinely exchange them.

Also:

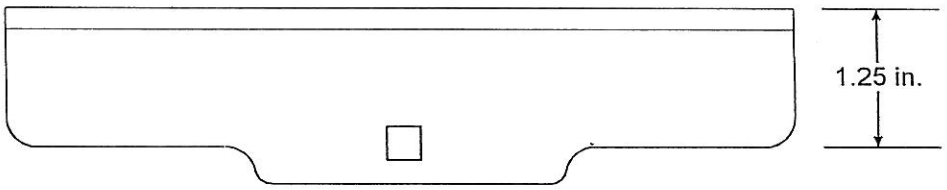
1. Routinely inspect the scraper blades. The frequency of required reconditioning will depend on hours of operation, type of product, and cleaning procedures.

2. Check scraper blades for straightness by holding scraping edge against a flat surface. Replace scraper blades which are more than 1/16 in. out of flat. They cannot be correctly reconditioned.

3. Check scraper blades for nicks or gouges in the scraping edge. Recondition or replace any scraper blades with nicks or gouges.

4. Check the width of the "heel" area of worn scraper blades. Recondition or replace when the "heel" dimension exceeds 1/32 in.

5. Check width at the end of the blade. Replace if width (before or after reconditioning) is less than 1.25 in. See Illustration.



Minimum Blade Width

Maintenance

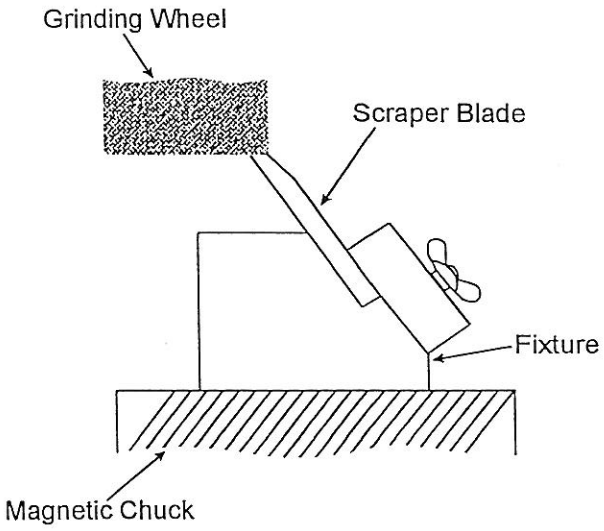
Reconditioning

1. Remove metal from only the 35 degree angle surface until all of the "heel" is removed. See illustration. The finished scraping edge must be smooth and straight.

A scraper blade reconditioning fixture is an available option. The fixture holds the blade at the correct angle for metal removal parallel to the bottom surface of the fixture. The fixture may be held with a magnetic chuck and used with a standard machine shop grinder.

2. Use a piece of hardwood to deburr the ground edges.

3. Install the scraper blades onto the dasher.



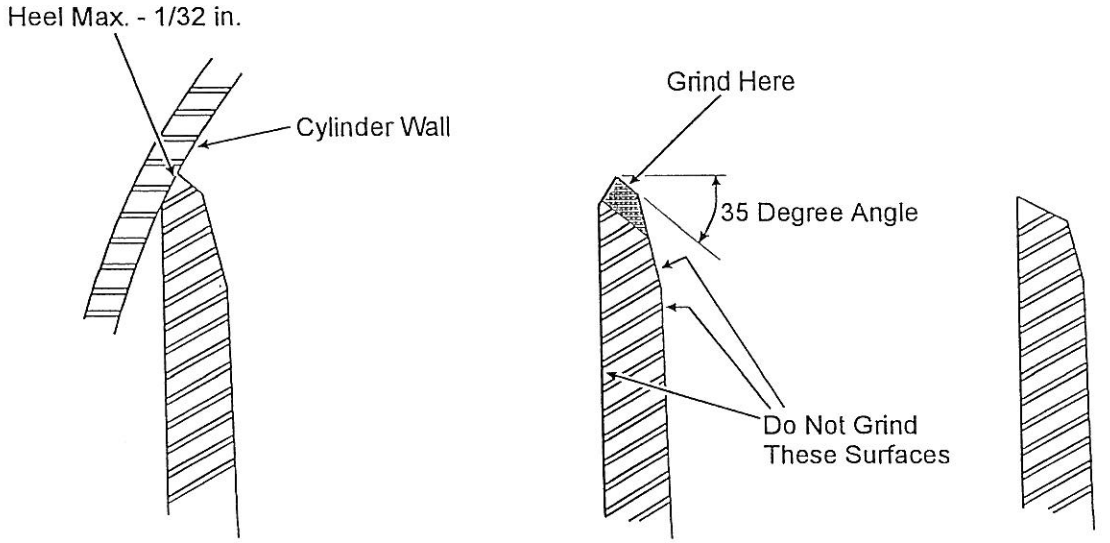
Reconditioning Scraper Blades

CAUTION

Grind slowly and only take off the amount of material necessary to remove the heel. Removing too much material causes premature replacement of scraper blades. Use a coolant when machining if possible to avoid overheating the scraper blade.

CAUTION

Do Not attempt to recondition plastic scraper blades. Plastic scraper blades should be replaced.



Worn Versus Correctly Reconditioned Scraper Blade (Grind Stainless Steel Only)

Maintenance

Belts

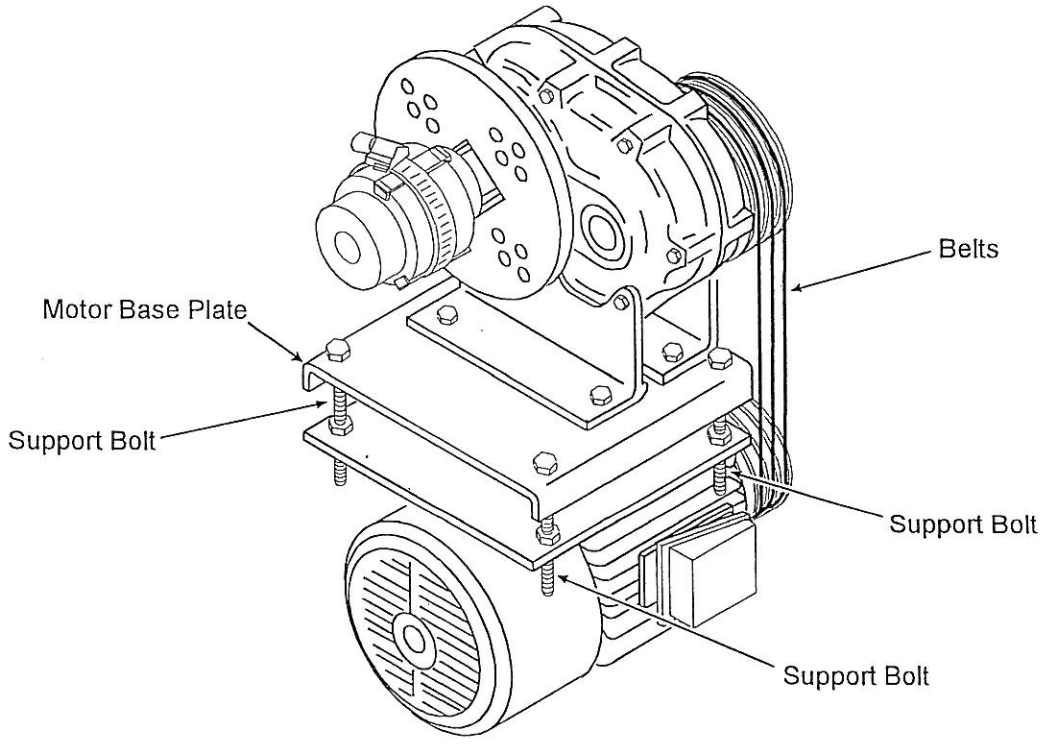
> **DANGER**
>
> *Turn off the electric power supply and Lock Out using a locking device for which only the person doing the work has the key.*

Replacement

1. Remove the panels at the rear and sides of the dasher drive area.
2. Raise the motor base plate by adjusting the nuts above and below the place on the four threaded support bolts. Remove worn belts.
3. Install new belts over the driven pulley. Do not combine new and used belts. All new belts must be "matched" to transmit power equally. Lower the motor base plate by adjusting the nuts above and below the plate on the two threaded support bolts.
4. Adjust the belt tension. See the Tensioning section on following page.

Inspection

1. Remove the panels at the rear of the dasher drive area.
2. Routinely inspect the dasher drive belts for tension and wear. Replace if belts are cracked or worn.

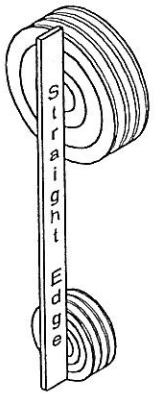


Belt Related Components

Maintenance

Tensioning

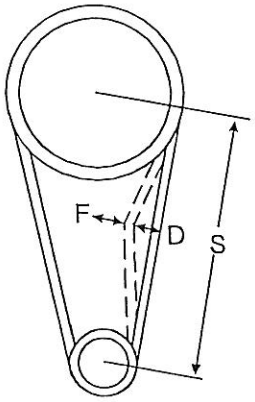
Raise or lower the motor base plate to adjust belt tension by adjusting the nuts above and below the plate on the two threaded support bolts. Check to be sure the pulleys are aligned, using a straight edge, after all bolts are tight.



Proper Pulley Alignment

Adjust the belt to the proper tension using the diagram and table below.

Use the tension tester (found in the extra parts shipped with the unit) to determine the tension of the belts.



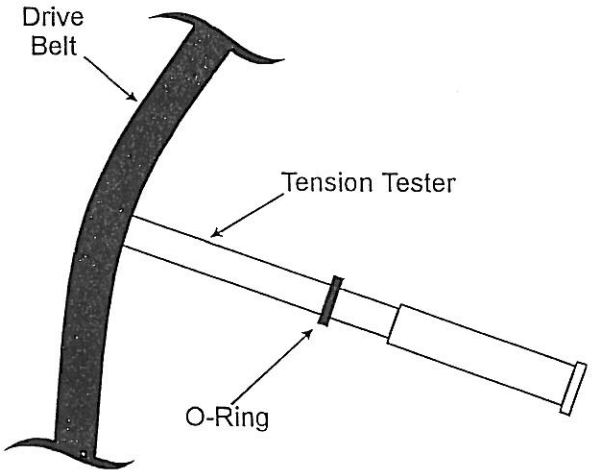
Drive Belt Tension Variables

S (Spacing)	D (Deflection)	F (Force)	
		New Belt	Used Belt
24.6 in.	3/8 in.	7.9 lb.	5.3 lb.

Drive Belt Tension

To use the tension tester:

1. Set the O-ring to the top or at 0 lb.
2. Use the tester to deflect the belt the specified distance. This produces the reading on the tester. The O-ring will move down the shaft of the tester and stop on the scale, thus recording the force needed to deflect the belt.
3. Compare the reading of the tester to the required amount from the chart. If the amount is different, adjust accordingly.



Using the Tension Tester

Maintenance

Rotary Pump

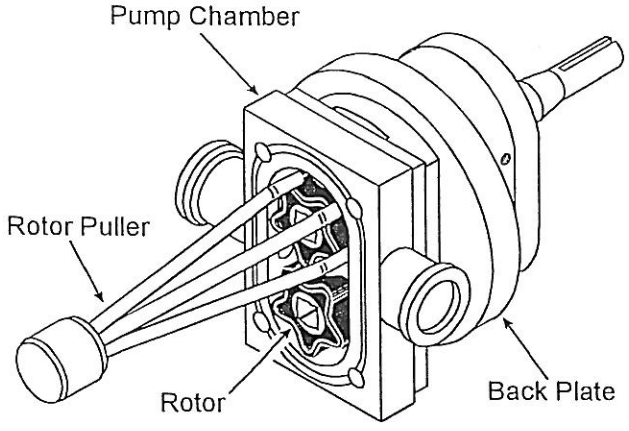
Rotor

Removal

1. Remove all product and mix piping from the rotary pump.
2. Remove the front cover from the pump chamber.
3. Insert the rotor puller furnished with the unit into the depression sections of the rotor lobes.

> **CAUTION**
>
> *Always use the rotor puller supplied with the unit to remove the rotors. Never use a sharp object such as a screwdriver or a knife. This will cause irreparable damage to the rotors.*

4. Press the fingers of the rotor puller and bring the rotor forward while holding the remaining rotor in place. A slight vertical or horizontal motion may be necessary to aid in withdrawing the rotor.



Rotor Removal

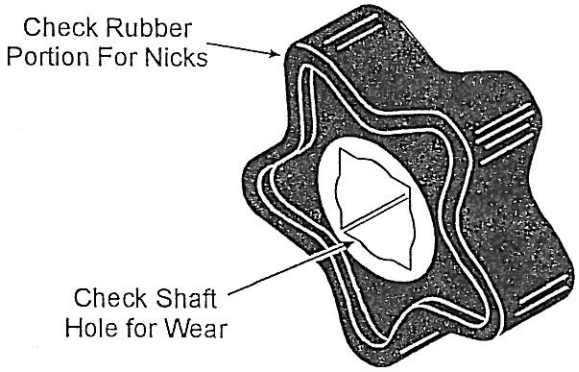
5. Remove the remaining rotor.
6. Remove the pump chamber and backplate.

Inspection

Inspect the rotors for the following.

1. Nicks in the rubber.
2. Worn shaft hole.
3. Worn rotor faces.
4. Rubber deterioration.

If the rotors are worn, replace them with new ones. Always replace the rotors in pairs.



Rotor

With the rotors removed, inspect the shafts for visible signs of wear. Refer to Shafts, Inspection.

Rotor Installation

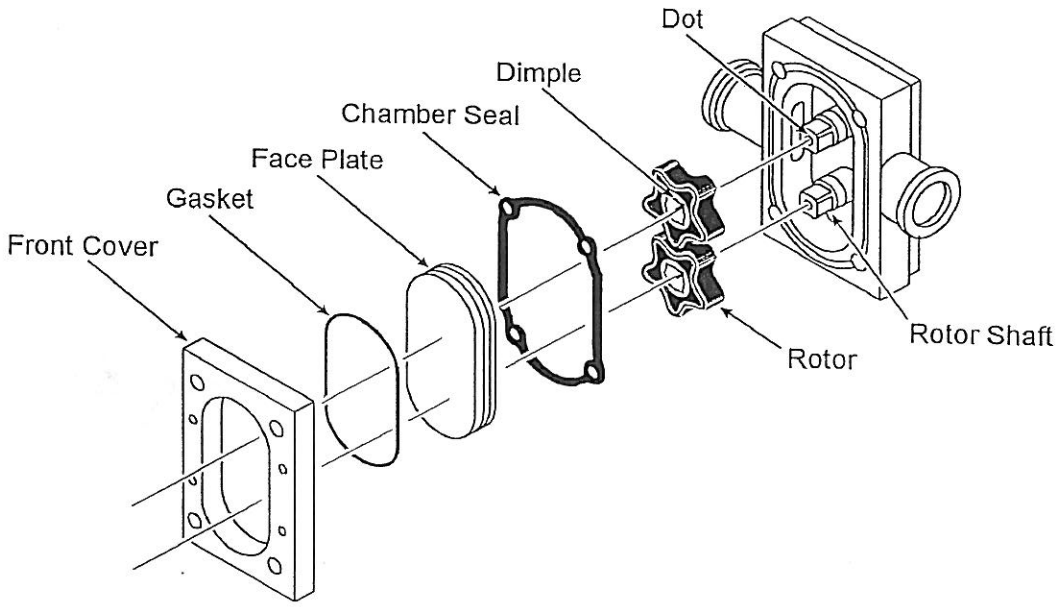
1. Install back plate and pump chamber.
2. Install shaft seals using the seal inserter.
3. Apply sanitary lubricant to rotors and shafts.

Maintenance

3. Assemble rotors onto shafts by hand. Make sure the dimple (match mark) on the rotor is lined up with the dot (match mark) on the rotor shaft.

4. Replace the old gasket with a new one as required.

5. Replace the front cover.



Rotor and Front Cover Installation

Shafts

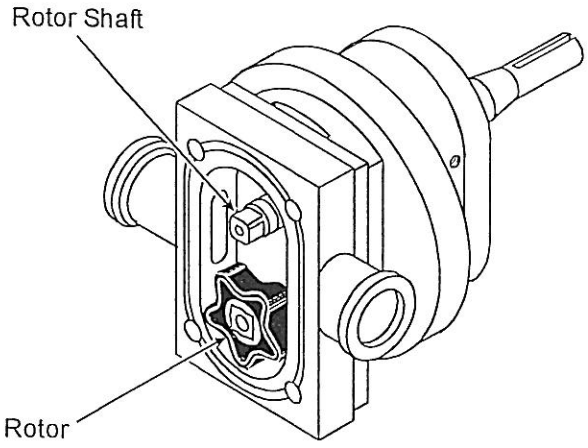
Inspection

With the rotors removed, inspect the rotor shafts for visible signs of wear. To check for wear, perform the following test:

1. With only one rotor on the rotor shaft (use an old rotor), check for lateral and vertical play.

2. If excess play is found, wear may be in the shaft or the rotor. Repeat the test with a new rotor. If no play is evident, the old rotor was worn.

3. If play still exists, then the shaft is worn. Replace the shaft or in extreme cases, the entire gear-case.

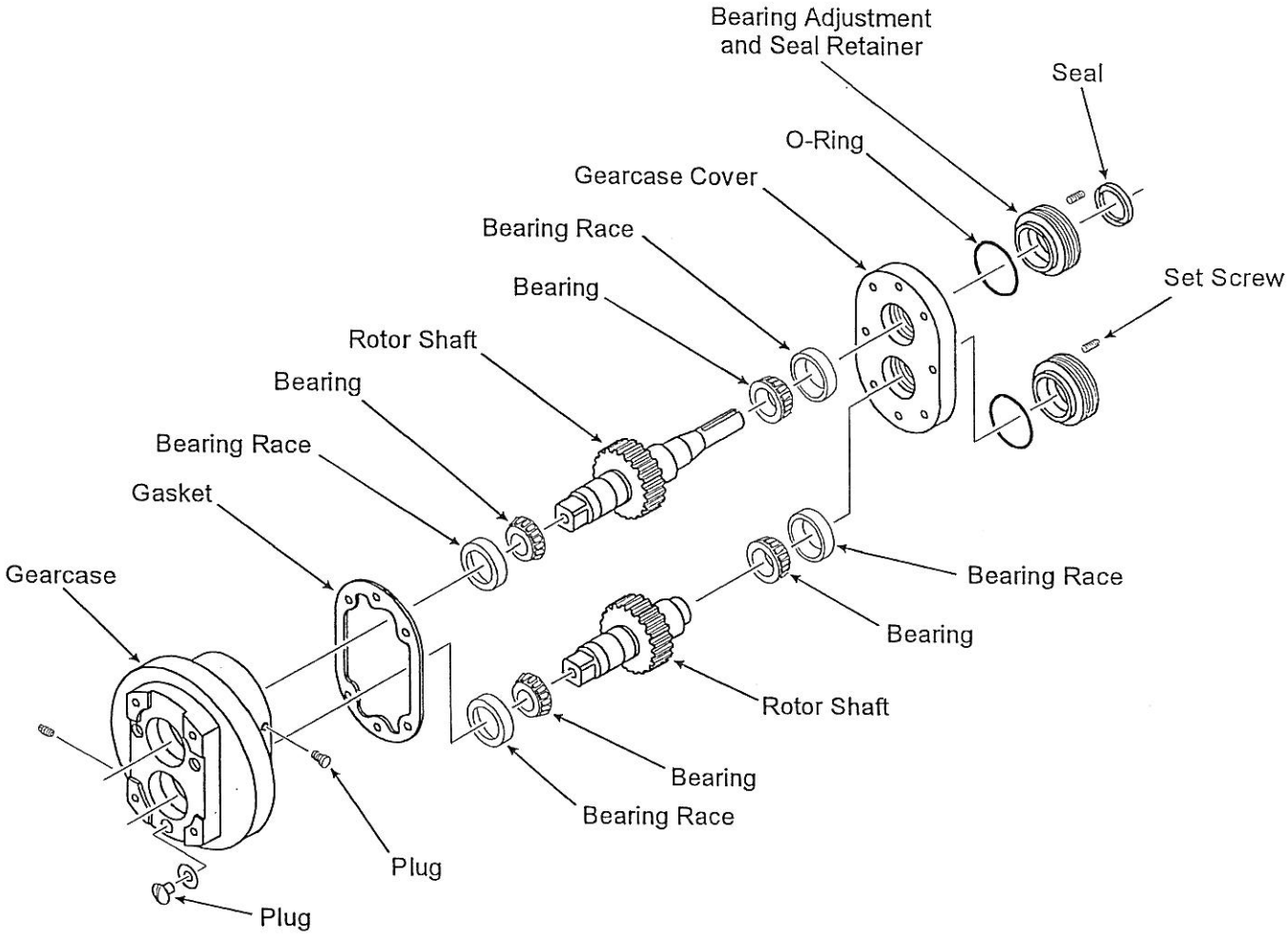


Rotor Shaft Inspection

Maintenance

Replacement

1. Remove the pump from the unit.
2. Drain the oil from the gearcase.
3. Remove the cap screws on the rear of the gearcase to remove the cover.
4. Carefully remove the gearcase cover by sliding it to the end of the drive shaft. Use care not to damage seals.
5. Slide the shafts out of the rear of the gearcase.
6. Install new bearings on the new shaft.
7. Reassemble the gearcase and adjust the bearings.
8. Fill the gearcase to the proper level with oil.



Shaft Replacement

Maintenance

Pump Chamber

Inspect the pump chamber for wear. If the pump chamber is worn, it must be replaced.

Inspection

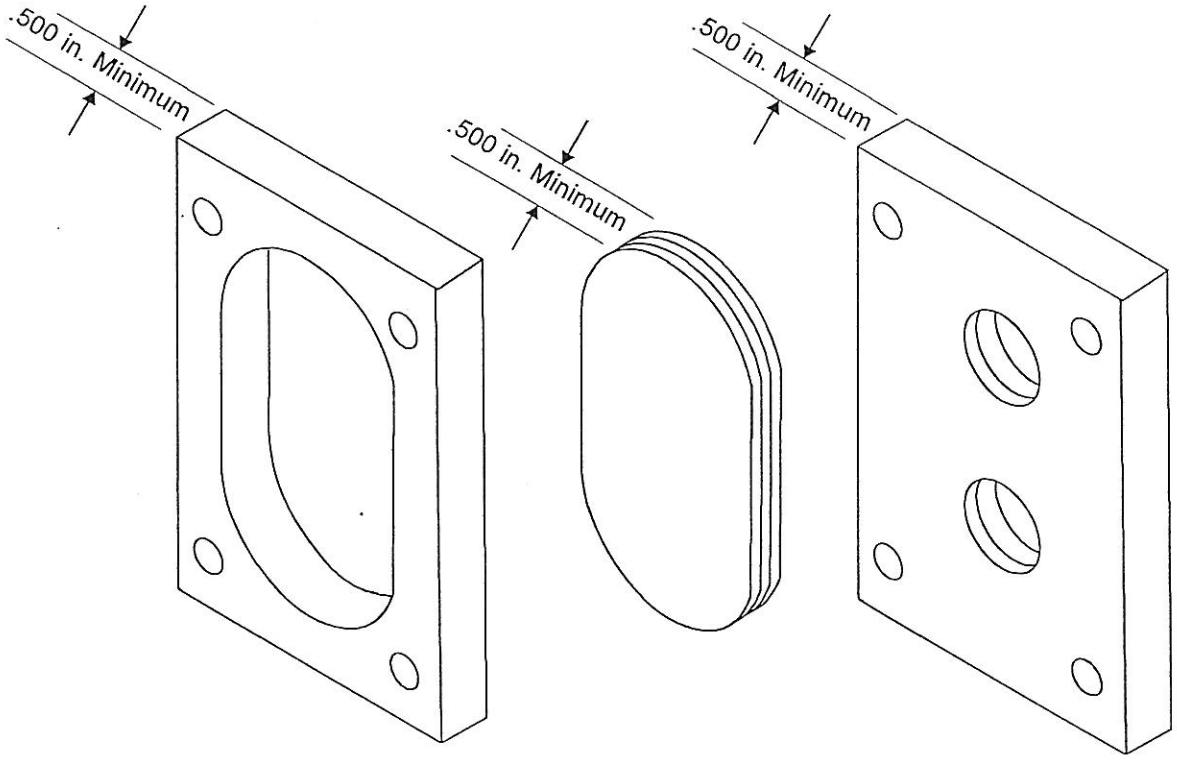
Inspect the pump cover, face plate, and back plate for wear. If the wear depth exceeds .005 in., they should be reconditioned or replaced.

Reconditioning

If the wear on the pump cover or plates reaches .005 to .010 in., they must be reconditioned. To recondition, do the following.

1. Remove the worn plates from the pump.
2. Surface grind the plate until the scores on the plate are gone. Do Not grind more than is needed.
3. If the plates reach the minimum thickness, they must be replaced. See table for minimum dimensions.
4. Reassemble plates.

When reconditioning more than one pump, make sure that the plates are reassembled in the same pumps that they were removed from.



Minimum Thickness of Front Cover, Face Plate, and Back Plate

Maintenance

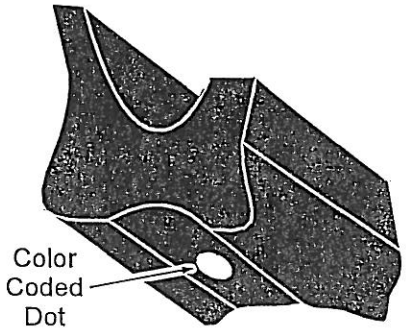
Shaft Seals

Replacement

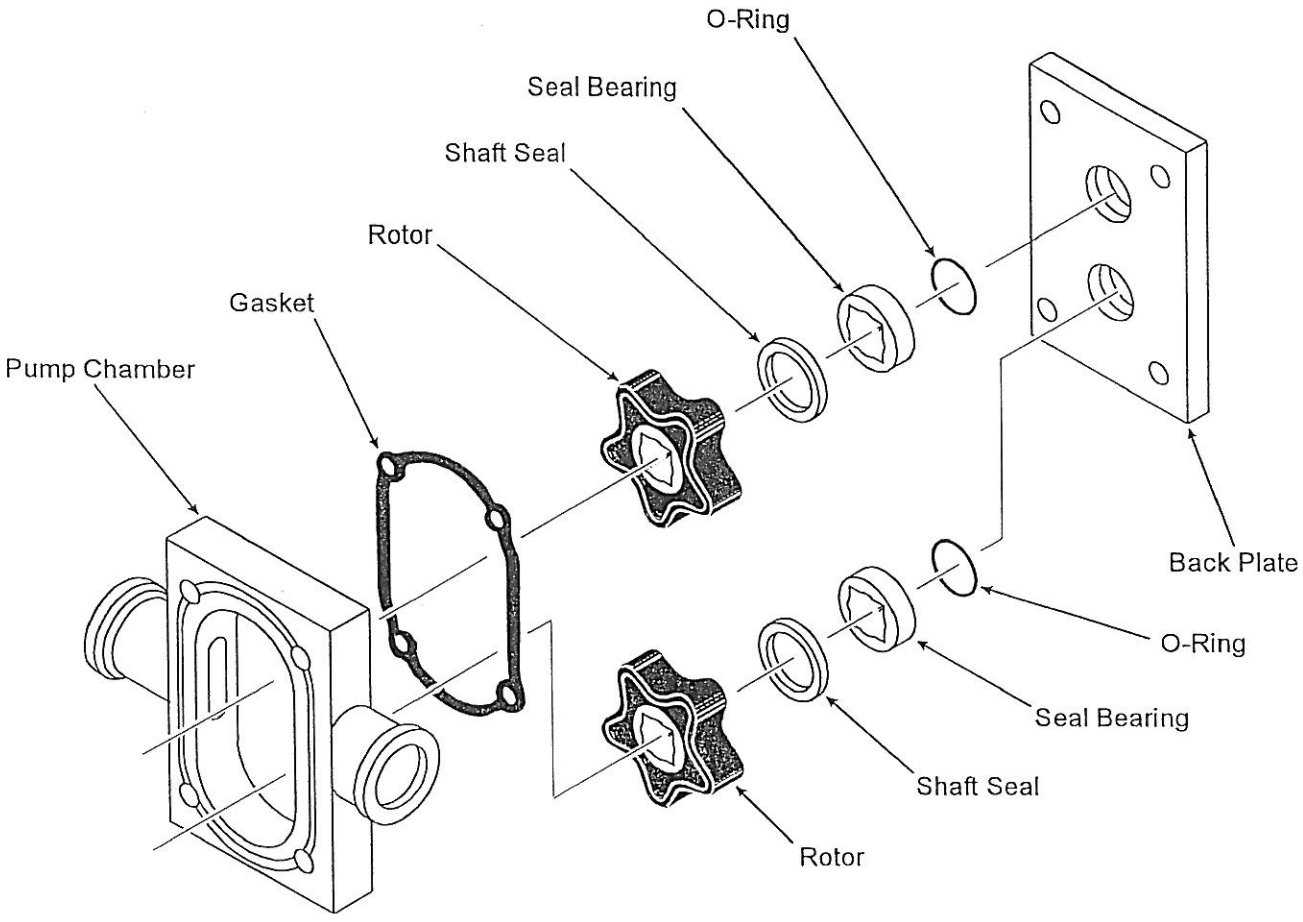
The product seals prevent the product from leaking out of the pump body around the shaft. If product is leaking, then the seals, and/or seal bearings, must be replaced. This is accomplished by:

1. Removing the rotors from the pump.
2. Removing the backplate from the pump.
3. Removing the old shaft seal.
4. Reassembling the backplate onto the pump.
5. Installing the new shaft seal using the seal inserter.

The color coded dot on the shaft seal is important. Always replace with a seal that has the same color coded dot as the one removed.



Color Coded Dot Location

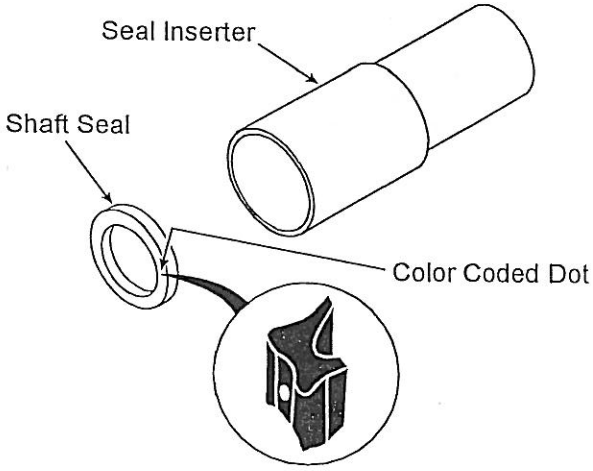


Replacing the Shaft Seals

Maintenance

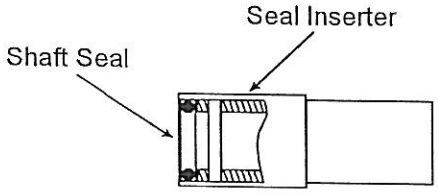
To use the seal inserter:

a. Lubricate the new shaft seal and insert it into the seal inserter, with the color coded dot facing outwards.



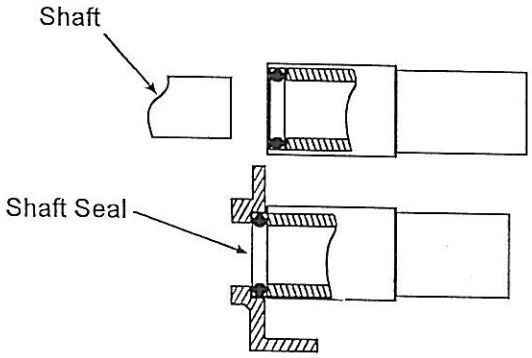
Lubricating and Positioning the Shaft Seal

b. Slide the inner cylinder of the seal inserter forward until it contacts the shaft seal.



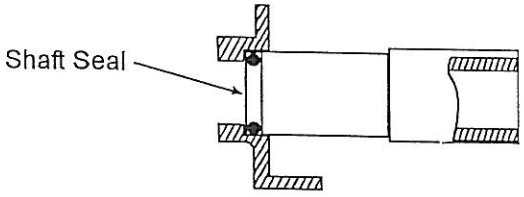
Inserting The Shaft Seal Into Seal Inserter

c. Carefully slide the inner cylinder forward until the seal is flush with the outer edge of the inserter. Place the inserter over the shaft and slide the seal into place by sliding the inner cylinder forward.



Installing New Shaft Seal Onto Shaft

d. On pump No. 2.5, reverse the seal inserter and seat the seal into the cavity.



Seating the No. 2.5 Pump Seal

6. Reassemble the pump.

Maintenance

Lubrication

Checking Oil Level

The oil level in the pump gearcase should be checked monthly and the oil should be changed every 500 hours of use.

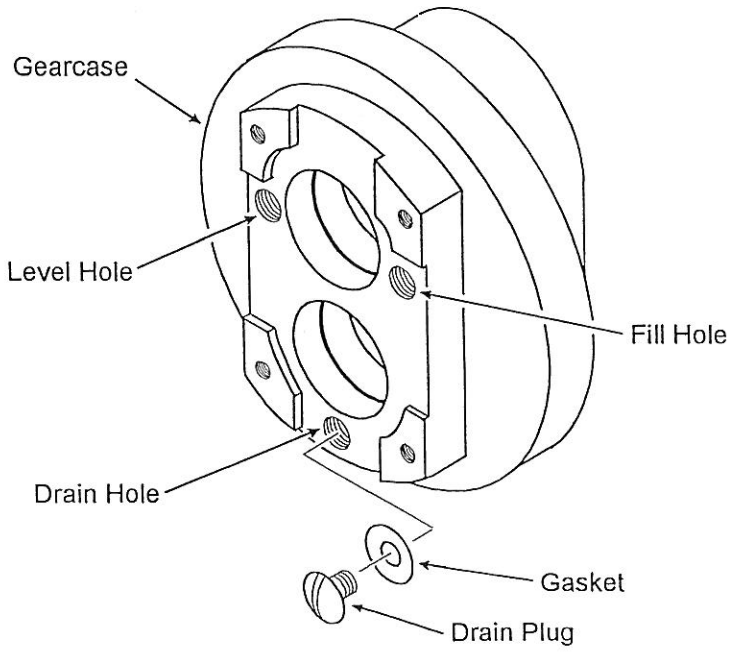
1. Remove the fill plug and the level plug.
2. Pour a small amount of fresh oil in the fill hole. APV CP Homolube (APV Crepaco Part Number 902-S-1456) is recommended.
3. Keep adding oil until it begins to run out the level hole.
4. When the oil stops flowing out the level hole, replace the plugs.

Changing the Oil

1. Remove the drain plug to drain the old oil from the gearcase.
2. Remove the fill plug and add a small amount of fresh oil to flush any contaminates from the gearcase.
3. When the oil stops flowing out, replace the drain plug.
4. Remove the level plug and add oil until it begins to flow out the level hole. APV CP Homolube (APV Crepaco Part Number 902-S-1456) is recommended.
5. Replace the fill plug and the level plug.

CAUTION

Do not over fill the gearcase with oil. If the gearcase is over filled, the gears are not lubricated properly. This can cause severe damage to the gears. Use the recommended oil only.



Gearcase Plug Location

Maintenance

Shaft Bearings

Replacement

To replace the bearings, do the following:

1. Disassemble the gearcase to remove the shafts.

2. To remove the shaft bearings, use a bearing puller (not included) or cut the old bearing off.

3. To install the new shaft bearing, the bearing inner race must first be heated until very hot. Heat until the grease starts to smoke.

4. The hot bearing races should slide on the shaft easily. If not, use a soft hammer to tap them into place.

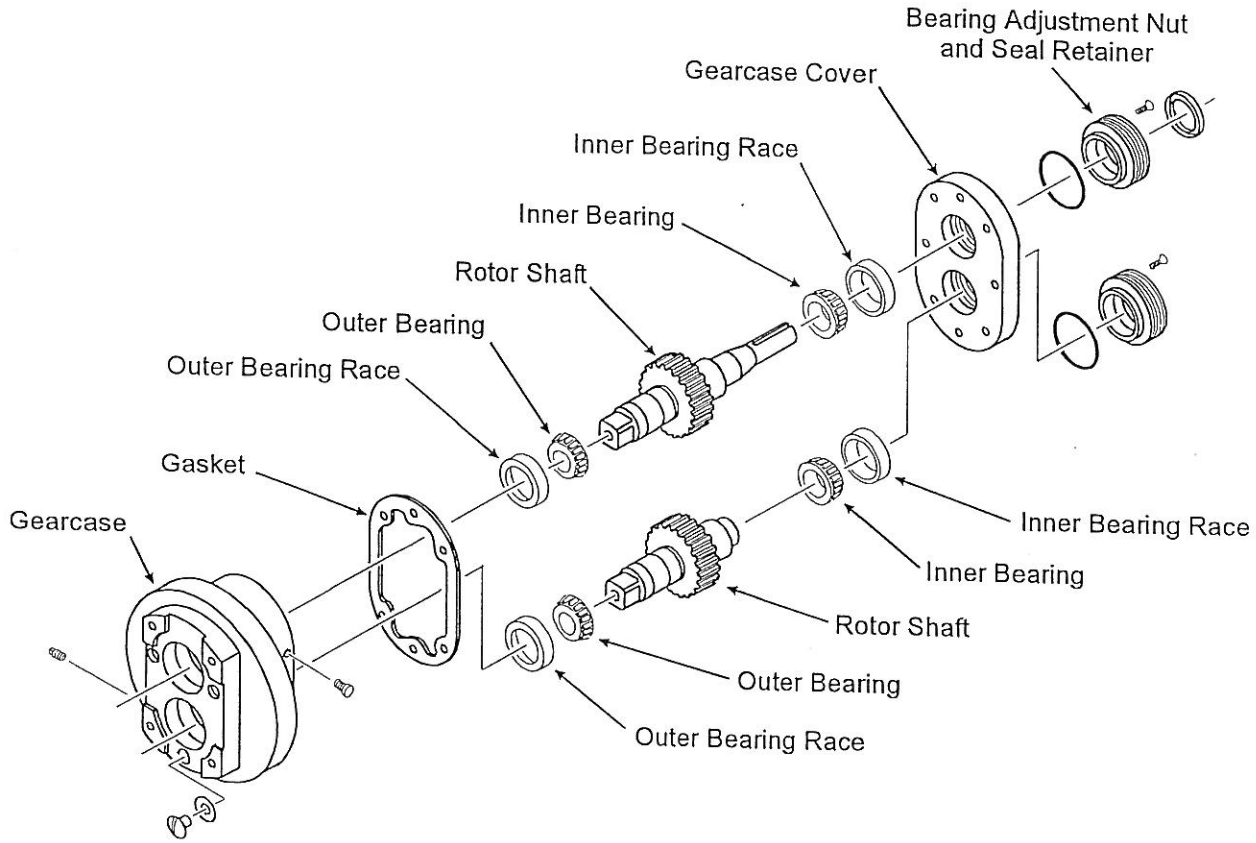
> **WARNING**
>
> *The shaft bearings need to be heated to a very high temperature to fit on the shaft. The bearings, therefore, can cause a severe burn. Always use insulated gloves or a clamping device to handle the hot bearings.*

5. The outer bearing race is a light press fit into the gearcase, use a soft hammer to tap it into place.

6. Reassemble the shafts in the gearcase and re-assemble gearcase.

7. Replace the oil seal if necessary.

8. Adjust the shaft bearings.



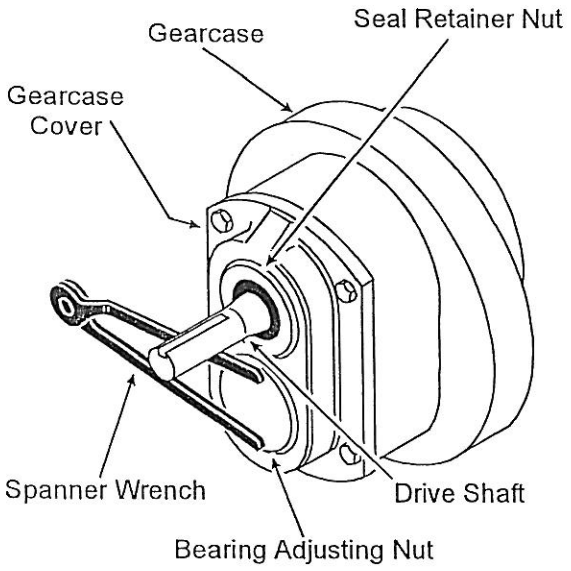
Shaft Bearing Replacement

Maintenance

Adjustment

The adjustment of the shaft bearings is critical in the smooth operation of the pumps. The adjustment made to the shaft bearings is to eliminate end play in the shaft. This is accomplished by doing the following:

1. Remove the set screws from the seal retainer nut and the bearing adjustment nut.
2. Rotate the drive shaft and tap lightly to free up the bearings.
3. While rotating the drive shaft, use a spanner wrench (not supplied) to tighten the seal retainer nut until resistance is felt in the shaft.
4. Mark the seal retainer nut and gearcase and back the nut off 180 degrees.
5. Tighten the bearing adjustment nut in the same fashion, but Do Not back off.
6. Tighten the seal retainer nut to the mark and replace the set screws.



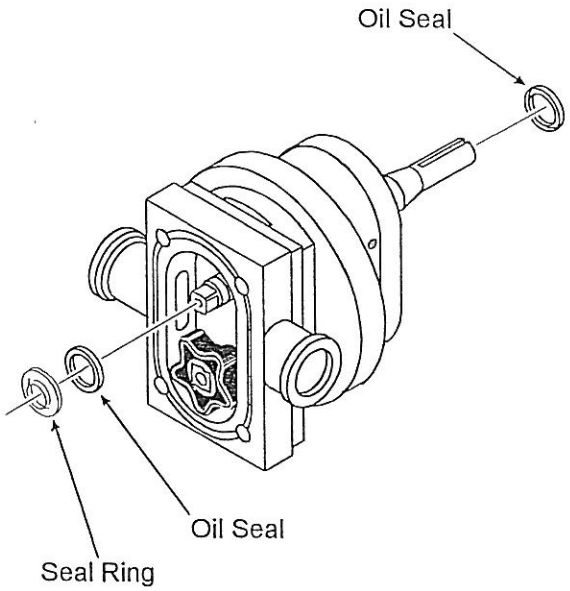
Adjusting Shaft Bearings

Oil Seals

Replacement

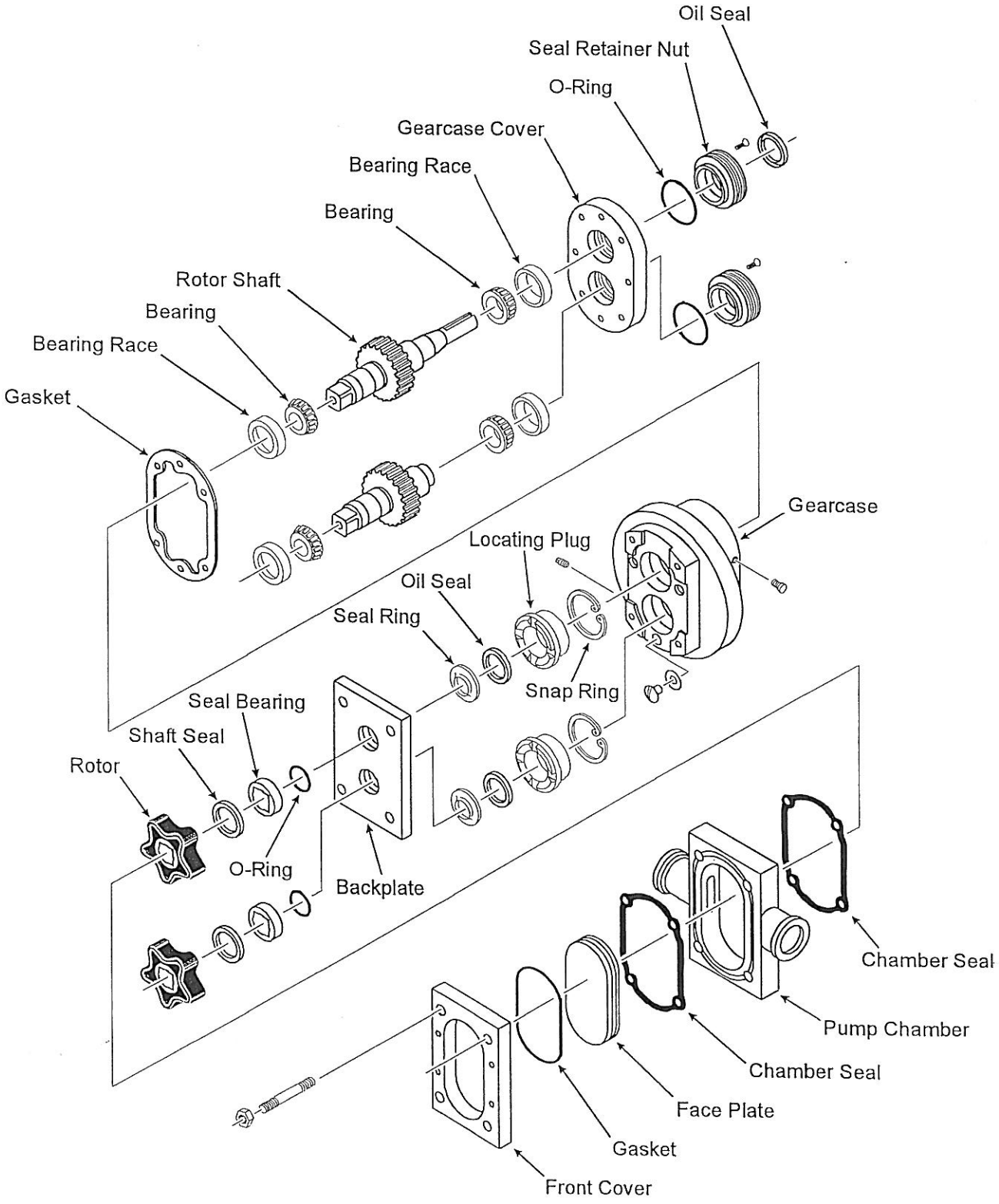
If oil leaks out of the gearcase from around the shafts, then the oil seal must be replaced. This is done by doing the following:

1. Inspect the shafts to locate the bad seal.
2. Remove the seal ring.
3. Remove the oil seal.
4. Install a new oil seal.
5. Install the seal ring. If the old seal ring is worn, replace it.



Replacing the Oil Seal

Maintenance



Rotary Pump Exploded View

Maintenance

Dasher Drive Gear Box

DANGER

Turn off the electric power supply and Lock Out using a locking device for which only the person doing the work has the key.

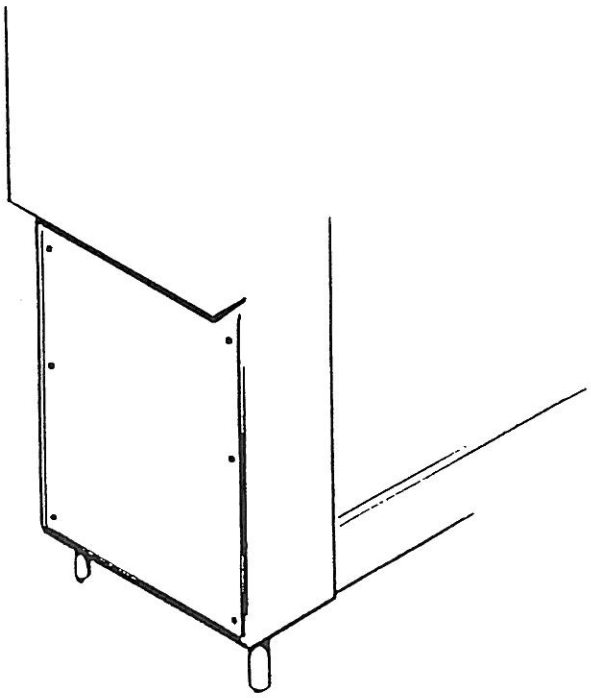
Disassembly

Refer to the Belts section for proper belt removal and installation procedures.

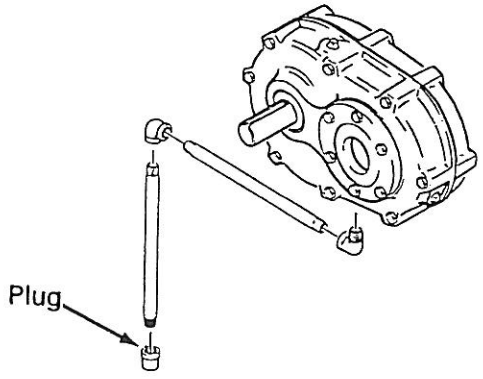
1. Remove the dasher drive belts from the pulleys.
2. Remove the pulley from the input shaft of the gear box.

Remove the key from the key slot on the input shaft after the pulley is removed.

3. Remove the dasher gear box from the unit.
4. Remove the plug on the bottom of the gear box and drain the oil.

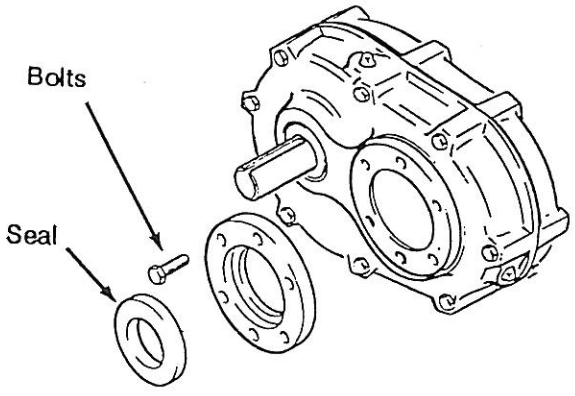


Rear Access to Belts and Pulley



Drain Plug Location

5. Remove the six bolts from the adapter plate and remove adapter plate.
   a. Remove any gasket particles that may remain on front housing or the adapter plate.
   b. Remove the seal from the adapter plate.



Adapter Plate

Maintenance

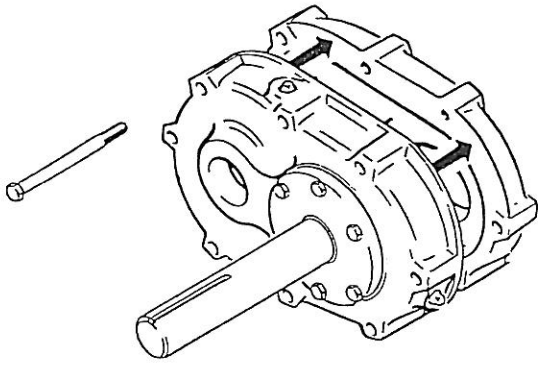
6. Remove the eight bolts which hold the two housing halves together.

7. Separate the two housing halves.

   a. Separate the housing halves evenly to prevent damage to the housing or internal parts.

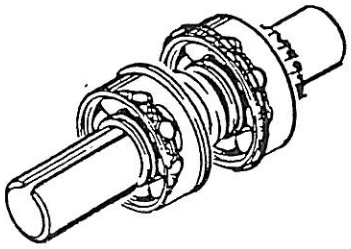
   b. Do Not use a hard hammer to tap on housing.

Be careful not to damage the housing when attempting to separate.

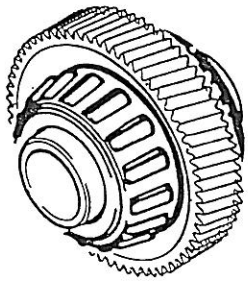


Separating Housing

8. Remove the input shaft assembly and the output shaft assembly from the housing.

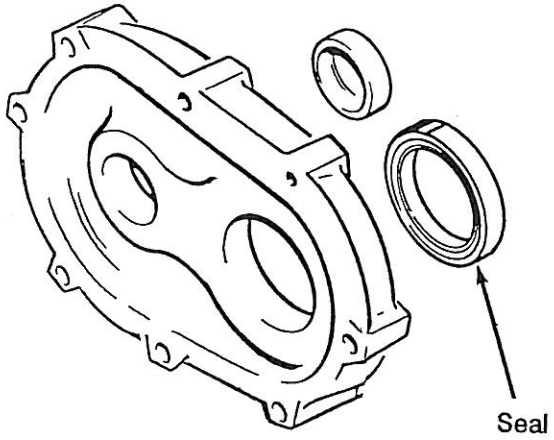


Input Shaft Assembly



Output Shaft Assembly

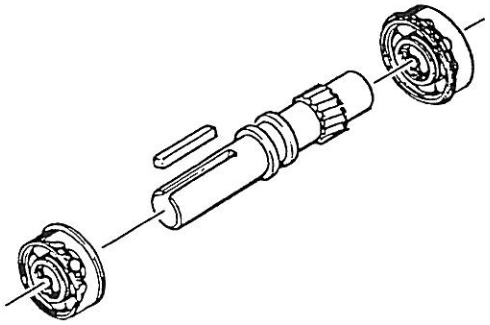
9. Remove the seal from the rear housing.



Rear Housing Seal

10. Disassemble the input shaft assembly using a press.

The bearings may be removed from the shaft with the use of a press. When using a press, be careful not to damage the shaft.



Input Shaft Disassembly

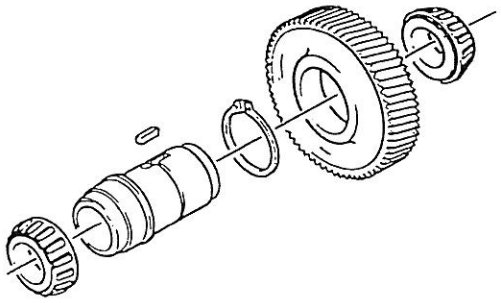
11. Disassemble the output shaft.

    a. The bearings may be removed from the shaft with the use of a press. The bearing races may be removed from the rear housing using a hammer and punch.

When using a press, be careful not to damage the shaft.

    b. Remove the snap ring from the output shaft.

    c. Slide the gear off of the output shaft and remove the key from the key slot. Note which direction the gear is facing on the shaft so it can be installed in the same direction during assembly.



Output Shaft Disassembly

Maintenance

Check the key and the key slot for wear. Replace if worn.

12. Clean all parts in solvent and dry thoroughly.

13. Inspect all parts for damage and/or wear. Replace any parts that are damaged or worn.

Assembly

1. Assemble the output shaft assembly.

   a. Install the key in the key slot on the output shaft.

   b. Slide the gear onto the shaft in the same direction as noted in disassembly.

   c. Install the snap ring.

   d. Install the new bearings on the output shaft using a press.

Press on the inner race only. This will prevent damage to the new bearing.

2. Assemble the input shaft assembly.

   - Press the new bearings onto the shaft.

3. Prepare the housing halves for re-assembly.

   - Press the bearing races for the output shaft into the housing.

Be careful not to damage the bearing races or housing while pressing in races.

4. Mesh the gears on the input and output shaft and slide assembly into housing half.

5. Place a bead of gasket replacer on both housing halves and spread evenly. Do not leave any bare spots.

6. Place the other housing half into position until the two housing halves touch.

7. Install the eight bolts, washers and nuts.

8. Install the adapter plate and the six bolts which secure it.

9. Install the oil seals.

Use care not to damage seals when installing them.

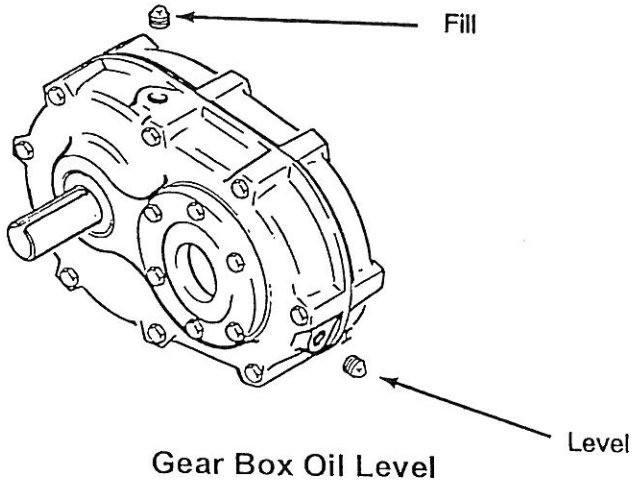
10. Replace the drain plug.

Lubrication

1. Remove the level plug and the fill plug from the housing.

2. Fill the gear box through the fill hole until the oil begins to run out of the level hole.

3. Replace both plugs.



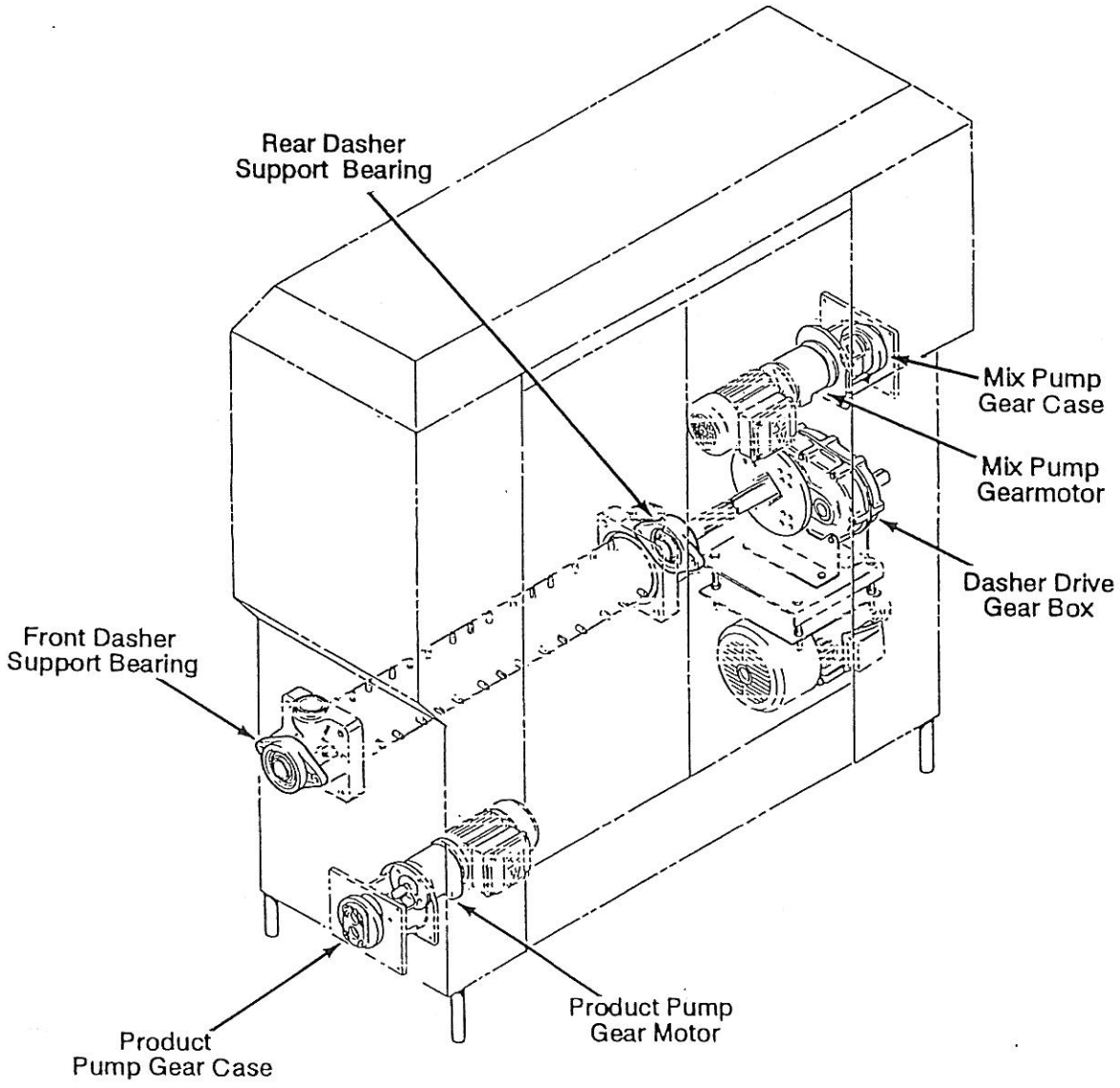
Gear Box Oil Level

Maintenance

Lubrication

The illustration below shows the items on the unit that need to be lubricated or checked on a regular basis.

Proper lubricant types and intervals can be found in the Specifications section.



Items Needing Lubrication on a Regular Basis

Maintenance

WS Preventative Maintenance Schedule

Operation	Hours	Description
Clean the Check Valve	**16**	**Perform on a Daily Basis**
Replace the Air Filter	**16**	**Perform on a Daily Basis**
Grease the Dasher Bearings	**16**	**Perform on a Daily Basis**
Check the Belts	80	Perform on a Weekly Basis
Check the Rotors and Pump Plates	500	Perform According to Your Process
Dasher, Blades, Bushings, Cylinder	500	Perform According to Your Process
Change Pump Gearcase Oil	500	Perform on a Weekly Basis
Drain Ammonia Oil	500	Perform on a Monthly Basis
Change the Dasher Gearbox Oil	2500	Perform on a Semi-Annual Basis
Replace the Dasher Coupling	4000	Perform on a Yearly Basis
Check the Pump Shafts and Couplings	4000	Perform on a Yearly Basis
Clean the Ammonia Strainers	4000	Perform on a Yearly Basis
Change the Float Cartridge	4000	Perform on a Yearly Basis
Perform a Complete Electrical Check	4000	Perform on a Yearly Basis
Change Pump Gearmotor Oil	10000	Perform on a Bi-Annual Basis

Maintenance

Maintenance Schedule

Check Valve	Clean on a Daily Basis
Air Filter	Replace on a Daily Basis
Dasher Bearings	Grease on a Daily Basis
Rotors	Replace According to Your Process
Blades	Replace According to Your Process
Belts	Perform on a Weekly Basis

Interval Time in 1000's of Hours • C-Check, R-Replace

	Cylinder	Dasher	Dasher Coupling	Dasher Gearbox Oil	Pump Plates	Pump Shafts	Pump Couplings	Pump Gearcase Oil	Pump Gearmotor Oil	Ammonia Strainers	Drain Ammonia Oil	Float Cartridge	Electrical Check
	C	C			C			R			C		
1	C	C			C			R			C		
	C	C			C			R			C		
2	C	C			C			R			C		
	C	C		R	C			R			C		
3	C	C			C			R			C		
	C	C			C			R			C		
4	C	C	R		C	C	R	R		C	C	R	C
	C	C			C			R			C		
5	C	C		R	C			R			C		
	C	C			C			R			C		
6	C	C			C			R			C		
	C	C			C			R			C		
7	C	C			C			R			C		
	C	C		R	C			R			C		
8	C	C	R		C	C	R	R		C	C	R	C
	C	C			C			R			C		
9	C	C			C			R			C		
	C	C			C			R			C		
10	C	C		R	C			R	R		C		
	C	C			C			R			C		
11	C	C			C			R			C		
	C	C			C			R			C		
12	C	C	R		C	C	R	R		C	C	R	C
	C	C		R	C			R			C		
13	C	C			C			R			C		
	C	C			C			R			C		
14	C	C			C			R			C		
	C	C			C			R			C		
15	C	C		R	C			R			C		
	C	C			C			R			C		
16	C	C	R		C	C	R	R		C	C	R	C
	C	C			C			R			C		
17	C	C			C			R			C		
	C	C		R	C			R			C		
18	C	C			C			R			C		
	C	C			C			R			C		
19	C	C			C			R			C		
	C	C			C			R			C		
20	C	C	R	R	C	C	R	R	R	C	C	R	C

Refrigeration Maintenance

Refrigeration System Pump Down

DANGER

The ammonia refrigerant is a hazardous chemical which, when used incorrectly, can cause severe injury or even loss of life. All refrigeration system maintenance and service must be performed by trained and authorized personnel only, properly equipped with protective clothing, eye protection, and respiratory protection. Before performing maintenance on any refrigeration system components, shut off liquid and hot gas supply, pump down the system, and chain or remove the handle of the liquid hand valve.

Before any service is done to the refrigeration system, a complete refrigerant pump down must be performed to remove the liquid ammonia. To pump down the refrigeration system:

1. Turn the refrigerant liquid and hot gas hand valves off and tag or remove the handles.

2. Place the Refrigeration-Run/Pump-Down switch in the Pump-Down position. (The switch is located inside the front control panel.)

Automatic units have no Refrigeration-Run/Pump-Down switch. Refer to "Pumpdown" on the Screen Menu.

3. Pump warm (100 F - 125 F) water through the cylinder.

4. Press the Refrigeration Start button to open liquid line solenoid.

5. Turn the refrigerant suction hand valve off and wait 5 minutes. If the accumulator pressure remains at 0 psig or below, the unit may be vented.

6. Vent the refrigeration system.

   a. Attach a hose to the drain valve at the bottom of the float chamber.

   b. Carefully open the drain valve. If there is a vacuum present, allow it to be completely released, then immerse the hose in a container of water to be certain no liquid ammonia is present. If pressure is noted, immerse the hose in water immediately and bleed off until bubbles are no longer escaping from the hose.

7. When it has been determined that there is no liquid ammonia present, refrigeration maintenance procedures may be initiated. There may still be ammonia fumes present even when the unit is completely pumped down so care must be taken when removing fittings and components.

WARNING

Do Not Attempt to Service Any Refrigeration System Components Before Completing a Proper Refrigeration System Pump Down.

Refrigeration Maintenance

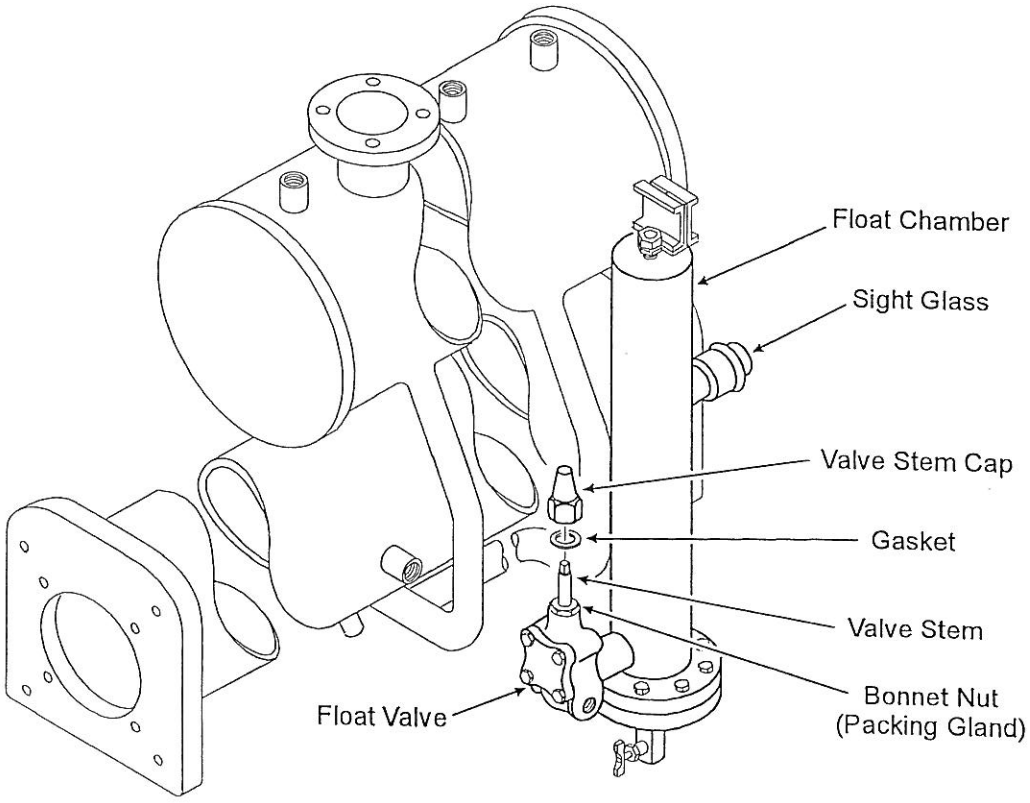
Initial Float Valve Adjustment

This procedure should only be used after a float valve has been replaced. It is not necessary to perform this procedure on new units.

1. Remove the valve stem cap from the float valve.

> **DANGER**
>
> *Do Not mistakenly loosen the bonnet nut (packing gland) located below the valve stem cap. Make sure the wrench is on the valve stem cap and that only the valve stem cap turns when removing it. Failure to do this may result in severe injury or death.*

2. Turn the valve stem fully counterclockwise (out).
3. Open the liquid line hand valve to allow refrigerant to flow to the float valve.
4. Turn the valve stem clockwise (in) until the flow of refrigerant stops.
5. Turn the valve stem counterclockwise (out) until the proper liquid level is established in the float chamber.
6. Make further adjustments to the liquid level in the float chamber by doing the following:
   a. Operate the unit as if in normal production.
   b. Monitor the sight glass on the float chamber. The refrigerant level should be near the middle of the sight glass.
   c. Turn the valve stem clockwise (in) to lower the liquid level in the float chamber.
   d. Turn the valve stem counterclockwise (out) to raise the liquid level in the float chamber.
7. Install the valve stem cap on the float valve.



Adjusting Float Valve for Initial Operation

Refrigeration Maintenance

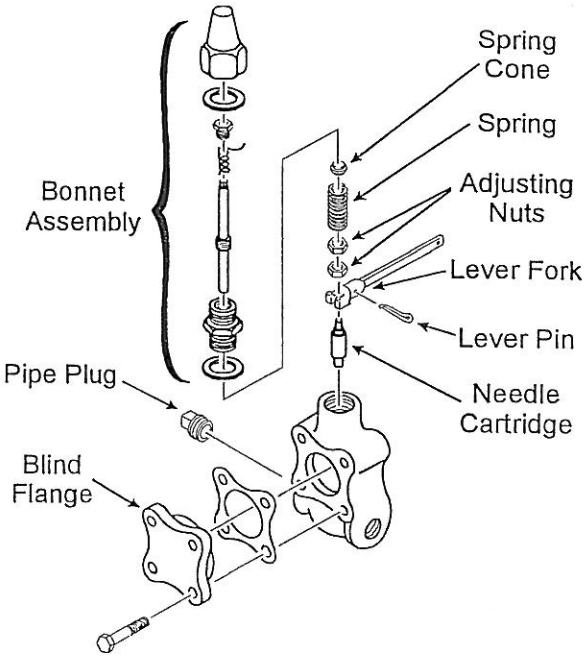
Float Valve Adjustment and Maintenance

Changing the Needle Cartridge

1. Pump down the refrigerant.
2. Remove the bonnet assembly, spring cone, spring and blind flange.
3. Remove the 1/4 in. pipe plug from the side of the valve and with a needle nose pliers, remove the lever pin.
4. Pull the lever fork down and push it back into the valve casting cavity to gain access to the needle cartridge.
5. Use a 5/8 in. open end wrench or socket and extension to remove the needle cartridge.
6. Remove the adjusting nuts from the old needle and place them loosely on the new needle.
7. Install the new cartridge.

The O-rings provide the seal - Do Not over tighten the cartridge.

8. Position the lever fork and replace the lever pin.



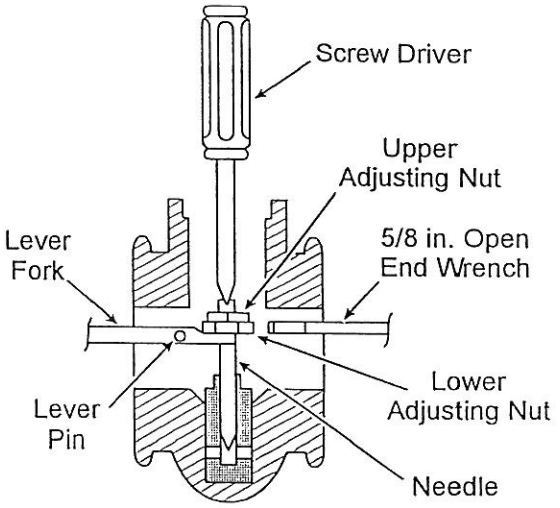
Float Valve Disassembly

Setting the Valve Movement

1. Hold the needle down firmly with a screw driver.
2. Turn down the lower adjustment nut until it just touches the level fork.
3. Hold the lower adjustment nut and turn the needle two turns counterclockwise.
4. Lock down the upper adjusting nut without changing the lower adjusting nut or the needle.

This may be done easier if the needle and nuts are removed.

5. Replace the spring, spring cone, bonnet assembly, pipe plug, and the blind flange.



Adjusting the Float Valve

Refrigeration Maintenance

Inner Cylinder

After a long period of time, deposits of oil and other contaminates may build up on the outer wall of the inner cylinder. These deposits greatly reduce the freezing ability of the unit. The inner cylinder should be removed and cleaned once a year to remove this build-up. If the cylinder is damaged, it must be replaced.

DANGER

Always turn off the electric power supply and Lock Out, using a locking device for which only the person doing the work has the key, before performing service or maintenance.

CAUTION

It is important that the items removed be returned to the same location. Failure to do this may cause cylinder misalignment. This would cause damage to the cylinder and the dasher.

Removal

1. Pump down the refrigerant.
2. Remove the front door, dasher, and the rear door.
3. Number the eight door studs and their location. Remove the eight door studs.

DO NOT remove the shims from the studs.

4. Remove the four bolts from the front spacer ring.
5. Mark the front spacer ring and the panel for location.
6. Use two M-12 metric hex head cap screws as jack screws in the threaded holes to remove the spacer ring/cylinder and place it on a firm wood holding rack.
7. Remove the rear spacer ring by removing the four bolts. Remove all O-rings and discard.

Cleaning

DANGER

Most cleaning solvents are VERY HAZARDOUS. They could give off poisonous fumes or damage your skin. Use protective gloves, clothing, and eye protection when using any dangerous solvents. Read all the manufacturer's directions and warnings before using.

With the cylinder on a firm holding rack, use an oil-free cleaning solvent and steel wool to remove the deposits from the outer wall of the inner cylinder.

When all of the deposits have been removed, wipe the outer wall and the refrigerant jacket with a lint free cloth.

Refrigeration Maintenance

Assembly

To reassemble the inner cylinder/front spacer ring into the unit, do the following:

1. Place tape on the lower lip, of the rear end of the cylinder, to avoid damage to the cylinder.

2. Clean the O-ring grooves on the front and rear spacer rings.

3. Place a small amount of grease or Vaseline at various locations in the O-ring grooves in the front spacer ring. This will retain the O-rings in their proper position in the grooves.

Do Not grease the entire O-ring because during this process, the O-ring may stretch and may not fit the groove properly.

4. Install the front O-rings from the rear of the cylinder to prevent stretching.

5. Carefully install the cylinder/front spacer ring and O-rings into the evaporator until the cylinder touches the rear flange of the evaporator. Lift on the rear of the cylinder to guide it through the rear flange of the evaporator.

6. Align the holes in the front spacer ring to the holes in the front evaporator flange. Install the four bolts and four door studs in the front spacer ring and into the evaporator flange. (Return the door studs to their original locations.) Turn them until they are hand tight. Then back them out 1/2 turn.

7. Place a long piece of wood into the front of the cylinder and lift on the wood to center the front spacer ring over the front flange. Alternately tighten the bolts and studs to 50 ft-lb of torque.

To reassemble the rear spacer ring onto the unit, do the following:

1. Remove the tape from the rear of the inner cylinder.

2. Install the smallest diameter O-ring over the rear of the cylinder. Install the other O-rings in the grooves of the rear spacer ring. Using small amounts of grease as before.

3. Install the rear spacer ring over the rear of the cylinder and pull it in using the four bolts removed earlier.

On the WS-06 models, longer bolts or threaded rods (4 in. or longer) may have to be used until the original bolts will reach the holes in the evaporator flange.

4. Return the door studs to their original locations. Alternately tighten the bolts and door studs to 50 ft-lb of torque.

5. Check the shimming of the front and rear door studs. Reshim if necessary.

Refrigeration Maintenance

Front Door Shimming

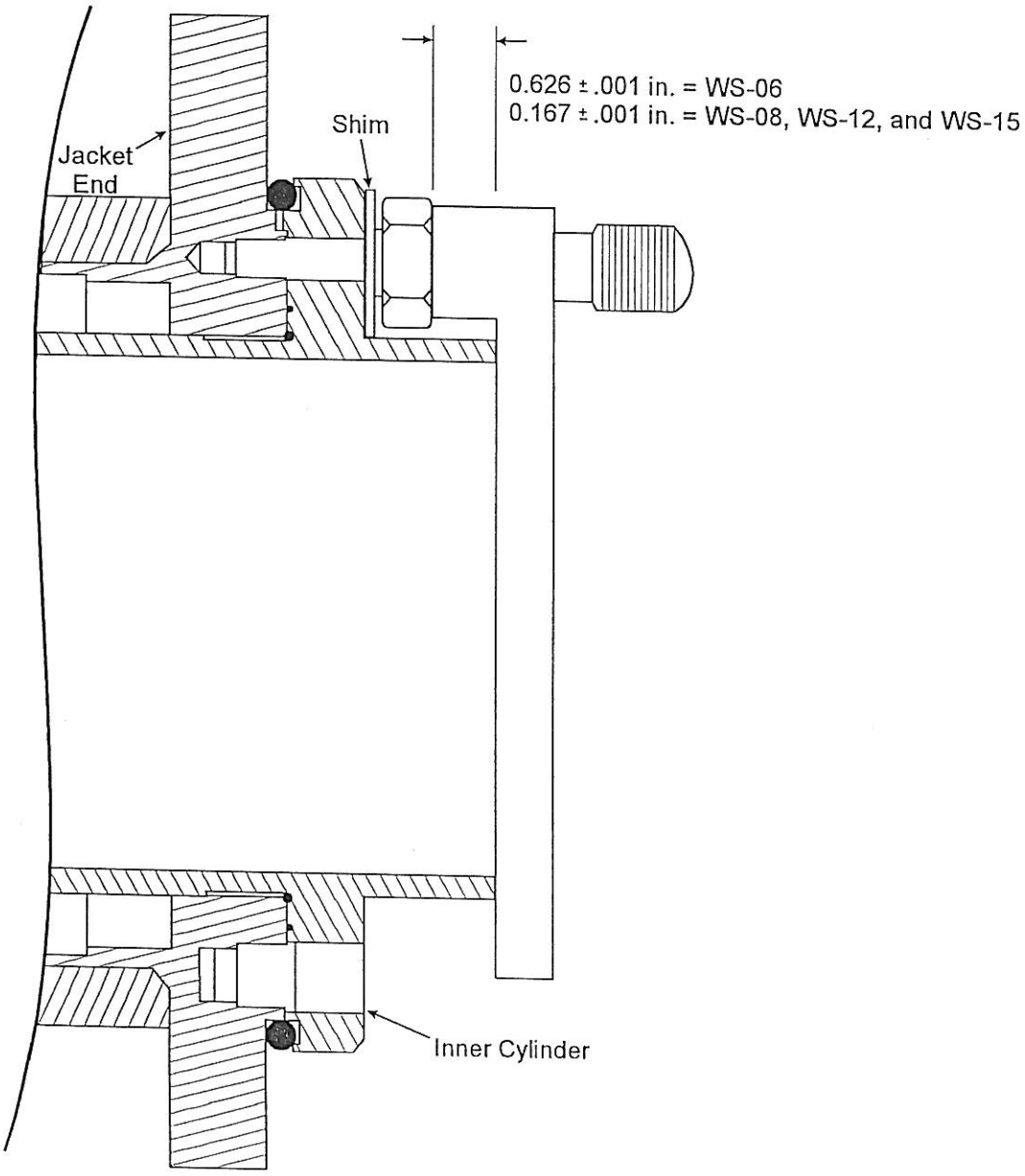
In the event that the shims on the studs are damaged or misplaced, or to check the clearance after the inner cylinder is reassembled, the shim gauge should be used.

Using the Cylinder Stud Shim Gauge

To use the shim gauge, place it across the end of the inner cylinder and rotate it. It should just touch the hex of the studs without gapping. Add or subtract shims until all the studs are correct. The distance from the cylinder end to the stud hex shoulder should be:

0.626 ±.001 in. for Model WS-06 units.

0.167 ±.001 in. for Model WS-08, 12, and 15 units.



Using the Cylinder Stud Shim Gauge

Refrigeration Maintenance

Dasher Expansion Gap
For WS-06 Units With 80 Dashers Only

The dasher expansion gap allows for axial thermal expansion between the dasher and the back door bearing during operation. The gap must be checked after the front door studs are shimmed or when a new dasher is installed. The gap is measured at room temperature.

1. Remove the doors and dasher as explained in the Maintenance section.

2. With the bearings fastened to the doors, assemble the rear door to the unit without the seals or O-rings.

3. Using a cylinder protector, slide the dasher (without the wear sleeves, seals, or blades) into the cylinder until the spline meshes with the coupling. Make sure the bearing drive pin on the dasher enters one of the slots on the rear bearing inner race.

4. Assemble the front door (without seals or O-rings) to the unit. Make sure the bearing drive pin on the dasher enters one of the slots on the front bearing inner race.

5. Install the dasher pull-up washer and screw and tighten the pull-up screw to approximately 10 ft-lbs.

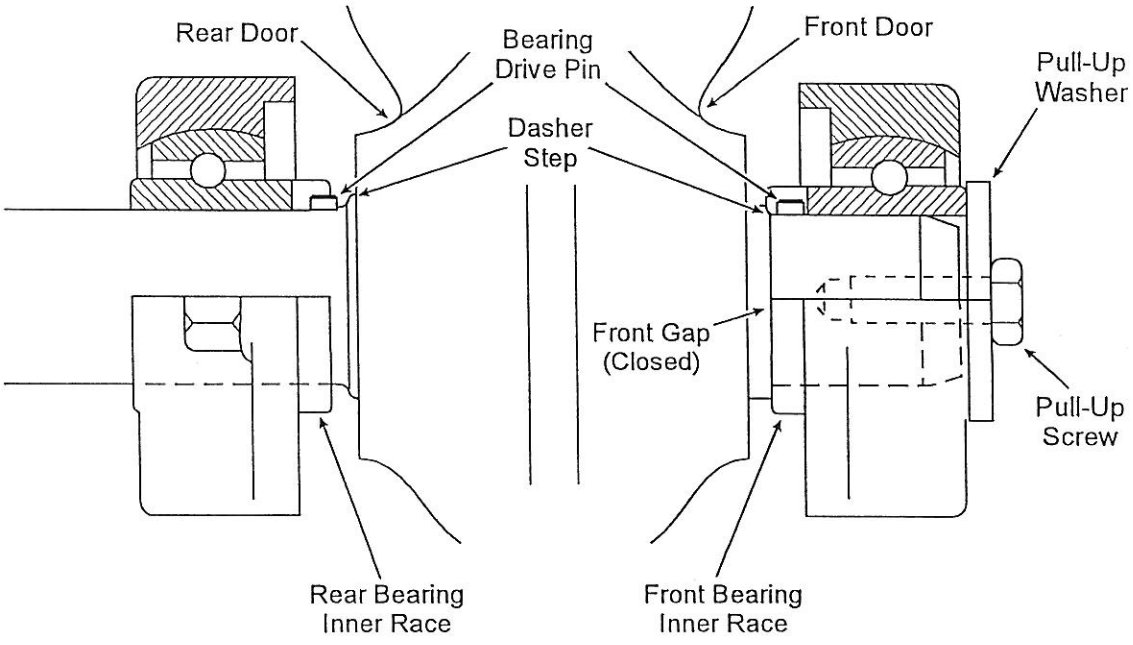
6. Make sure the front gap between the dasher step and the front bearing inner race is closed.

7. With the front gap closed, check the width of the rear gap between the dasher step and the rear bearing inner race. (A feeler gauge or equivalent device may be used). Minimum gap is .180 in. and maximum gap is .220 in.

8. If the rear gap is out of tolerance, reshim the front door studs to bring the gap dimension back into tolerance.

Adding shims to the front door studs will open the rear gap. Removing shims from the front door studs will close the rear gap. Always remove or add the same number of shims to each front door stud.

9. After checking the dasher expansion gap, reassemble the unit.



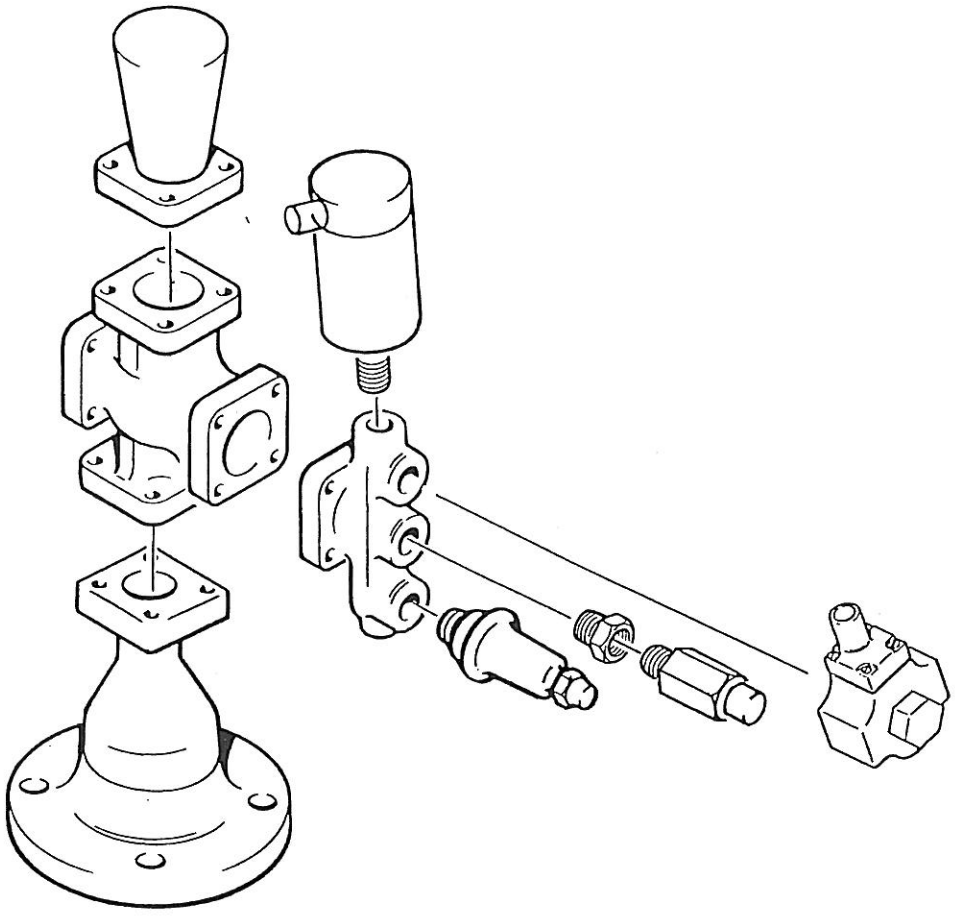
Checking the Dasher Expansion Gap

Refrigeration Maintenance

Danfoss Back Pressure Regulator Valve

If the Danfoss Back Pressure Regulator Valve is suspected of being faulty, check all other items before servicing the Danfoss valve. Check all hand valves to make sure they are in the correct position. Check solenoids to see if they are opening and closing properly. Check control circuitry to be sure all circuits are operable.

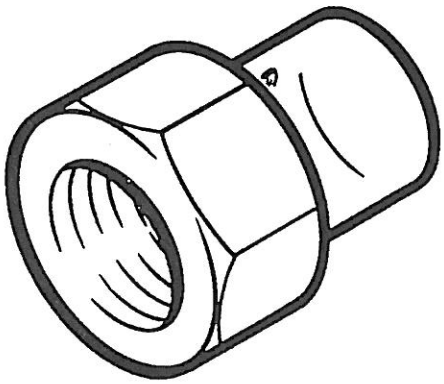
If the Danfoss Back Pressure Regulator Valve is in need of service, it should be performed by qualified personnel using the manufacturer's recommended procedures.



Danfoss Back Pressure Regulator Valve

Air System Maintenance

The sanitary air assembly is located in the rear door of the unit. Its purpose is to filter the overrun air. To ensure that no contaminates get into the mix, the filter disc located in the check valve must be changed daily, or following CIP.

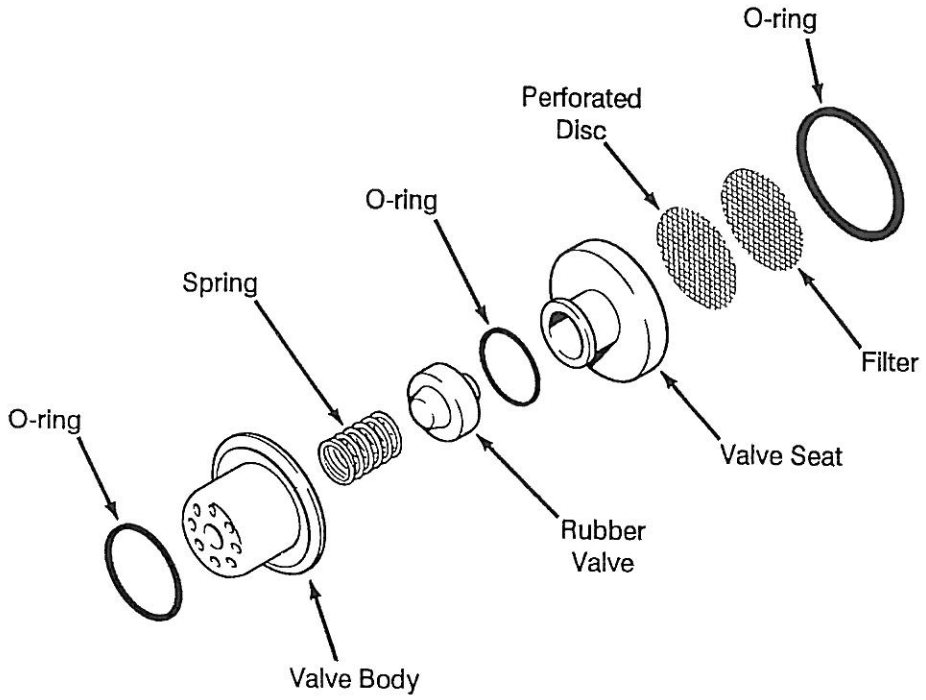


Sanitary Air Assembly

To change the disc, do the following:

1. Disconnect the air line to the air assembly.
2. Remove the retaining nut and transparent observation cup. The check valve is located in the rear door of the unit.
3. Remove the check valve and install the new filter disc. While the check valve is apart, hand clean and inspect the following parts for wear:
   a. O-rings
   b. Perforated Disc
   c. Valve Seat
   d. Rubber Valve
   e. Spring
   f. Valve Body

   Replace any part that shows wear.
4. Reassemble in reverse order using care to be sure of a leak-free check valve assembly.



Check Valve Assembly

Electrical Maintenance

Power Supplies and Components

The control system utilizes:

1. A 24 volt field and a 24 volt analog supply.

2. An AC Isolation transformer is used to electrically isolate incoming single phase power and for safety.

3. A filter is used to suppress line transients and power line harmonics.

Power Supplies

Two power supplies are utilized.

1. 24 Volt Regulated Supply. This supply powers the control circuits. The output is isolated from ground. Voltage is typically 23.8 - 24.2 volts.

2. 24 Volt Unregulated Supply. This supply powers the solenoid valves. Voltage is typically 21 - 28 volts. The voltage varies on power supply loading.

Transformer

Control Transformer. The transformer is utilized when the Danfoss Back Pressure Regulator valve is supplied. Input is 120 or 220 VAC and the output is fixed at 24 VAC. The transformer is rated at 100 VA.

Electrical Maintenance

Control System Components

The control system utilizes various transducers, transmitters and converters.

I/P Transducer

This transducer is used when the back pressure control valve is a Camflex type. It has a 4-20 mA DC input and has a 3-15 PSI output pressure. Its purpose is to control refrigeration back pressure.

P/I Transmitter

This transmitter is used to measure cylinder pressure. Typically the air pressure it measures is in the 0-100 PSI range but for high cylinder pressure it could be 0-150 PSI range. The output from the transmitter is 4-20 mA.

C/I Transmitter

This transmitter is used to measure the dasher load. The input to the transmitter is 0-5 amps AC from the secondary of the current transformer. The output of the transmitter is 4-20 mA.

Mix and Product Temperature RTD Transmitters

These transmitters are used to measure mix and product temperatures. They convert the RTD output (millivolts) into mA (milliamps). (0-100 F temperature range) (4-20 mA output).

DANGER

Do not open the High Voltage control panel door while the dasher is running. Dangerous voltages may be present.

Signal Converter

This converter is used only when the Danfoss Back Pressure Regulator valve is provided. The input to the converter is 4-20 mA. The output from the converter is 0-10 volts DC to the Danfoss interface module EKA46.

AC Inverters

The AC inverters interface to the unit via power cables and control signal cables. The control signal cables carries the drive enable, speed reference drive fault and on the mix pump inverter frequency analog output.

The drive enable is a digital signal 0 or 24 volts DC. The speed reference cable and frequency output cable signal is 4-20 mA. The power cable supplies the 3 phase main power and another cable supplies the motor with power from the inverter.

Service Outlet

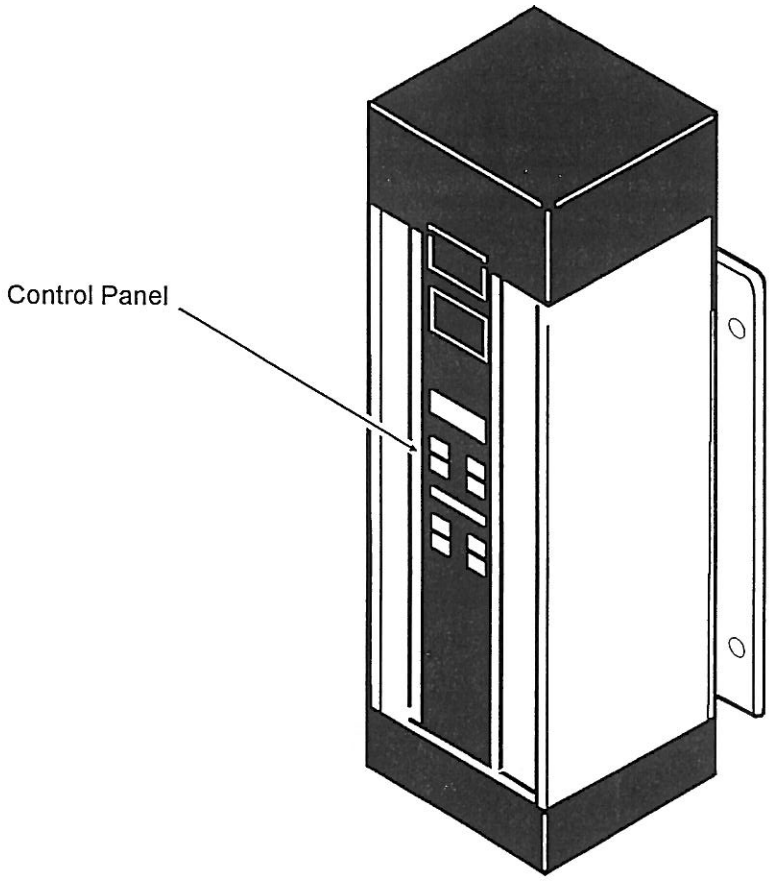
Allows personnel to connect portable test equipment power supplies.

Electrical Maintenance

Danfoss Inverters (VLT 2000 Series)

Two Danfoss inverters are used to control the pumps on the unit. One inverter drives the mix pump and the other drives the product pump. Both inverters are shipped with the unit from the factory.

A third inverter may be provided (optional) to control the premixer.



Typical Danfoss Inverter (VLT 2000 Series)

Control Panel

The control panel on the inverter consists of a keyboard and a display. The keyboard serves two purposes:

1. Operation.
2. Programming of the inverter.

The digital display allows the operator to obtain information about the status of the inverter.

The following pages explain the functions of the controls, found on the control panel.

Electrical Maintenance

Once the inverter has been programmed, it is normally not necessary to press any of the keys on the inverter. Unit functions are normally controlled on the operator work station.

Menu Key

The Menu key is used for entering the Menu mode. It is also used to enter a specific group of parameters.

Data Key

The Data key is used for entering Data mode, or Display mode from the Menu mode. It is also used to move the cursor in the data values.

Jog Key

The Jog key is used to jog the inverter (pump motor). This can be used for checking pump motor rotation etc.

Stop-Reset Key

The Stop-Reset key is used to stop the inverter (pump motor). When the inverter is active, pressing the Stop-Reset key will deactivate the inverter and the pump motor will stop. The Stop-Reset key is also used to reset the inverter when a Reset Message is displayed.

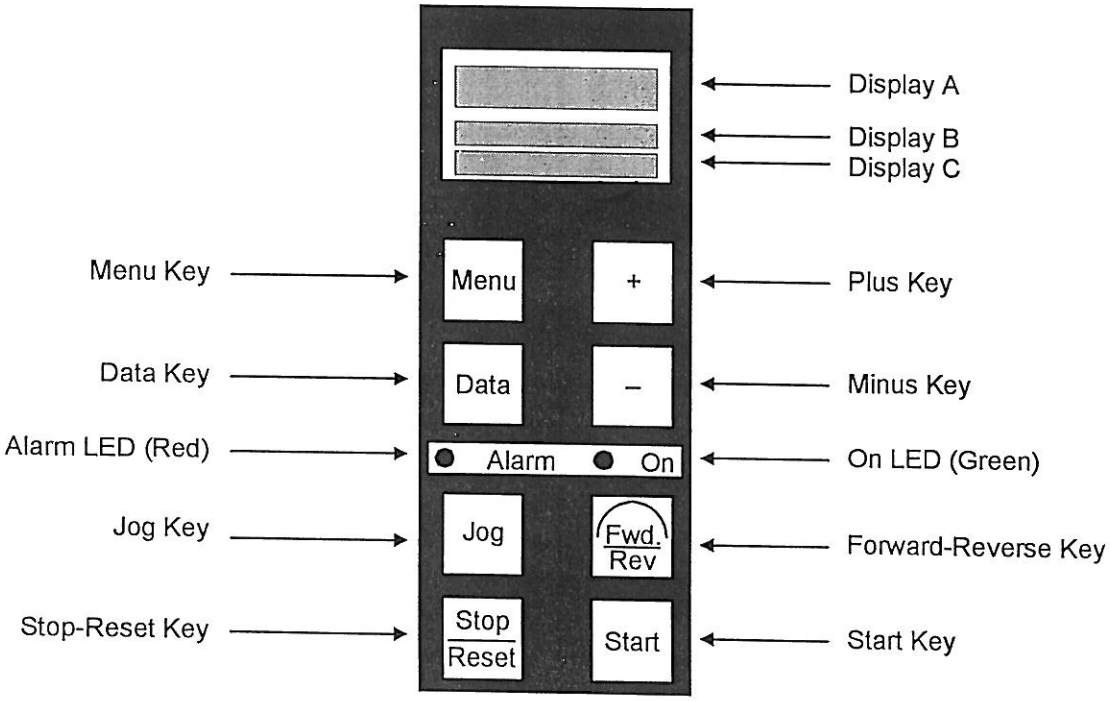
It is necessary to press the Stop-Reset key before changing the data value of some parameters.

Start Key

The Start key is used to start the inverter (pump motor). When the inverter is non-active, pressing the Start key will activate the inverter and the pump motor will start.

Forward-Reverse Key

The Forward-Reverse key is disabled for this application.



Control Panel

Electrical Maintenance

Minus Key

The Minus key is used for selecting a group of parameters, a specific parameter, or a data value. Pressing the Minus key will allow the display to decrease parameter values.

Plus Key

The Plus key is used for selecting a group of parameters, a specific parameter, or a data value. Pressing the Plus key will allow the display to increase parameter values.

Display A

Display A is used for operating displays. It will show the value corresponding to the setting in the Display mode. The set value will remain on the display during programming of parameters.

Display A will flash when the inverter is in the Stop mode.

Display B

Display B shows information about parameters and direction of pump motor rotation.

Display C

Display C shows information about status and setup or data value.

Alarm LED (Red)

The Alarm LED is used for alarm indications. When the unit is in the Alarm mode, the LED will flash.

On LED (Green)

When the On LED is illuminated, there is AC power applied to the inverter.

Combined Key Functions

Pressing the Menu key, and then pressing the Plus or Minus key, will move from group to group.

Pressing the Menu key again, and then pressing the Plus or Minus key, will allow you to move within the parameters of a group.

Pressing the Data key, and then the Plus or Minus key, will allow you to change a parameter.

Pressing the Menu key again, will allow you to move through the parameters.

Pressing the Menu key again, will allow you to move from group to group.

Electrical Maintenance

Terminal Connections

A jumper wire must be placed across terminals 12 and 27 for proper operation.

To enable the inverter, a circuit must be made from terminal 18 to terminal 20. (Start signal terminals.)

The speed reference signal (4-20 mA) is connected to terminals 60 and 55.

Terminal 60 = positive (+).
Terminal 55 = negative (-).

The inverter drive fault signal is connected to terminals 01 and 03.

Terminal 01 = positive (+).
Terminal 03 = negative (-).

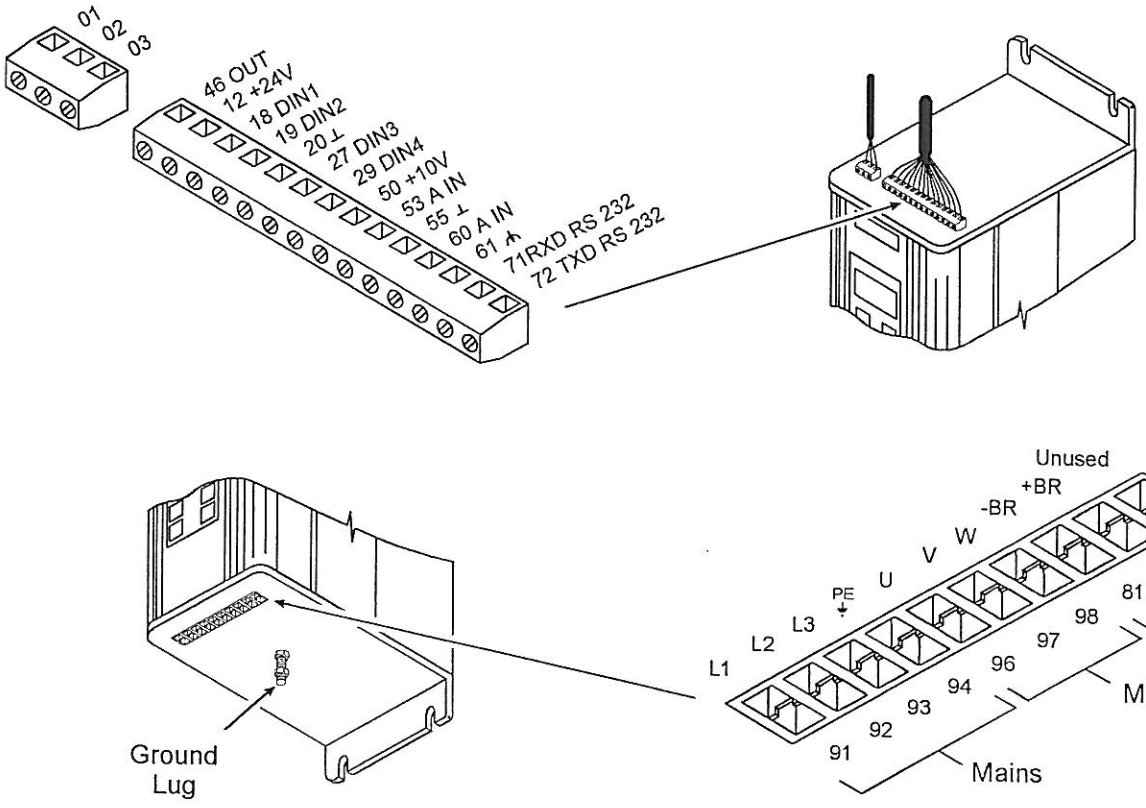
An optional RS232 serial communications cable can be connected to terminals 20, 71 and 72. This is used for monitoring or downloading parameters via a laptop computer using Danfoss communications software.

The AC line power (L1-L3) to the inverter should connect as follows:

L1 wire to terminal 91.
L2 wire to terminal 92.
L3 wire to terminal 93.
Ground wire (PE) to terminal 94 and ground lug.

The motor wiring should be connected to the inverter as follows:

Wire U to terminal 96.
Wire V to terminal 97.
Wire W to terminal 98.
Ground wire (PE) to ground lug.



Terminals

Electrical Maintenance

Inverter (VLT) Fault Messages

If the inverter senses a problem, it will display information on the displays. The following chart indicates possible fault messages and the possible causes for them.

Fault Message	Reason for Message	Cause of Fault Condition
Inverter fault	The VLT power section is defective.	
Over voltage	The voltage of the VLT intermediate circuit (DC voltage) is too high.	Line voltage too high, transients on the line voltage, or regenerative motor operation. When the VLT is stopped, repeated transients are charging the intermediate circuit, as it supplies no power to the motor. If the fault condition is given when the speed is reduced, the ramp down time can be increased. If this is not possible, the application may require a VLT with a dynamic brake.
Under voltage	The voltage of the VLT intermediate circuit (DC voltage) is too low.	Line voltage too low or defect in the VLT charging circuit/rectifier. Make sure the line voltage is acceptable.
Over current	The peak current limit of the inverter has been reached.	This may be due to a short circuit in the output of the VLT. Check the motor and motor cable for ground, or phase to phase short circuit.
Ground fault	Ground failure on the VLT output, or motor cable is too long.	Check the motor and motor cable for ground leakage. Consult Specifications Chart in the Appendix at the end of this manual.
Over temp	The temperature in the VLT is too high.	The ambient temperature may be too high. The VLT cooling ribs may be covered. The VLT fan may be defective. Reduce the abient temperature by increasing ventilation. Uncover/clean the cooling ribs. Replace the fan.
Overload	The electronic motor protection is active.	The motor has drawn more than 105% of the rated VLT current for over the permissable time. Reduce the motor load. If this is not possible, the application may require a larger VLT.
Motor trip	The electronic motor protection is active.	The current consumed by the motor at low speed has been too high for too long. The motor has been loaded excessively at low speed. If the load cannot be changed, you must replace the motor with a bigger one, or provide extra cooling of the existing motor. If so, the electronic motor protection can be deactivated in parameter 315.

Electrical Maintenance

Factory Parameters for Inverter

* Default Values
** Set Per Application
*** These parameters are set automatically when the value of 104 is changed.

	Parameter	Description	Parameter Setting
*	000	Language Select	English (Can be changed for final customer location.)
*	001	Menu Setup Select	Setup 1
*	002	Setup Copy	No Copy
*	003	Operation Place	Remote
	005	Display Value	100
*	006	Local Reset	Enable
*	007	Local Start-Stop	Enable
*	008	Local Reversing	Disable
*	009	Local Jogging	Enable
	010	Local Reference	Disable
*	013	Data Change Lock	Not Locked
*	101	Speed Control	Slip Compensated
*	102	Current Limit Control	Preprogrammed Value
**	103	Motor Power	
**	104	Motor Voltage	
**	105	Motor Frequency	
***	107	Motor Current	
***	108	Motor Magnetizing Current	
***	109	Start Voltage	
***	110	Start Compensation	
***	111	U/F Ratio	
***	112	Slip Compensation	
*	114	Feed Back Type	Current (20 mA)
*	119	Feed Forward Factor	100
*	120	Controller Range	100
*	121	Proportional Gain	0.01
*	122	Integral Time	9999
*	125	Feedback Factor	100.00
*	200	Frequency Range	120 Hz.
**	201	Min. Frequency	
**	202	Max. Frequency	
*	203	Job Frequency	10
*	205	Digital Reference 1	0.00

Electrical Maintenance

	Parameter	Description	Parameter Setting
*	206	Digital Reference 2	0.00
*	207	Digital Reference 3	0.00
*	208	Digital Reference 4	0.00
**	209	Current Limit	Rated Motor Current
	211	Warning Frequency High	500
**	213	Warning Current High	Rated Motor Current
	215	Ramp-Up Time	1
	216	Ramp-Down Time	1
*	224	Carrier Frequency	4.5
*	230	Digital Speed Up/Down	Disable
*	300	Brake Option	Not Applied
*	306	DC Braking Time	0
*	307	DC Brake Cut-In Frequency	1
*	308	DC Brake Voltage	10
*	309	Reset Mode	Manual Reset
*	310	Trip Delay at Current Limit	Infinite
	315	Motor Thermal Protection	Trip
*	402	Binary Input 18	Start
*	403	Binary Input 19	No Operation
*	404	Binary Input 27	Reset and Motor Coasting
*	405	Binary Input 29	Jogging
*	408	Signal Output 46	Unit Ready Remote Control
	409	Relay Output 01	Alarm
*	412	Analog Input 53	No Function
	413	Analog Input 60	4-20 mA
*	500	Address	01
*	501	Baud Rate	1200
*	503	Coasting	Or
*	504	Q-Stop	Or
*	505	DC-Brake	Or
*	506	Start	Or
*	507	Direction	Digital
*	508	Reset	Or
*	509	Set-Up Select	Or
*	510	Speed Select	Or
*	511	Bus Jog 1	10
*	514	Bus Bit 4	Q-Stop
*	516	Bus Reference	0
*	517	Store Data Values	Off

Electrical Maintenance

Manual Set-Up Parameters for Danfoss Inverters with LCD Displays

The following procedure explains the correct parameter settings for some, but not all, parameters. If a parameter is not listed in this procedure, then the parameter should be left at default or listed setting.

1. Set the Group 1 (Load and Motor) parameters as follows:

The stop key must be pressed to set parameters 103 through 105, and parameter 107.

   a. Parameter 103 (Motor Power)

      Read the motor name plate. Enter the value in kilowatts. (1 horsepower = .746 watts) To convert, multiply horsepower x .746 =kilowatts.

   b. Parameter 104 (Motor Voltage)

      Read the motor name plate and enter the value in volts.

   c. Parameter 105 (Motor Frequency)

      Read the motor name plate. Enter the value in hertz.

   d. Parameter 107 (Motor Current)

      Read the motor nameplate. Enter the value in amps.

2. Set the Group 2 (References and Limits) parameters as follows:

   a. Parameter 201 (Minimum Frequency)

      Set the value to 10 hertz initially. This value will be set to minimum mix and product pump speed when testing.

   b. Parameter 202 (Maximum Frequency)

      Leave at default. This value will be set to maximum mix and product pump speed when testing.

3. Set the Group 3 (Functions and Timers) parameters as follows:

   a. Parameter 315 (Motor Thermal Protection)

      Set to "trip".

4. Set the Group 4 (Inputs and Outputs) parameters as follows:

   a. Parameter 409 (Relay Output 01)

      Set to "alarm".

   b. Parameter 412 (Analog Input 53)

      Set to "No Operation".

CAUTION

Parameters 107 and 315 must be correctly set, as previously described in steps 1 and 3, to assure proper motor overload protection.

Electrical Maintenance

Mix Pump Inverter Set-Up

Some of the following procedures are done on the operator control panel and some are done on the mix pump inverter.

1. Start the pumps.
2. Set the Mix Pump Speed Control on the operator control panel to minimum speed.
3. Adjust Parameter 201 (Minimum Frequency) on the mix pump inverter until the minimum mix pump speed is obtained.
4. Set the Mix Pump Speed Control on the operator control panel to maximum speed.
5. Adjust Parameter 202 (Maximum Frequency) on the mix pump inverter until the maximum mix pump speed is obtained.
6. Record this value for later reference.

Product Pump Inverter Set-Up

Some of the following procedures are done on the operator control panel and some are done on the product pump inverter.

1. Start the pumps.
2. Place the Cylinder Pressure Process Controller in the Manual mode.
3. Set the product pump speed to 0% on the Cylinder Pressure Process Controller.
4. Adjust Parameter 201 (Minimum Frequency) on the product pump inverter until the minimum product pump speed is obtained.
5. Set the product pump speed to 100% on the Cylinder Pressure Process Controller.
6. Adjust Parameter 202 (Maximum Frequency) on the product pump inverter until the maximum product pump speed is obtained.
7. Record this value for later reference.
8. Place the Cylinder Pressure Process Controller in the Automatic mode.

Final Parameter Setting

1. Set the Group 0 (Operation and Display) parameters as follows:
2. Press the Menu key to change to Group 0.
3. Press the Data key.
4. Press the Plus key to change the display from "reference" to "frequency".

This completes the manual set-up of Danfoss inverters.

Electrical Maintenance

Danfoss Inverter Set-Up Using a Personal Computer (PC)

This procedure requires Danfoss communications software and a suitable cable. (Consult the APV Crepaco factory.)

To prepare the PC to run the Set-Up program, do the following:

1. Turn the PC on and wait for it to boot.
2. At the DOS prompt, type CD\DANFOSS
3. Press the Enter key. C:\DANFOSS should appear on the screen.
4. Type VLT2000. Press the Enter key. The Danfoss Inverter Set-Up program will now begin.

Down Loading a Saved Program to the Inverter

1. Press the Enter key twice. The screen will appear to be blank except for a few words across the top and the bottom of it.
2. Press the F10 key.
   a. The word "file" at the top of the screen should now be highlighted.
   b. Press the Right Arrow key to move the cursor (highlighted area) to the "programming" mode.
   c. Press the Enter key and a menu should appear.
   d. Press the Down Arrow key to move the cursor to "load menu disk". Press the Enter key. A menu of programs should appear.
   e. Press the Down Arrow key to move the cursor to the program file that fits the freezer, voltage, and horsepower that you are programming. Press the Enter key to load the program.
3. Press the F10 key.
   a. Press the Enter key if "programming" is highlighted.
   b. Press the Down Arrow key to move the cursor to "down load menu".
   c. Press the Enter key. A down load menu will appear.
4. Press the Stop key on the inverter before continuing to the next step.
   a. Press the Enter key to highlight "down load". Select address 1.

The Stop-Reset key on the inverter must be pressed to down load and save a program to the inverter. Make sure to press the Stop-Reset key on the inverter before continuing to the next step.

   b. Press the D key to begin downloading of preselected program to the inverter.
   c. Press the Tab key to highlight "store parameters".
   d. Press the Space Bar once to turn on "store parameters". It takes approximately 20-60 seconds for the inverter to completely store the program in it's memory.

After the word "working" has disappeared from the screen, it still takes approximately 20-60 seconds for the inverter to completely store the program in it's memory.

Do not disconnect or turn off the power until this time has elapsed or the program will not be properly stored.

   e. Turn the power off to the inverter for a few seconds. Power the invert up and make sure the program was retained in memory. If the program was not retained in memory, repeat steps a through e and press the Stop-Reset key on the inverter.

The VLT 2000 program cannot be used to set the motor voltage. This must be done through the keypad.

5. Follow the instructions on the preceding page.

Electrical Maintenance

Saving and Printing an Uploaded Inverter Program

Do the following procedure only after the unit has been successfully tested.

To prepare the PC to run the Set-Up program, do the following:

1. Turn the PC on and wait for it to boot.
2. At the DOS prompt, type CD\DANFOSS
3. Press the Enter key. C:\DANFOSS should appear on the screen.
4. Type VLT2000. Press the Enter Key. The Danfoss Inverter Set-Up program will now begin.
5. Press the Enter key twice. The screen will appear to be blank except for a few words across the top and the bottom of it.
6. Press the F10 key.
   a. The word "file" at the top of the screen should now be highlighted.
   b. Press the Right Arrow key to move the cursor (highlighted area) to the "programming" mode.
   c. Press the Enter key and a menu should appear.
   d. Press the Up or Down Arrow key to move the cursor to "upload menu". Press the Enter key.
7. Press the F10 key.
   a. Press the Enter key if "programming" is highlighted.
   b. Press the Up or Down Arrow key to move the cursor to "save menu to disk".
   c. Press the Enter key.
   d. Press the N key for new program.
   e. Type the name of the new program in the highlighted box at the bottom of the menu.
   f. Press the Enter key to save the new program.
8. The word "programming" should be highlighted.
9. Press the Enter key.
10. Connect a printer to the parallel port on the back of the PC.
11. Press the Up or Down key to highlight "print menu".
12. Press the Enter key to print the program.
13. When printing is complete, write on the top of the first page whether it is for the mix pump or the product pump. Place it in the envelope holder on the back door of the unit.
14. Do the same for both the mix pump and product pump inverters.

This completes uploading, saving, and printing an inverter program.

Options

This section covers optional equipment that may not be applicable to all units.

- Freon Refrigerants
- Hot Gas Pressure Switch
- Turbon Mixer
- Motor Starters

Options

Freon Refrigerants

The unit has the ability to use refrigerant R-22 or R-502 (optional) as an alternative to ammonia for it's cooling medium. The installation and operation of units utilizing freon refrigerants are similar to units using ammonia with just a few minor exceptions.

Two additional valves are added to the unit for use with freon refrigerants, therefore, two additional customer connections are required during installation.

Additional Valves Used On the Freon Units

- Liquid Dump Valve
- Oil Bleed Valve

The inlet side of the liquid dump valve is factory piped to the lower end of the float chamber, however, the outlet side of the valve is a customer connection.

The outlet side of the valve should be connected to the customers suction line.

The liquid dump valve is closed during the freezing process (unit On) and opens during Shutdown to remove the remaining freon from the unit.

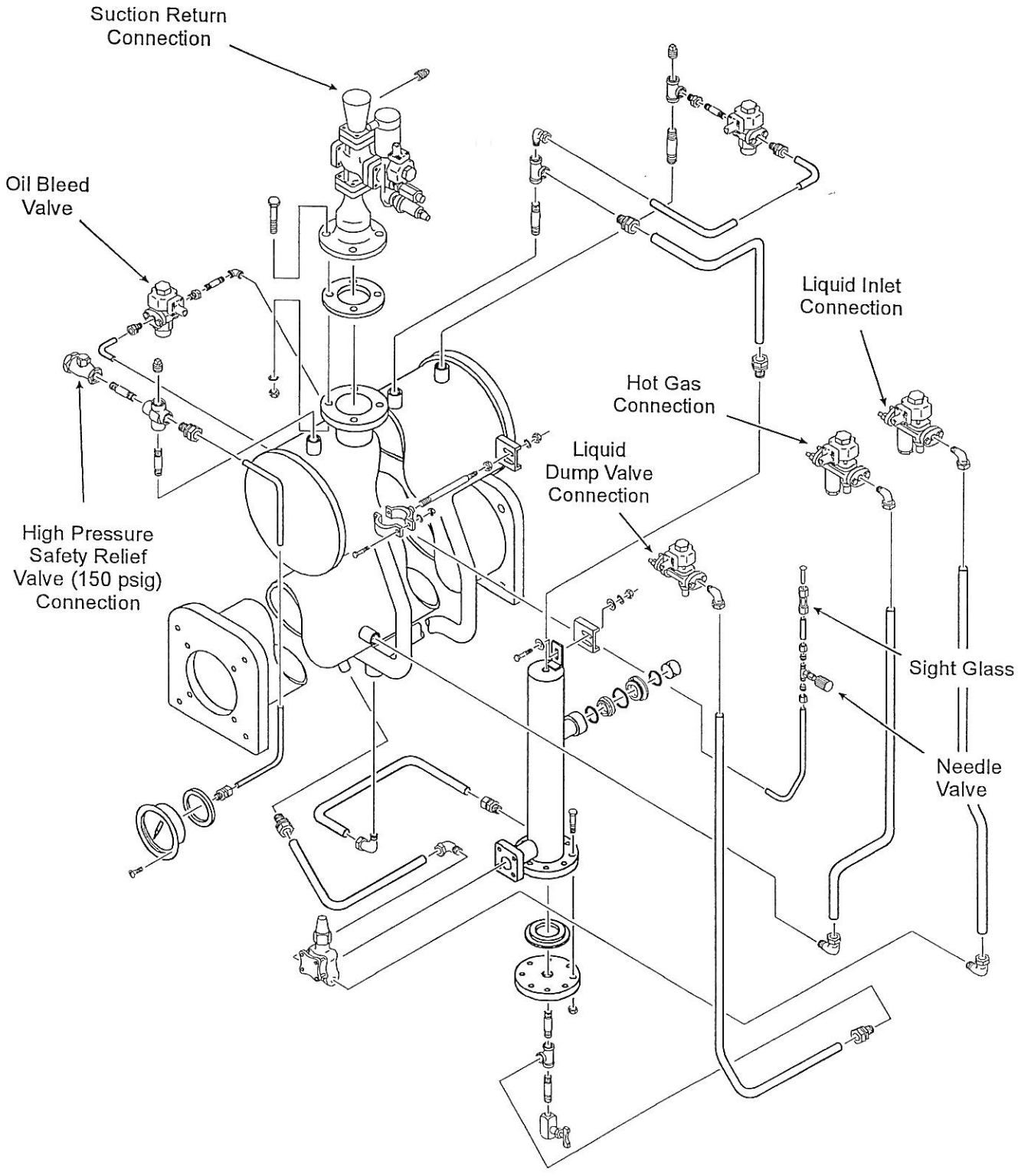
The inlet side of the oil bleed valve is factory piped to the outer jacket of the freezing cylinder, however the outlet side of the valve is a customer connection. The outlet side of the valve should be connected to the customers suction line.

The oil bleed valve is closed when the unit is shutdown and is open during the freezing process (unit On). During the freezing process, the oil bleed valve allows the excess refrigerant oil to be skimmed off of the freon and removed from the freezing cylinder.

The following page shows the locations of the customer connections required for the Freon units.

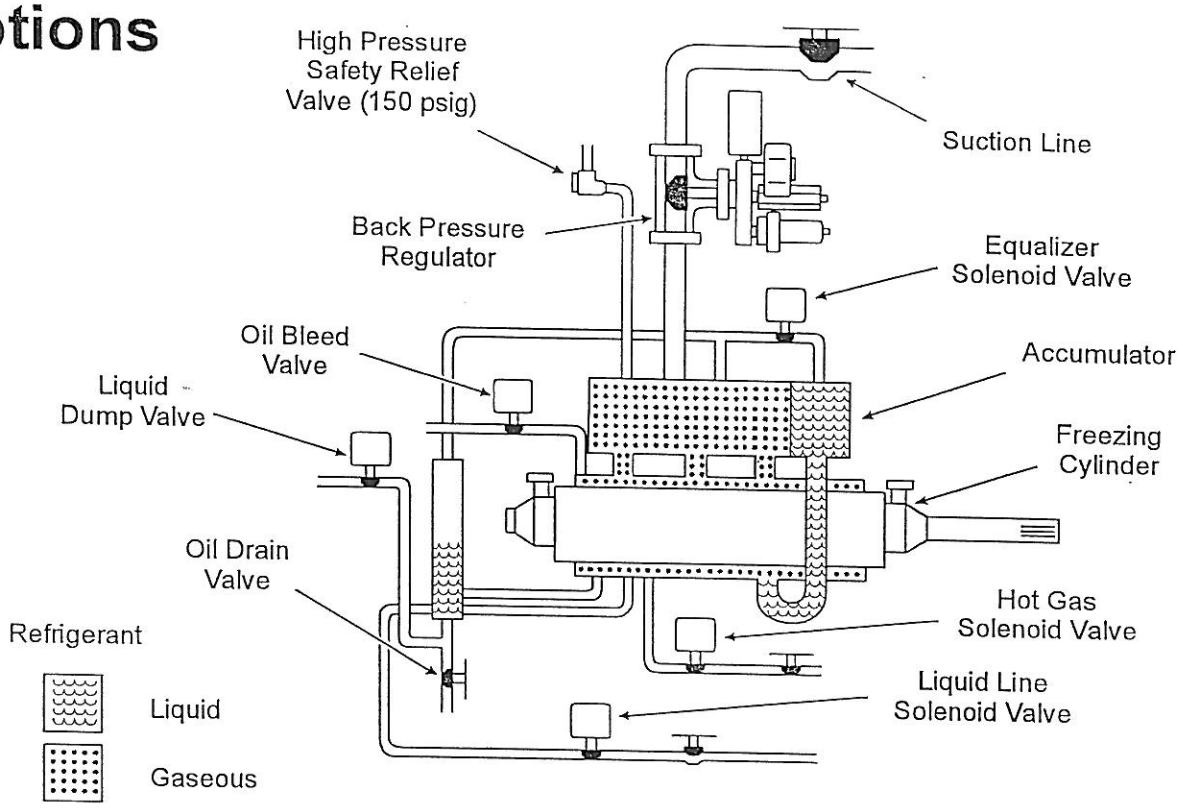
Refer to Halocarbon Hazards in the Safety Information Section

Options

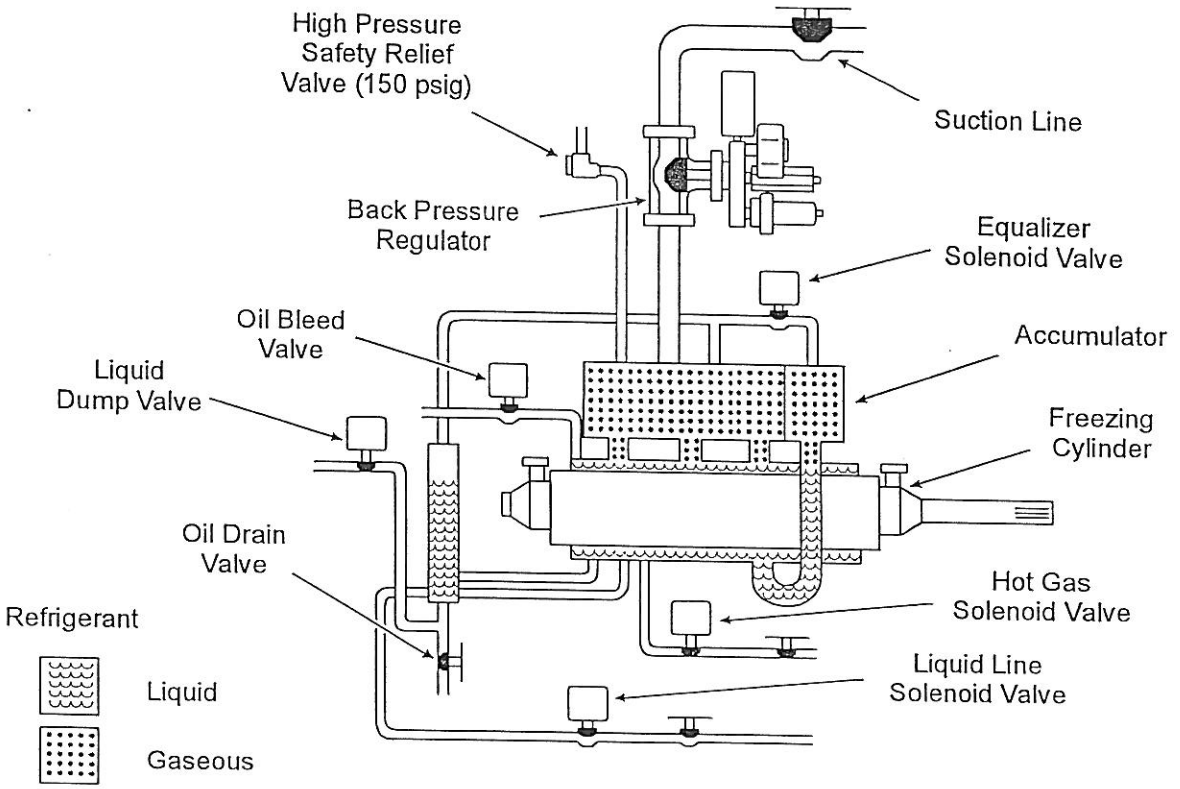


Freon Refrigerant Supply Connections

Options

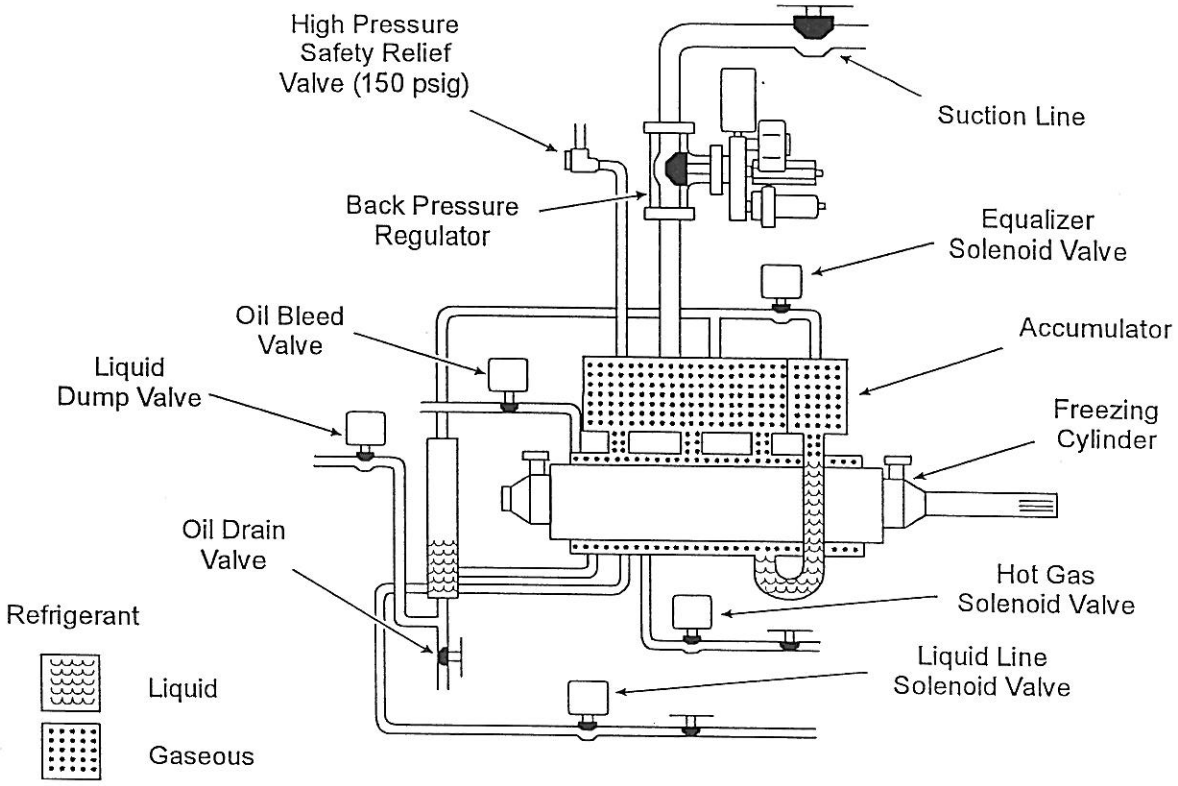


Freon Refrigeration System - Unit in the Off Mode



Freon Refrigeration System - Unit in the On Mode

Options



Freon Refrigeration System - Unit in the Pump Down Mode

Hot Gas Pressure Switch

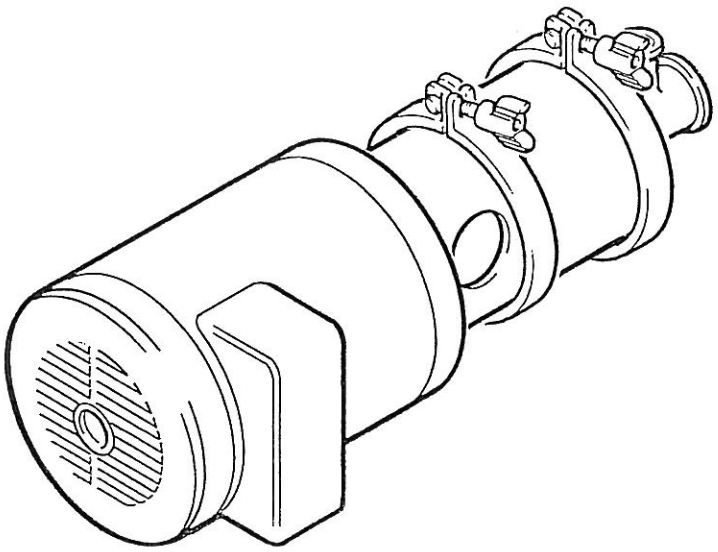
The hot gas pressure switch is wired in series with the hot gas solenoid coil. It closes the hot gas solenoid valve if the pressure in the accumulator exceeds a preset value. For ammonia units, the preset value is 70 psig maximum.

Options

Turbon Mixer

The Turbon Mixer is located at the rear of the unit in the mix supply line. The Turbon Mixer enhances the process of mixing the sanitary air and mix before it enters the freezing cylinder.

Cleaning or maintenance of the Turbon Mixer should be done by qualified service personnel using the manufacturer's recommended procedures.



Turbon Mixer

Options

Motor Starters

Optional motor starters are installed in the rear enclosure. The motor starter package includes various circuit breakers and contactors.

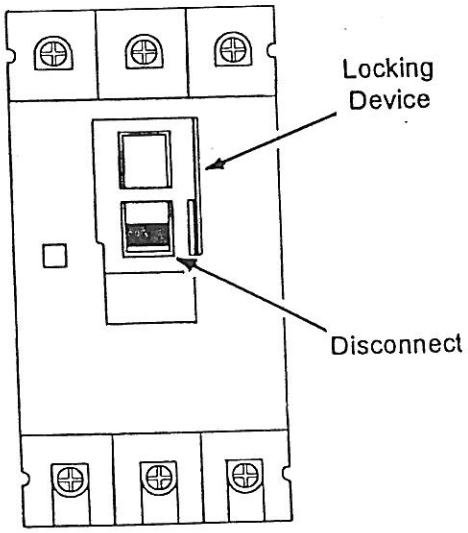
Circuit Breakers

All circuit breakers are thermal magnetic breakers that protect the motor and wiring against operating at a higher current than it is designed to. The circuit breaker also has the capability to be used as a disconnect.

The main circuit breaker contains a locking device in which a padlock can be installed. This prevents the circuit breaker from being turned on, therefore all three phase power is locked out to the unit.

WARNING

Placing a padlock in the locking device does not Lock Out the single phase (110 or 220) Vac used for control voltage.



Circuit Breaker

Contactors

All contactors are IEC Type/Rating. Coil voltage is 24 Vdc. The contactors can be manually jogged by using the test button (press momentarily). This can be useful to check rotation.

Starters

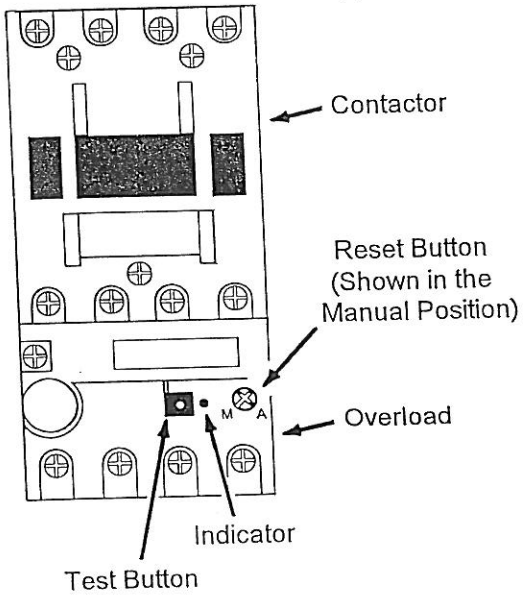
Starters have thermal type overloads and should be adjusted to match the full load current rating of the motor.

A trip indicator is visible on the overload.

The overload can be reset by pressing in on the Reset button (After the overload trips, wait one minute before trying to reset it. This allows the overload to cool down properly.)

CAUTION

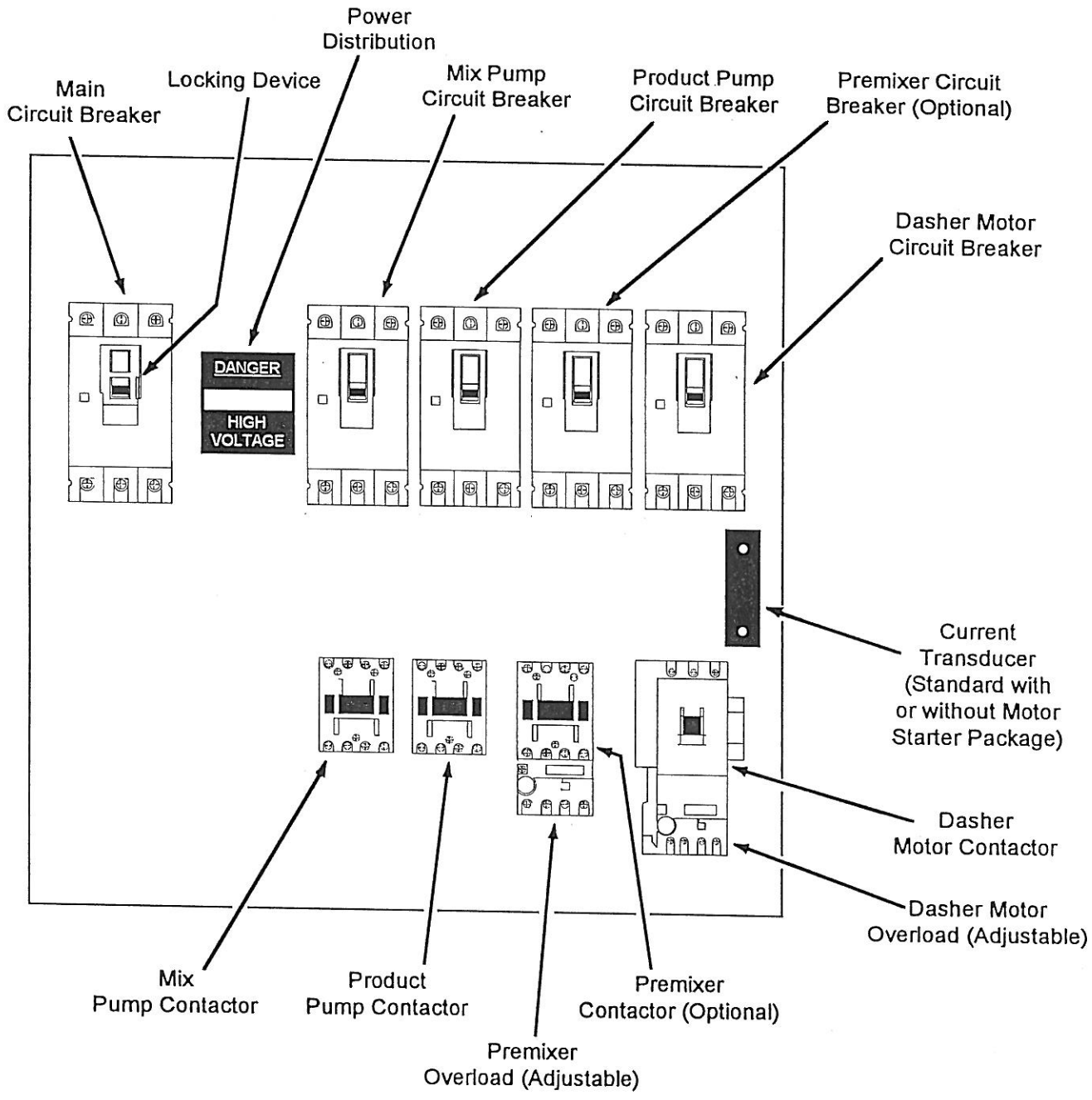
It is not recommended to set these controls for automatic reset, but rather they should be set so that if they trip for some reason, they have to be manually reset. Locate and repair the cause of the problem before resetting.



If the tip of the indicator is below the surface, the overload has not tripped. If the tip of the indicator is above the surface, the overload has tripped.

Starter

Options



Motor Starter Components

Fahrenheit to Celsius Conversion Table

F=(1.8 x C) + 32

C=(F-32) x .556

Fahrenheit	Celsius
-30.0	-34.5
-29.0	-33.9
-28.0	-33.4
-27.0	-32.8
-26.0	-32.2
-25.0	-31.7
-24.0	-31.1
-23.0	-30.6
-22.0	-30.0
-21.0	-29.5
-20.0	-28.9
-19.0	-28.4
-18.0	-27.8
-17.0	-27.2
-16.0	-26.7
-15.0	-26.1
-14.0	-25.6
-13.0	-25.0
-12.0	-24.5
-11.0	-23.9
-10.0	-23.4
-9.0	-22.8
-8.0	-22.2
-7.0	-21.8
-6.0	-21.1
-5.0	-20.6
-4.0	-20.0
-3.0	-19.5
-2.0	-18.9
-1.0	-18.3
0.0	-17.8
1.0	-17.2
2.0	-16.7
3.0	-16.1
4.0	-15.6
5.0	-15.0
6.0	-14.5
7.0	-13.9
8.0	-13.3
9.0	-12.8
10.0	-12.2
11.0	-11.7
12.0	-11.1
13.0	-10.6
14.0	-10.0
15.0	-9.5
16.0	-8.9
17.0	-8.3
18.0	-7.8
19.0	-7.2
20.0	-6.7
21.0	-6.1
22.0	-5.6
23.0	-5.0
24.0	-4.4
25.0	-3.9
26.0	-3.3
27.0	-2.8
28.0	-2.2
29.0	-1.7
30.0	-1.1
31.0	-0.6
32.0	0.0
33.0	0.6
34.0	1.1
35.0	1.7
36.0	2.2
37.0	2.8
38.0	3.3
39.0	3.9
40.0	4.4
41.0	5.0
42.0	5.6
43.0	6.1
44.0	6.7
45.0	7.2
46.0	7.8
47.0	8.3
48.0	8.9
49.0	9.5
50.0	10.0
51.0	10.6
52.0	11.1
53.0	11.7
54.0	12.2
55.0	12.8
56.0	13.3
57.0	13.9
58.0	14.5
59.0	15.0
60.0	15.6
61.0	16.1
62.0	16.7
63.0	17.2
64.0	17.8
65.0	18.3
66.0	18.9
67.0	19.5
68.0	20.0
69.0	20.6
70.0	21.1
71.0	21.7
72.0	22.2
73.0	22.8
74.0	23.4
75.0	23.9
76.0	24.5
77.0	25.0
78.0	25.6
79.0	26.1
80.0	26.7
81.0	27.2
82.0	27.8
83.0	28.4
84.0	28.9
85.0	29.5
86.0	30.0
87.0	30.6
88.0	31.1
89.0	31.7
90.0	32.2
91.0	32.8
92.0	33.4
93.0	33.9
94.0	34.5
95.0	35.0
96.0	35.6
97.0	36.1
98.0	36.7
99.0	37.3
100.0	37.8
101.0	38.4
102.0	38.9
103.0	39.5
104.0	40.0
105.0	40.6
106.0	41.1
107.0	41.7
108.0	42.3
109.0	42.8
110.0	43.4
111.0	43.9
112.0	44.5
113.0	45.0
114.0	45.6
115.0	46.1
116.0	46.7
117.0	47.3
118.0	47.8
119.0	48.4
120.0	48.9
121.0	49.5
122.0	50.0
123.0	50.6
124.0	51.2
125.0	51.7
126.0	52.3
127.0	52.8
128.0	53.4
129.0	53.9
130.0	54.5
131.0	55.0
132.0	55.6
133.0	56.2
134.0	56.7
135.0	57.3
136.0	57.8
137.0	58.4
138.0	58.9
139.0	59.5
140.0	60.0
141.0	60.6
142.0	61.2
143.0	61.7
144.0	62.3
145.0	62.8
146.0	63.4
147.0	63.9
148.0	64.5
149.0	65.1
150.0	65.6
151.0	66.2
152.0	66.7
153.0	67.3
154.0	67.8
155.0	68.4
156.0	68.9
157.0	69.5
158.0	70.1
159.0	70.6
160.0	71.2
161.0	71.7
162.0	72.3
163.0	72.8
164.0	73.4
165.0	73.9
166.0	74.5
167.0	75.1
168.0	75.6
169.0	76.2
170.0	76.7
171.0	77.3
172.0	77.8
173.0	78.4
174.0	79.0
175.0	79.5
176.0	80.1
177.0	80.6
178.0	81.2
179.0	81.7
180.0	82.3
181.0	82.8
182.0	83.4
183.0	84.0
184.0	84.5
185.0	85.1
186.0	85.6
187.0	86.2
188.0	86.7
189.0	87.3
190.0	87.8
191.0	88.4
192.0	89.0
193.0	89.5
194.0	90.1
195.0	90.6
196.0	91.2
197.0	91.7
198.0	92.3
199.0	92.9
200.0	93.4
201.0	94.0
202.0	94.5
203.0	95.1
204.0	95.6
205.0	96.2
206.0	96.7
207.0	97.3
208.0	97.9
209.0	98.4
210.0	99.0
211.0	99.5
212.0	100.1
213.0	100.6
214.0	101.2
215.0	101.7
216.0	102.3
217.0	102.9
218.0	103.4
219.0	104.0
220.0	104.5
221.0	105.1
222.0	105.6
223.0	106.2
224.0	106.8
225.0	107.3
226.0	107.9
227.0	108.4
228.0	109.0
229.0	109.5
230.0	110.1
231.0	110.6
232.0	111.2
233.0	111.8
234.0	112.3
235.0	112.9
236.0	113.4
237.0	114.0
238.0	114.5
239.0	115.1
240.0	115.6
241.0	116.2
242.0	116.8
243.0	117.3
244.0	117.9
245.0	118.4
246.0	119.0
247.0	119.5
248.0	120.1
249.0	120.7
250.0	121.2

Foot Pounds (ft-lb) to Newton Meters (N·M) Conversion Table

1 ft-lb = 1.3355818 N·M (Newton Meter)

ft-lb	N·M	ft-lb	N·M
1	1.35	51	69.16
2	2.71	52	70.51
3	4.07	53	71.87
4	5.42	54	73.22
5	6.78	55	74.58
6	8.14	56	75.94
7	9.49	57	77.29
8	10.85	58	78.65
9	12.20	59	80.00
10	13.56	60	81.36
11	14.92	61	82.72
12	16.27	62	84.07
13	17.63	63	85.43
14	18.98	64	86.78
15	20.34	65	88.14
16	21.70	66	89.50
17	23.05	67	90.85
18	24.41	68	92.21
19	25.76	69	93.56
20	27.12	70	94.92
21	28.48	71	96.28
22	29.83	72	97.63
23	31.19	73	98.99
24	32.54	74	100.34
25	33.90	75	101.70
26	35.26	76	103.06
27	36.61	77	104.41
28	37.97	78	105.77
29	39.32	79	107.12
30	40.68	80	108.48
31	42.04	81	109.84
32	43.39	82	111.19
33	44.75	83	112.55
34	46.10	84	113.90
35	47.46	85	115.26
36	48.82	86	116.62
37	50.17	87	117.97
38	51.53	88	119.33
39	52.88	89	120.68
40	54.24	90	122.04
41	55.60	91	123.40
42	56.95	92	124.75
43	58.31	93	126.11
44	59.66	94	127.46
45	61.02	95	128.82
46	62.38	96	130.18
47	63.73	97	131.53
48	65.09	98	132.89
49	66.44	99	134.24
50	67.80	100	135.60

US Fluid Ounces to Liters Conversion Table

1 Ounce = .02957 Liters

Ounces	Liters	Ounces	Liters
1	0.030	51	1.530
2	0.060	52	1.560
3	0.090	53	1.590
4	0.120	54	1.620
5	0.150	55	1.650
6	0.180	56	1.680
7	0.210	57	1.710
8	0.240	58	1.740
9	0.270	59	1.770
10	0.300	60	1.800
11	0.330	61	1.830
12	0.360	62	1.860
13	0.390	63	1.890
14	0.420	64	1.920
15	0.450	65	1.950
16	0.480	66	1.980
17	0.510	67	2.010
18	0.540	68	2.040
19	0.570	69	2.070
20	0.600	70	2.100
21	0.630	71	2.130
22	0.660	72	2.160
23	0.690	73	2.190
24	0.720	74	2.220
25	0.750	75	2.250
26	0.780	76	2.280
27	0.810	77	2.310
28	0.840	78	2.340
29	0.870	79	2.370
30	0.900	80	2.400
31	0.930	81	2.430
32	0.960	82	2.460
33	0.990	83	2.490
34	1.020	84	2.520
35	1.050	85	2.550
36	1.080	86	2.580
37	1.110	87	2.610
38	1.140	88	2.640
39	1.170	89	2.670
40	1.200	90	2.700
41	1.230	91	2.730
42	1.260	92	2.760
43	1.290	93	2.790
44	1.320	94	2.820
45	1.350	95	2.850
46	1.380	96	2.880
47	1.410	97	2.910
48	1.440	98	2.940
49	1.470	99	2.970
50	1.500	100	3.000

Inches to Millimeters Conversion Table

1 inch = 25.4 mm

in.	mm	in.	mm
0.10	2.54	11.25	285.75
0.15	3.81	11.50	292.10
0.20	5.08	11.75	298.45
0.25	6.35	12.00	304.80
0.30	7.62	12.25	311.15
0.35	8.89	12.50	317.50
0.40	10.16	12.75	323.85
0.45	11.43	13.00	330.20
0.50	12.70	13.25	336.55
0.55	13.97	13.50	342.90
0.60	15.24	13.75	349.25
0.65	16.51	14.00	355.60
0.70	17.78	14.25	361.95
0.75	19.05	14.50	368.30
0.80	20.32	14.75	374.65
0.85	21.59	15.00	381.00
0.90	22.86	15.25	387.35
0.95	24.13	15.50	393.70
1.00	25.40	15.75	400.05
1.25	31.75	16.00	406.40
1.50	38.10	16.25	412.75
1.75	44.45	16.50	419.10
2.00	50.80	16.75	425.45
2.25	57.15	17.00	431.80
2.50	63.50	17.25	438.15
2.75	69.85	17.50	444.50
3.00	76.20	17.75	450.85
3.25	82.55	18.00	457.20
3.50	88.90	18.25	463.55
3.75	95.25	18.50	469.90
4.00	101.60	18.75	476.25
4.25	107.95	19.00	482.60
4.50	114.30	19.25	488.95
4.75	120.65	19.50	495.30
5.00	127.00	19.75	501.65
5.25	133.35	20.00	508.00
5.50	139.70	20.25	514.35
5.75	146.05	20.50	520.70
6.00	152.40	20.75	527.05
6.25	158.75	21.00	533.40
6.50	165.10	21.25	539.75
6.75	171.45		
7.00	177.80		
7.25	184.15		
7.50	190.50		
7.75	196.85		
8.00	203.20		
8.25	209.55		
8.50	215.90		
8.75	222.25		
9.00	228.60		
9.25	234.95		
9.50	241.30		
9.75	247.65		
10.00	254.00		
10.25	260.35		
10.50	266.70		
10.75	273.05		
11.00	279.40		

Inches to Centimeters Conversion Table

1 inch = 2.54 cm

in.	cm	in.	cm	in.	cm
0.25	0.635	54.00	137.160	113.00	287.020
0.50	1.270	55.00	139.700	114.00	289.560
0.75	1.905	56.00	142.240	115.00	292.100
1.00	2.540	57.00	144.780	116.00	294.640
1.25	3.175	58.00	147.320	117.00	297.180
1.50	3.810	59.00	149.860	118.00	299.720
1.75	4.445	60.00	152.400	119.00	302.260
2.00	5.080	61.00	154.940	120.00	304.800
3.00	7.620	62.00	157.480	121.00	307.340
4.00	10.160	63.00	160.020	122.00	309.880
5.00	12.700	64.00	162.560	123.00	312.420
6.00	15.240	65.00	165.100	124.00	314.960
7.00	17.780	66.00	167.640	125.00	317.500
8.00	20.320	67.00	170.180	126.00	320.040
9.00	22.860	68.00	172.720	127.00	322.580
10.00	25.400	69.00	175.260	128.00	325.120
11.00	27.940	70.00	177.800	129.00	327.660
12.00	30.480	71.00	180.340	130.00	330.200
13.00	33.020	72.00	182.880	131.00	332.740
14.00	35.560	73.00	185.420	132.00	335.280
15.00	38.100	74.00	187.960	133.00	337.820
16.00	40.640	75.00	190.500	134.00	340.360
17.00	43.180	76.00	193.040	135.00	342.900
18.00	45.720	77.00	195.580	136.00	345.440
19.00	48.260	78.00	198.120	137.00	347.980
20.00	50.800	79.00	200.660	138.00	350.520
21.00	53.340	80.00	203.200	139.00	353.060
22.00	55.880	81.00	205.740	140.00	355.600
23.00	58.420	82.00	208.280	141.00	358.140
24.00	60.960	83.00	210.820	142.00	360.680
25.00	63.500	84.00	213.360	143.00	363.220
26.00	66.040	85.00	215.900	144.00	365.760
27.00	68.580	86.00	218.440	145.00	368.300
28.00	71.120	87.00	220.980	146.00	370.840
29.00	73.660	88.00	223.520	147.00	373.380
30.00	76.200	89.00	226.060	148.00	375.920
31.00	78.740	90.00	228.600	149.00	378.460
32.00	81.280	91.00	231.140	150.00	381.000
33.00	83.820	92.00	233.680	151.00	383.540
34.00	86.360	93.00	236.220	152.00	386.080
35.00	88.900	94.00	238.760	153.00	388.620
36.00	91.440	95.00	241.300	154.00	391.160
37.00	93.980	96.00	243.840	155.00	393.700
38.00	96.520	97.00	246.380	156.00	396.240
39.00	99.060	98.00	248.920	157.00	398.780
40.00	101.600	99.00	251.460	158.00	401.320
41.00	104.140	100.00	254.000	159.00	403.860
42.00	106.680	101.00	256.540	160.00	406.400
43.00	109.220	102.00	259.080	161.00	408.940
44.00	111.760	103.00	261.620	162.00	411.480
45.00	114.300	104.00	264.160	163.00	414.020
46.00	116.840	105.00	266.700	164.00	416.560
47.00	119.380	106.00	269.240	165.00	419.100
48.00	121.920	107.00	271.780	166.00	421.640
49.00	124.460	108.00	274.320	167.00	424.180
50.00	127.000	109.00	276.860	168.00	426.720
51.00	129.540	110.00	279.400	169.00	429.260
52.00	132.080	111.00	281.940	170.00	431.800
53.00	134.620	112.00	284.480	171.00	434.340

Gallons to Liters Conversion Table

1 Gallon = 3.785 Liters

Gallons	Liters
1	3.785
2	7.570
3	11.355
4	15.140
5	18.925
6	22.710
7	26.495
8	30.280
9	34.065
10	37.850
20	75.700
30	113.550
40	151.400
50	189.250
60	227.100
70	264.950
80	302.800
90	340.650
100	378.500
110	416.350
120	454.200
130	492.050
140	529.900
150	567.750
160	605.600
170	643.450
180	681.300
190	719.150
200	757.000
210	794.850
220	832.700
230	870.550
240	908.400
250	946.250
260	984.100
270	1021.950
280	1059.800
290	1097.650
300	1135.500
310	1173.350
320	1211.200
330	1249.050
340	1286.900
350	1324.750
360	1362.600
370	1400.450
380	1438.300
390	1476.150
400	1514.000
410	1551.850

Gallons	Liters
420	1589.700
430	1627.550
440	1665.400
450	1703.250
460	1741.100
470	1778.950
480	1816.800
490	1854.650
500	1892.500
510	1930.350
520	1968.200
530	2006.050
540	2043.900
550	2081.750
560	2119.600
570	2157.450
580	2195.300
590	2233.150
600	2271.000
610	2308.850
620	2346.000
630	2384.550
640	2422.400
650	2460.250
660	2498.100
670	2535.950
680	2573.800
690	2611.650
700	2649.500
710	2687.350
720	2725.200
730	2763.050
740	2800.900
750	2838.750
760	2876.600
770	2914.450
780	2952.300
790	2990.150
800	3028.000
810	3065.850
820	3103.700
830	3141.550
840	3179.400
850	3217.250
860	3255.100
870	3292.950
880	3330.800
890	3368.650
900	3406.500

Quarts to Liters Conversion Table

1 Quart = .946 Liters

Quarts	Liters
1	0.946
2	1.892
3	2.838
4	3.784
5	4.730
6	5.676
7	6.622
8	7.568
9	8.514
10	9.460
11	10.406
12	11.352
13	12.298
14	13.244
15	14.190
16	15.136
17	16.082
18	17.028
19	17.974
20	18.920
21	19.866
22	20.812
23	21.758
24	22.704
25	23.650
26	24.596
27	25.542
28	26.488
29	27.434
30	28.380
31	29.326
32	30.272
33	31.218
34	32.164
35	33.110
36	34.056
37	35.002
38	35.948
39	36.894
40	37.840
41	38.786
42	39.732
43	40.678
44	41.624
45	42.570
46	43.516
47	44.462
48	45.408
49	46.354
50	47.300

Quarts	Liters
51	48.246
52	49.192
53	50.138
54	51.084
55	52.030
56	52.976
57	53.922
58	54.868
59	55.814
60	56.760
61	57.706
62	58.652
63	59.598
64	60.544
65	61.490
66	62.436
67	63.382
68	64.328
69	65.274
70	66.220
71	67.166
72	68.112
73	69.058
74	70.004
75	70.950
76	71.896
77	72.842
78	73.788
79	74.734
80	75.680
81	76.626
82	77.572
83	78.518
84	79.464
85	80.410
86	81.356
87	82.302
88	83.248
89	84.194
90	85.140
91	86.086
92	87.032
93	87.978
94	88.924
95	89.870
96	90.816
97	91.762
98	92.708
99	93.654
100	94.600

Pounds per Square Inch Gauge(PSIG) to Bar Conversion Table

1 PSIG = 0.069 Bar

PSIG	Bar	PSIG	Bar	PSIG	Bar	PSIG	Bar	PSIG	Bar
1	0.069	58	4.002	115	7.935	172	11.868	228	15.732
2	0.138	59	4.071	116	8.004	173	11.937	229	15.801
3	0.207	60	4.140	117	8.073	174	12.006	230	15.870
4	0.276	61	4.209	118	8.142	175	12.075	231	15.939
5	0.345	62	4.278	119	8.211	176	12.144	232	16.008
6	0.414	63	4.347	120	8.280	177	12.213	233	16.077
7	0.483	64	4.416	121	8.349	178	12.282	234	16.146
8	0.552	65	4.485	122	8.418	179	12.351	235	16.215
9	0.621	66	4.554	123	8.487	180	12.420	236	16.284
10	0.690	67	4.623	124	8.556	181	12.489	237	16.353
11	0.759	68	4.692	125	8.625	182	12.558	238	16.422
12	0.828	69	4.761	126	8.694	183	12.627	239	16.491
13	0.897	70	4.830	127	8.763	184	12.696	240	16.560
14	0.966	71	4.899	128	8.832	185	12.765	241	16.629
15	1.035	72	4.968	129	8.901	186	12.834	242	16.698
16	1.104	73	5.037	130	8.970	187	12.903	243	16.767
17	1.173	74	5.106	131	9.039	188	12.972	244	16.836
18	1.242	75	5.175	132	9.108	189	13.041	245	16.905
19	1.311	76	5.244	133	9.177	190	13.110	246	16.974
20	1.380	77	5.313	134	9.246	191	13.179	247	17.043
21	1.449	78	5.382	135	9.315	192	13.248	248	17.112
22	1.518	79	5.451	136	9.384	193	13.317	249	17.181
23	1.587	80	5.520	137	9.453	194	13.386	250	17.250
24	1.656	81	5.589	138	9.522	195	13.455	251	17.319
25	1.725	82	5.658	139	9.591	196	13.524	252	17.388
26	1.794	83	5.727	140	9.660	197	13.594	253	17.457
27	1.863	84	5.796	141	9.729	198	13.662	254	17.526
28	1.932	85	5.865	142	9.798	199	13.731	255	17.595
29	2.001	86	5.934	143	9.867	200	13.800	256	17.664
30	2.070	87	6.003	144	9.936	201	13.869	257	17.733
31	2.139	88	6.072	145	10.005	202	13.938	258	17.802
32	2.208	89	6.141	146	10.074	203	14.007	259	17.871
33	2.277	90	6.210	147	10.143	204	14.076	260	17.940
34	2.346	91	6.279	148	10.212	205	14.145	261	18.009
35	2.415	92	6.348	149	10.281	206	14.214	262	18.078
36	2.484	93	6.417	150	10.350	207	14.283	263	18.147
37	2.553	94	6.486	151	10.419	208	14.352	264	18.216
38	2.622	95	6.555	152	10.488	209	14.421	265	18.285
39	2.691	96	6.624	153	10.557	210	14.490	266	18.354
40	2.760	97	6.693	154	10.626	211	14.559	267	18.423
41	2.829	98	6.762	155	10.695	212	14.628	268	18.492
42	2.898	99	6.831	156	10.764	213	14.697	269	18.561
43	2.967	100	6.900	157	10.833	214	14.766	270	18.630
44	3.036	101	6.969	158	10.902	215	14.835	271	18.699
45	3.105	102	7.038	159	10.971	216	14.904	272	18.768
46	3.174	103	7.107	160	11.040	217	14.973	273	18.837
47	3.243	104	7.176	161	11.109	218	15.042	274	18.906
48	3.312	105	7.245	162	11.178	219	15.111	275	18.975
49	3.381	106	7.314	163	11.247	220	15.180	276	19.044
50	3.450	107	7.383	164	11.316	221	15.249	277	19.113
51	3.519	108	7.452	165	11.385	222	15.318	278	19.182
52	3.588	109	7.521	166	11.454	223	15.387	279	19.251
53	3.657	110	7.590	167	11.523	224	15.456	280	19.320
54	3.726	111	7.659	168	11.592	225	15.525	281	19.389
55	3.795	112	7.728	169	11.661	226	15.594	282	19.458
56	3.864	113	7.797	170	11.730	227	15.663	283	19.527
57	3.933	114	7.866	171	11.799	228	15.732	284	19.596

Wire Size Conversion Table

Wire Gauge	Diameter of Wire in Inches	Diameter of Wire in mm	Resistance at 77 F (Ohms per 1000 ft.)
0000	.4600	11.684	000.0500
000	.4097	10.404	000.0630
00	.3648	9.266	000.0795
0	.3248	8.250	000.1002
1	.2893	7.349	000.1264
2	.2576	6.543	000.1593
3	.2294	5.827	000.2009
4	.2043	5.190	000.2533
6	.1620	4.115	000.4028
8	.1284	3.262	000.6405
10	.1018	2.586	001.0180
12	.0808	2.053	001.6190
14	.0640	1.626	002.5750
16	.0508	1.291	004.0940
18	.0403	1.024	006.5100
20	.0319	0.811	010.3500
22	.0254	0.646	016.4600
24	.0201	0.511	026.1700
26	.0159	0.404	041.6200
28	.0126	0.320	066.1700
30	.0100	0.254	105.2000
32	.0080	0.204	167.3000
34	.0063	0.160	266.0000
36	.0050	0.127	423.0000
38	.0040	0.102	672.6000
40	.0031	0.079	1069.0000
42	.0025	0.064	1701.0000
44	.0020	0.051	2703.0000
46	.0016	0.041	4299.0000
48	.0012	0.031	6836.0000
50	.0010	0.026	10870.0000

Feet to Meters Conversion Table

1 Foot = 0.3048 Meter

Feet	Meters
1	0.3048
2	0.6096
3	0.9144
4	1.2190
5	1.5240
6	1.8288
7	2.1336
8	2.4384
9	2.7432
10	3.0480
11	3.3528
12	3.6576
13	3.9624
14	4.2672
15	4.5720
16	4.8768
17	5.1816
18	5.4864
19	5.7912
20	6.0960
21	6.4008
22	6.7056
23	7.0104
24	7.3152
25	7.6200
100	30.4800
1000	304.8000
2000	609.6000

Viscosity Conversion Table

When Specific Gravity is 1		When Specific Gravity is other than 1											
Read Directly Across		Find CKS, Then Multiply CKS x SG = CPS	Find Stokes, Then Multiply Stoke x SG = Poise										
CPS	Poise	CKS	Stoke	Saybolt Universal (SSU)	Seconds Engler	Degrees Engler	Dupont Parlin #7	Dupont Parlin #10	Dupont Parlin #15	Dupont Parlin #20	Krebs Units	Mac-Michael	Pratt & Lambert F
1	.01	1	.01	31	54	1.0	20		4.2				
2	.02	2	.02	34	57	1.1	23		4.3				
4	.04	4	.04	38	61	1.3	24		4.4				
7	.07	7	.07	47	75	1.6	26		4.6				
10	.10	10	.10	60	94	1.9	28	11	4.7				
15	.15	15	.15	80	125	2.5	30	12	4.9				
20	.20	20	.20	100	170	3.0	32	13	5.0			125	
25	.24	25	.24	130	190	4.1	37	14	5.1			139	
30	.30	30	.30	160	210	4.9	43	15	5.4			151	
40	.40	40	.40	210	300	6.0	50	16	5.7			177	
50	.50	50	.50	260	350	7.5	57	17	6.0		30	201	
60	.60	60	.60	320	450	9.1	63	18	6.3	3.1	33	230	
70	.70	70	.70	370	525	10.5	68	20	6.8	3.2	35	260	
80	.80	80	.80	430	600	12.4	73	22	7.5	3.3	37	290	7.3
90	.90	90	.90	480	875	14.0	78	23	7.7	3.4	38	315	7.8
100	1.0	100	1.0	530	750	15.3	81	25	8.0	3.5	40	335	8.3
120	1.2	120	1.2	580	900	16.1	90	30	8.3	3.6	43	380	8.9
140	1.4	140	1.4	690	1050	20.0	106	32	8.9	3.9	46	415	9.8
160	1.6	160	1.6	790	1200	23.0	120	37	9.7	4.1	48	465	10.8
180	1.8	180	1.8	900	1350	26.3	135	41	10.7	4.3	50	520	11.9
200	2.0	200	2.0	1000	1500	29.2	149	43	11.5	4.5	52	570	12.5
220	2.2	220	2.2	1100	1650	32.2		45	12.2	4.8	54	610	13.0
240	2.4	240	2.4	1200	1800	35.0		49	13.0	5.0	56	660	14.2
260	2.6	260	2.6	1280	1950	37.7		53	13.7	5.3	58	700	15.1
280	2.8	280	2.8	1380	2100	40.5		58	14.4	5.6	59	750	15.6
300	3.0	300	3.0	1475	2250	43.0		64	15.0	5.9	60	800	16.7
320	3.2	320	3.2	1530	2400	44.7		66	15.5	6.1		825	17.3
340	3.4	340	3.4	1630	2550	47.5		70	16.4	6.4		875	18.5
360	3.6	360	3.6	1730	2700	50.3		74	17.3	6.7	62	925	19.6
380	3.8	380	3.8	1850	2850	54.0		79	18.2	7.0		980	21.0
400	4.0	400	4.0	1950	3000	57.0		84	19.1	7.3	64	1035	22.1
420	4.2	420	4.2	2050	3150	59.9		88	20.0	7.6		1070	23.2
440	4.4	440	4.4	2160	3300	63.6		93	21.0	8.0		1125	24.4
460	4.6	460	4.6	2270	3450	67.0		100	22.0	8.5	65	1180	26.7
480	4.8	480	4.8	2380	3600	69.5		104	23.0	8.9	67	1240	27.0
500	5.0	500	5.0	2480	3750	73.1		107	23.9	9.2	68	1290	28.1
550	5.5	550	5.5	2660	4125	78.0		115	26.3	9.7	69	1385	30.1
600	6.0	600	6.0	2900	4500	85.0		126	28.5	10.6	71	1510	32.8
700	7.0	700	7.0	3380	5250	95.0		145	31.9	12.1	74	1760	38.2
800	8.0	800	8.0	3880	6000	110		168	36.4	13.9	77	2020	44.4
900	9.0	900	9.0	4300	8750	125		185	40.0	15.5	81	2240	48.6
1000	10.0	1000	10.0	4600	7500	135		198	43.0	16.8	85	2395	52.0

Viscosity Conversion Table (Continued)

When Specific Gravity is 1		When Specific Gravity is other than 1												
Read Directly Across		Find CKS, Then Multiply CKS x SG = CPS	Find Stokes, Then Multiply Stoke x SG = Poise											
CPS	Poise	CKS	Stoke	Saybolt Universal (SSU)	Seconds Engler	Decrees Engler	Dupont Parlin #7	Dupont Parlin #10	Dupont Parlin #15	Dupont Parlin #20	Krebs Units	Mac-Michael	Pratt & Lambert F
1100	11	1100	11	5200	8250	151		224	48.0	18.7	88	2710	58.1
1200	12	1200	12	5620	9000	164		242	53.2	20.2	92	2930	63.6
1300	13	1300	13	6100	9750	177		262	58.0	22.0	95	3180	69.0
1400	14	1400	14	6480	10350	188		280	61.6	23.2	96	3370	73.4
1500	15	1500	15	7000	11100	203		300	69.0	25.0	98	3650	79.3
1600	16	1600	16	7500	11850	217		322	72.0	26.7	100	3900	85.0
1700	17	1700	17	8000	12600	233		344	76.0	28.5	101	4180	90.5
1800	18	1800	18	8500	13300	248		366	81.0	30.0		4420	96.2
1900	19	1900	19	9000	13900	263		387	86.0	31.8		4830	102.0
2000	20	2000	20	9400	14600	275		405	90.0	33.0	103	4900	106.2
2100	21	2100	21	9850	15300	287		433	94.5	34.7		5120	111.3
2200	22	2200	22	10,300	16100	300		453	99.0	36.0		5360	116.6
2300	23	2300	23	10,750	16800	314		473	105.7	38.0	105	5600	124
2400	24	2400	24	11,200	17500	325		493	110.3	39.5	109	5840	127
2500	25	2500	25	11,600	18250	339		510	114	40.8	114	6040	131
3000	30	3000	30	14,500	21800	425		638	142	51.0	121	7550	165
3500	35	3500	35	16,500	25200	485		725	164	57.0	129	8600	187
4000	40	4000	40	18,500	28800	540		814	186	64.5	133	9640	210
4500	45	4500	45	21,000	32400	615		924	214	73.5	136	10920	238
5000	50	5000	50	23,500	36000	690			239	82.0		12220	267
5500	55	5500	55	26,000	39600	765			265	90.6		13510	295
6000	60	6000	60	28,000	43100	820			285	97.5		14570	318
6500	65	6500	65	30,000	46000	885			306	104		15610	340
7000	70	7000	70	32,500	49600	960			331	113		16900	369
7500	75	7500	75	35,000	53200	1035			356	122		18200	397
8000	80	8000	80	37,000	56800	1095			377	129		19250	420
8500	85	8500	85	39,500	60300	1175			402	138		20600	449
9000	90	9000	90	41,080	63900	1220			417	143		21350	465
9500	95	9500	95	43,000	67400	1280			433	150		22400	488
10,000	100	10,000	100	46,500		1385			464	162		24200	527
15,000	150	15,000	150	69,400	106000					242			
20,000	200	20,000	200	92,500	140000					322			
30,000	300	30,000	300	138,500	210000					483			
40,000	400	40,000	400	185,000	276000					645			
50,000	500	50,000	500	231,000	345000					805			
60,000	600	60,000	600	277,500	414000					957			
70,000	700	70,000	700	323,500	484000					1127			
80,000	800	80,000	800	370,000	550000					1290			
90,000	900	90,000	900	415,500	620000					1445			
100,000	1000	100,000	1100	462,000	689000					1810			
125,000	1250	125,000	1250	578,000	850000					2010			
150,000	1500	150,000	1500	694,000						2420			
175,000	1750	175,000	1750	810,000						2820			
200,000	2000	200,000	2000	925,000						3220			

JANUARY 8, 1996

APV Crepaco
Service Parts Manual

CONTINUOUS ICE CREAM FREEZER

Model:	**"WS-212GS"**
Serial Number:	**N-1307**
Order Number:	**32-03079**
Drawing Number:	**07B-P-482339**

RICHMOND ICE CREAM

When requesting information about your machine, always state serial number, name of machine, and model number, or any other pertinent information that might apply.

Keep this manual in a safe place for future reference.

Additional copies may be ordered through your local APV Crepaco Sales Representative.

STANDARD WARRANTY

Obligations of Seller

During the warranty period, Seller shall repair, or at Seller's option, replace parts determined by Seller to be defective in material or workmanship. The warranty period is one (1) year from the date of delivery to Buyer F.O.B. point of manufacture. The foregoing shall be the sole obligation of Seller under this warranty with respect to the equipment and other property included in this Agreement. With respect to equipment, materials, parts and accessories manufactured by others, Seller's sole obligation shall be to use reasonable efforts to obtain for Buyer the full benefit of the manufacturers' warranties.

Warranty Exclusions

Repair or replacement of parts required because of misuse, improper care or storage, negligence, alteration, accident, use of incompatible supplies or lack of specified maintenance are excluded from Seller's warranty obligations.

DISCLAIMER OF WARRANTIES

THE FOREGOING WARRANTY EXPRESSIONS ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND EXISTENCE OF ANY SUCH OTHER WARRANTY IS HEREBY DENIED.

Limitation of Liability and Remedies

The liability of Seller for breach of any warranty obligation hereunder is limited to:

1. The repair or replacement of the equipment on which the liability is based; or,

2. At Sellers option, the refund to Buyer of the amount paid by Buyer to Seller for said equipment.

All other liability of Seller with respect to this Agreement, or from the manufacture, installation, maintenance, repair or use of any equipment covered by or furnished under this Agreement, whether in contract or in tort, or otherwise, is limited to the amount paid by Buyer to Seller pursuant to the terms hereon: SELLER SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

Breach

Any breach by Seller with respect to any items or unit of equipment shall be deemed a breach with respect to that item or unit only.

Infringement

Seller will not be liable for the infringement of any patent by the Buyer's use of any equipment or materials delivered hereunder.

POLICY REGARDING AVAILABILITY OF SERVICE PARTS

APV Crepaco will attempt to remain in a position to supply replaceable service parts during the normal life of any item of APV Crepaco equipment. This will be contingent upon availability of tools, material, and facilities of our own as well as of our suppliers.

After expiration of this period, supply of service parts will be limited to available stock of completed parts. If unable to supply the service part, drawings will be furnished when available to permit local manufacturing, if desired.

APV Crepaco reserves the right to improve, change or modify the construction of its equipment or any parts thereof without incurring any obligation to provide like changes to equipment previously sold.

A Word About APV Crepaco Service Parts

We want to raise your awareness to the problem associated with purchase of parts not manufactured to the high quality specifications of APV Crepaco, INC.

In addition to our high quality, APV Crepaco parts are manufactured to meet regulatory agency authorizations, approvals and certification (3-A Sanitary Standards, USDA, ASME, BISSC and OSHA). Where applicable, materials used in construction of APV parts conform to FDA regulations.

WARNING

PARTS NOT MANUFACTURED TO OUR SPECIFICATIONS MAY CAUSE DAMAGES TO YOUR APV CREPACO EQUIPMENT AND VOID ALL WARRANTIES. USE OF PARTS THAT DO NOT MEET APV CREPACO, INC. SPECIFICATIONS MAY CAUSE PROPERTY DAMAGES AND SERIOUS BODILY INJURY.

Types of equipment include, but are not limited to, rotary pumps, centrifugal pumps, homogenizers, ice cream freezers, scrape surface heat exchangers, plate heat exchangers, ingredient feeders, process tanks and contact plate freezers.

We bring this potentially serious problem to your attention in order to safeguard your best interest and those of your employees.

If you have any questions, please feel free to call 1-800-358-4100 or your local APV Crepaco Regional Sales Office.

APV Crepaco Offices

Engineering and Manufacturing Facilities

100 S. CP Ave.
Lake Mills, WI 53551
Tel: (414) 648-8311
Fax: (414) 648-3418

Factory Direct Service Parts Sales, Toll Free (800) 358-4100

Regional Sales Offices

Central Region
9525 West Bryn Mawr Ave.
Rosemont, IL 60018
Tel: (708) 678-4300
Fax: (708) 678-5037

6663 Huntley Rd.
Suite L
Columbus, OH 43229
Tel: (614) 846-8503
Fax: (614) 846-4932

4226 Park Glen Rd.
St. Louis Park, MN 55416
Tel: (612) 927-4910
Fax: (612) 927-6895

Western Region
16641 Valley View Ave.
Cerritos, CA 90701
Tel: (310) 926-9700
Fax: (310) 926-1179

4380 S. 500 West
Salt Lake City, UT 84123
Tel: (801) 262-8494
Fax: (801) 262-9467

1138 Industry Drive
Seattle, WA 98188
Tel: (206) 575-8900
Fax: (206) 575-1221

Southern Region
P.O. Box 166199
2920 Skyway Circle N.
Irving, TX 75038
Tel: (214) 257-3455
Fax: (214) 594-1339

Eastern Region
330 Franklin Turnpike
Mahwah, NJ 07430
Tel: (201) 529-5959
Fax: (201) 529-2676

2252 Northwest Parkway
Suite B
Marietta, GA 30067
Tel: (404) 956-9110
Fax: (404) 956-8993

Canada

APV Canada, Inc.
Central Region-Toronto
30 Whitmore Rd.
Woodbridge, Ont. L4L 7Z4
Tel: (905) 850-1852
Fax: (905) 850-1863

APV Canada, Inc.
Eastern Region-Montreal
6555 Cote De Liesse
Montreal, Quebec H4T 1E6
Tel: (514) 737-0006
Fax: (514) 737-1310

APV Canada, Inc.
Western Region-Vancouver
Unit #10-8075 Enterprise Street
Burnaby, B.C. V5A 1V5
Tel: (604) 420-4344
Fax: (604) 420-2419

International

APV Crepaco (Far East) Inc.
Hoko Bldg., Ginza 1-18-19
Chuo-Ku, Tokyo 104, Japan
Tel: 03-562-3921
Fax: 03-561-1719
Telex: 02523295

APV de Mexico
Periferico Sur 4225-106
Colonia Jardines en la Montana
CP 14210, Mexico, D.F., Mexico
Tel: 52(5)-644-2439
Fax: 52(5)-644-2730

APV Crepaco Service GmbH
Spinnereistrasse 11
D-88239 Wangen/Allgau
Germany
Tel: 07522-80024
Fax: 07522-80010

WS ICE CREAM FREEZER

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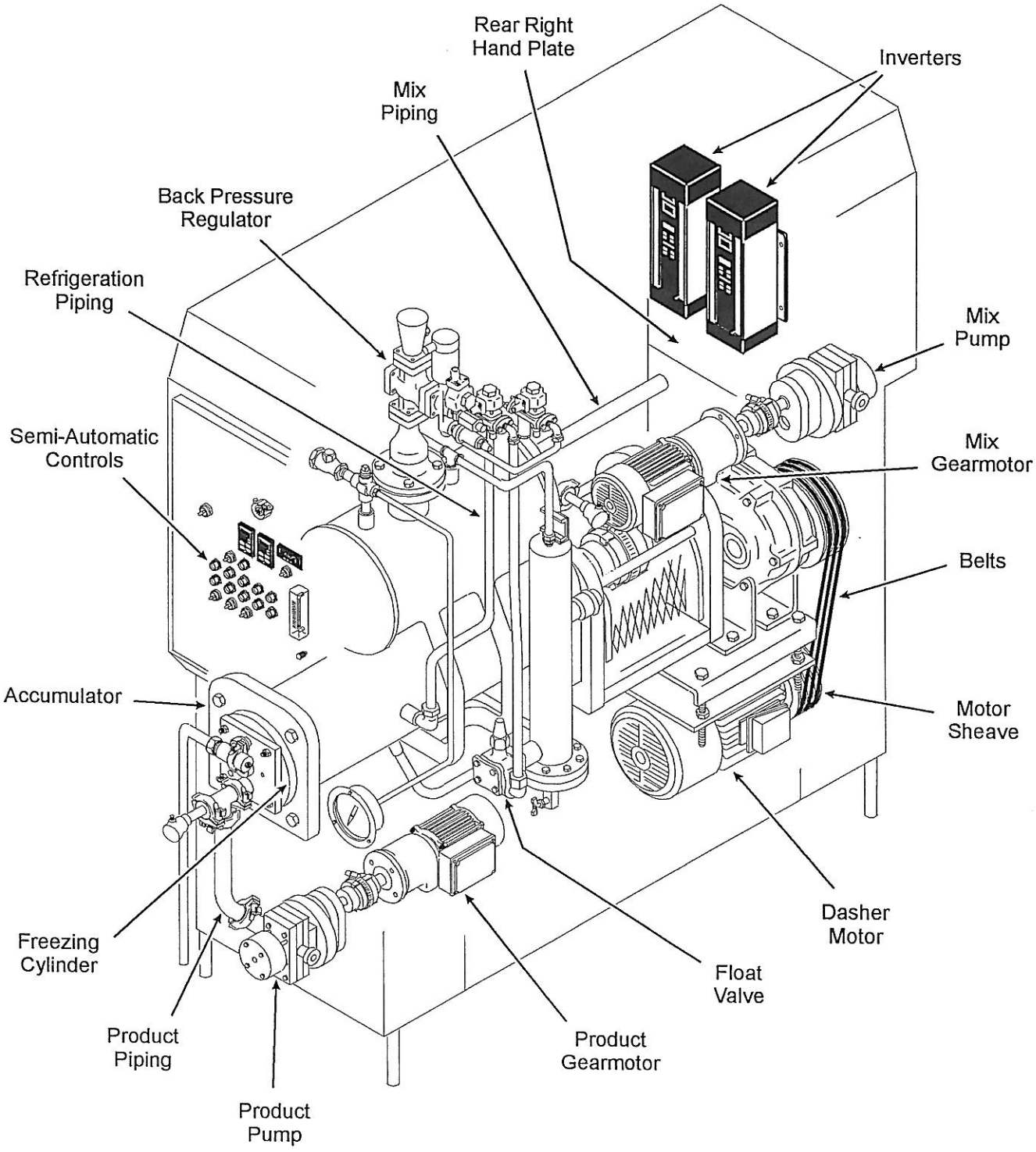
CUSTOMER SPECIFICATION SHEET



WSF00576

CUSTOMER SPECIFICATION SHEET

Serial Number:	N-1307
Model:	WS-212GS
Order Number:	32-03079
Drawing Number:	07B-P-482339

Controls	
Automatic	
Semi-Automatic	X
Manual	
Mass Flow Air Controller	
Dasher Type	
Series #30 (Open)	07A-P-464870
Series # 80 (Solid)	
Accumulator	07A-P-457962
Inner Cylinder	07A-P-464153
Refrigeration Type	
Ammonia	X
Freon	
Back Pressure Regulator	583-S-R041-D
Float Valve	582-S-G850-D
Rear Right Hand Plate	07H-P-464497
Mix Gear Motor	501-S-D999-R
Horse Power	2 hp
Motor Voltage	3/50/415V
Inverter	503-S-R843-B
Pump Size: 2.5 FAR	03B-P-365160
Product Gear Motor	501-S-D1003-R
Horse Power	3 hp
Motor Voltage	3/50/415V
Inverter	503-S-R844-B
Pump Size: 2.5 FAR	03B-P-365161
Dasher Motor	502-S-D931-QR
Horse Power	30 hp
Motor Voltage	3/50/415V
Sheave	625-S-5387-JF
Hub	625-S-R271-LB
Belt Selection	623-V-026317 (6 EA.)

Reducer	627-S-R330-F
Sheave	625-S-5387-PF
Hub	625-S-5787-AA
Special Options	

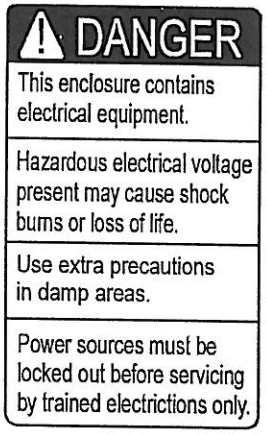
WSF00184

DECALS

1

681-P-419854

2



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681-P-151170

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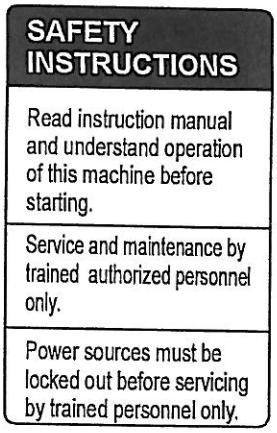

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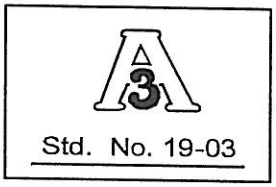

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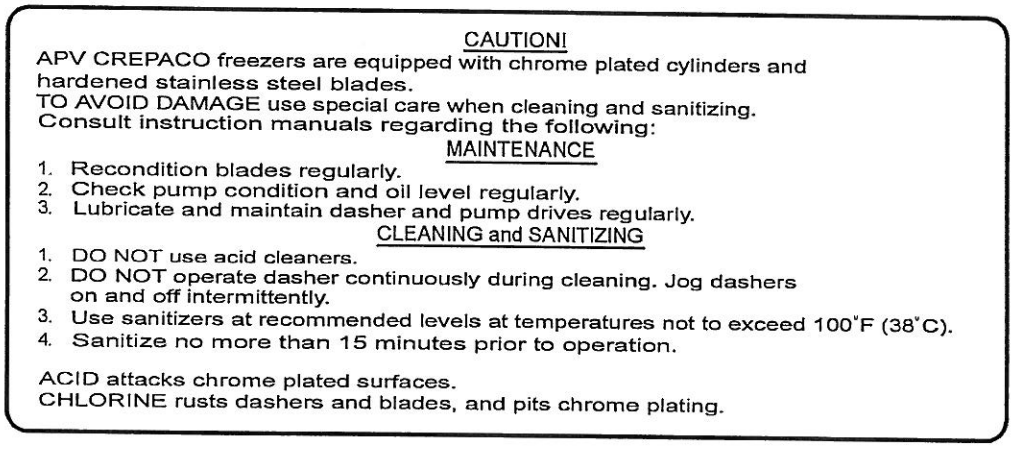

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681-P-431689

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681-P-482046

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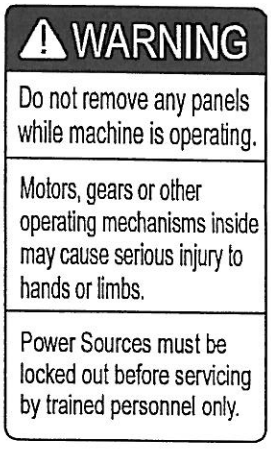

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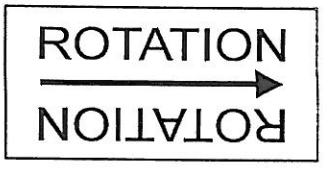
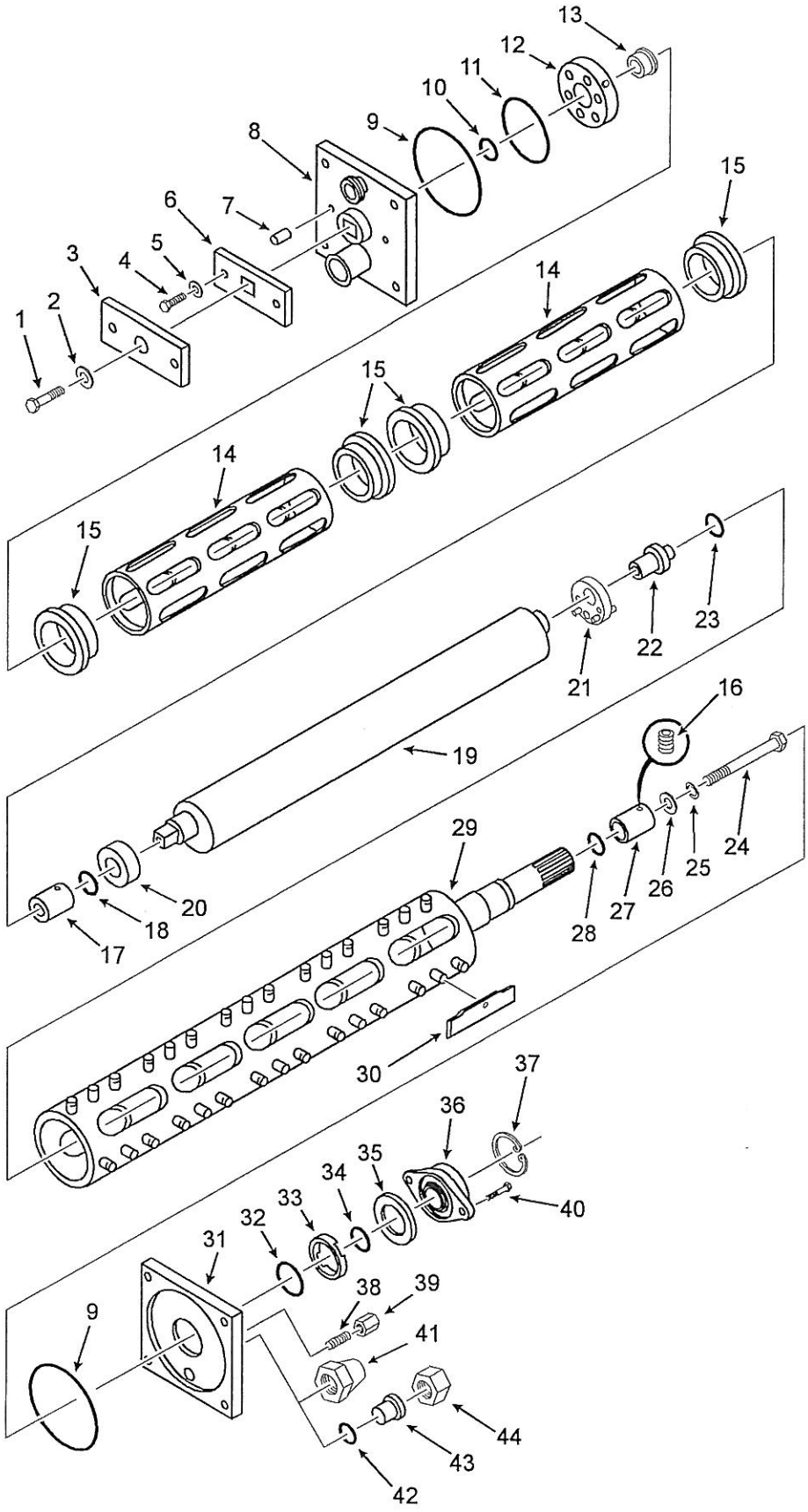


681-P-288335

WSF00186

DASHER ASSEMBLY - SERIES 30



NOTE: Order by part number, not by item number.

07W-P-464371/WSF00008

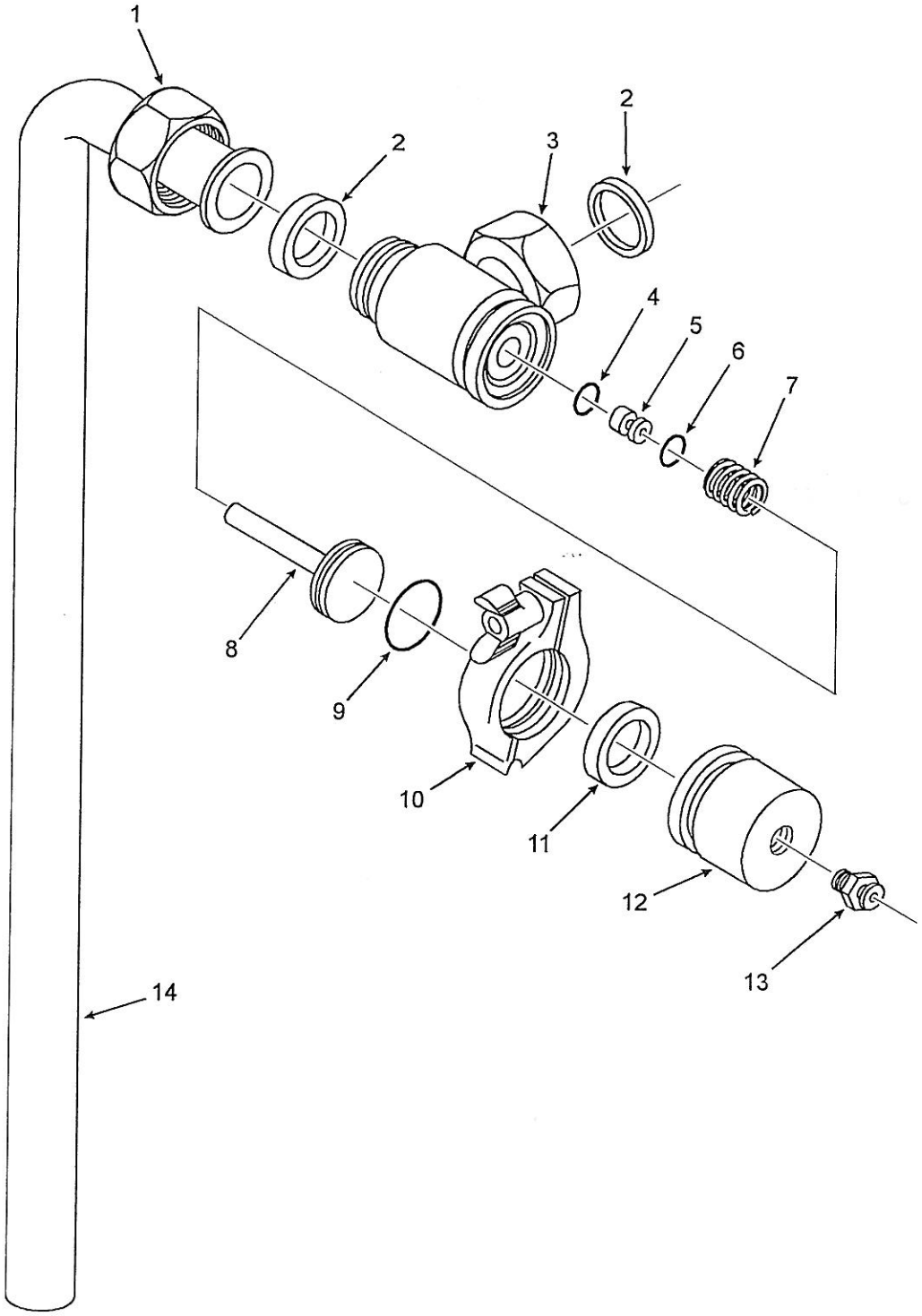
DASHER ASSEMBLY - SERIES 30

ITEM No.	PART No.	DESCRIPTION	QTY
1	*521-V-007228	SCREW - Hex. Hd. Cap 1/2 - 13 x 3/4 in. lg. (Pkg. of 5)	1
2	*523-V-007179	WASHER - Plain 1/2 in. (Pkg. of 10)	1
3	07H-P-337430	COVER - Beater Retaining Plate	1
4	*521-V-006678	SCREW - Hex. Hd. Cap 3/8 - 16 x 1/2 in. lg. (Pkg. of 10)	2
5	*523-V-007178	WASHER - Plain 3/8 in. (Pkg. of 10)	2
6	07H-P-334252	PLATE - Beater Retainer	1
7	07H-P-457675	STUD - Dasher Pin Anti-Rotation	2
8	07A-P-464305	DOOR - Front	1
9	07H-P-205681	O-RING	2
10	*543-S-1313-25	O-RING (Pkg. of 10)	1
	07A-P-464870	DASHER	1
11	622-P-221918	•RING - Snap	1
12	07A-P-457672	•HEAD - Front	1
13	07H-P-464122	•BUSHING - Head	1
14	07A-P-457321	•BEATER	2
15	07H-P-378949	••BUSHING - Beater	4
16	*521-V-006876	•SCREW - Set 3/8 - 16 x 3/8 in. lg. (Pkg. of 10)	1
17	07H-P-364640	•SLEEVE	1
18	*543-S-G150-17	•O-RING (Pkg. of 10)	1
19	07A-P-464251	•SHAFT - Eccentric	1
20	07H-P-457673	••SLEEVE	1
21	07A-P-360641	•DISC - Thrust	1
22	07A-P-389889	•BEARING	1
23	*543-S-1313-38	•O-RING (Pkg. of 10)	1
24	07A-P-464622	•BOLT	1
25	524-S-5922-A	•WASHER - Lock	1
26	*523-V-007179	•WASHER - Plain 1/2 in. (Pkg. of 10)	1
27	07H-P-343954	•SLEEVE	1
28	*543-S-1313-36	•O-RING (Pkg. of 10)	1
29	07A-P-464871	•FRAME - Dasher	1
30	07H-P-464181	BLADE - Scraper	28
31	07A-P-470850	DOOR - Rear	1
32	07H-P-313433	RING - Seal	1
33	07H-P-347977	RING - Retaining	1
34	*543-S-1313-34	O-RING (Pkg. of 10)	1
35	12H-P-451701	GASKET - Bearing Protecting	1
36	621-P-388278	BEARING - Rear Door	1
	621-S-H882	•INSERT - Rear Bearing	1
37	523-S-4186-AM	RING - Retaining	1
38	07H-P-311235	STUD	2
39	07H-P-311236	NUT - Cap	2
40	07H-P-189119	SCREW	2
41		AIR CHECK VALVE	1
42	*543-S-1313-AL	O-RING (Preaerator Only) (Pkg. of 10)	1
43	07H-P-470848	PLUG (Preaerator Only)	1
44	563-V-004305	NUT- #13H 1 in. (Preaerator Only)	1

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

07W-P-464371/WSF00009

VENT VALVE ASSEMBLY



NOTE: Order by part number, not by item number.

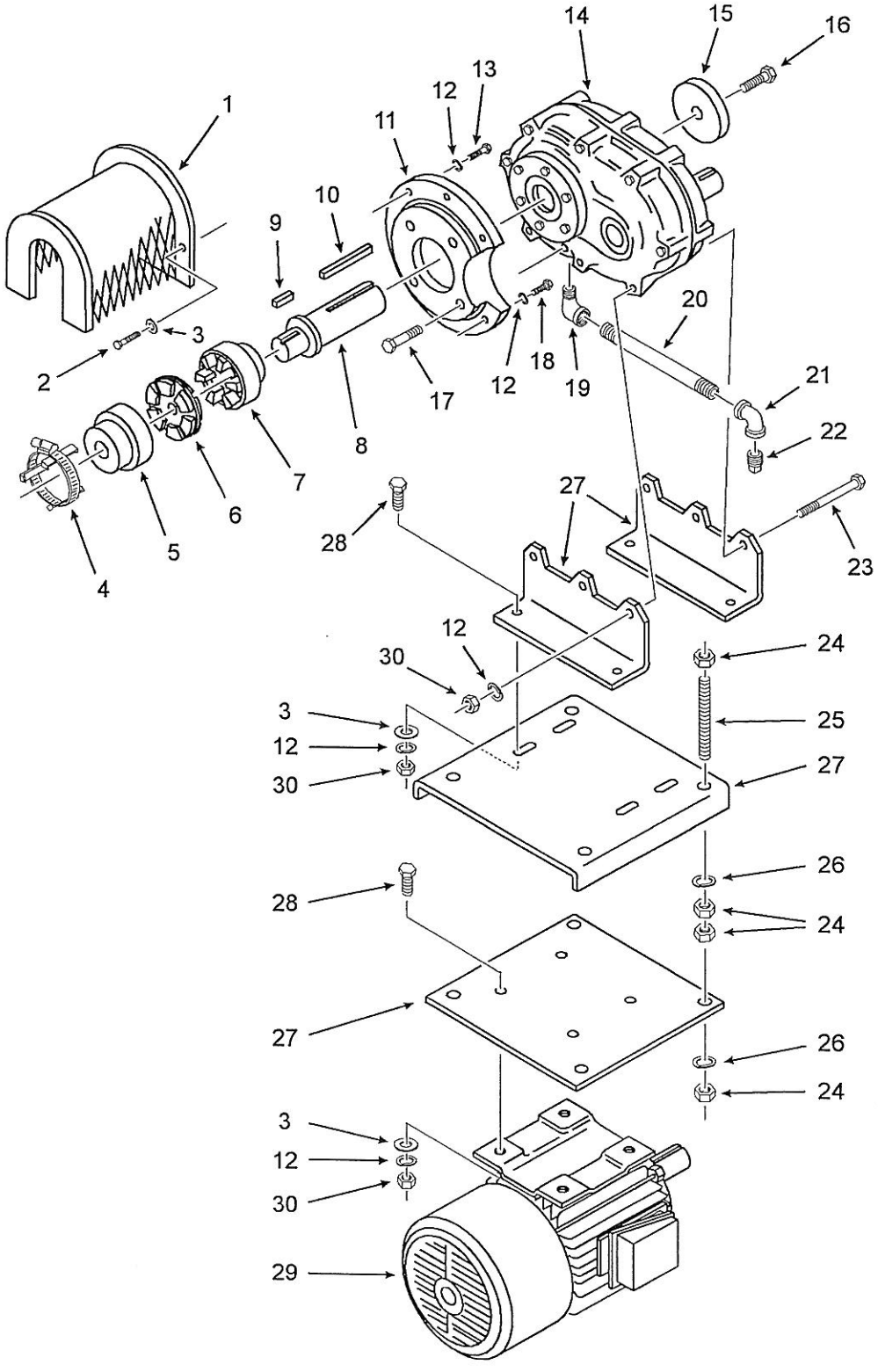
VENT VALVE ASSEMBLY

ITEM No.	PART No.	DESCRIPTION	QTY
1	563-V-004305	NUT - Hex. - #13H - 1 in.	1
2	543-V-001504	GASKET - #101H - 1 in.	2
	07A-P-284040	VENT VALVE	1
3	07A-P-293764	•BODY - Valve	1
4	*543-S-1313-08	•O-RING (Pkg. of 10)	1
5	07H-P-331001	•SEAT	1
6	*543-S-1313-11	•O-RING (Pkg. of 10)	1
7	622-S-F924	•SPRING	1
8	07H-P-278165	•PISTON	1
9	*543-S-1313-19	•O-RING (Pkg. of 10)	1
10	563-V-004308	•CLAMP - #K13 - 1-1/2 in.	1
11	543-V-001505	•GASKET - #101H - 1-1/2 in.	1
12	07H-P-278164	•CAP - Valve	1
13	566-S-4753-B	COUPLING	1
14	07A-P-464399	PIPE - Vent Line	1

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

07W-P-464383/WSF00026

DASHER DRIVE



NOTE: Order by part number, not by item number.

07W-P-464374/WSF00035

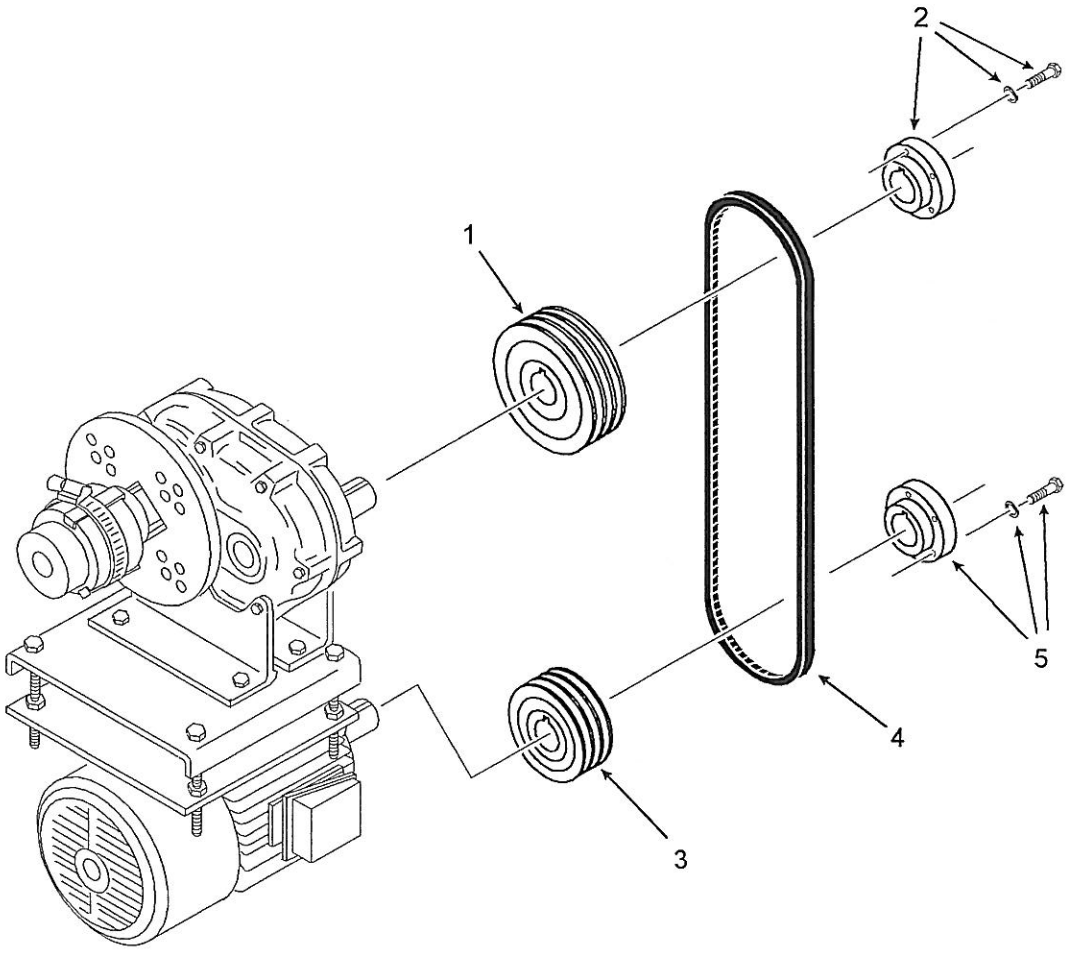
DASHER DRIVE

ITEM No.	PART No.	DESCRIPTION	QTY
1	07A-P-464400	GUARD - Coupling	1
2	521-S-R203-XC	SCREW - Hex. Hd. Cap M12 - 1.75 x 20 mm lg. (Cl 10)	2
3	523-S-R349-G	WASHER - Flat M12.	10
4	12A-P-464146	CLAMP	1
5	12H-P-457915	HUB - Dasher Drive	1
6	629-S-R285-S	INSERT - Flexible Coupling	1
7	12H-P-464098	HUB - Drive Shaft	1
8	12H-P-464455	SHAFT - Dasher Drive	1
9	529-S-R389-TA	KEY	1
10	529-S-R375-F	KEY - Output Shaft	1
11	07A-P-464314	PLATE - Reducer Adapter	1
12	523-S-R348-G	WASHER - Lock M12	21
13	521-S-R203-DD	SCREW - Hex. Hd. Cap M12 - 1.75 x 50 mm lg. (Cl 10)	4
14	* *	REDUCER	1
15	07H-P-464326	RETAINER - Drive Shaft	1
16	521-S-R203-YC	SCREW - Hex. Hd. Cap M12 - 1.75 x 25 mm lg. (Cl 10)	1
17	521-V-007232	SCREW - Hex. Hd. Cap 5/8 - 11 x 3-1/4 in. lg.	4
18	521-S-R203-AD	SCREW - Hex. Hd. Cap M12 - 1.75 x 35 mm lg. (Cl 10)	2
19	567-S-F102-D	ELBOW - 90° Street - 1/2 in.	1
20	567-S-R216-ZD	NIPPLE - 1/2 x 13 in. lg.	1
21	567-S-F099-D	ELBOW - 90° Straight - 1/2 in.	1
22	567-S-F137-D	PLUG - 1/2 in.	1
23	521-S-R203-SD	SCREW - Hex. Hd. Cap M12 - 1.75 x 150 mm lg. (Cl 10)	3
24	523-S-R206-F	NUT - Hex. M20 - 2.50 mm (Cl 10).	16
25	728-S-R387-F	ROD - Threaded M20 - 2.50 mm (Cl 10) (Cut to 9 in. lg.)	-
26	523-S-R348-K	WASHER - Lock M20.	8
27	07A-P-464874	BRACKET - Motor Mounting	1
28	521-S-R203-BD	SCREW - Hex. Hd. Cap M12 - 1.75 x 40 mm lg. (Cl 10)	8
29	* *	MOTOR	1
30	523-S-R206-D	NUT - Hex. M12 - 1.75 mm (Cl 10)	11

NOTE: * *See Customer Specification Sheet.

07W-P-464374/WSF00036

BELTS AND SHEAVES



NOTE: Order by part number, not by item number.

WSF00039

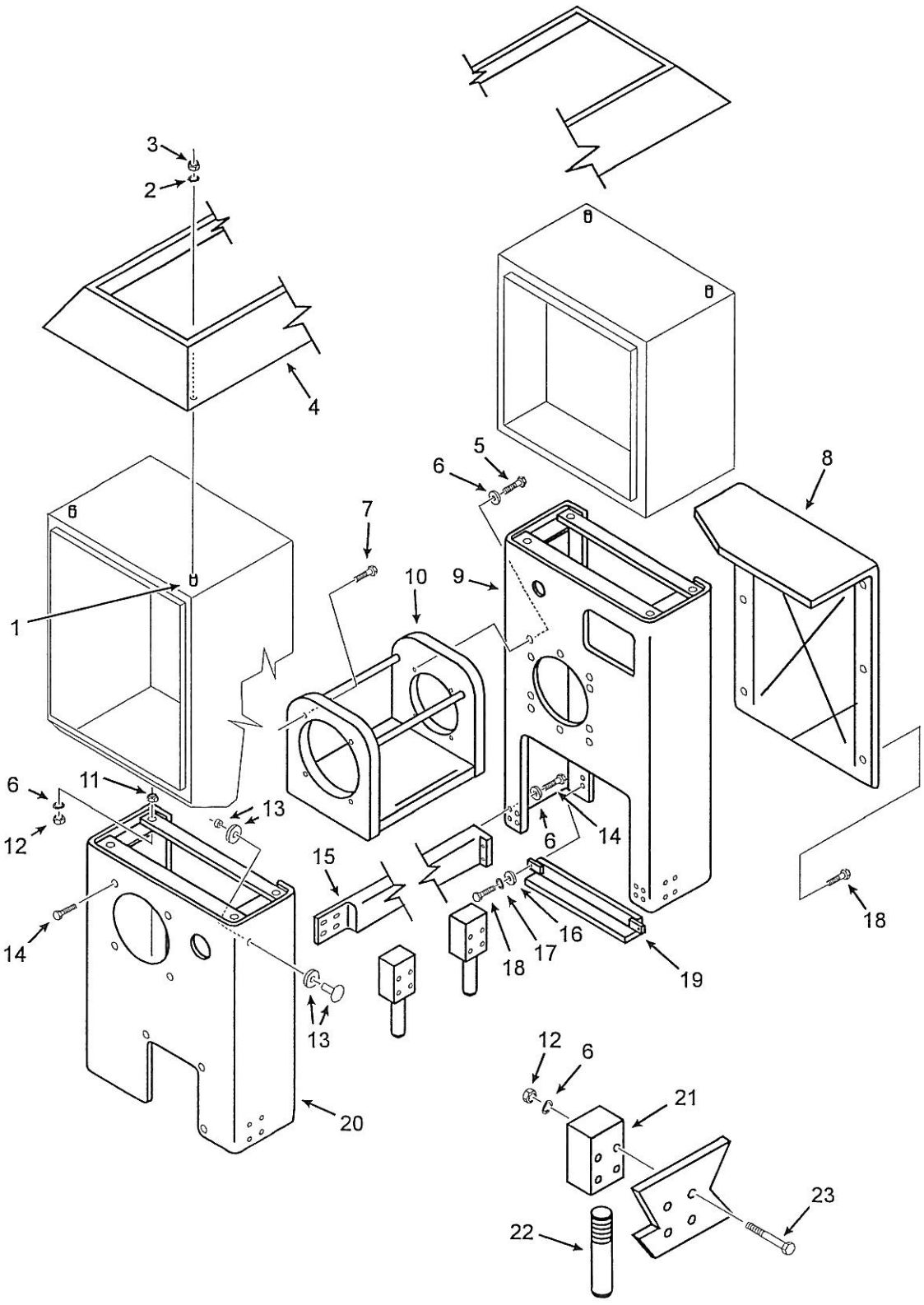
BELTS AND SHEAVES

ITEM No.	PART No.	DESCRIPTION	QTY
1	**	SHEAVE	1
2	**	HUB (Supplied with Lockwashers and Screws)	1
3	**	SHEAVE	1
4	**	V-BELT	-
5	**	HUB (Supplied with Lockwashers and Screws)	1

NOTE: **See Customer Specification Sheet.

WSF00040

FRAME COMPONENTS



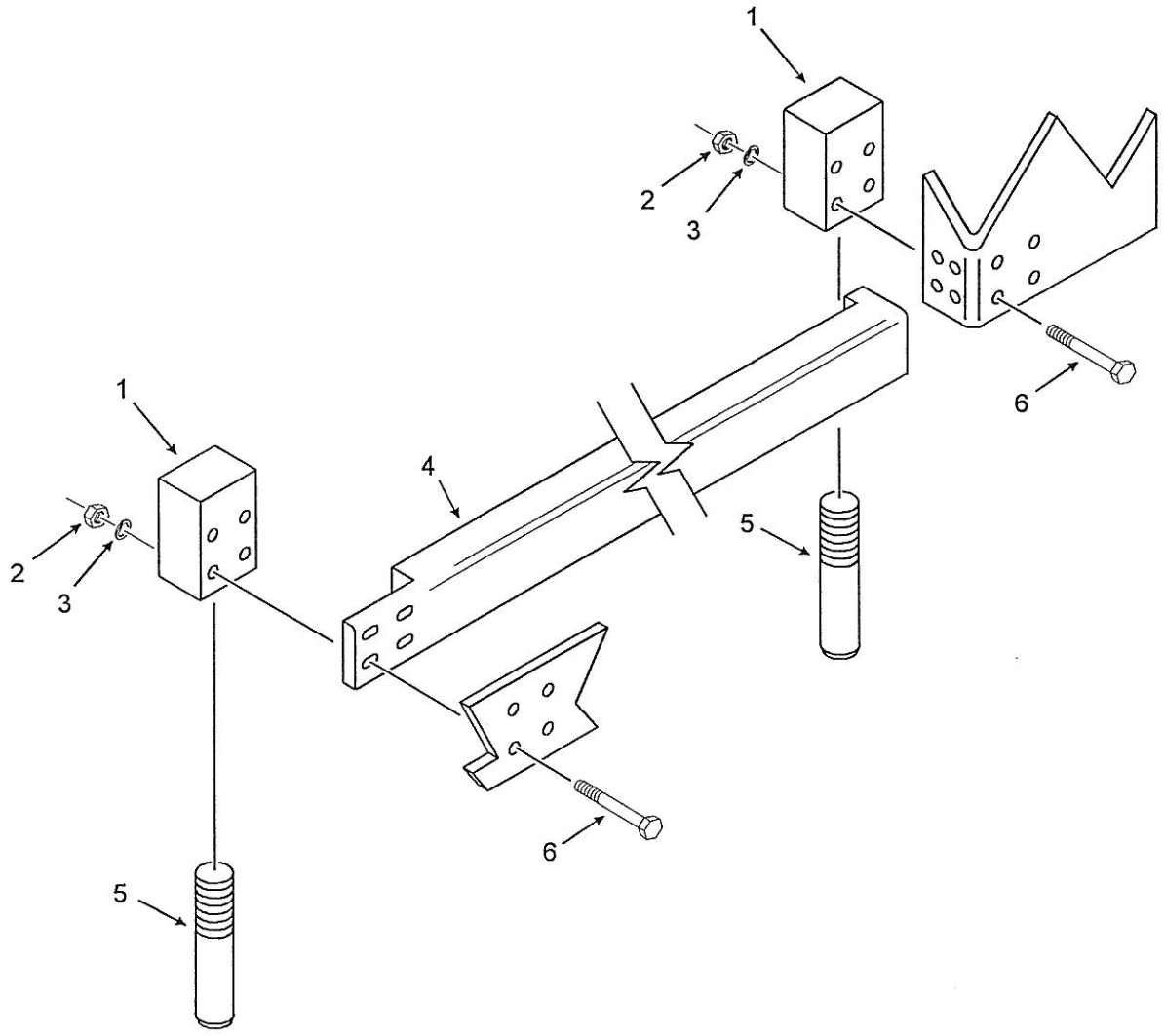
NOTE: Order by part number, not by item number.

07W-P-464829/WSF00047

FRAME COMPONENTS

ITEM No.	PART No.	DESCRIPTION	QTY
1	622-S-R686	STUD	4
2	523-S-R348-D	WASHER - Lock M6	4
3	523-S-R206-A	NUT - Hex. M6 - 1.00 mm (Cl 10)	4
4	07A-P-464939	SHROUD - Top	1
5	521-S-R203-BD	SCREW - Hex. Hd. Cap M12 - 1.75 x 40 mm lg. (Cl 10)	4
6	523-S-R348-G	WASHER - Lock M12	28
7	521-S-R203-VE	SCREW - Hex. Hd. Cap M20 - 2.50 x 50 mm lg. (Cl 10)	4
8	07H-P-470360	PANEL - Rear Lower	1
9	07A-P-464329	SUPPORT - Rear	1
10	07A-P-464201	YOKE	1
11	523-S-R545-D	NUT - Hex. Jam M12 - 1.75 mm (Cl 10)	8
12	523-S-R206-D	NUT - Hex. M12 - 1.75 mm (Cl 10)	16
13	609-S-F619-A	PLUG	1
14	521-S-R203-YC	SCREW - Hex. Hd. Cap M12 - 1.75 x 25 mm lg. (Cl 10)	12
15	07A-P-464333	SUPPORT - Front to Rear	1
16	523-S-R349-E	WASHER - Plain M8	2
17	523-S-R348-E	WASHER - Lock M8	2
18	521-S-R203-CB	SCREW - Hex. Hd. Cap M8 - 1.25 x 16 mm lg. (Cl 10)	8
19	07A-P-470363	ANGLE - Rear Lower Support	1
20	07A-P-464328	SUPPORT - Front	1
21	07H-P-464301	BLOCK - Leg Mounting	2
22	07H-P-464300	LEG - Adjustable	2
23	521-S-R203-MD	SCREW - Hex. Hd. Cap M12 - 1.75 x 100 mm lg. (Cl 10)	8

SINGLE CYLINDER SUPPORT AND LEGS

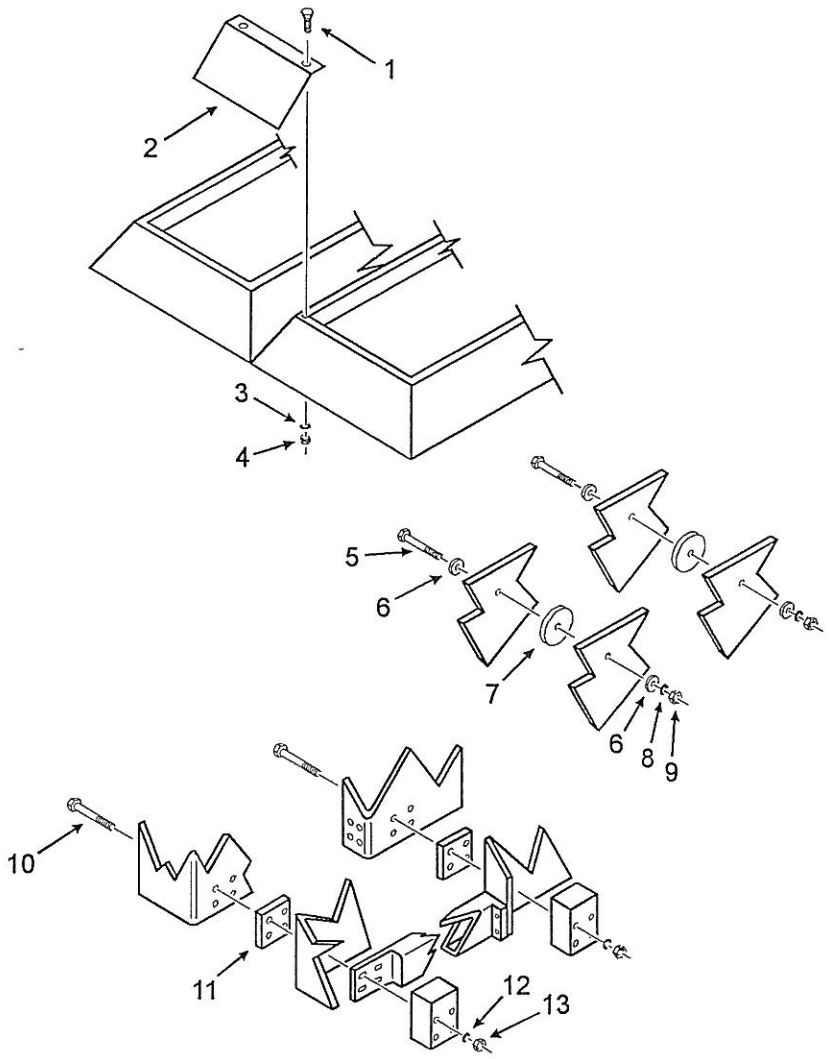


NOTE: Order by part number, not by item number.

ITEM No.	PART No.	DESCRIPTION	QTY
1	07H-P-464301	BLOCK - Leg Mounting	2
2	523-S-R206-D	NUT - Hex. M12 - 1.75 mm (Cl 10)	8
3	523-S-R348-G	WASHER - Lock M12	8
4	07A-P-464333	SUPPORT - Front to Rear	1
5	07H-P-464300	LEG - Adjustable	2
6	521-S-R203-MD	SCREW - Hex. Hd. Cap M12 - 1.75 x 100 mm lg. (Cl 10)	8

07W-P-464833/WSF00052

DOUBLE AND TRIPLE CYLINDER MARRIAGE COMPONENTS



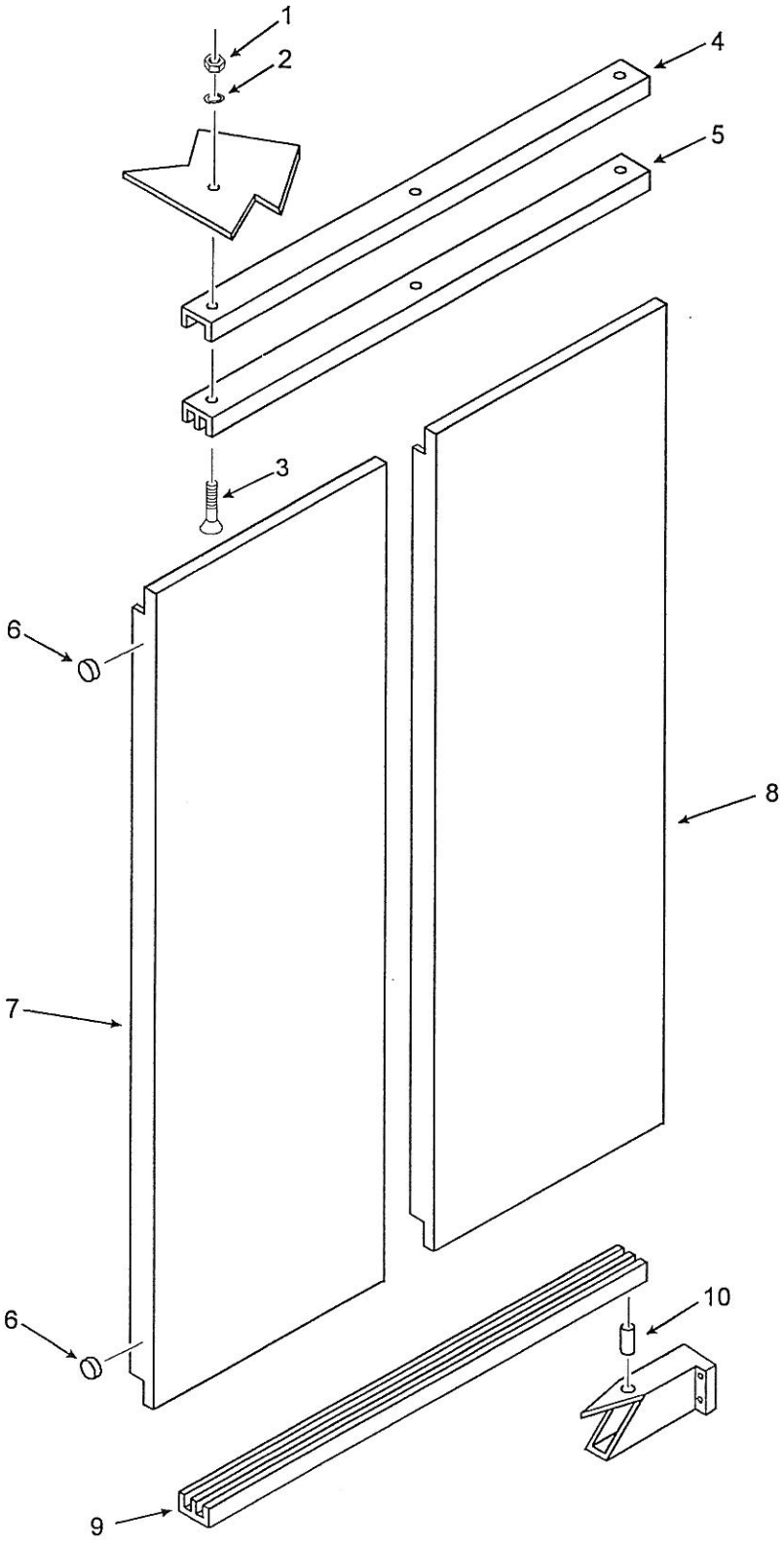
Not Required On Single Cylinder Units

NOTE: Order by part number, not by item number.

ITEM No.	PART No.	DESCRIPTION	QTY
1	521-S-R203-DA	SCREW - Hex. Hd. Cap M6 - 1.00 x 6 mm lg. (Cl 10)	4
2	07H-P-464768	PANEL - Multi-Cylinder Filler	2
3	523-S-R348-D	WASHER - Lock M6	4
4	523-S-R206-A	NUT - Hex. M6 - 1.00 mm (Cl 10)	4
5	521-S-R203-YD	SCREW - Hex. Hd. Cap M16 - 2.00 x 45 mm lg. (Cl 10)	2
6	523-S-R349-H	WASHER - Plain M16	4
7	07H-P-464769	SPACER - Upper Support	2
8	523-S-R348-H	WASHER - Lock M16	2
9	523-S-R206-E	NUT - Hex. M16 - 2.00 mm (Cl 10)	2
10	521-S-R203-PD	SCREW - Hex. Hd. Cap M12 - 1.75 x 120 mm lg. (Cl 10)	4
11	07H-P-464770	SPACER - Lower Support	2
12	523-S-R348-G	WASHER - Lock M12	8
13	523-S-R206-D	NUT- Hex. M12 - 1.75 mm (Cl 10)	8

07W-P-464687/WSF00055

SLIDING DOORS



NOTE: Order by part number, not by item number.

07W-P-464828/WSF00059

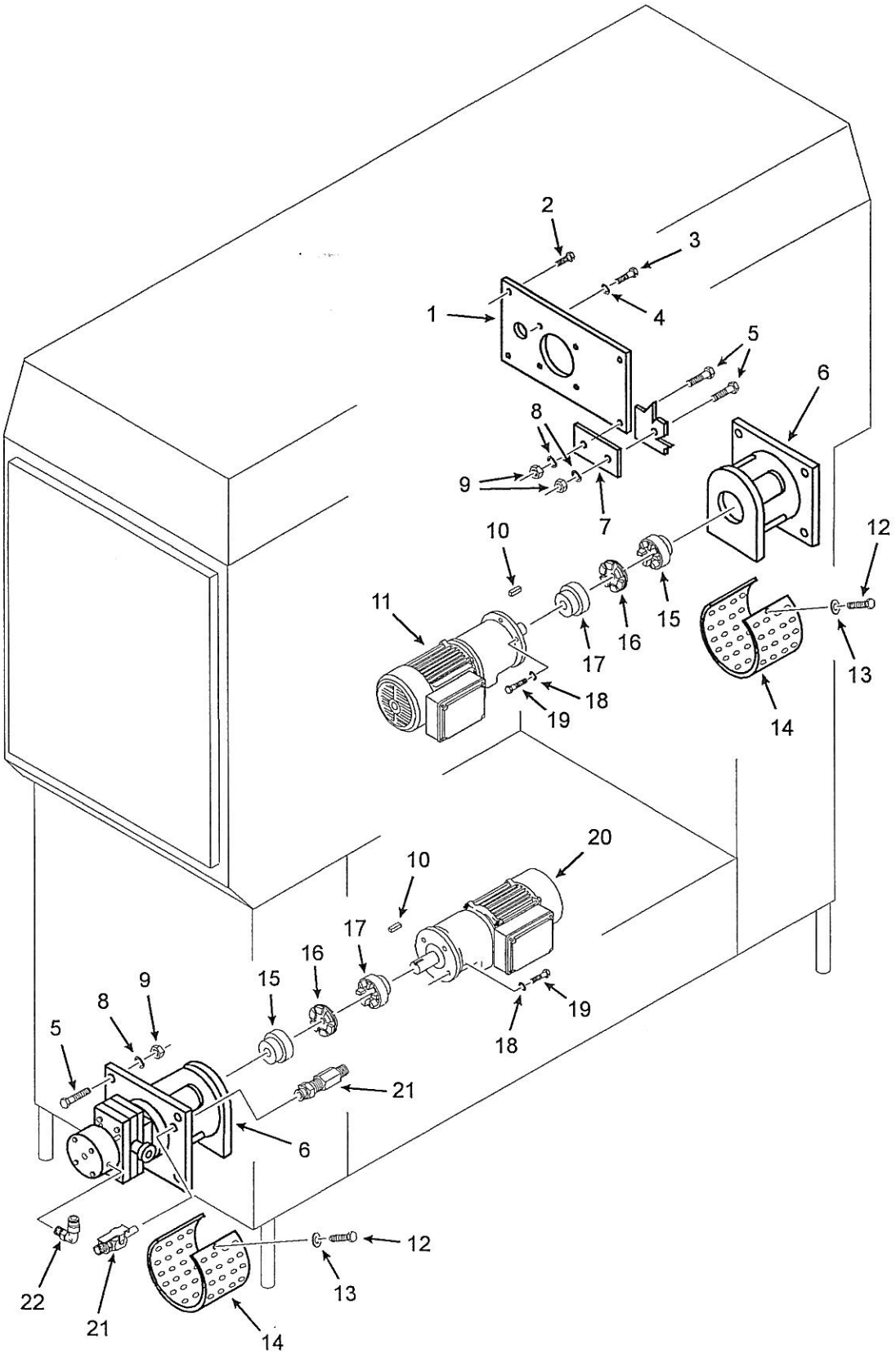
SLIDING DOORS

ITEM No.	PART No.	DESCRIPTION	QTY
1	*523-V-006507	NUT - Hex. 1/4 - 20 (Pkg. of 10)	6
2	*523-V-007190	WASHER - Lock 1/4 in. (Pkg. of 10)	6
3	*521-V-006997	SCREW - Flat Hd. Slot 1/4 - 20 x 1-1/4 in. lg. (Pkg. of 10)	6
4	07H-P-464866	CHANNEL - Upper Door Guide	2
5	07H-P-464864	GUIDE - Upper Sliding Door	2
6	007307	BUMPERS - Rubber	8
7	07A-P-464862	DOOR - Sliding (Outside)	2
8	07A-P-464863	DOOR - Sliding (Inside)	2
9	07H-P-464865	GUIDE - Lower Sliding Door	2
10	622-S-R685	PIN - 1/4 x 3/4 in. lg.	6

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

07W-P-464828/WSF00060

PUMP DRIVE



NOTE: Order by part number, not by item number.

07W-P-464830/WSF00548

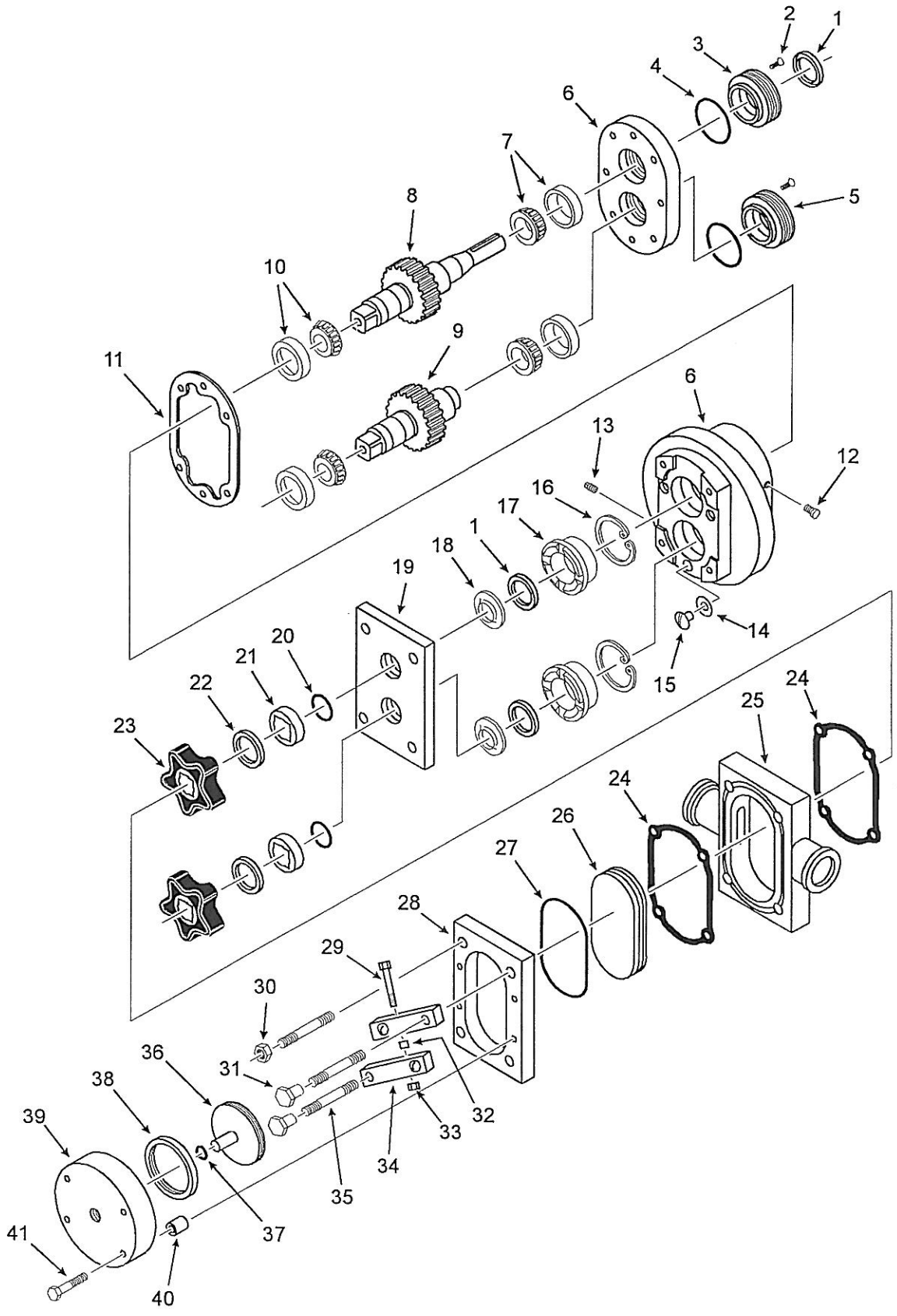
PUMP DRIVE

ITEM No.	PART No.	DESCRIPTION	QTY
1	* *	PLATE	1
2	521-S-R203-YC	SCREW - Hex. Hd. Cap M12 - 1.75 x 25 mm lg. (Cl 10)	6
3	*521-V-006682	SCREW - Hex. Hd. Cap 3/8-16 x 1-1/2 in. (Pkg. of 5)	4
4	*523-V-007192	WASHER - Lock 3/8 in. (Pkg. of 10)	4
5	521-S-R203-AD	SCREW - Hex. Hd. Cap M12 - 1.75 x 35 mm lg. (Cl 10)	6
6	07A-P-464676	BRACKET - Pump and Motor Mounting	2
7	07H-P-470244	PLATE	1
8	523-S-R348-G	WASHER - Lock M12	6
9	523-S-R206-D	NUT - Hex. M12 - 1.75 mm (Cl 10)	6
10	529-P-470359	KEY	2
11	* *	GEARMOTOR	1
12	521-S-R203-BB	SCREW - Hex. Hd. Cap M8 - 1.25 x 12 mm lg. (Cl 10)	4
13	523-S-R349-E	WASHER - Plain M8	4
14	07H-P-464395	GUARD - Pump	2
15	629-S-R356-D	COUPLING - Hub	2
16	629-S-R285-G	INSERT - Flexible Coupling	2
17	629-S-R356-B	COUPLING - Hub	2
18	523-S-R348-E	WASHER - Lock M8	8
19	521-S-R203-FB	SCREW - Hex. Hd. Cap M8 - 1.25 x 25 mm lg. (Cl 10)	8
20	* *	GEARMOTOR	1
21	566-S-7114-A	FITTING - Air	2
22	568-S-K785-C	ELBOW - 1/4 in. Tube x 1/8 in. NPT	2

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.
NOTE: * *See Customer Specification Sheet.

07W-P-464830/WSF00549

ROTARY PUMP ASSEMBLY (PRODUCT)



NOTE: Order by part number, not by item number.

03B-P-365161/WSF00073

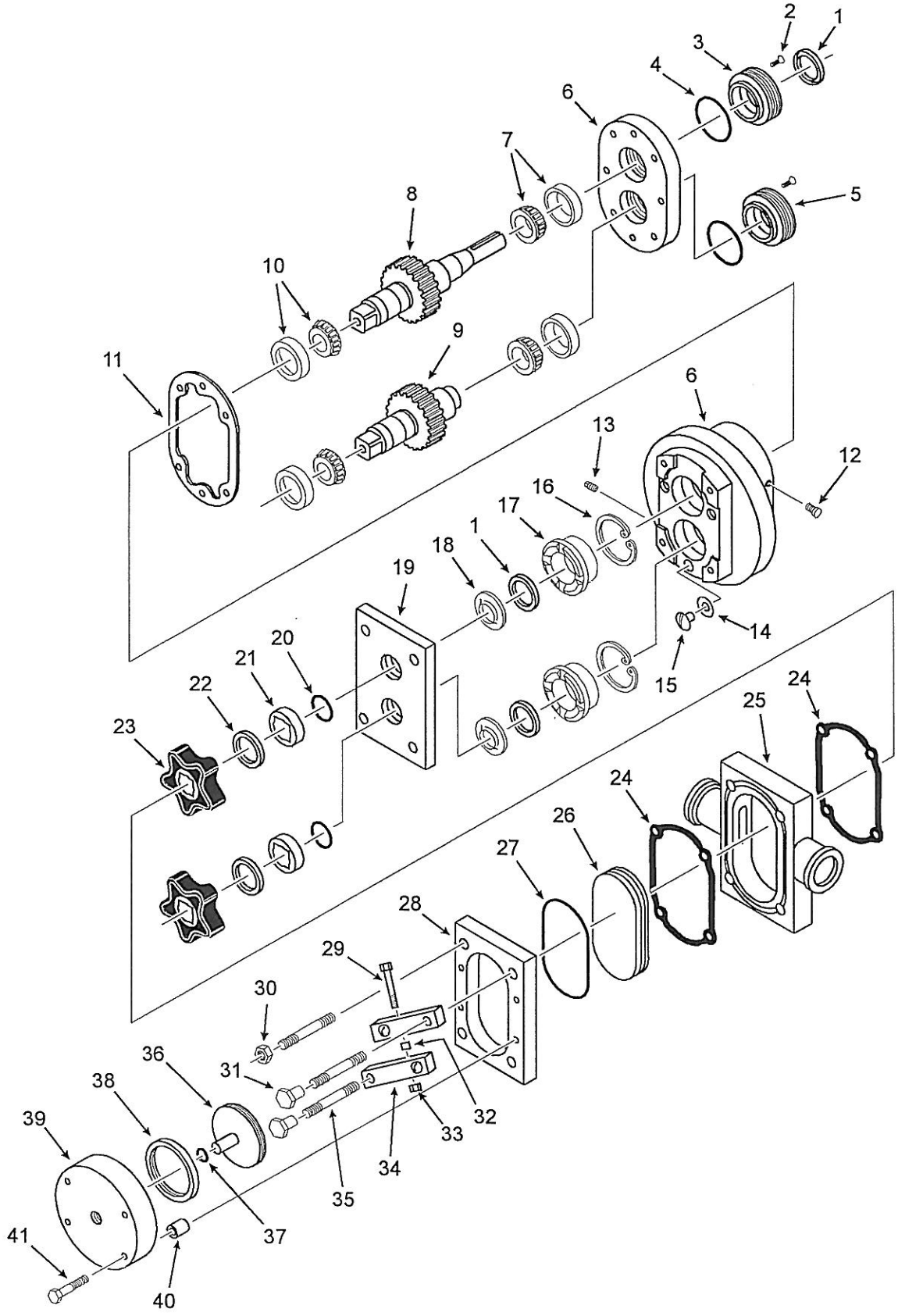
ROTARY PUMP ASSEMBLY (PRODUCT)

ITEM No.	PART No.	DESCRIPTION	QTY
	03B-P-365161	#2.5 FAR ROTARY PUMP	
	03A-P-350215	•GEARCASE	1
1	543-S-K608	••SEAL - Oil	1
2	*522-V-006970	••SCREW - Set 3/8 - 16 x 1/4 in. lg. (Pkg. of 10)	3
3	03H-P-138303	••PLUG - Bearing	2
4	*543-S-1314-11	••O-RING (Pkg. of 10)	1
5	03H-P-156448	••NUT - Bearing	2
6	03A-P-138301	••GEARCASE & COVER	1
7	621-S-4158-H	••BEARING - Roller	1
8	03A-P-334299	••SHAFT & GEAR - Long	2
9	03A-P-334297	••SHAFT & GEAR - Short	1
10	621-S-4158-G	••BEARING - Roller	1
11	549-P-138206	••GASKET	2
12	569-P-454323	••PLUG - Vent	1
13	567-S-F049-A	••PLUG - Pipe 1/8 in.	1
14	549-P-184443	••GASKET	1
15	689-P-184444	••PLUG	3
16	*524-S-4806-J	••RING - Retaining (Pkg. of 10)	3
17	03H-P-133572	••PLUG - Locating	2
18	*03H-P-137722	RING - Seal (Pkg. of 5)	2
19	03H-P-286288	PLATE - Back	2
20	*543-S-1313-20	O-RING (Pkg. of 10)	1
21	03H-P-137713	BEARING - Seal	2
22	*03H-P-203232	SEAL - Shaft (Pkg. of 10)	2
23	03H-P-420171	ROTOR	2
24	543-S-8425	O-RING	2
25	03A-P-365150	CHAMBER - Pump	2
26	07H-P-474775	PLATE - Face	1
27	03H-P-326655	GASKET	1
28	03H-P-307834	COVER - By-Pass	1
29	521-V-006670	SCREW - Hex. Hd. Cap 1/4 - 20 x 3 in. lg.	1
30	*523-V-006529	NUT - Hex. 1/2 - 13 (Pkg. of 5)	1
31	03H-P-326670	NUT	2
32	03H-P-326672	SPACER	2
33	523-S-4145-E	NUT - Hex. 1/4 - 20	1
34	03A-P-326674	LEVER	1
35	03H-P-356417	STUD	2
36	03H-P-326669	PISTON - Air	4
37	*543-S-1313-12	O-RING (Pkg. of 10)	1
38	543-S-K361-AP	SEAL	1
39	03H-P-326668	HOUSING	1
40	03H-P-326673	SPACER	1
41	521-V-032944	SCREW - Hex. Hd. Cap 3/8 - 16 x 4-1/4 in. lg.	4

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

03B-P-365161/WSF00568

ROTARY PUMP ASSEMBLY (MIX)



NOTE: Order by part number, not by item number.

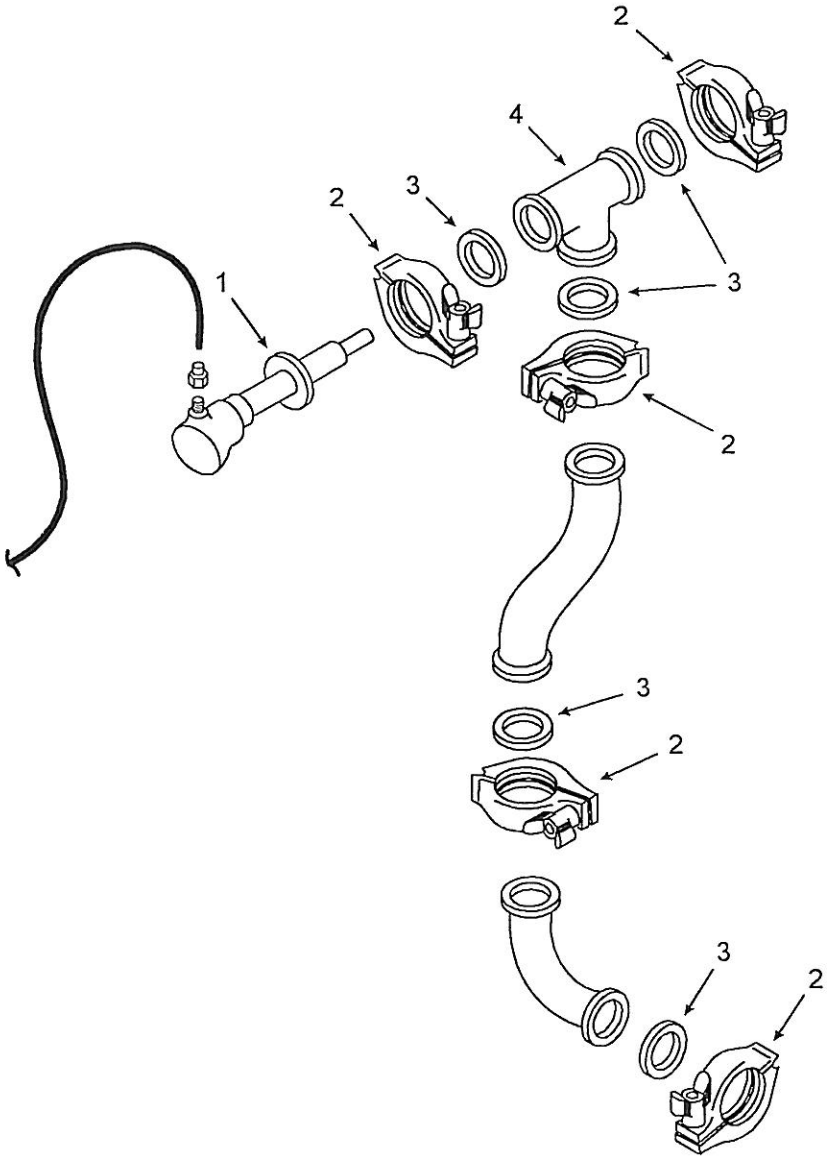
03B-P-365160/WSF00076

ROTARY PUMP ASSEMBLY (MIX)

ITEM No.	PART No.	DESCRIPTION	QTY
	03B-P-365160	#2.5 FAR ROTARY PUMP	1
	03A-P-350215	•GEARCASE	1
1	543-S-K608	••SEAL - Oil	3
2	*522-V-006970	••SCREW - Set 3/8 - 16 x 1/4 in. lg. (Pkg. of 10)	2
3	03H-P-138303	••PLUG - Bearing	1
4	*543-S-1314-11	••O-RING (Pkg. of 10)	2
5	03H-P-156448	••NUT - Bearing	1
6	03A-P-138301	••GEARCASE & COVER	1
7	621-S-4158-H	••BEARING - Roller	2
8	03A-P-334299	••SHAFT & GEAR - Long	1
9	03A-P-334297	••SHAFT & GEAR - Short	1
10	621-S-4158-G	••BEARING - Roller	2
11	549-P-138206	••GASKET	1
12	569-P-454323	••PLUG - Vent	1
13	567-S-F049-A	••PLUG - Pipe 1/8 in.	1
14	549-P-184443	••GASKET	3
15	689-P-184444	••PLUG	3
16	*524-S-4806-J	••RING - Retaining (Pkg. of 10)	2
17	03H-P-133572	••PLUG - Locating	2
18	*03H-P-137722	RING - Seal (Pkg. of 5)	2
19	03H-P-286288	PLATE - Back	1
20	*543-S-1313-20	O-RING (Pkg. of 10)	2
21	03H-P-137713	BEARING - Seal	2
22	*03H-P-203232	SEAL - Shaft (Pkg. of 10)	2
23	03H-P-420171	ROTOR	2
24	543-S-8425	O-RING	2
25	03A-P-365140	CHAMBER - Pump	1
26	07H-P-474775	PLATE - Face	1
27	03H-P-326655	GASKET	1
28	03H-P-307834	COVER - By-Pass	1
29	521-V-006670	SCREW - Hex. Hd. Cap 1/4 - 20 x 3 in. lg.	1
30	*523-V-006529	NUT - Hex. 1/2 - 13 (Pkg. of 5)	2
31	03H-P-326670	NUT	2
32	03H-P-326672	SPACER	1
33	523-S-4145-E	NUT - Hex. 1/4 - 20	1
34	03A-P-326674	LEVER	2
35	03H-P-356417	STUD	4
36	03H-P-326669	PISTON - Air	1
37	*543-S-1313-12	O-RING (Pkg. of 10)	1
38	543-S-K361-AP	SEAL	1
39	03H-P-326668	HOUSING	1
40	03H-P-326673	SPACER	4
41	521-V-032944	SCREW - Hex. Hd. Cap 3/8 - 16 x 4-1/4 in. lg.	4

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

PRODUCT PIPING



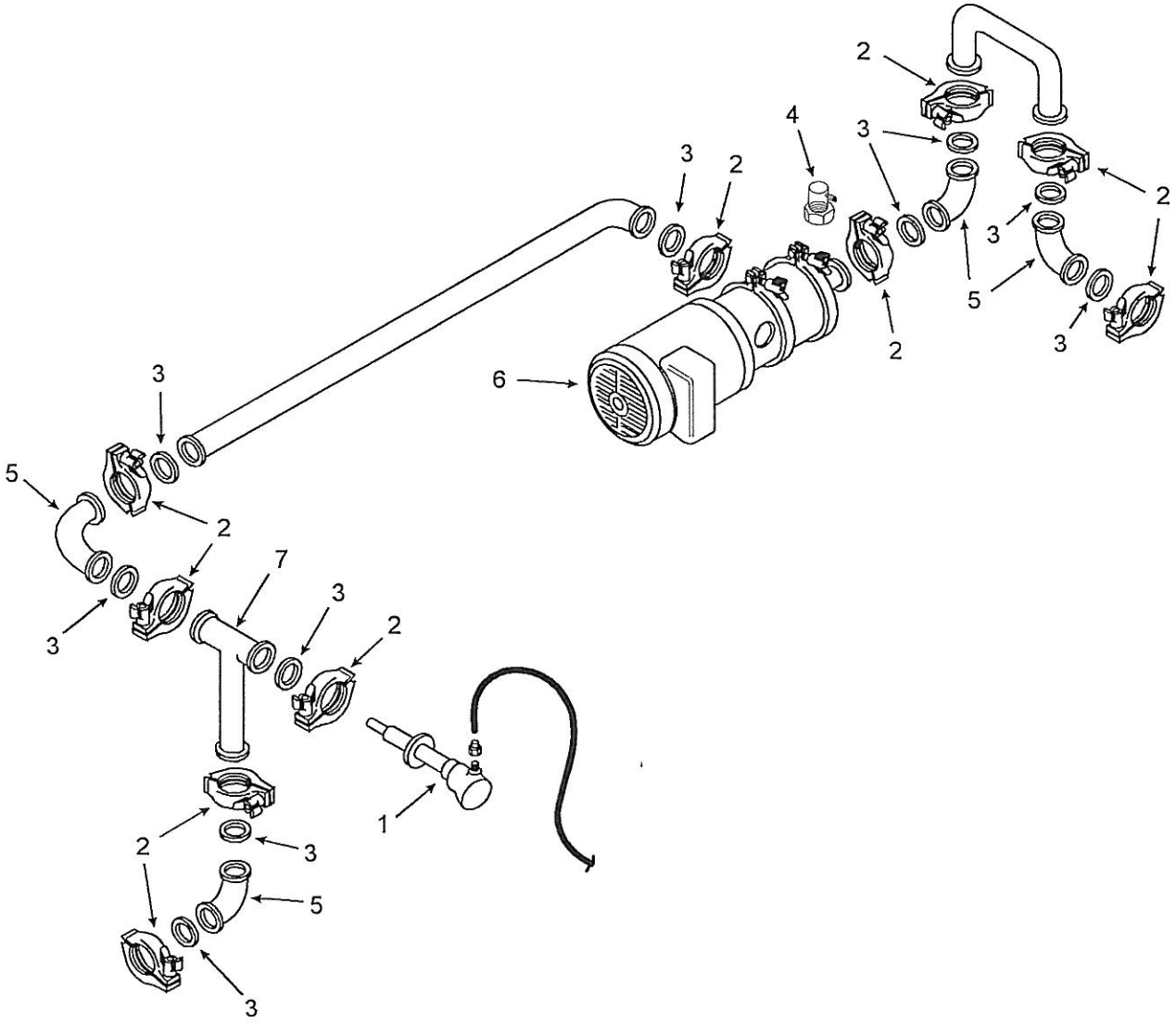
NOTE: Order by part number, not by item number.

07W-P-464881/07W-P-464387/WSF00082

PRODUCT PIPING

ITEM No.	PART No.	DESCRIPTION	QTY
1	585-S-R585-B	PROBE	1
2	563-V-004312	CLAMP - #K13 - 2 in.	5
3	543-V-001507	GASKET - #101H - 2 in.	5
4	563-V-026987	TEE - 2 in.	1

MIX PIPING



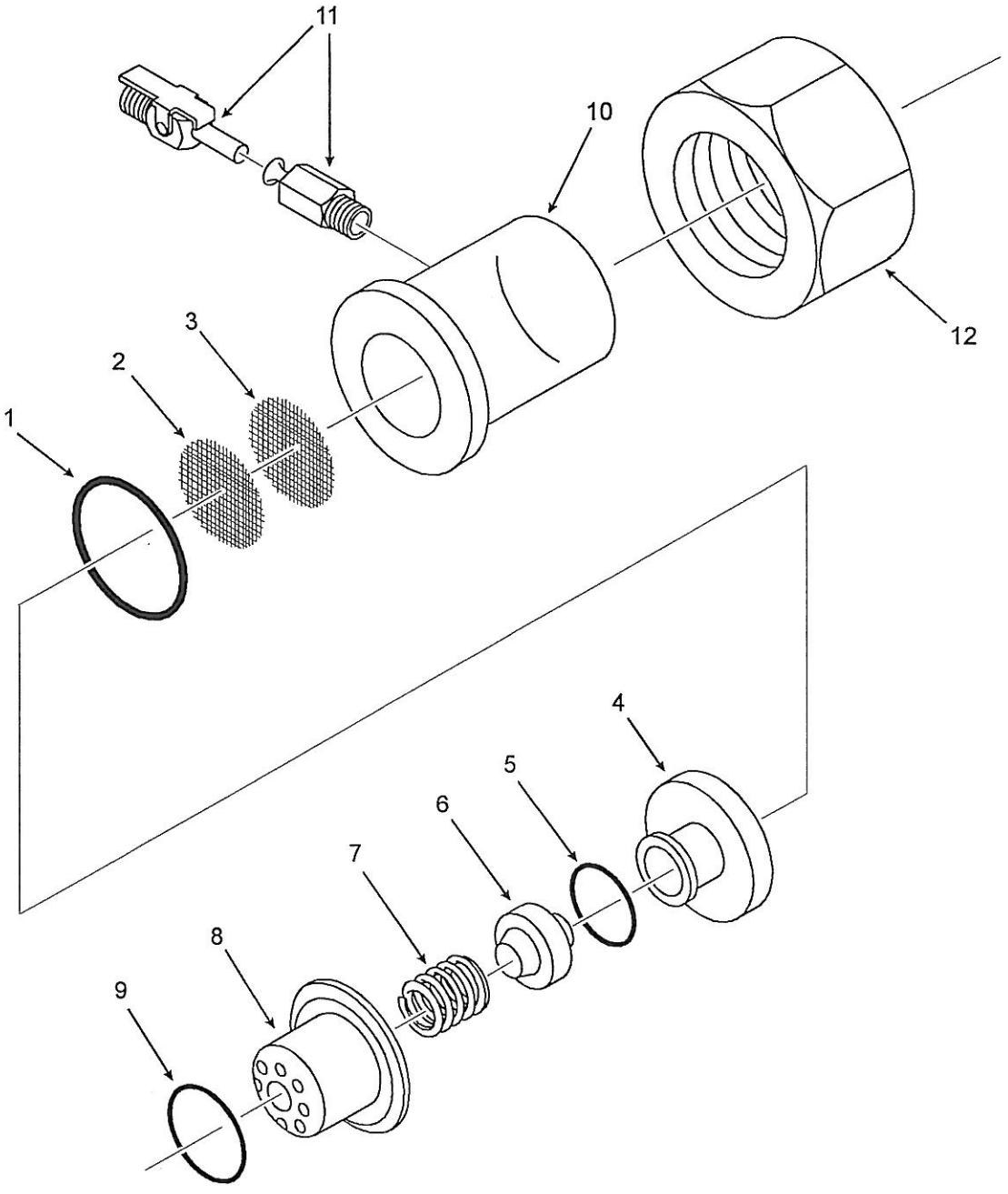
NOTE: Order by part number, not by item number.

07W-P-464881/WSF00092

MIX PIPING

ITEM No.	PART No.	DESCRIPTION	QTY
1	585-S-R585-C	PROBE	1
2	563-V-004308	CLAMP - #K13 - 1-1/2 in.	10
3	543-V-001505	GASKET - #101H - 1-1/2 in.	10
4		AIR CHECK VALVE	1
5	563-V-004366	ELBOW - 90° 1-1/2 in.	4
6	661-S-R350-A	PUMP - Turbon Mixer	1
7	07A-P-474145	TEE	1

AIR CHECK VALVE



NOTE: Order by part number, not by item number.

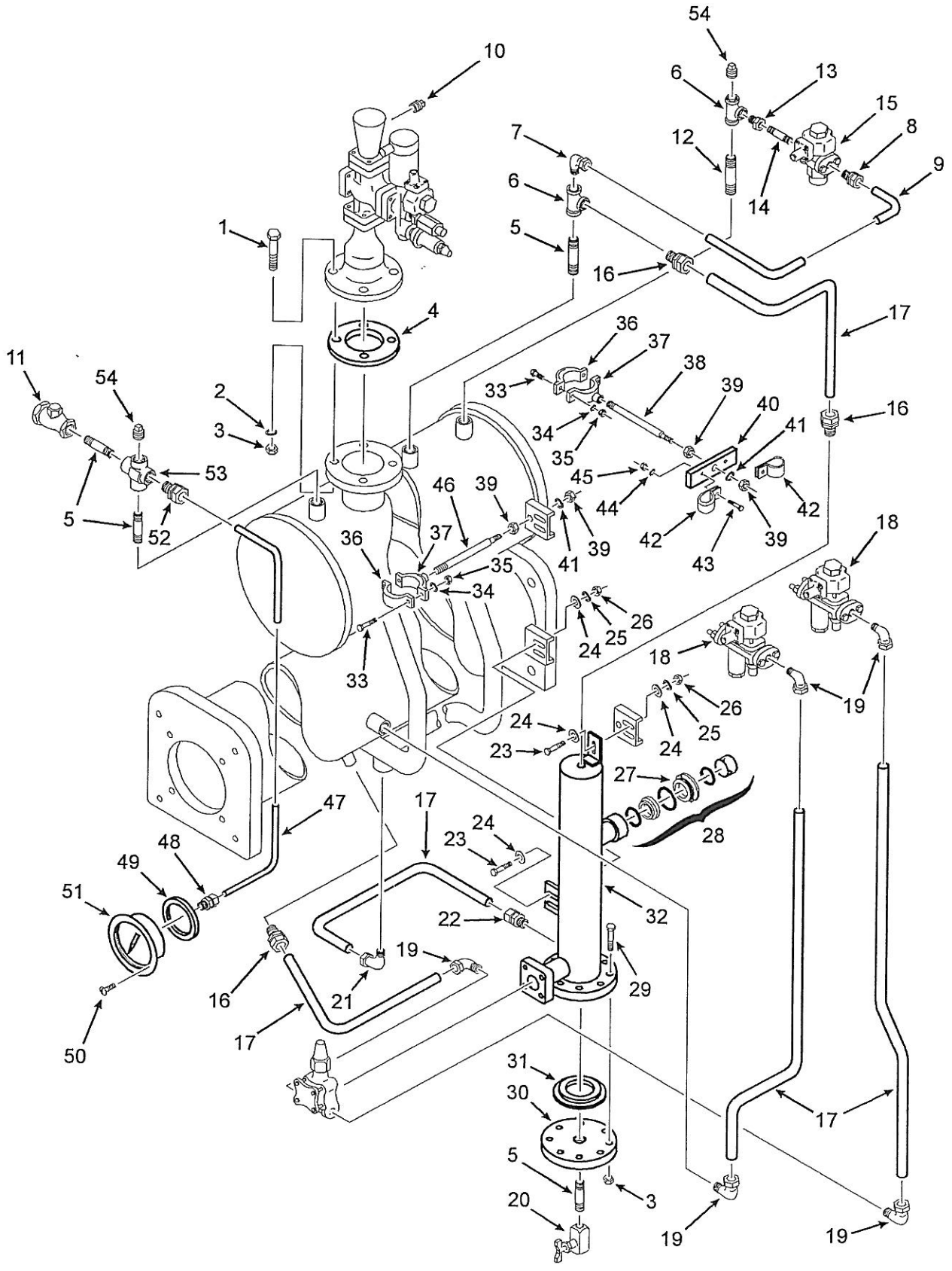
07W-P-464641/WSF00016

AIR CHECK VALVE

ITEM No.	PART No.	DESCRIPTION	QTY
	07A-P-153161	AIR CHECK VALVE	1
1	*543-S-1313-19	•O-RING (Pkg. of 10)	1
2	*644-1-57668	•FILTER - Discharge (Pkg. of 1000)	1
3	*07H-1-49295	•DISC - Perforated (Pkg. of 10)	1
4	07H-P-153138	•SEAT - Valve	1
5	*543-S-1313-11	•O-RING (Pkg. of 10)	1
6	*07H-P-149122	•VALVE - Rubber (Pkg. of 5)	1
7	07H-1-52892	•SPRING	1
8	07H-P-153139	•BODY - Valve	1
9	*543-S-1313-16	•O-RING (Pkg. of 10)	1
10	07H-P-325133	INLET - Air	1
11	566-S-4753-B	COUPLING	1
12	07H-1-57954	NUT - Hex	1

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

REFRIGERATION PIPING (AMMONIA)



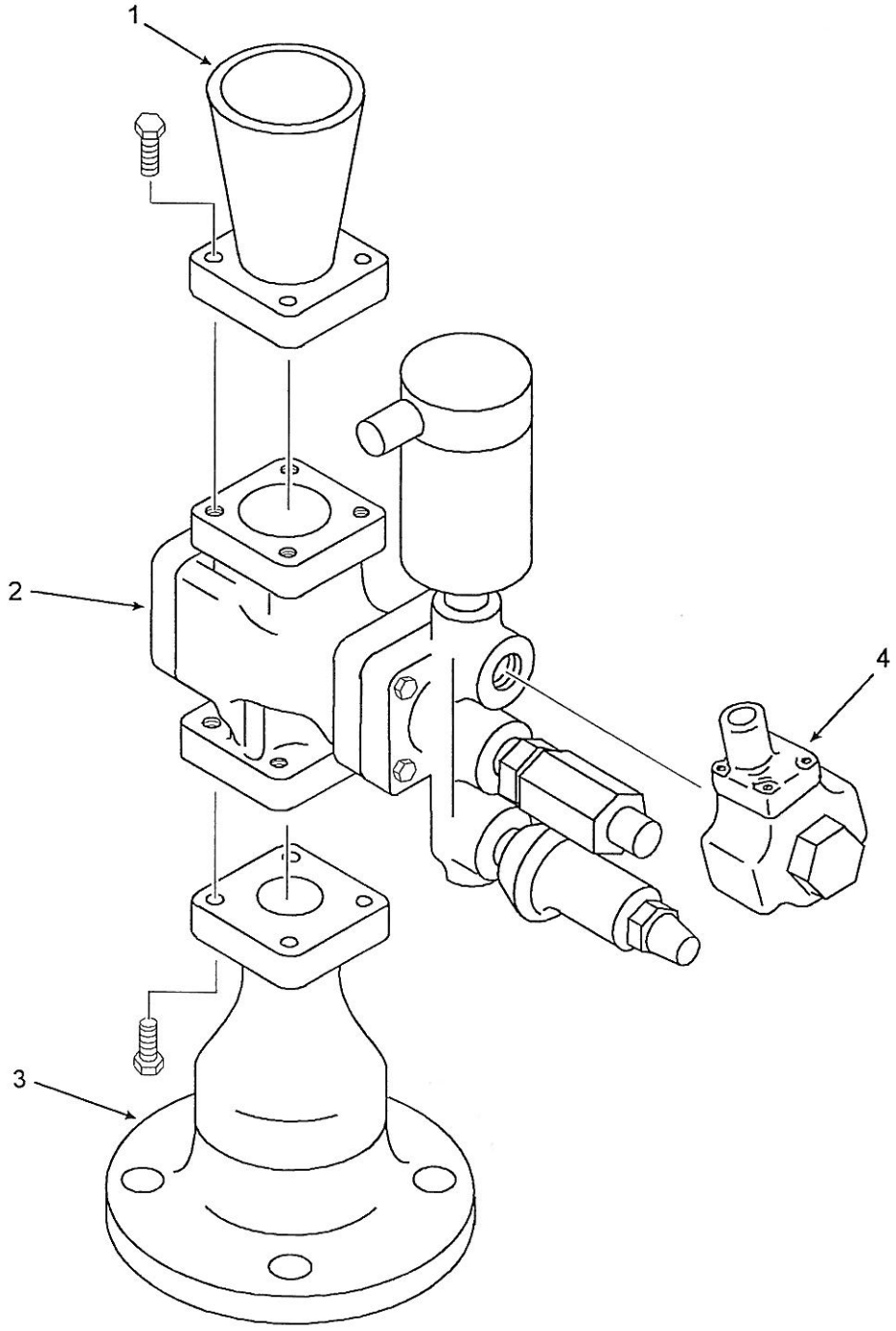
NOTE: Order by part number, not by item number.

07W-P-470500/WSF00106

REFRIGERATION PIPING (AMMONIA)

ITEM No.	PART No.	DESCRIPTION	QTY
1	521-S-R203-FE	SCREW - Hex. Hd. Cap M16 - 2.00 x 80 mm lg. (Cl 10)	4
2	523-S-R348-H	WASHER - Lock M16	4
3	523-S-R206-E	NUT - Hex. M16 - 2.00 mm (Cl 10)	12
4	545-S-R188-E	GASKET - 3 in.	1
5	567-S-R217-MB	NIPPLE - 1/2 in. MPT x 2 in. lg.	4
6	567-S-F105-D	TEE - 1/2 in. FPT	2
7	568-S-H682-C	ELBOW - 90° 1/2 in. Tube x 1/2 in. MPT	1
8	568-S-H681-F	CONNECTOR - Male 1/2 in. Tube x 3/8 in. MPT	1
9	726-V-011469	TUBING - 1/2 in. o.d.	-
10	567-S-F137-C	PLUG - Sq. Hd. - 3/8 in. MPT	1
11	582-S-6922-B	VALVE - Relief.	1
12	567-S-R217-RB	NIPPLE - 3/8 in. MPT x 2 in. lg.	1
13	567-S-F138-D	REDUCER - 1/2 in. x 3/8 in.	1
14	567-S-R217-AB	NIPPLE - 3/8 in. MPT x 2 in. lg	1
15	582-S-R287-C	VALVE - Solenoid (N.C.).	1
16	568-S-H681-D	CONNECTOR - Male 3/4 in. Tube x 1/2 in. MPT	3
17	726-V-001072	TUBING - 3/4 in. o.d.	-
18	582-S-R534	VALVE - Solenoid (24 vdc)	2
19	568-S-H682-A	ELBOW - 90° 3/4 in. Tube x 1/2 in. MPT	5
20	562-S-6269-D	VALVE - Needle.	1
21	568-S-H682-F	ELBOW - 90° 3/4 in. Tube x 3/4 in. MPT	1
22	568-S-H681-G	CONNECTOR - Male 3/4 in. Tube x 3/4 in. MPT	1
23	521-S-R203-CC	SCREW - Hex. Hd. Cap M10 - 1.50 x 25 mm lg. (Cl 10)	4
24	523-S-R349-F	WASHER - Flat M10	8
25	523-S-R348-F	WASHER - Lock M10	4
26	523-S-R206-C	NUT - Hex. M10 - 1.50 mm (Cl 10)	4
27	12H-P-464038	RETAINER - Sightglass.	1
28	583-S-R281	KIT - Sightglass	1
29	521-S-R203-EE	SCREW - Hex. Hd. Cap M16 - 2.00 x 75 mm lg. (Cl 10)	8
30	12H-P-457819	COVER - Float Chamber.	1
31	545-S-R188-G	GASKET - 4.0 in.	1
32	12A-P-464047	CHAMBER - Float	1
33	521-S-R203-GB	SCREW - Hex. Hd. Cap M8 - 1.25 x 30 mm lg. (Cl 10)	4
34	523-S-R348-E	WASHER - Lock M8	4
35	523-S-R206-B	NUT - Hex. M8 - 1.25 mm (Cl 10)	4
36	31H-P-442296	HANGER - Bottom Half	2
37	31H-P-442293	HANGER -Top Half	2
38	07A-P-464500	SUPPORT - Refrigeration Piping	1
39	523-S-R206-D	NUT - Hex. M12 - 1.75 mm (Cl 10)	4
40	07H-P-464501	BRACKET	1
41	523-S-R348-G	WASHER - Lock M12	2
42	529-S-R494-D	CLAMP - 3/4 in. Tube	2
43	521-S-R203-EA	SCREW - Hex. Hd. Cap M6 - 1.00 x 20 mm lg. (Cl 10)	2
44	523-S-R348-D	WASHER - Lock M6	2
45	523-S-R206-A	NUT - Hex. M6 - 1.00 mm (Cl 10)	2
46	07A-P-470034	SUPPORT - Refrigeration Piping	1
47	726-V-001135	TUBING - 1/4 in. o.d.	-
48	568-S-R028-B	CONNECTOR - Female 1/4 in. Tube x 1/4 in. FPT	1
49	07H-P-416979	GASKET - Pressure Gauge.	1
50	521-V-009449	SCREW - Rd. Hd. Mach. #8 - 32 x 5/8 in. lg.	3
51	581-S-6413	GAUGE - Pressure	1
52	568-S-H681-L	CONNECTOR - Male 1/4 in. Tube x 1/2 in. MPT	1
53	567-V-007428	CROSS - 1/2 in. FPT	1
54	567-S-F137-D	PLUG - Sq. Hd. - 1/2 in. MPT	2

BACK PRESSURE REGULATOR



NOTE: Order by part number, not by item number.

WSF00113

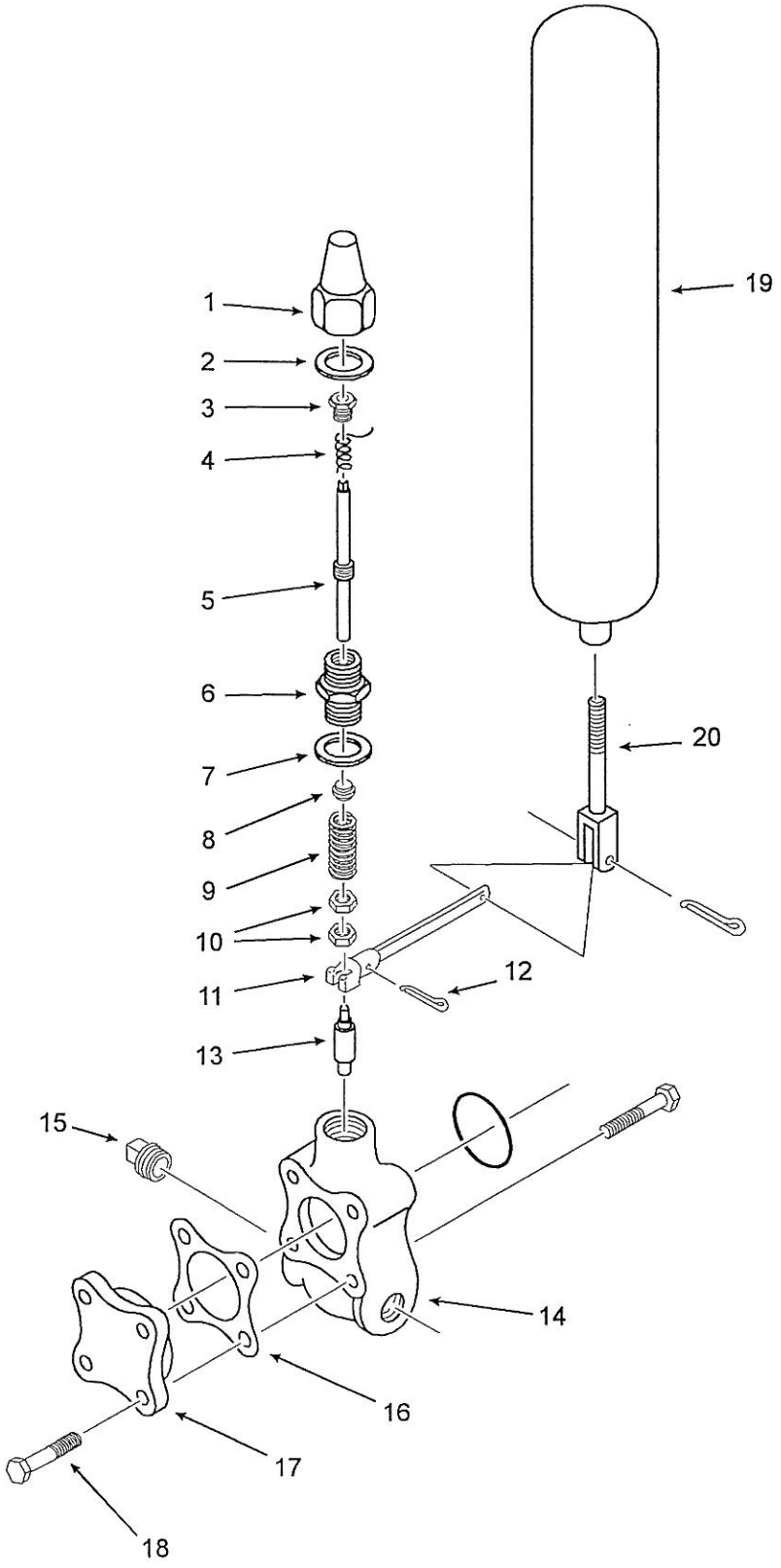
BACK PRESSURE REGULATOR

ITEM No.	PART No.	DESCRIPTION	QTY
1	07A-P-470009	ADAPTER	1
2	* *	REGULATOR - Back Pressure	1
3	07A-P-464779	ADAPTER	1
4	607-S-R130-D	COIL - Solenoid	1

NOTE: * *See Customer Specification Sheet.

WSF00114

FLOAT VALVE ASSEMBLY



NOTE: Order by part number, not by item number.

WSF00127

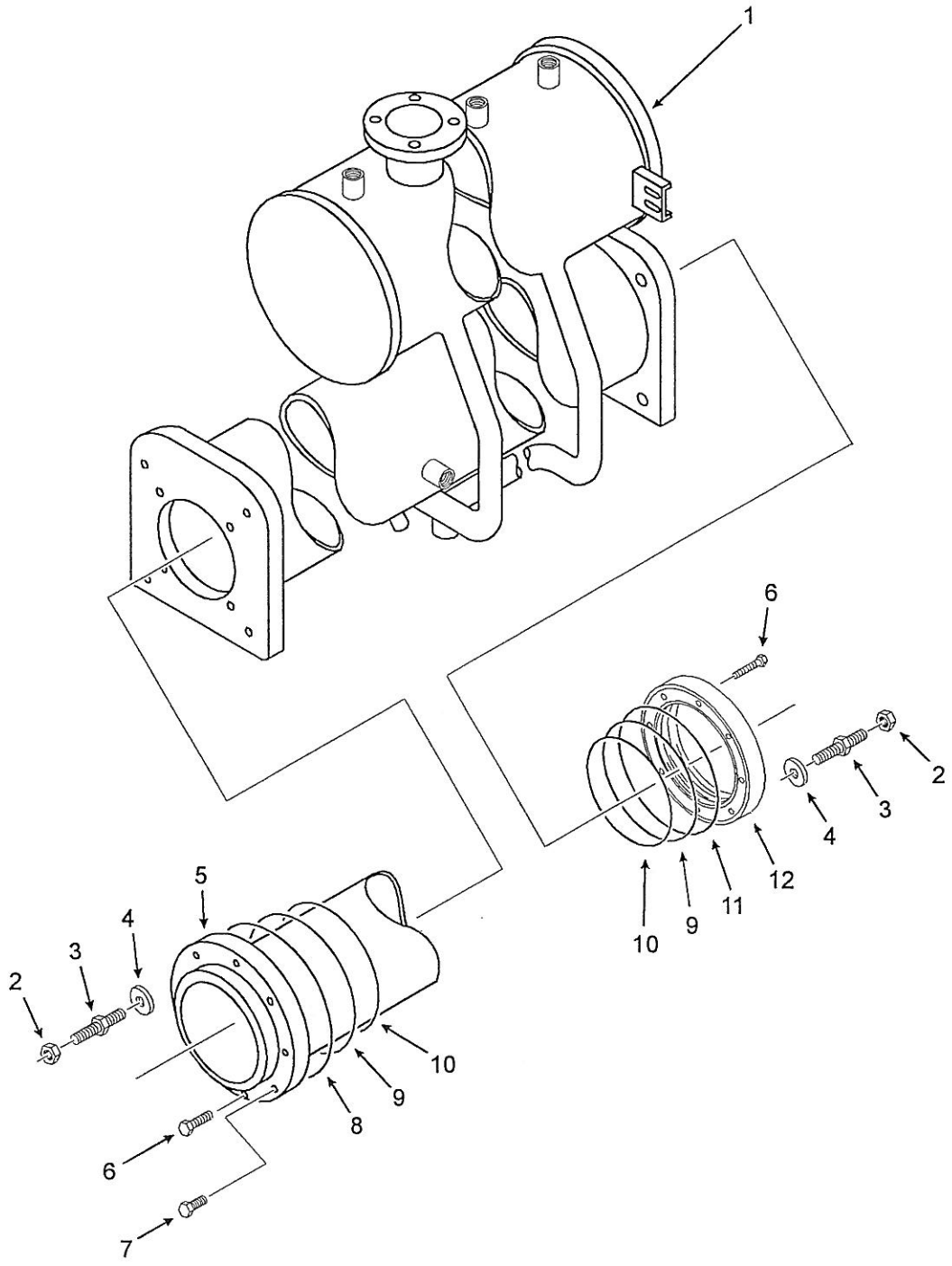
FLOAT VALVE ASSEMBLY

ITEM No.	PART No.	DESCRIPTION	QTY
1	714	CAP - Seal	1
2	720	GASKET	1
3	582-V-003656	GLAND - #8	1
4	583-V-004056	PACKING - #775	-
5	7	STEM	1
6	9-F	BONNET	1
7	582-V-003577	GASKET - #19	1
8	6	CONE - Spring	1
9	5-30A	SPRING	1
10	4	NUT	2
11	10-CP	LEVER	1
12	11	PIN - Lever	1
13	See Below	CARTRIDGE	1
14	101	BODY - Valve (1/2 in. LH)	1
15	12	PLUG - Pipe	1
16	63	GASKET	1
17	61-F	FLANGE - Blind	1
18	62	SCREW - Cap	1
19	See Below	DISPLACER	-
20	12A-P-464187	CLEVIS - Displacer	1

FLOAT VALVE PART NO.	ORIFICE SIZE	ITEM #13 CARTRIDGE W/NEEDLE	REPLACEMENT CARTRIDGE KIT	O-RINGS & CARTRIDGE ALONE	ITEM #19 DISPLACER
582-S-G850-A	3/32	582-S-F689-A	582-S-F690-A	582-S-F689-A	331-IS
582-S-G850-B	1/8	582-S-F689-B	582-S-F690-B	582-S-F689-B	331-IS
582-S-G850-C	5/32	582-S-F689-C	582-S-F690-C	582-S-F689-C	331-IS
582-S-G850-D	3/16	582-S-F689-D	582-S-F690-D	582-S-F689-D	331-IS
582-S-G850-E	1/4	582-S-F689-F	582-S-F690-F	582-S-F689-F	331-IS
582-S-G850-F	5/64	582-S-F689-J	582-S-F690-G	582-S-F689-J	331-IS
582-S-G850-G	1/16	582-S-F689-K	582-S-F690-H	582-S-F689-K	331-IS
582-S-G850-H	5/16	582-S-F689-L	582-S-F690-J	582-S-F689-L	331-IS
582-S-G851-A	3/32	582-S-F689-A	582-S-G517-A	582-S-F689-A	582-S-P350
582-S-G851-B	1/8	582-S-F689-B	582-S-G517-B	582-S-F689-B	582-S-P350
582-S-G851-C	5/32	582-S-F689-C	582-S-G517-C	582-S-F689-C	582-S-P350
582-S-G851-D	3/16	582-S-F689-D	582-S-G517-D	582-S-F689-D	582-S-P350
582-S-G851-E	1/4	582-S-F689-F	582-S-G517-F	582-S-F689-F	582-S-P350
582-S-G851-F	5/16	582-S-F689-G	582-S-G517-G	582-S-F689-G	582-S-P350
582-S-G851-G	3/8	582-S-F689-H	582-S-G517-H	582-S-F689-H	582-S-P350

WSF00128

FREEZING CYLINDER COMPONENTS



NOTE: Order by part number, not by item number.

07W-P-464381/WSF00121

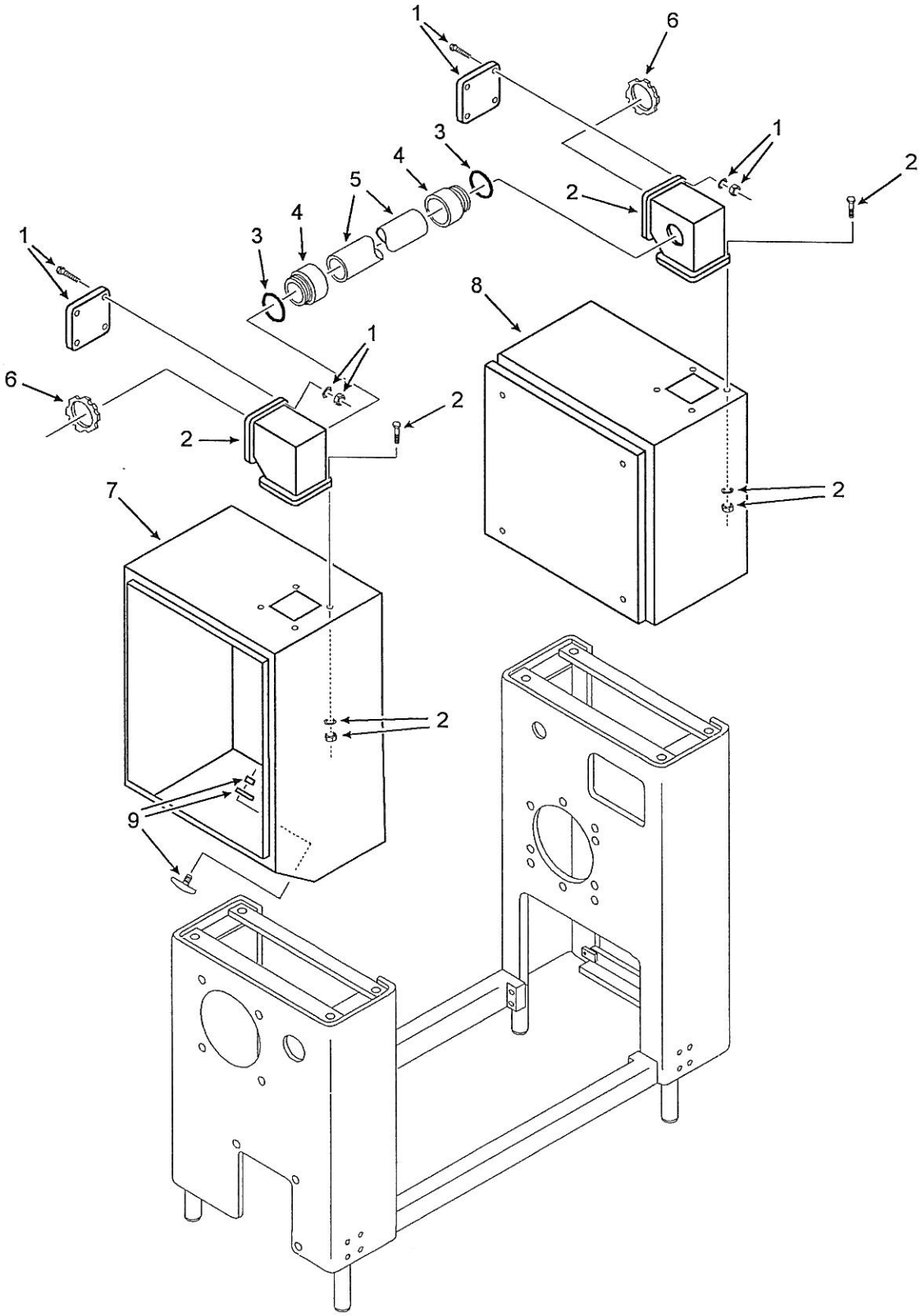
FREEZING CYLINDER COMPONENTS

ITEM No.	PART No.	DESCRIPTION	QTY
1	* *	ACCUMULATOR	1
2	523-S-R206-F	NUT - Hex. M20 - 2.50 mm (Cl 10)	8
3	07H-P-464309	STUD - Front and Rear Doors	8
4	07H-P-464310	SHIM - Door Stud	4
5	* *	CYLINDER - Inner	1
6	521-S-R203-AD	SCREW - Hex. Hd. Cap M12 - 1.75 x 35 mm lg. (Cl 10)	8
7	521-S-R203-XC	SCREW - Hex. Hd. Cap M12 - 1.75 x 20 mm lg. (Cl 10)	2
8	543-S-1313-HL	O-RING.	1
9	543-S-G320-48	O-RING.	2
10	543-S-G320-46	O-RING.	2
11	543-S-G150-95	O-RING.	1
12	07H-P-464155	RING - Spacer	1

NOTE: * *See Customer Specification Sheet.

07W-P-464381/WSF00122

ELECTRICAL ENCLOSURES



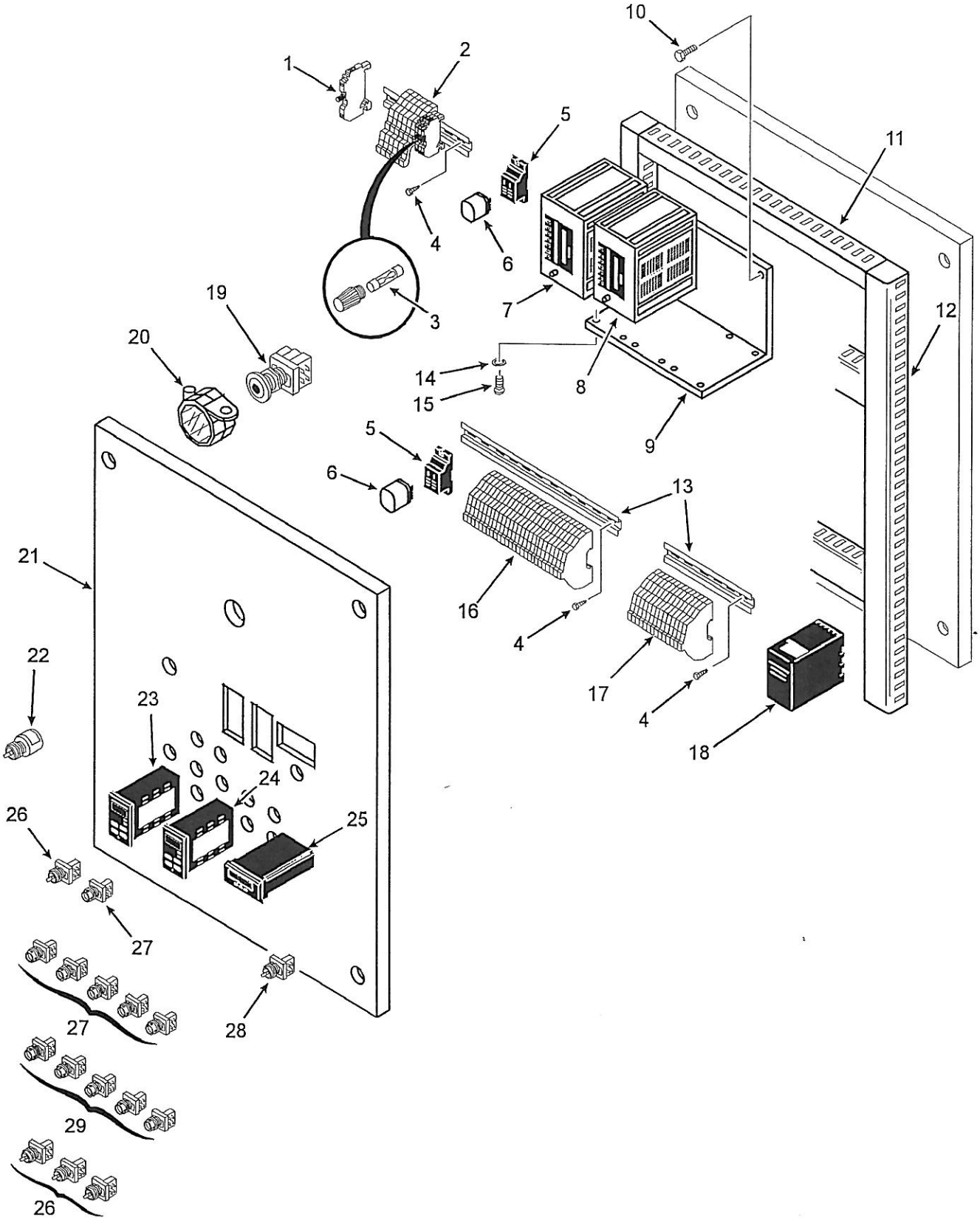
NOTE: Order by part number, not by item number.

07W-P-424808/07W-P-424809/07W-P-424810/WSF00131

ELECTRICAL ENCLOSURES

ITEM No.	PART No.	DESCRIPTION	QTY
1	606-S-R275-L	PLATE - Panduit Closure	2
2	606-S-R275-G	ELBOW - 90° - Panduit	2
3	601-S-R709	RING - Sealing	2
4	601-S-R703	ADAPTER	2
5	601-S-R704	CONDUIT	1
6	601-S-R705	LOCKNUT - 2 in.	2
7	606-S-R347-D	ENCLOSURE - Front	1
8	606-S-R347-E	ENCLOSURE - Rear	1
9	609-S-F619-F	PLUG - Hole	1

FRONT ELECTRICAL ENCLOSURE



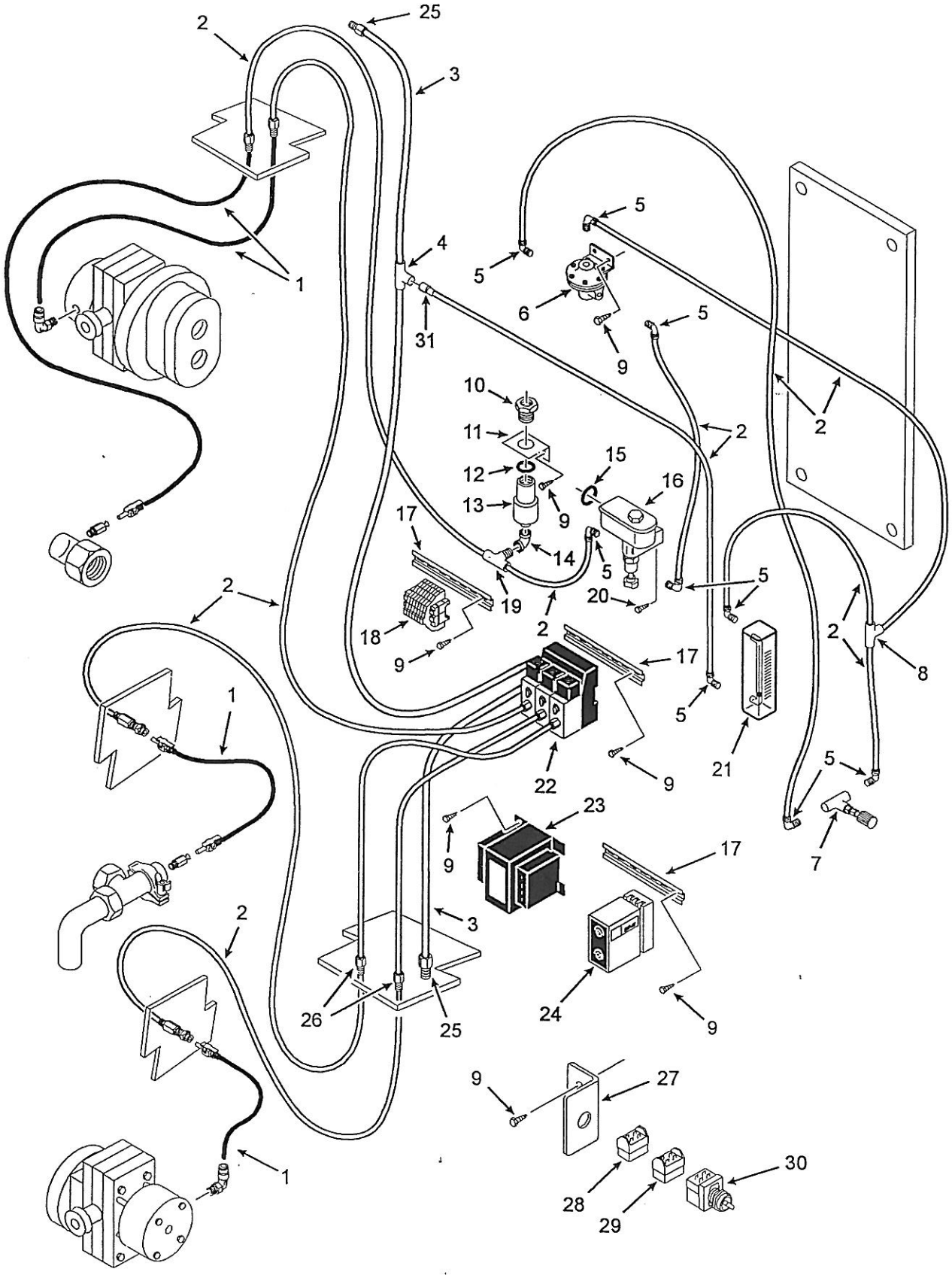
NOTE: Order by part number, not by item number.

FRONT ELECTRICAL ENCLOSURE

ITEM No.	PART No.	DESCRIPTION	QTY
1	605-S-R343-A	BREAKER - Circuit (4 amp - 230V)	1
2	586-P-424729	BLOCK - Terminal	1
3	604-S-H723-B	FUSE - (1 amp - 250V)	2
4	522-S-R634-HA	SCREW - Self-Tapping - #10 x 3/4 in. lg.	6
5	605-S-J619-A	SOCKET - Relay	2
6	605-S-J619-D	RELAY - Power	2
7	586-S-R329-A	POWER SUPPLY - 115 vac-24 vdc (Unregulated)	1
	586-S-R329-B	POWER SUPPLY - 230 vac-24 vdc (Unregulated)	1
8	586-S-R329-C	POWER SUPPLY - 115 vac-24 vdc (Regulated)	1
	586-S-R329-D	POWER SUPPLY - 230 vac-24 vdc (Regulated)	1
9	07H-P-470767	BRACKET - Power Supply Triple Mounting	1
10	*521-V-007392	SCREW - Hex. Hd. Cap - 1/4 - 20 x 5/8 in. lg. (Pkg. of 10)	2
11	603-S-5002-J	DUCT - Wire 1 in. x 2 in.	-
12	603-S-5002-P	DUCT - Wire 2 in. x 2 in.	-
13	586-S-R321-C	RAIL	-
14	*523-V-007188	WASHER - Lock - #8 (Pkg. of 10)	12
15	*521-V-006999	SCREW - Rd. Hd. Mach. - #8 - 32 x 3/8 in. lg. (Pkg. of 10)	12
16	586-P-424730	BLOCK - Terminal	1
17	586-P-424732	BLOCK - Terminal	1
18	583-S-R358-A	TRANSMITTER	1
19	605-S-R342-D	SWITCH - 3 Position	1
20	605-S-R367-A	COVER - Emergency Off Switch	1
21	606-S-R347-M	DOOR - Front	1
22	585-S-H367-D	POTENTIOMETER	1
23	587-S-K762-L	CONTROLLER	1
24	587-S-K762-K	CONTROLLER	1
25	581-S-P389	INDICATOR	1
26	605-S-K479-A	SWITCH - Illuminated (2 Position)	4
	605-S-K483-D	MODULE - Lamp Socket	4
	605-S-P115-B	LAMP	4
27	605-S-K477-A	PUSHBUTTON - Illuminated	6
	605-S-K483-D	MODULE - Lamp Socket	6
	605-S-K485-C	LENS - Yellow	6
	605-S-P115-B	LAMP	6
28	605-S-8933-B	SWITCH - Non-Illuminated (2 Position)	1
	603-S-8929-H	BLOCK - Contact	1
29	605-S-K476-A	PUSHBUTTON - Non-Illuminated	5
	605-S-K481-B	BLOCK - Contact	5

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.

SANITARY AND INSTRUMENT AIR COMPONENTS



NOTE: Order by part number, not by item number.

SPECIAL/O7W-P-464641/WSF00579

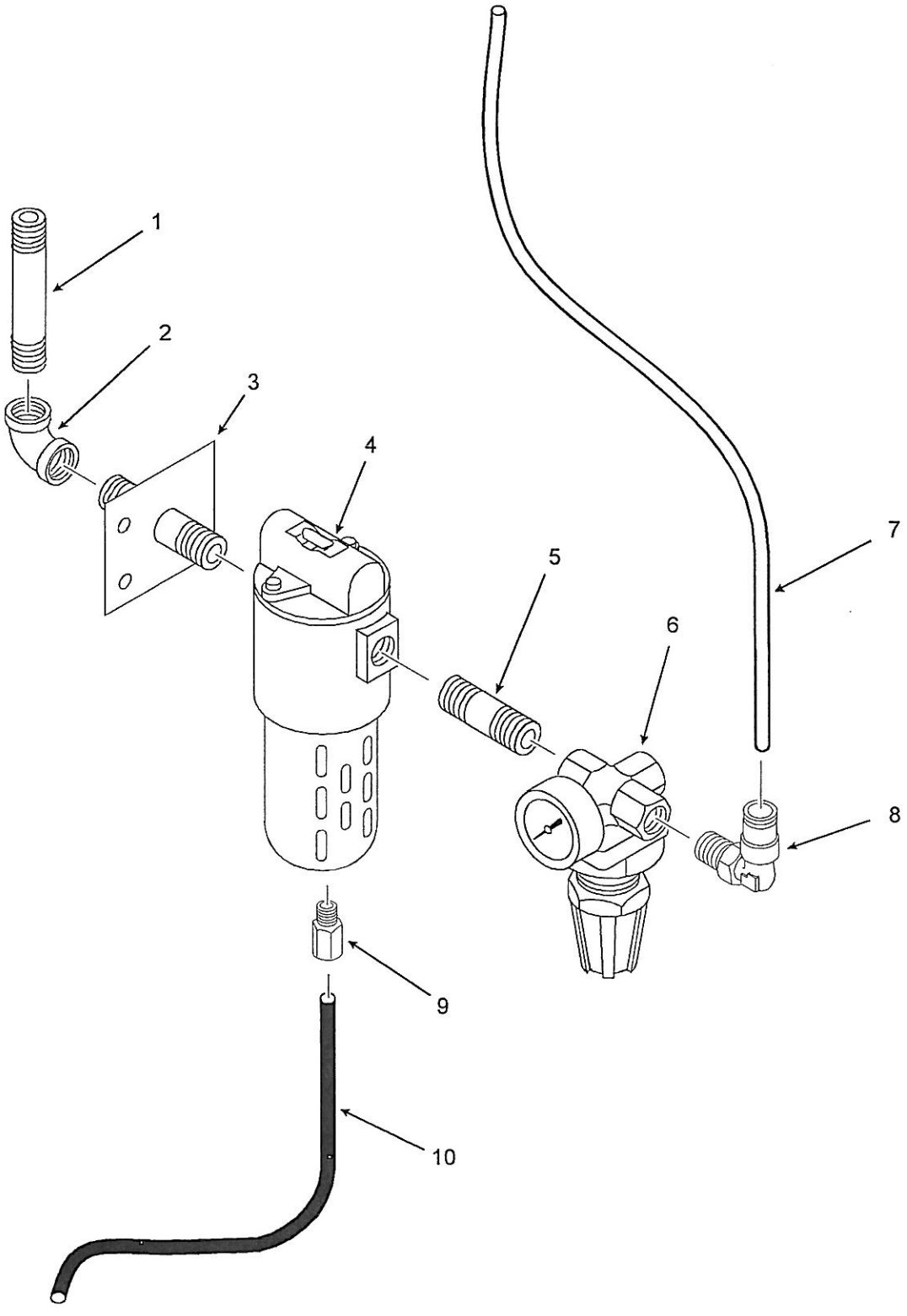
SANITARY AND INSTRUMENT AIR COMPONENTS

ITEM No.	PART No.	DESCRIPTION	QTY
1	762-S-1816-C	TUBE - 1/4 in. Black	-
2	762-S-1816-E	TUBE - 1/4 in. Natural	-
3	762-S-1817-C	TUBE - 3/8 in. Natural	-
4	568-S-G359-F	TEE - 3/8 in.	1
5	568-S-G354-F	ELBOW - 1/4 in. Tube x 1/8 in. MPT	9
6	583-S-G113	CONTROL - Flow	1
7	582-S-G116-F	VALVE - Needle	1
8	568-S-G359-D	TEE - 1/4 in.	1
9	522-S-R634-HA	SCREW - Self-Tapping - #10 x 3/4 in. lg.	16
10	601-S-6174-A	NIPPLE - Chase	1
11	07H-P-440589	BRACKET	1
12	609-S-4918-A	GASKET - 1/2 in.	1
13	583-S-K892-D	TRANSMITTER - Pressure (0-100 PSIA)	1
14	567-S-F099-A	ELBOW - 90° 1/8 in.	1
15	569-S-4839-AC	BUSHING - Snap	1
16	582-S-J538	SOLENOID - Air	1
17	605-S-J643-A	RAIL - Mounting	-
18	586-P-424733	BLOCK - Terminal	1
19	568-S-G355-D	TEE - 1/4 in. Tube x 1/8 in. MPT	1
20	522-S-R634-EA	SCREW - Self-Tapping - #8 x 3/4 in. lg.	2
21	584-S-G120-A	FLOW METER	1
22	582-S-R362-R	VALVE - Air Solenoid	1
23	607-S-R360-B	TRANSFORMER - 115/230 vac	1
24	586-S-R048	MODULE - EKA 46	1
	604-S-G739-K	RESISTOR - 510 ohm	1
25	568-S-R104-B	FITTING - Bulkhead Union - 3/8 in.	2
26	568-S-R104-A	FITTING - Bulkhead Union - 1/4 in.	2
27	07H-P-464761	BRACKET - Pump Run Down	1
28	605-S-K482-B	BLOCK - Contact	1
29	605-S-K481-C	BLOCK - Contact	1
30	605-S-K478-A	SWITCH (2-Position)	1
31	568-S-G364-L	REDUCER - 1/4 in. x 3/8 in.	1

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.
NOTE: **See Customer Specification Sheet.

SPECIAL/07W-P-464641/WSF00580

REGULATOR AND AIR FILTER MOUNTING



NOTE: Order by part number, not by item number.

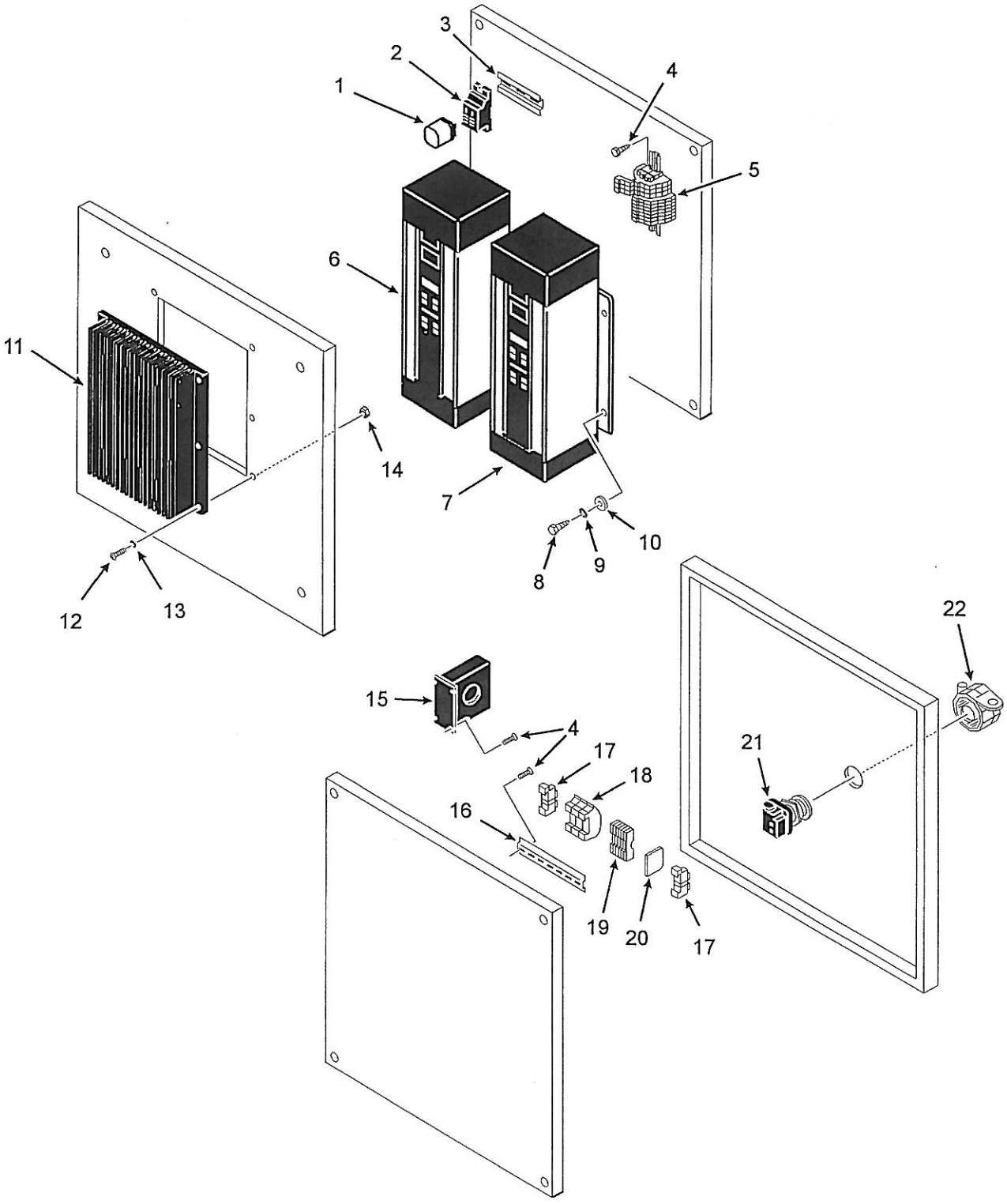
07W-P-474839/WSF00438

REGULATOR AND AIR FILTER MOUNTING

ITEM No.	PART No.	DESCRIPTION	QTY
1	03H-P-278475	NIPPLE	1
2	567-S-F099-B	ELBOW - 90° - 1/4 in.	1
3	07A-P-474203	BRACKET	1
4	644-S-H697	FILTER - Air	1
5	567-V-001824	NIPPLE - 1/4 in. NPT x 1-1/2 in. lg.	1
6	583-S-K836-B	REGULATOR	1
7	762-S-1817-C	TUBE - 3/8 in. Natural	-
8	568-S-K785-F	ELBOW - 3/8 in. Tube x 1/4 in. NPT	1
9	568-S-P549-C	CONNECTOR - 1/4 in. Tube x 1/8 in. NPT	1
10	762-S-1816-C	TUBE - 1/4 in. Black	-

07W-P-474839/WSF00439

REAR ELECTRICAL ENCLOSURE



NOTE: Order by part number, not by item number.

07W-P-424853/07A-P-424803/WSF00511

REAR ELECTRICAL ENCLOSURE

ITEM No.	PART No.	DESCRIPTION	QTY
1	605-S-J619-D	RELAY - Power	1
2	605-S-J619-A	SOCKET - Relay	1
3	586-S-R321-C	RAIL	-
4	522-S-R634-HA	SCREW - Self-Tapping - #10 x 3/4 in. lg.	8
5	586-P-424736	BLOCK - Terminal	1
6	**	INVERTER	1
7	**	INVERTER	1
8	*521-V-007392	SCREW - Hex. Hd. Cap - 1/4 - 20 x 5/8 in. lg. (Pkg. of 10)	8
9	*523-V-007190	WASHER - Lock - 1/4 in. (Pkg. of 10)	8
10	*523-V-007176	WASHER - Plain - 1/4 in. (Pkg. of 10)	8
11	609-S-R697	HEAT EXCHANGER - Sink	1
12	*521-V-007032	SCREW - Rd. Hd. Mach. - #8 - 32 x 3/4 in lg. (Pkg. of 10)	6
13	*523-V-007188	WASHER - Lock - #8 (Pkg. of 10)	6
14	*523-V-006500	NUT - Hex. #8 - 32 (Pkg. of 10)	6
15	586-S-R606-A	TRANSDUCER	1
16	603-S-R614-G	RAIL	-
17	603-S-R614-F	BLOCK - End Stop	2
18	603-S-R614-D	BLOCK	3
19	603-S-R614-A	BLOCK	6
20	603-S-R614-C	PLATE - Terminal End	1
21	605-S-R342-A	SWITCH - 2-Position 115 vac.	1
	605-S-R342-B	SWITCH - 2-Position 230 vac.	1
22	605-S-R367-A	COVER - Emergency Off Switch	1

NOTE: *Certain Items Are Packaged in Minimum Quantity Lots as Indicated.
NOTE: **See Customer Specification Sheet.

Recommended Inventory - APV Crepaco Freezer

Model : WS-212GS
Serial No.: N-1307

Suggested for export service or for domestic service where minimum loss of service is essential. Supplies typical service part usage for 1 year or 2000 hours, whichever occurs first.
(Quantities listed are per cylinder.)

Dasher - Dasher Drive - Door Components - (#30 Dasher)		
Part Number	**Part Description**	**Number Required**
621-S-H882	INSERT - Rear Bearing	1
523-S-4186-AM	RING - Snap	2
07A-P-389889	BEARING - Rear Support	1
07H-P-464122	BUSHING - Front Support	1
07H-P-334252	PLATE - Beater Retaining	2
07H-P-378949	BUSHING - Beater	2
07H-P-343954	SLEEVE - Rear Wear	1
543-S-1313-38	O-RING (Pkg. of 10)	1 Pkg.
543-S-1313-36	O-RING (Pkg. of 10)	1 Pkg.
07H-P-313433	RING - Seal	20
543-S-1313-25	O-RING (Pkg. of 10)	1 Pkg.
07H-P-464181	BLADE - Scraper	28
07H-P-205681	O-RING - Door Seal	10
543-S-G150-95	O-RING	10
543-S-G320-46	O-RING	10
543-S-G320-48	O-RING - Cylinder Seal	10
543-V-001505	GASKET - #101H - 1-1/2 in.	100
543-V-001504	GASKET - #101H - 1 in.	25
543-S-1313-HL	O-RING	10
622-P-221918	RING - Snap	2
623-V-026317	V-BELT	6
629-S-R285-S	INSERT - Flexible Coupling	1
543-S-G150-17	O-RING (Pkg. of 10)	1 Pkg.
07H-P-364640	SLEEVE - Front Wear	1
543-V-001507	GASKET - #101H - 2 in.	50

Refrigeration Components (Ammonia) - Back Pressure Regulator		
Part Number	**Part Description**	**Number Required**
07H-P-416979	GASKET - Pressure Gauge	1
545-S-R188-E	GASKET - 3 in.	5
545-S-R188-G	GASKET - 4 in.	5
562-S-6269-D	VALVE - Needle	1
607-S-R130-D	COIL - Solenoid	2
582-S-F690-D	KIT - Cartridge (3/16 in.)	1

#2.5 FAR Rotary Pump (03B-P-365160)		
Part Number	**Part Description**	**Number Required**
03H-P-137713	SEAL - Bearing	10
549-P-138206	GASKET - Gearcase	5
543-S-8425	O-RING - Pump Case Seal	10
03H-P-326655	GASKET - Front Plate	10
543-S-1313-20	O-RING - Seal Bearing (Pkg. of 10)	1 Pkg.
03H-P-420171	ROTOR	4
543-S-K361-AP	SEAL	1
543-S-K608	SEAL - Oil	3
03H-P-203232	SEAL - Shaft (Pkg. of 10)	4 Pkg.
549-P-184443	GASKET - Drain Plug	10
03H-P-137722	RING - Seal (Pkg. of 5)	2 Pkg.
524-S-4806-J	RING - Retaining (Pkg. of 10)	1 Pkg.
543-S-1314-11	O-RING (Pkg. of 10)	1 Pkg.
543-S-1313-12	O-RING (Pkg. of 10)	1 Pkg.
629-S-R285-G	INSERT - Flexible Coupling	1

#2.5 FAR Rotary Pump (03B-P-365161)		
Part Number	**Part Description**	**Number Required**
03H-P-137713	SEAL - Bearing	10
549-P-138206	GASKET - Gearcase	5
543-S-8425	O-RING - Pump Case Seal	10
03H-P-326655	GASKET - Front Plate	10
543-S-1313-20	O-RING - Seal Bearing (Pkg. of 10)	1 Pkg.
03H-P-420171	ROTOR	4
543-S-K361-AP	SEAL	1
543-S-K608	SEAL - Oil	3
03H-P-203232	SEAL - Shaft (Pkg. of 10)	4 Pkg.
549-P-184443	GASKET - Drain Plug	10
03H-P-137722	RING - Seal (Pkg. of 5)	2 Pkg.
524-S-4806-J	RING - Retaining (Pkg. of 10)	1 Pkg.
543-S-1314-11	O-RING (Pkg. of 10)	1 Pkg.
543-S-1313-12	O-RING (Pkg. of 10)	1 Pkg.
629-S-R285-G	INSERT - Flexible Coupling	1

Pneumatic Components		
Part Number	**Part Description**	**Number Required**
644-1-57668	DISC - Filter (Pkg. of 1000)	1 Pkg.
07H-1-49295	DISC - Perforated (Pkg. of 10)	1 Pkg.
543-S-1313-08	O-RING (Pkg. of 10)	1 Pkg.
543-S-1313-11	O-RING (Pkg. of 10)	1 Pkg.
543-S-1313-16	O-RING (Pkg. of 10)	1 Pkg.
543-S-1313-19	O-RING (Pkg. of 10)	1 Pkg.
07H-1-52892	SPRING	10
07H-P-149122	VALVE - Rubber (Pkg. of 5)	1 Pkg.
762-S-1816-C	TUBE - 1/4 in. Black	10 ft.
762-S-1816-E	TUBE - 1/4 in. Natural	10 ft.
762-S-1817-C	TUBE - 3/8 in. Natural	10 ft.
644-S-H696	ELEMENT - Air Filter	2
07H-P-325133	INLET - Air	1

Electrical Components - 230V - (Semi-Automatic)		
Part Number	**Part Description**	**Number Required**
587-S-K762-L	CONTROLLER	1
605-S-P115-B	LAMP	5
582-S-R362-P	SOLENOID - Air	1
605-S-K483-D	MODULE - Lamp Socket	1
605-S-K479-A	SWITCH - Illuminated (2 Position)	1
605-S-K477-A	PUSHBUTTON - Illuminated	1
605-S-K476-A	PUSHBUTTON - Non-Illuminated	1
585-S-H367-D	POTENTIOMETER	1
605-S-J619-D	RELAY	1
604-S-H723-B	FUSE - 1 amp	5