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Service—

30015/30020/30022 Washer-Extractors

Read the separate safety manual before installing, operating, or servicing

PELLERIN MILNOR CORPORATION POST OFFICE BOX 400, KENNER, LOUISIANA 70063-0400, U.S.A.

Please Read

About the Manual Identifying Information on the Cover

The front cover displays pertinent identifying information for this manual. Most important, are the published manual number (part number) /ECN (date code). Generally, when a replacement manual is furnished, it will have the same published manual number, but the latest available ECN. This provides the user with the latest information applicable to his machine. Similarly all documents comprising the manual will be the latest available as of the date the manual was printed, **even though older ECN dates for those documents may be listed in the table of contents**.

When communicating with the Milnor factory regarding this manual, please also provide the other identifying information shown on the cover, including the publishing system, access date, and whether the document ECN's are the latest available or exact.

References to Yellow Troubleshooting Pages

This manual may contain references to "yellow pages." Although the pages containing troubleshooting procedures are no longer printed on yellow paper, troubleshooting instructions, if any, will be contained in the easily located "Troubleshooting" chapter or section. See the table of contents.

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Table of Contents
for MAP30RM1AE/2006145A
30015/30020/30022 Washer-Extractors

Table of Contents, cont.

ABOUT THIS MANUAL

Scope—This instruction manual is intended to provide preventive maintenance procedures, service procedures, and mechanical parts identification for all Milnor® 30015, 30020, and 30022 model rigid mount washer-extractors. Measurements are in commonly used US and metric units unless otherwise noted.

See the appropriate programming, operating, and troubleshooting manual for information on the control system. See the schematic manual for electrical parts identification and electrical troubleshooting.

Manual Number/Date Code (When To Discard or Save)—The manual number/date code is located on the inside front cover, upper right corner just above the manual name. Whenever the manual is reprinted with new information, part of this number changes. **If the *date code* after the "/" changes, the new version applies to all machines covered by the old version, but is improved— thus the old version can be discarded. If the *manual number* before the "/" changes, the new manual covers only new machines.** Example: Discard MATMODELAE/8739**C**V when MATMODELAE/8739**D**V is received (minor improvements). Also, discard MATMODELAE/87**39D**V when MATMODELAE/87**46A**V is received (major improvements). But keep MATMODEL**A**E/8746FV when MATMODEL**B**E/8815AV is received, since the new manual no longer applies to machines originally shipped with the old manual.

Documents and Change Bars—The individual documents comprising this manual use the same revision criteria as the manual. Text documents also display change bars. Example: When section MSOP0599AE/9135**B**V becomes MSOP0599AE/9135**C**V, change bars with the letter "C" appear next to all changes for this revision. For a major rewrite (e.g., MSOP0599AE/92**26A**V), all change bars are deleted.

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PELLERIN MILNOR CORPORATION

LIMITED STANDARD WARRANTY

We warrant to the original purchaser that MILNOR machines including electronic hardware/software (hereafter referred to as “equipment”), will be free from defects in material and workmanship for a period of one year from the date of shipment from our factory with no operating hour limitation. This warranty is contingent upon the equipment being installed, operated and serviced as specified in the operating manual supplied with the equipment, and operated under normal conditions by competent operators.

Providing we receive written notification of a warranted defect within 30 days of its discovery, we will – at our option – repair or replace the defective part or parts, FOB our factory. We retain the right to require inspection of the parts claimed defective in our factory prior to repairing or replacing same. We will not be responsible, or in any way liable, for unauthorized repairs or service to our equipment, and this warranty shall be void if the equipment is repaired or altered in any way without MILNOR’s written consent.

Parts which require routine replacement due to normal wear – such as gaskets, contact points, brake and clutch linings and similar parts – are not covered by this warranty, nor are parts damaged by exposure to weather or to chemicals.

We reserve the right to make changes in the design and/or construction of our equipment (including purchased components) without obligation to change any equipment previously supplied.

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How to order repair parts

Repair parts may be ordered either from the authorized dealer who sold you this machine, or directly from the MILNOR factory. In most cases, your dealer will have these parts in stock.

When ordering parts, please be sure to give us the following information:

1. Model and serial number of the machine for which the parts are required
2. Part number
3. Name of the part
4. Quantity needed
5. Method of shipment desired
6. In correspondence regarding motors or electrical controls, please include all nameplate data, including wiring diagram number and the make or manufacturer of the motor or controls.

All parts will be shipped C.O.D. transportation charges collect only.

Please read this manual

It is strongly recommended that you read the installation and operating manual before attempting to install or operate your machine. We suggest that this manual be kept in your business office so that it will not become lost.

PELLERIN MILNOR CORPORATION
P.O. BOX 400, KENNER, LA., 70063-0400, U.S.A.
FAX: Administration 504/468-9307, Engineering 504/469-1849, Service 504/469-9777

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BIUUUS27 (Published) Book specs- Dates: 20051111 / 20051111 / 20060322 Lang: ENG01 Applic: RUU

Safety—Rigid Washer Extractors

1. General Safety Requirements—Vital Information for Management Personnel [Document BIUUUS04]

Incorrect installation, neglected preventive maintenance, abuse, and/or improper repairs, or changes to the machine can cause unsafe operation and personal injuries, such as multiple fractures, amputations, or death. The owner or his selected representative (owner/user) is responsible for understanding and ensuring the proper operation and maintenance of the machine. The owner/user must familiarize himself with the contents of all machine instruction manuals. The owner/user should direct any questions about these instructions to a Milnor® dealer or the Milnor® Service department.

Most regulatory authorities (including OSHA in the USA and CE in Europe) hold the owner/user ultimately responsible for maintaining a safe working environment. Therefore, the owner/user must do or ensure the following:

- recognize all foreseeable safety hazards within his facility and take actions to protect his personnel, equipment, and facility;
- work equipment is suitable, properly adapted, can be used without risks to health or safety, and is adequately maintained;
- where specific hazards are likely to be involved, access to the equipment is restricted to those employees given the task of using it;
- only specifically designated workers carry out repairs, modifications, maintenance, or servicing;
- information, instruction, and training is provided;
- workers and/or their representatives are consulted.

Work equipment must comply with the requirements listed below. The owner/user must verify that installation and maintenance of equipment is performed in such a way as to support these requirements:

- control devices must be visible, identifiable, and marked; be located outside dangerous zones; and not give rise to a hazard due to unintentional operation;
- control systems must be safe and breakdown/damage must not result in danger;
- work equipment is to be stabilized;
- protection against rupture or disintegration of work equipment;
- guarding, to prevent access to danger zones or to stop movements of dangerous parts before the danger zones are reached. Guards to be robust; not give rise to any additional hazards; not be easily removed or rendered inoperative; situated at a sufficient distance from the danger zone; not restrict view of operating cycle; allow fitting, replacing, or maintenance by restricting access to relevant area and without removal of guard/protection device;
- suitable lighting for working and maintenance areas;
- maintenance to be possible when work equipment is shut down. If not possible, then protection measures to be carried out outside danger zones;
- work equipment must be appropriate for preventing the risk of fire or overheating; discharges of gas, dust, liquid, vapor, other substances; explosion of the equipment or substances in it.

1.1. **Laundry Facility**—Provide a supporting floor that is strong and rigid enough to support–with a reasonable safety factor and without undue or objectionable deflection–the weight of the fully loaded machine and the forces transmitted by it during operation. Provide sufficient clearance for machine movement. Provide any safety guards, fences, restraints, devices, and verbal and/or posted restrictions necessary to prevent personnel, machines, or other moving machinery from accessing the machine or its path. Provide adequate ventilation to carry away heat and vapors. Ensure service connections to installed machines meet local and national safety standards, especially regarding the electrical disconnect (see the National Electric Code). Prominently post safety information, including signs showing the source of electrical disconnect.

1.2. **Personnel**—Inform personnel about hazard avoidance and the importance of care and common sense. Provide personnel with the safety and operating instructions that apply to them. Verify that personnel use proper safety and operating procedures. Verify that personnel understand and abide by the warnings on the machine and precautions in the instruction manuals.

1.3. **Safety Devices**—Ensure that no one eliminates or disables any safety device on the machine or in the facility. Do not allow machine to be used with any missing guard, cover, panel or door. Service any failing or malfunctioning device before operating the machine.

1.4. **Hazard Information**—Important information on hazards is provided on the machine safety placards, in the Safety Guide, and throughout the other machine manuals. **Placards must be kept clean so that the information is not obscured. They must be replaced immediately if lost or damaged. The Safety Guide and other machine manuals must be available at all times to the appropriate personnel.** See the machine service manual for safety placard part numbers. Contact the Milnor Parts department for replacement placards or manuals.

1.5. **Maintenance**—Ensure the machine is inspected and serviced in accordance with the norms of good practice and with the preventive maintenance schedule. Replace belts, pulleys, brake shoes/disks, clutch plates/tires, rollers, seals, alignment guides, etc. before they are severely worn. Immediately investigate any evidence of impending failure and make needed repairs (e.g., cylinder, shell, or frame cracks; drive components such as motors, gear boxes, bearings, etc., whining, grinding, smoking, or becoming abnormally hot; bending or cracking of cylinder, shell, frame, etc.; leaking seals, hoses, valves, etc.) Do not permit service or maintenance by unqualified personnel.

2. Safety Alert Messages—Internal Electrical and Mechanical Hazards [Document BIUUUS11]

The following are instructions about hazards inside the machine and in electrical enclosures.

WARNING 1: Electrocution and Electrical Burn Hazards—Contact with electric power can kill or seriously injure you. Electric power is present inside the cabinetry unless the main machine power disconnect is off.

- Do not unlock or open electric box doors.
- Do not remove guards, covers, or panels.
- Do not reach into the machine housing or frame.
- Keep yourself and others off of machine.
- Know the location of the main machine disconnect and use it in an emergency to remove all electric power from the machine.

WARNING 2: Entangle and Crush Hazards—Contact with moving components normally isolated by guards, covers, and panels, can entangle and crush your limbs. These components move automatically.

- Do not remove guards, covers, or panels.
- Do not reach into the machine housing or frame.
- Keep yourself and others off of machine.
- Know the location of all emergency stop switches, pull cords, and/or kick plates and use them in an emergency to stop machine motion.

3. Safety Alert Messages—Cylinder and Processing Hazards

[Document BIUUUS13]

The following are instructions about hazards related to the cylinder and laundering process.

DANGER 3: Entangle and Sever Hazards—Contact with goods being processed can cause the goods to wrap around your body or limbs and dismember you. The goods are normally isolated by the locked cylinder door.

- Do not attempt to open the door or reach into the cylinder until the cylinder is stopped.
- Do not touch goods inside or hanging partially outside the turning cylinder.
- Do not operate the machine with a malfunctioning door interlock.
- Know the location of all emergency stop switches, pull cords, and/or kick plates and use them in an emergency to stop machine motion.
- Know the location of the main machine disconnect and use it in an emergency to remove all electric power from the machine.

WARNING 4: Crush Hazards—Contact with the turning cylinder can crush your limbs. The cylinder will repel any object you try to stop it with, possibly causing the object to strike or stab you. The turning cylinder is normally isolated by the locked cylinder door.

- Do not attempt to open the door or reach into the cylinder until the cylinder is stopped.
- Do not place any object in the turning cylinder.
- Do not operate the machine with a malfunctioning door interlock.

WARNING 5: Confined Space Hazards—Confinement in the cylinder can kill or injure you. Hazards include but are not limited to panic, burns, poisoning, suffocation, heat prostration, biological contamination, electrocution, and crushing.

- Do not attempt unauthorized servicing, repairs, or modification.

WARNING 6: Explosion and Fire Hazards—Flammable substances can explode or ignite in the cylinder, drain trough, or sewer. The machine is designed for washing with water, not any other solvent. Processing can cause solvent-containing goods to give off flammable vapors.

- Do not use flammable solvents in processing.
- Do not process goods containing flammable substances. Consult with your local fire department/public safety office and all insurance providers.

4. Safety Alert Messages—Unsafe Conditions [Document BIUUUS14]

4.1. Damage and Malfunction Hazards

4.1.1. Hazards Resulting from Inoperative Safety Devices

DANGER 7: Entangle and Sever Hazards—Cylinder door interlock—Operating the machine with a malfunctioning door interlock can permit opening the door when the cylinder is turning and/or starting the cycle with the door open, exposing the turning cylinder.

- Do not operate the machine with any evidence of damage or malfunction.

WARNING 8: Multiple Hazards—Operating the machine with an inoperative safety device can kill or injure personnel, damage or destroy the machine, damage property, and/or void the warranty.

- Do not tamper with or disable any safety device or operate the machine with a malfunctioning safety device. Request authorized service.

WARNING 9: Electrocution and Electrical Burn Hazards—Electric box doors—Operating the machine with any electric box door unlocked can expose high voltage conductors inside the box.

- Do not unlock or open electric box doors.

WARNING 10: Entangle and Crush Hazards—Guards, covers, and panels—Operating the machine with any guard, cover, or panel removed exposes moving components.

- Do not remove guards, covers, or panels.

4.1.2. Hazards Resulting from Damaged Mechanical Devices

WARNING 11: Multiple Hazards—Operating a damaged machine can kill or injure personnel, further damage or destroy the machine, damage property, and/or void the warranty.

- Do not operate a damaged or malfunctioning machine. Request authorized service.

WARNING 12: Explosion Hazards—Cylinder—A damaged cylinder can rip apart during extraction, puncturing the shell and discharging metal fragments at high speed.

- Do not operate the machine with any evidence of damage or malfunction.

WARNING 13: Explosion Hazards—Clutch and speed switch (multiple motor machines)—A damaged clutch or speed switch can permit the low speed motor to engage during extract. This will over-speed the motor and pulleys and can cause them to rip apart, discharging metal fragments at high speed.

- Stop the machine immediately if any of these conditions occur: • abnormal whining sound during extract • skidding sound as extract ends • clutches remain engaged or re-engage during extract

4.2. Careless Use Hazards

4.2.1. Careless Operation Hazards—Vital Information for Operator Personnel (see also operator hazards throughout manual)

WARNING 14: Multiple Hazards—Careless operator actions can kill or injure personnel, damage or destroy the machine, damage property, and/or void the warranty.

- Do not tamper with or disable any safety device or operate the machine with a malfunctioning safety device. Request authorized service.
- Do not operate a damaged or malfunctioning machine. Request authorized service.
- Do not attempt unauthorized servicing, repairs, or modification.
- Do not use the machine in any manner contrary to the factory instructions.
- Use the machine only for its customary and intended purpose.
- Understand the consequences of operating manually.

4.2.2. Careless Servicing Hazards—Vital Information for Service Personnel (see also service hazards throughout manuals)

WARNING 15: Electrocution and Electrical Burn Hazards—Contact with electric power can kill or seriously injure you. Electric power is present inside the cabinetry unless the main machine power disconnect is off.

- Do not service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- Abide by the current OSHA lockout/tagout standard when lockout/tagout is called for in the service instructions. Outside the USA, abide by the OSHA standard in the absence of any other overriding standard.

WARNING 16: Entangle and Crush Hazards—Contact with moving components normally isolated by guards, covers, and panels, can entangle and crush your limbs. These components move automatically.

- Do not service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- Abide by the current OSHA lockout/tagout standard when lockout/tagout is called for in the service instructions. Outside the USA, abide by the OSHA standard in the absence of any other overriding standard.

WARNING 17: Confined Space Hazards—Confinement in the cylinder can kill or injure you. Hazards include but are not limited to panic, burns, poisoning, suffocation, heat prostration, biological contamination, electrocution, and crushing.

- Do not enter the cylinder until it has been thoroughly purged, flushed, drained, cooled, and immobilized.

— End of BIUUUS27 —

About the Forces Transmitted by Milnor® Washer-extractors

Document BIWUUI02
Specified Date 20001108
As-of Date 20001108
Access Date 20001108

Applicability ..... WUU

During washing and extracting, all washer-extractors transmit both static and dynamic (cyclic) forces to the floor, foundation, or any other supporting structure. During washing, the impact of the goods as they drop imparts forces which are quite difficult to quantify. Size for size, both rigid and flexibly-mounted machines transmit approximately the same forces during washing. During extracting, rigid machines transmit forces up to 30 times greater than equivalent flexibly-mounted models. The actual magnitude of these forces vary according to several factors:

- machine size,
- final extraction speed,
- amount, condition, and type of goods being processed,
- the liquor level and chemical conditions in the bath preceding extraction, and
- other miscellaneous factors.

Estimates of the maximum force normally encountered are available for each Milnor® model and size upon request. Floor or foundation sizes shown on any Milnor® document are only for on-grade situations based only on previous experience without implying any warranty, obligation, or responsibility on our part.

1. Rigid Machines

Size for size, rigid washer-extractors naturally require a stronger, more rigid floor, foundation, or other supporting structure than flexibly-mounted models. If the supporting soil under the slab is itself strong and rigid enough and has not subsided to leave the floor slab suspended without support, on grade installations can often be made directly to an existing floor slab if it has enough strength and rigidity to safely withstand our published forces without transmitting undue vibration. If the subsoil has subsided, or if the floor slab itself has insufficient strength and rigidity, a deeper foundation, poured as to become monolithic with the floor slab, may be required. Support pilings may even be required if the subsoil itself is “springy” (i.e., if its resonant frequency is near the operating speed of the machine). Above-grade installations of rigid machines also require a sufficiently strong and rigid floor or other supporting structure as described below.

2. Flexibly-mounted Machines

Size for size, flexibly-mounted machines generally do not require as strong a floor, foundation, or other supporting structure as do rigid machines. However, a floor or other supporting structure having sufficient strength and rigidity, as described in section 3, is nonetheless vitally important for these models as well.

3. How Strong and Rigid?

Many building codes in the U.S.A. specify that laundry floors must have a minimum live load capacity of 150 pounds per square foot (732 kilograms per square meter). However, even compliance with this or any other standard does not necessarily guarantee sufficient rigidity. In any event, it is the sole responsibility of the owner/user to assure that the floor and/or any other supporting structure exceeds not only all applicable building codes, but also that the floor and/or any other supporting structure for each washer-extractor or group of washer-extractors actually

has sufficient strength and rigidity, plus a reasonable factor of safety for both, to support the weight of all the fully loaded machine(s) including the weight of the water and goods, and including the published 360º rotating sinusoidal RMS forces that are transmitted by the machine(s). Moreover, the floor, foundation, or other supporting structure must have sufficient rigidity (i.e., a natural or resonant frequency many times greater than the machine speed with a reasonable factor of safety); otherwise, the mentioned 360º rotating sinusoidal RMS forces can be multiplied and magnified many times. It is especially important to consider all potential vibration problems that might occur due to all possible combinations of forcing frequencies (rotating speeds) of the machine(s) compared to the natural frequencies of the floor and/or any other supporting structure(s). A qualified soil and/or structural engineer must be engaged for this purpose.

Figure 1: How Rotating Forces Act on the Foundation

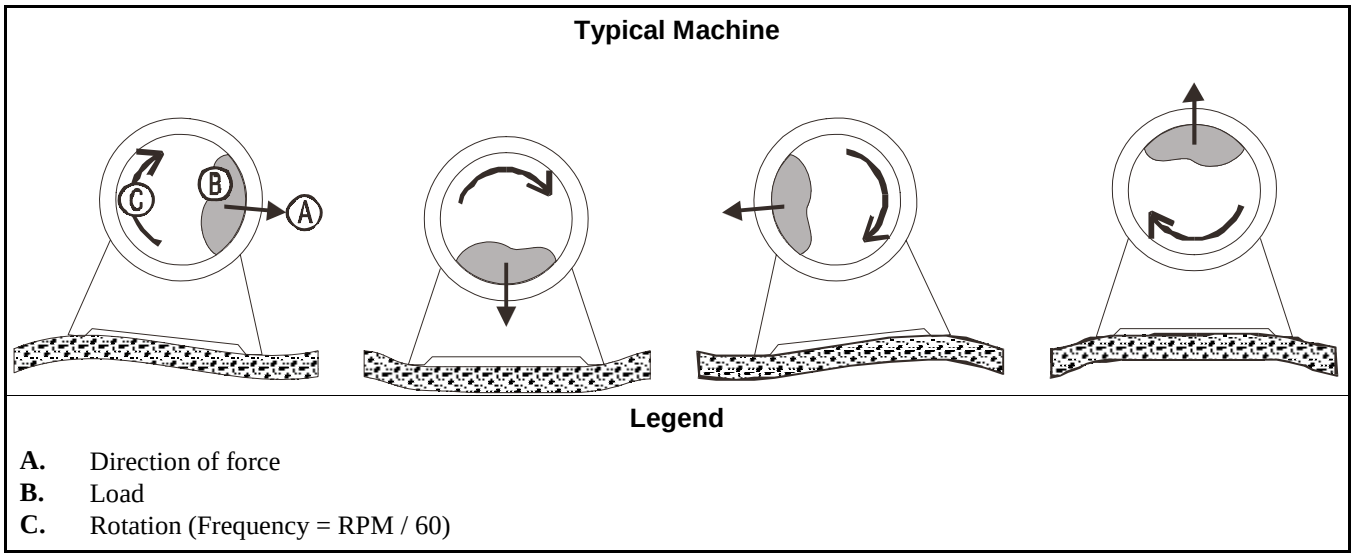


Figure 1 above is intended to depict both on-grade and above-grade installations and is equally applicable to flexibly-mounted washer-extractors, as well as to rigid models installed either directly on a floor slab or on a foundation poured integrally with the slab. Current machine data is available from Milnor® upon request. All data is subject to change without notice and may have changed since last printed. It is the sole responsibility of every potential owner to obtain written confirmation that any data furnished by Milnor® applies for the model(s) and serial number(s) of the specific machines.

— End of BIWUUI02 —

Glossary of Tag Illustrations— G-Style, 30" T-Style, & 30" V-Style Washer-Extractors

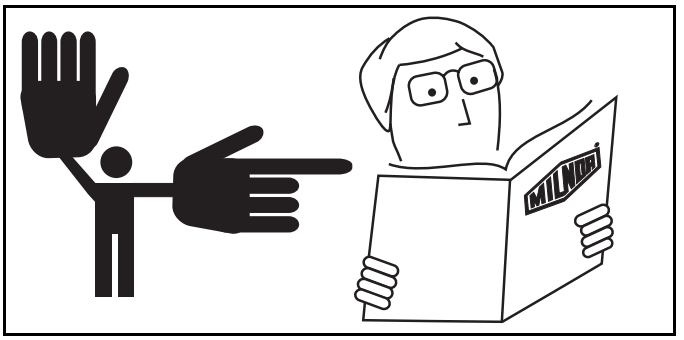
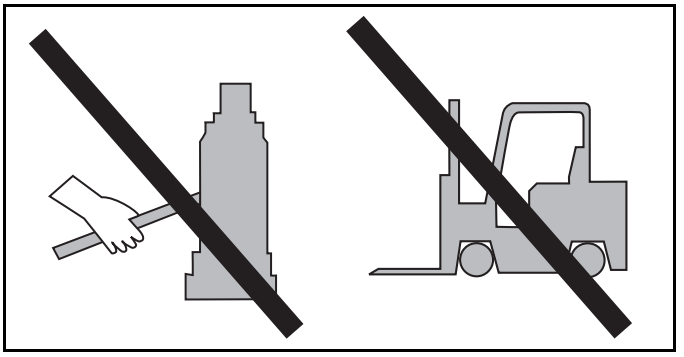
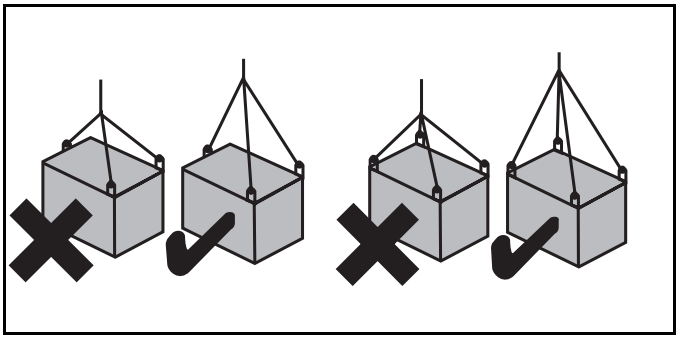
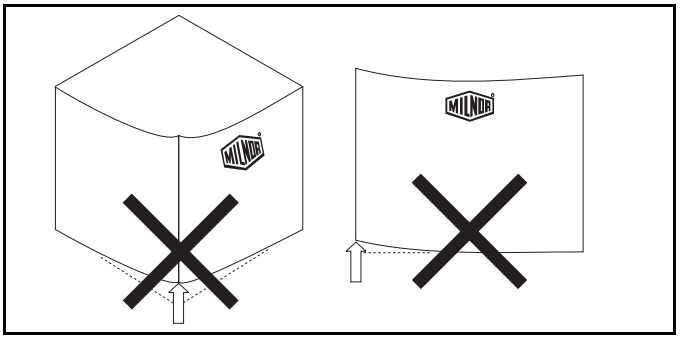
Illustration	Explanation
	Stop! Read the manual first for complete instructions before continuing.
	Do not jack the machine here. Do not lift the machine here.
	Use three point or four point lifting as determined by the lifting eyes furnished. Rig the load using lifting cables of sufficient size and length to ensure cables are not over-stressed.
	Do not lift the machine from one corner or one side edge.

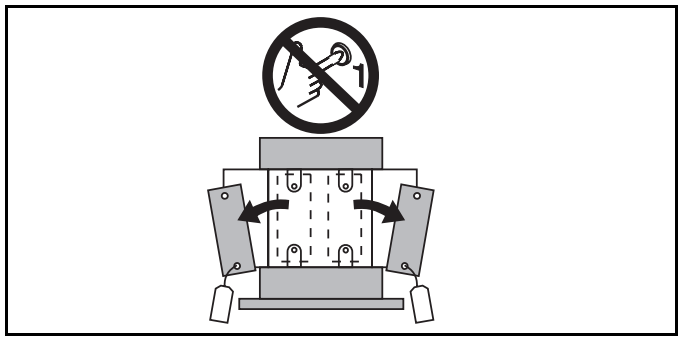
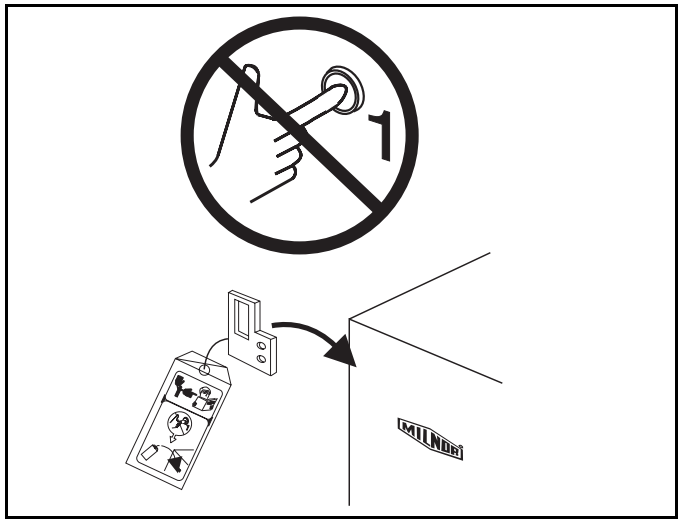
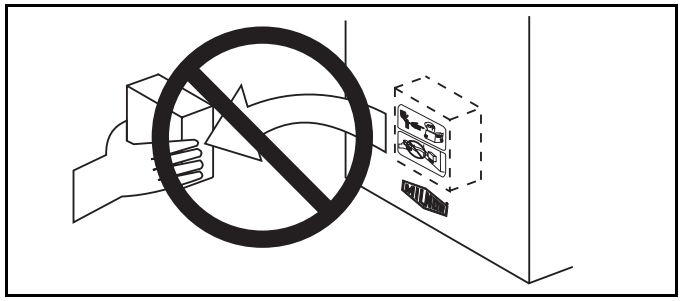
Illustration	Explanation
	Do not start this machine until the packing materials, lifting brackets, etc. with this tag attached or behind this panel are removed. These materials are painted red. Safety stands or brackets (also painted red) may be provided with this machine. Do not discard safety stands or brackets
	This motor or pump should rotate in the direction of the arrow.
	Do not start this machine until the part with this tag is installed on the machine.
	Do not remove this component from the machine.

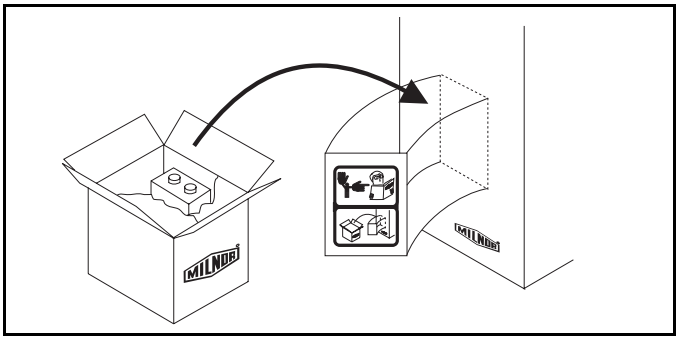
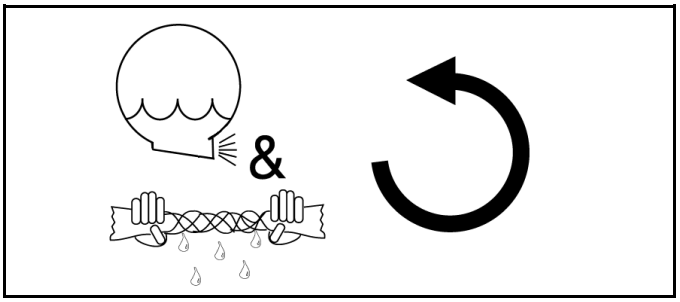
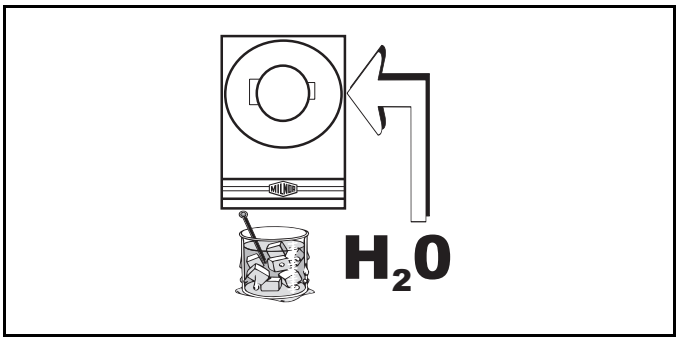
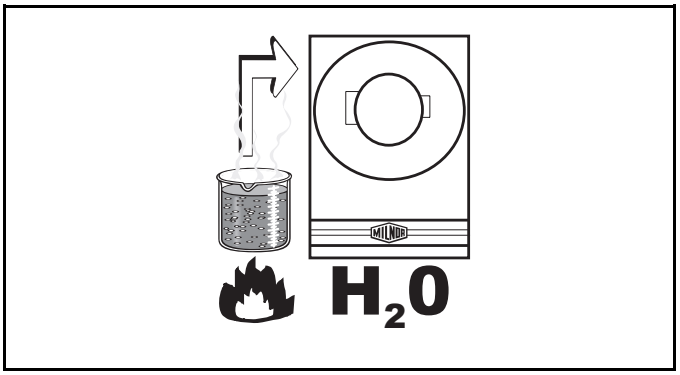
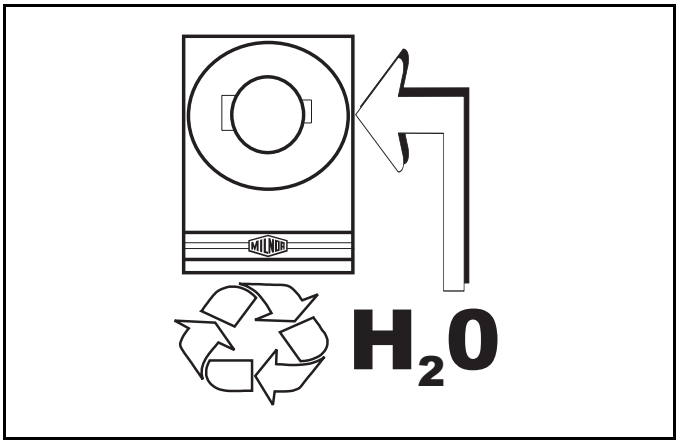
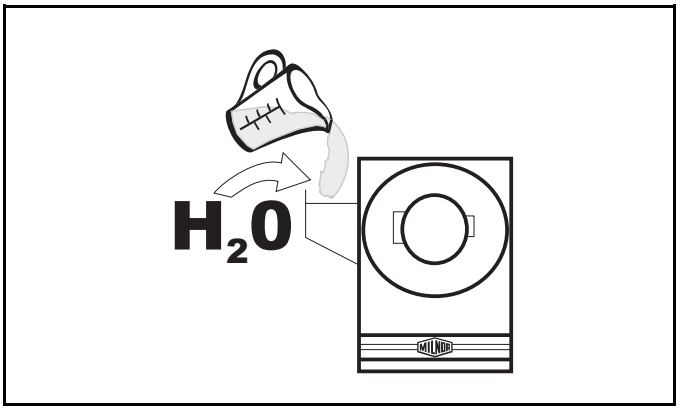
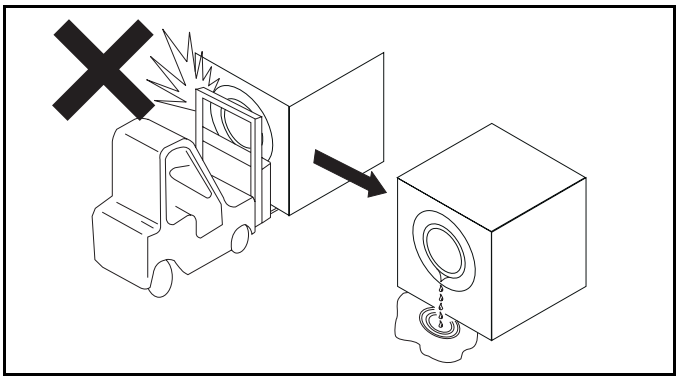
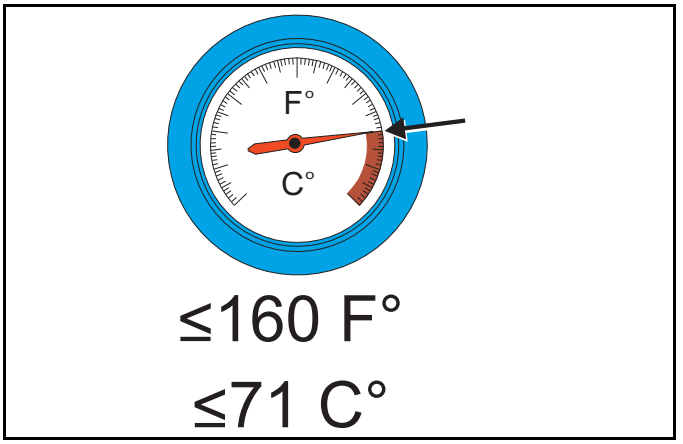
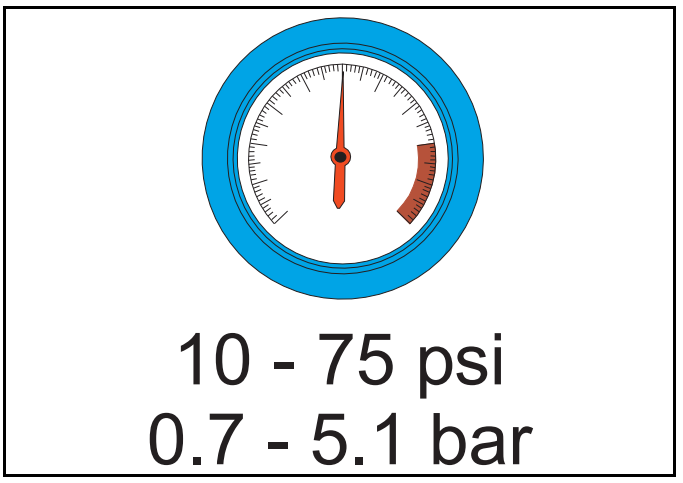
Illustration	Explanation
	Install the appropriate part here before operating the machine.
	During drain and extract, the cylinder must rotate counterclockwise when viewed from here (rear of machine).
	Make cold water connection here.
	Make hot water connection here.

Illustration	Explanation
	Make third (reuse) water connection here.
	Make flushing water connection here.
	Do not strike shell front of washer-extractors during fork lifting. Striking shell front will cause door to leak.
	Water hammer will rupture the water inlet valves on this machine. Eliminate water hammer on waterlines to this machine. Follow all applicable codes when installing water hammer arresters on water lines.



Excessive water temperture will damage valves. Do not exceed 160 degrees Fahrenheit (71 degrees Celsius).



Excessive air pressure will damage valves. Do not exceed 80 psi (5.5 bar).

Avoiding Damage From Allied Remote Chemical Delivery Systems

Milnor® does not manufacture or supply remote chemical delivery systems and this document is meant only to illustrate some of the possible problems that can be minimized during installation of such systems by the chemical supply company. Milnor washer-extractors and CBW® batch washers (tunnels) are available with convenient inlets for such systems (see Figure 1). Most common of the types of systems currently used in commercial laundering operations are pumped chemical systems. Other types, such as constant pressure, re-circulating ring main systems have also been, and may continue to be used with Milnor equipment.

This document warns about some of the possible hazards posed by chemical systems and lists certain requirements needed to minimize those hazards. The procedures for interfacing with allied chemical systems and information pertinent to chemical use in general are provided elsewhere in the product manuals (see Note 1).

Figure 1: Pumped Chemical Inlets on CBW Batch Washer

Note 1: Misuse of laundering chemicals (such as injecting excessive concentrations of chlorine bleach or permitting acid sours to react with hypo chlorite) due to incorrect formulation can also be hazardous. Information pertinent to chemical use is provided elsewhere in the product manuals.

1. How a Chemical System Can Damage the Machine It Serves

Milnor has manufactured washer-extractors and tunnel washers with the same stainless steel specification since its founding. Every batch of steel used is certified and documented by the steel mill. Testing of samples damaged by corrosion have, in every case, proven the steel to be well within the AISI 304 specification.

Chemical products commonly found in the laundry industry, when used in **established** dosages and proper operating parameters, under the auspices of an experienced chemical specialist, should produce satisfactory results, with no consequential detrimental effects. The industry has published standards in Riggs and Sherrill, “Textile Laundering Technology”. However, the stainless steel can be damaged and even destroyed by **abnormal** contact with chlorine bleach, hydrofluosilicic acid and other commonly used chemicals, as will occur if chemicals are unintentionally leaked into the machine, particularly when it is no longer in use and especially when machine surfaces are dry.

Some chemical systems have been found to permit chemicals to dribble from the supply lines, or worse, to siphon from the supply tank into the machine, during operation and long after the system is shut down—as after working hours and during weekends. If this occurs, **deterioration (rusting) of the stainless steel and damage to any textiles therein will inevitably result. If this condition goes undetected, machine damage is likely to be catastrophic.** No machine is immune to such damage.

CAUTION 1: Equipment and Textile Damage Hazards—Chemicals leaked into the machine, particularly when it is idle can destroy machine components and textiles left in the machine. **Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its equipment or to textiles therein from abnormal contact with chemicals.**

- Ensure that the chemical system prevents unintentional release of chemicals.
- Inspect regularly for proper operation and evidence of damage.

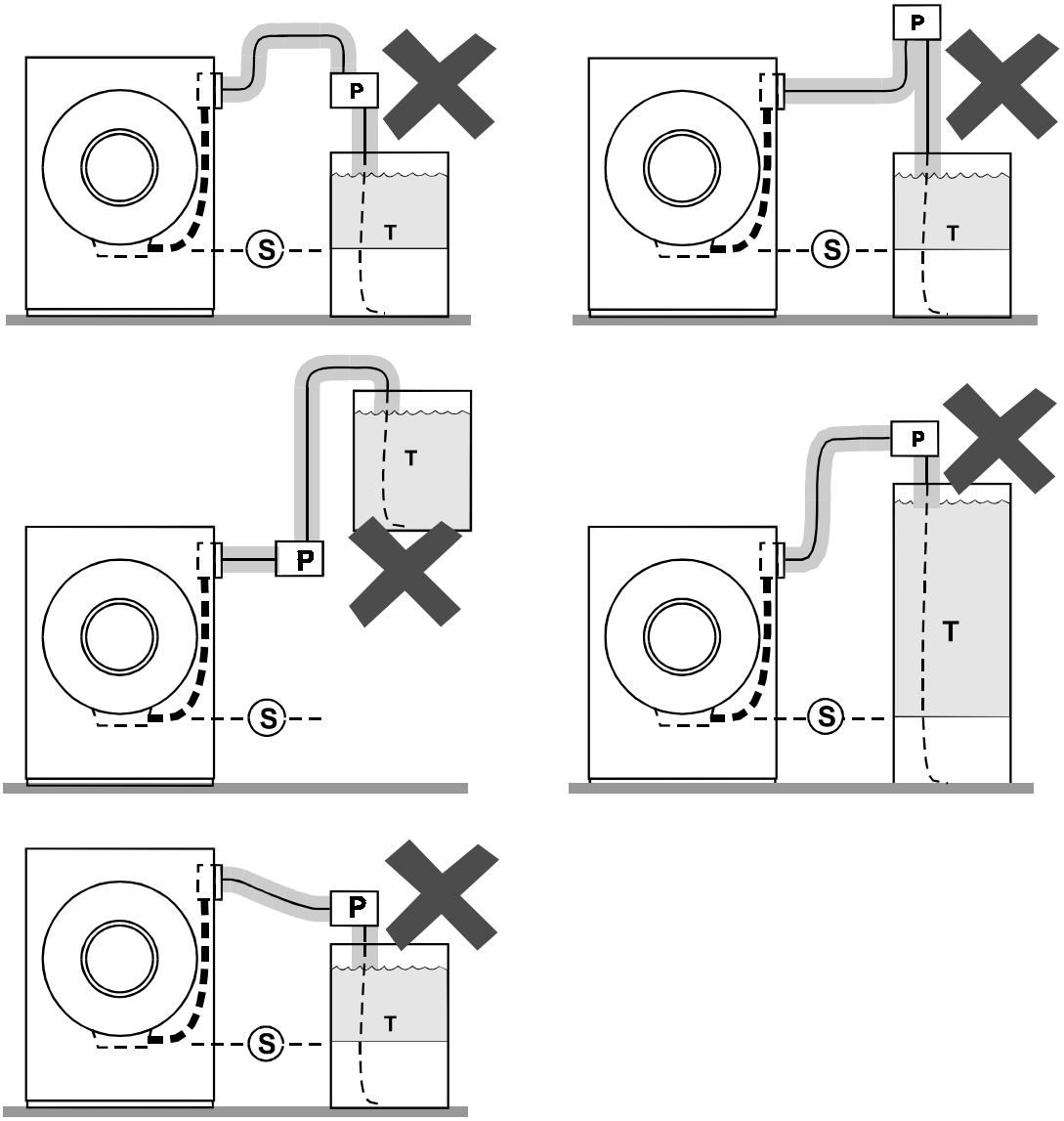
2. Requirements for Chemical Systems Used With Milnor Machines

It is the responsibility of the chemical system manufacturer and supplier to ensure that their system is safe for personnel and equipment. Some important points are described below.

2.1. Ensure the System Cannot Siphon.—The supply system must be designed to counteract any siphoning that could occur as a result of having a sealed supply line between the bottom of the chemical tank and the internal machine connection at the drain trough. As shown in the Figure 2 examples, if the pump (P) and/or the valving does not provide positive closure and there is no vacuum breaker protection, siphoning is likely to occur. In each of the Figure 2 illustrations, the volume of chemical in the tank above the siphon level (S), and indicated by shading, will flow into the machine.

Figure 2: Siphoning From the Chemical Tank into the Machine

Examples

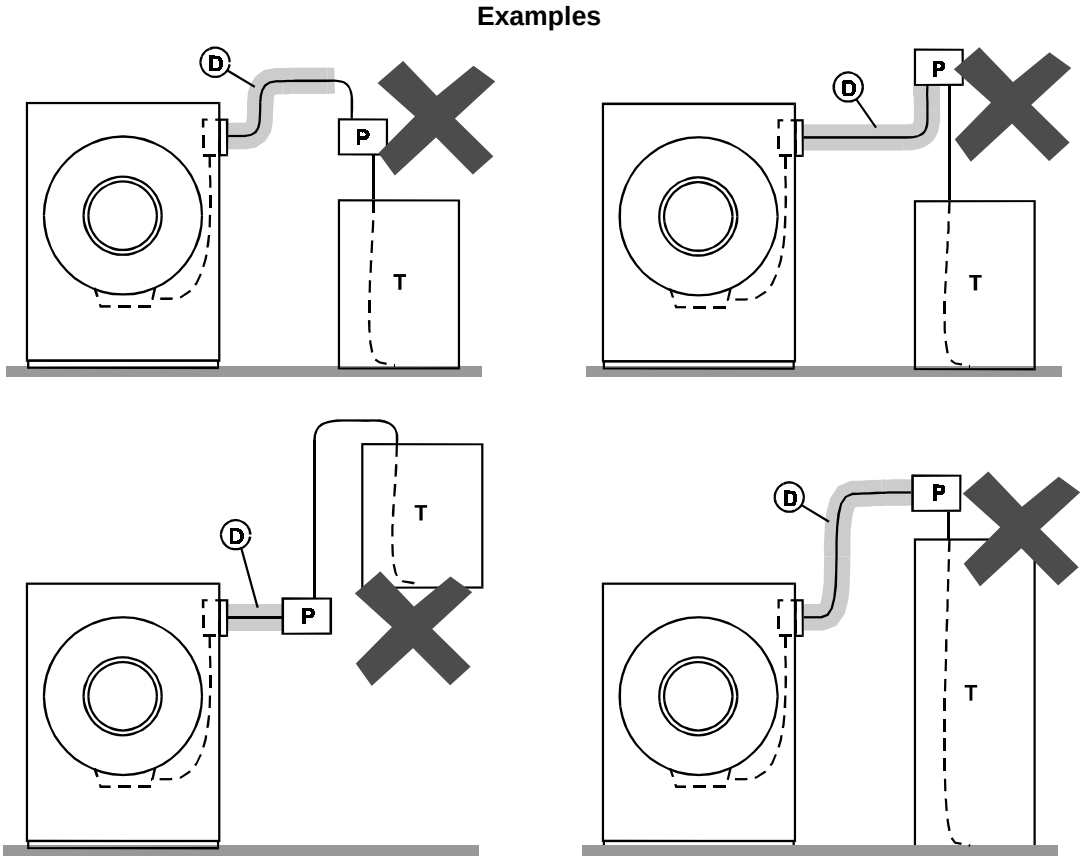


Legend

P. Pump
S. Siphon level. Shading indicates the chemical delivery line and tank content that can siphon into the machine.
T. Chemical tank

2.2. Ensure the Chemical Lines Cannot Dribble—The pumped chemical system may provide a means of positively closing the chemical line at the pump location, but not at the injection site. Hence, any concentrated chemical that remains in the injection line between the pump and the machine is free to flow into the machine. Some examples of this are shown in Figure 3.

Figure 3: Dribbling From Chemical Supply Line Into Machine (assumes positive closure at the pump)



Legend

D. Portion of supply line, the contents of which can dribble into the machine
P. Pump
T. Chemical tank

3. Design and Installation Recommendations

It is the responsibility of the chemical system manufacturer and supplier to use whatever measures are necessary to ensure that their system is safe for personnel and equipment. The following are some of the possible methods the manufacturer or supplier may wish to use, as appropriate.

3.1. Siphoning: Positively close the line.—If the pump does not provide positive closure when the system is off, employ a shutoff valve in the line to serve this purpose.

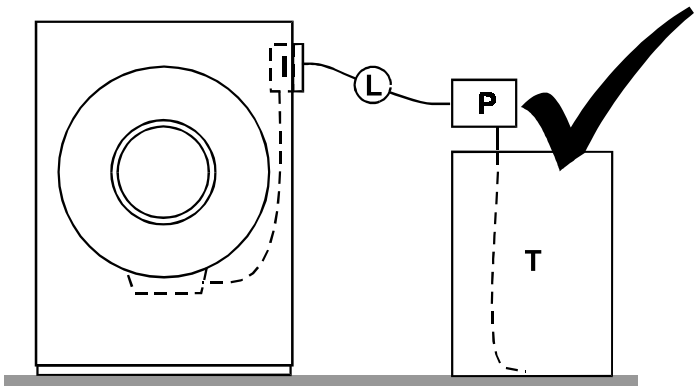
3.2. Siphoning: Break the siphon.—Provide an air gap or vacuum breaker in the chemical delivery line. This must be located above the "full" line of the tank.

3.3. Dribbling: Flush the entire chemical delivery line.—If any concentrated chemical that remains in the injection line between the pump and the machine is free to flow into the machine, employ a system that flushes the entire line between the pump and the injection point with fresh water after each injection.

3.4. Dribbling: Locate the entire chemical line below the machine inlet.—Assuming the chemical system does not retain any line pressure and that the pump provides positive closure when the system is off, locate the entire chemical delivery line below the level of the chemical inlet. An example of this is shown in Figure 4.

Figure 4: Locating a Pumped Chemical System With Positive Closure To Protect Against Machine Damage

Example of Correct Placement



Legend

I. Chemical inlet on machine
L. Chemical delivery line
P. Pump with positive closure when system is off
T. Chemical tank

4. Guarding Against Leaks

All personnel who may work with the chemical system (e.g., chemical system manufacturer, chemical system supplier, chemical supplier, operator, maintenance personnel) should be vigilant in observing for leaks in the system. When connecting, or reconnecting chemical lines, whether at installation, after taking samples, or when replacing components, at a minimum ensure that:

1. the proper components are used,
2. all connections are the proper fit, and
3. all components are securely connected.

CAUTION 2: Injury and Damage Hazards—Chemicals leaking from a chemical system may be corrosive or toxic. Such chemicals can injure personnel and damage equipment.

- Use care when connecting chemical lines.
- Inspect regularly for leaks.

— End of BIWUUI03 —

Section 1

Service and Maintenance

PREVENTIVE MAINTENANCE

As required by the warranty, to ensure safe operation, and to achieve optimum performance and service life from Milnor® washer-extractors, **the schedules, instructions, and precautions herein must be strictly followed.**

Preventive Maintenance Schedule

Component	Procedure	Frequency	Info. Source
Door interlock (coin machines)	Test functioning for safe operation.	daily	MSOP0512AE in Operating and Troubleshooting Manual
Electronic coin counter (coin machines)	Test functioning for safe operation.	monthly	
Main bearing housing	Change lubricant. Check rear bolt tightness and adjust if necessary.	every four months	this section (see FIGURE 1)
Foundation bolts	Check bolt tightness and wear. Adjust or replace if necessary.	every four months	dimensional drawing (see NOTE 1)
Drive train	Check belt tension and wear. Check pulleys and other drive components for wear. Replace if necessary.	every four months	MSSM0706BE (see NOTE 1)
3/5 Compartment Supply injector (if so equipped)	Inspect and clean strainers in water valves, and each compartment. If rust is detected, carefully clean it away once each week.	every four months	BMP770149 BMP920019 (see NOTE 2)
Steam strainer (if so equipped)	Inspect and clean strainer.	every four months	BMP920015 (see NOTE 2)

NOTE 1: See Table of Contents for information not in this section.
NOTE 2: Drawings apply only to 30015Mxx, and Sxx; 30020Mxx; 30022Mxx, and Sxx models.

Main Bearing Housing Preventive Maintenance

⚠ DANGER ⚠

ELECTROCUTION HAZARD—High voltage is present inside electric boxes, motors, and many other components. Power switches on machine disable only control circuit power in certain boxes. You can be killed or seriously injured on contact with high voltage.

☞ **Lock OFF and tag out power at the wall disconnect before servicing.**

⚠ WARNING ⚠

ENTANGLE AND CRUSH HAZARD—Belts and pulleys can entangle and crush body parts.

- ☞ **Lock OFF and tag out power at the wall disconnect before servicing, except where specifically instructed otherwise in this section.**
- ☞ **Permit only qualified maintenance personnel to perform these procedures.**

Lubrication Procedures—See the appropriate *main bearing assembly* drawing (if provided) during this procedure (see Table of Contents).

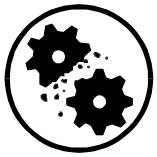
1. Remove the console top by prying out the four plugs from each corner on the top of the machine and removing the four bolts. Remove the belt guard.
2. Remove the drain plug on the bottom of the main bearing housing and allow the bearing housing to drain completely. Inspect the leak-off, drained oil, and magnetic drain plug for water and/or metal particles. Water and/or metal particles can indicate worn or damaged seals and bearings. See "REPLACING MAIN BEARINGS AND SEALS," if provided (see Table of Contents). Install the drain plug.
3. Locate the two 1/2" plastic tubes secured to the frame. Clean the surrounding area and remove the cork stoppers from each.

⚠ CAUTION ⚠

MALFUNCTION HAZARD—Oil spilled on components may cause machine malfunction.

- ☞ **Refill bearing housing carefully.**

⚠ CAUTION ⚠



MACHINE DAMAGE HAZARD—Mixing incompatible lubricants will result in severe machine damage.

- ☞ **DO NOT mix different base lubricants.**
- ☞ **Before using a non-specified lubricant, consult the lubricant manufacturer to determine compatibility.**

4. Strictly following lubrication specifications, refill the bearing housing. After refilling the bearing housing, reinstall the cork stoppers and clean any excess lubricant from the machine.

Lubrication Specifications

Component	Lubricant/Type	Amount of Lubricant
Main bearing housing	Any high quality SAE 30, 40, or 50 (ISO 100, 140, or 220) single weight heavy duty motor oil, non-detergent if available	22 ounces (623.7 grams)

Bolt Inspection

Check the main bearing support bolts for tightness as shown in FIGURE 1.

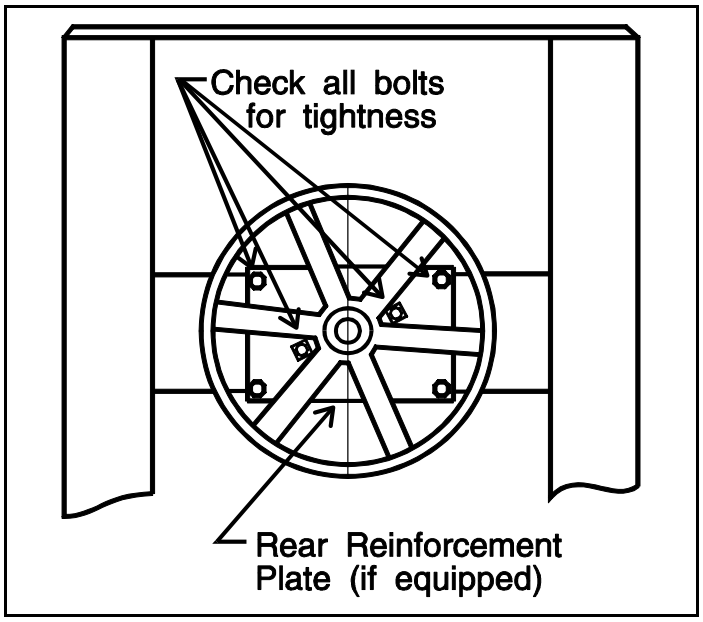


FIGURE 1 (MSSM0705CE)
Main Bearing Housing
Bolt Locations

FASTENER TORQUE REQUIREMENTS

The specifications in this section apply to 1/4 inch and larger Unified National fine and coarse fasteners used on Milnor® machines. This information is to be used only when torque specifications are not stated in the installation or service instructions.

When tightening applicable fastener, abide by the following precautions:

1. Always use new fasteners. Replace bolts, nuts, flat washers, and lock washers in the order shown on the parts drawing.

2. Unless otherwise specified, use:

- Loctite® 271 threadlocker or equivalent for bearing housing mounting bolts from one half to one inch in diameter.
- Loctite® 277 threadlocker or equivalent for bearing housing mounting bolts of one inch diameter or larger.
- Loctite® 242 threadlocker for all other fasteners requiring thread locking compound.

3. Use a torque wrench to assure proper tightness.

4. Never lubricate fasteners. The values specified herein are maximum recommended torques and are calculated from published ASTM and SAE data. Actual allowable torques are application dependent and can vary for many reasons, (joint types, gaskets, etc.). Use these values as a guide.

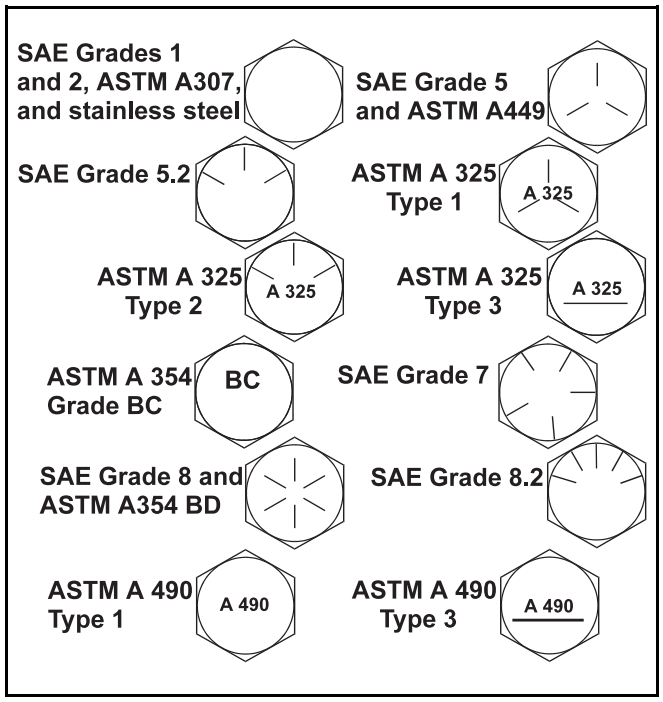


FIGURE 1 (MSSM0101CE)
Fastener Grade Markings

5. Although FIGURE 1 depicts hex head bolts, the table applies to all head types.

Fasteners and Threadlocker

How Fasteners Loosen—Standard threaded fasteners are manufactured with a clearance fit for easy assembly. With the fastener at the proper torque, 85% of the tightening torque is absorbed in the threads and under the fastener head. The remaining 15% provides the friction that prevents the thread from slipping. When this friction is overcome (by bending, thermal expansion, internal pressures, functional loads, or impact) the thread slips and loosens. Although higher torques reduce the likelihood of thread slippage, if slippage occurs, the threads unwind and the fastener loosens. Once thread slippage begins, vibration increases the rate of loosening.

Preventing Loosening—The most effective way to prevent loosening of threaded parts is by proper application of a threadlocking compound. Threadlocker provides lubrication during assembly, then hardens to seal the threads against corrosion and provide resistance to thread slippage.

Applying Threadlocker

NOTE: The following threadlocker information and illustrations are excerpts from the Loctite® User's Guide and are used with permission.

For maximum strength, threadlocker must fill the thread voids completely, as shown in FIGURE 2. Organic or petroleum solvent will remove excess uncured adhesive from joints. Consult information below for the specific fastener application.

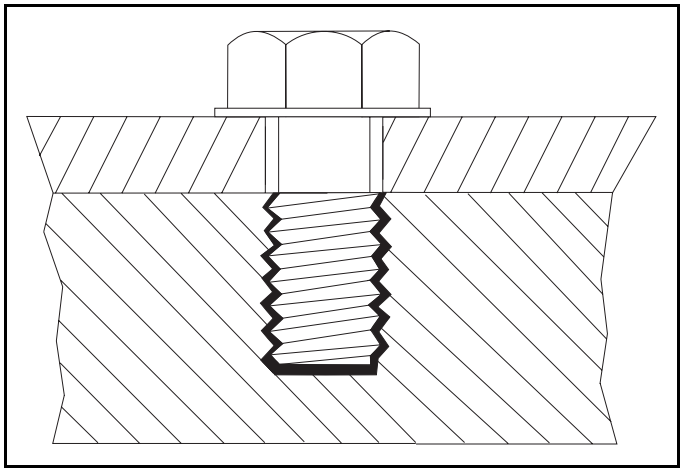


FIGURE 2 (MSSM0101CE)
Correct Threadlocker Use

Bolts and Nuts—See FIGURE 3.

1. Clean all threads (bolt and nut) with cleaning solvent.
2. Spray all threads with Loctite® Primer N. Allow to dry.
3. Insert bolt into through hole assembly.
4. Apply several drops of threadlocker onto bolt engagement area.
5. Assemble and tighten nut to correct torque for the threadlocker.

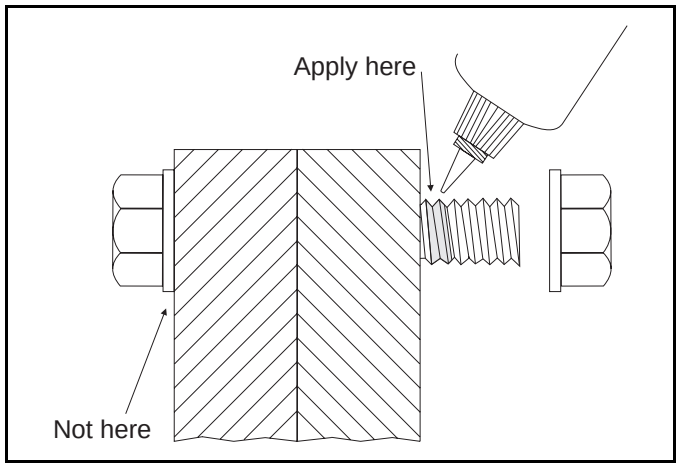


FIGURE 3 (MSSM0101CE)
Applying Threadlocker to Through Hole

Blind Holes—See FIGURE 4.

1. Clean all threads (bolt and nut) with cleaning solvent.
2. Spray all threads with Loctite® Primer N. Allow to dry.
3. Squirt several drops down female threads into bottom of hole.
4. Apply several drops to bolt.
5. Tighten to correct torque for the threadlocker.

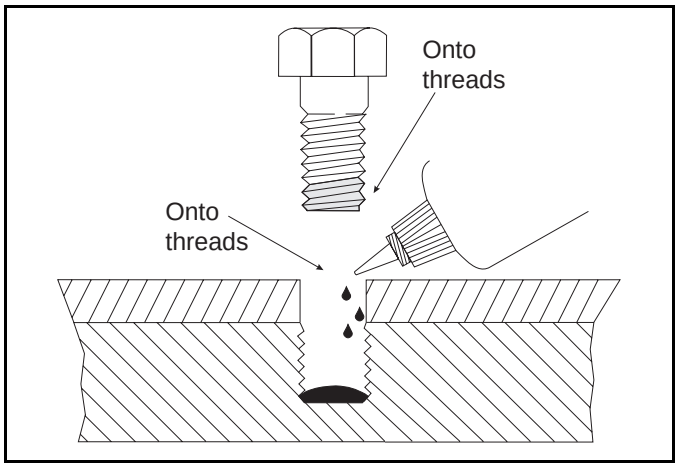


FIGURE 4 (MSSM0101CE)
Applying Threadlocker to Blind Holes

Removing Fasteners

High strength threadlockers like Loctite® 271 (or equivalent) may be weakened by heating to at least 500° F (260° C) as follows.

1. Apply localized heat to fastener as shown in FIGURE 5.
2. Disassemble while hot. Once disassembled, the cured adhesive can be removed with Loctite® Gasket Remover #790 (or equivalent).

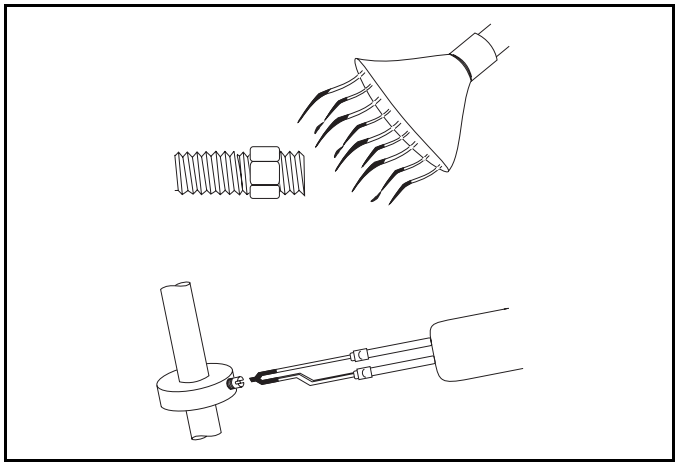


FIGURE 5 (MSSM0101CE)
Removing High Strength Threadlocker

Carbon Steel Fasteners

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1/4 - 20	SAE Grade 1 ASTM A307	2.5 (3.39)	3.0 (4.06)	3.3 (4.47)	3.6 (4.88)	4.6 (6.23)	4.3 (5.83)	3.3 (4.47)
	SAE Grade 2	4.1 (5.56)	4.9 (6.64)	5.5 (7.45)	6.0 (8.13)	7.7 (10.44)	7.1 (9.63)	5.5 (7.46)
	SAE Grade 4	4.8 (6.50)	5.8 (7.86)	6.4 (8.67)	7.0 (9.49)	9.0 (12.20)	8.3 (11.25)	6.4 (8.67)
	SAE Grade 5 ASTM A449	6.3 (8.54)	7.6 (10.3)	8.4 (11.38)	9.3 (12.60)	11.8 (15.99)	11.0 (14.91)	8.4 (11.39)
	SAE Grade 7	7.9 (10.7)	9.4 (12.7)	10.5 (14.23)	11.5 (15.59)	14.7 (19.93)	13.6 (18.44)	10.5 (14.23)
	SAE Grade 8 ASTM A354 Grade BD	8.9 (12.0)	10.7 (14.5)	11.9 (16.13)	13.1 (17.76)	16.6 (22.50)	15.4 (20.88)	11.9 (16.13)
	ASTM A354 Grade BC	7.9 (10.7)	9.4 (12.7)	10.5 (14.23)	11.5 (15.59)	14.7 (19.93)	13.6 (18.44)	10.5 (14.23)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1/4 - 28	SAE Grade 1 ASTM A307	2.8 (3.80)	3.4 (4.61)	3.8 (5.15)	4.1 (5.56)	5.3 (7.18)	4.9 (6.64)	3.8 (5.15)
	SAE Grade 2	4.7 (6.37)	5.6 (7.60)	6.3 (8.54)	6.9 (9.36)	8.8 (11.93)	8.1 (10.98)	6.3 (8.54)
	SAE Grade 4	5.5 (7.46)	6.6 (8.95)	7.3 (9.90)	8.1 (10.98)	10.3 (13.96)	9.5 (12.88)	7.3 (9.90)
	SAE Grade 5 ASTM A449	7.3 (9.90)	8.7 (11.80)	9.7 (13.15)	10.7 (14.50)	13.6 (18.44)	12.6 (17.08)	9.7 (13.15)
	SAE Grade 7	8.9 (12.07)	10.7 (14.50)	11.9 (16.13)	13.1 (17.76)	16.6 (22.51)	15.4 (20.88)	11.9 (16.13)
	SAE Grade 8 ASTM A354 Grade BD	10.2 (13.83)	12.2 (16.54)	13.6 (18.44)	15.0 (20.34)	19.0 (25.76)	17.7 (23.99)	13.6 (18.44)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
5/16 - 18	SAE Grade 1 ASTM A307	5.1 (6.91)	6.2 (8.40)	6.8 (9.22)	7.5 (10.17)	9.6 (13.02)	8.9 (12.07)	6.8 (9.22)
	SAE Grade 2	8.5 (11.52)	10.2 (13.83)	11.3 (15.32)	12.5 (16.95)	15.9 (21.56)	14.7 (19.93)	11.3 (15.32)
	SAE Grade 4	10.0 (13.56)	12.0 (16.27)	13.3 (18.03)	14.6 (19.79)	18.6 (25.22)	17.3 (23.46)	13.3 (18.03)
	SAE Grade 5 ASTM A449	13.0 (17.63)	15.6 (21.15)	17.4 (23.60)	19.1 (25.90)	24.3 (32.95)	22.6 (30.64)	17.4 (23.60)
	SAE Grade 7	16.1 (21.83)	19.3 (26.17)	21.5 (29.15)	23.6 (31.99)	30.1 (40.81)	27.9 (37.83)	21.5 (29.15)
	SAE Grade 8 ASTM A354 Grade BD	18.5 (25.08)	22.1 (29.96)	24.6 (33.35)	27.1 (36.74)	34.5 (46.78)	32.0 (43.39)	24.6 (33.35)
	ASTM A354 Grade BC	16.1 (21.83)	19.3 (26.17)	21.5 (29.15)	23.6 (31.99)	30.1 (40.81)	27.9 (37.83)	21.5 (29.15)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc orCadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
5/16 - 24	SAE Grade 1 ASTM A307	5.6 (7.59)	6.7 (9.08)	7.4 (10.03)	8.2 (11.12)	10.4 (14.10)	9.6 (13.01)	7.4 (10.03)
	SAE Grade 2	9.4 (12.74)	11.3 (15.32)	12.5 (16.94)	13.8 (18.71)	17.5 (23.73)	16.3 (22.09)	12.5 (16.94)
	SAE Grade 4	11.0 (14.91)	13.2 (17.90)	14.6 (19.79)	16.1 (21.83)	20.5 (27.79)	19.0 (25.76)	14.6 (19.79)
	SAE Grade 5 ASTM A449	14.4 (19.52)	17.2 (23.32)	19.1 (25.90)	21.1 (28.60)	26.8 (36.35)	24.9 (33.76)	19.1 (25.90)
	SAE Grade 7	17.9 (24.27)	21.4 (29.01)	23.8 (32.27)	26.2 (35.52)	33.4 (45.28)	31.0 (42.03)	23.8 (32.27)
	SAE Grade 8 ASTM A354 Grade BD	20.4 (27.66)	24.4 (33.08)	27.1 (36.74)	29.9 (40.54)	38.0 (51.52)	35.3 (47.86)	27.1 (36.74)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
3/8 - 16	SAE Grade 1 ASTM A307	9.0 (12.20)	10.8 (14.64)	12.0 (16.27)	13.1 (17.76)	16.7 (22.64)	15.5 (21.01)	12.0 (16.27)
	SAE Grade 2	14.9 (20.20)	17.9 (24.27)	19.9 (26.98)	21.9 (29.69)	27.9 (37.83)	25.9 (35.11)	19.9 (26.98)
	SAE Grade 4	17.8 (24.13)	21.3 (28.88)	23.7 (32.13)	26.0 (35.25)	33.1 (44.87)	30.8 (41.76)	23.7 (32.13)
	SAE Grade 5 ASTM A449	23.2 (31.45)	27.8 (37.69)	30.9 (41.89)	34.0 (46.09)	43.3 (58.70)	40.2 (54.50)	30.9 (41.89)
	SAE Grade 7	28.7 (38.91)	34.4 (46.64)	38.2 (51.79)	42.0 (56.94)	53.5 (72.54)	49.7 (67.39)	38.2 (51.79)
	SAE Grade 8 ASTM A354 Grade BD	32.7 (44.33)	39.2 (53.15)	43.6 (59.11)	48.0 (65.08)	61.0 (82.70)	56.7 (76.87)	43.6 (59.11)
	ASTM A354 Grade BC	28.7 (38.91)	34.4 (46.64)	38.2 (51.79)	42.0 (56.94)	53.5 (72.54)	49.7 (67.39)	38.2 (51.79)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
3/8 - 24	SAE Grade 1 ASTM A307	10.2 (13.83)	12.2 (16.54)	13.6 (18.44)	15.0 (20.33)	19.0 (25.76)	17.7 (24.00)	13.6 (18.44)
	SAE Grade 2	16.9 (22.91)	20.3 (27.52)	22.5 (30.52)	24.8 (33.62)	31.5 (42.70)	29.3 (39.73)	22.5 (30.50)
	SAE Grade 4	20.0 (27.11)	24.0 (32.54)	26.7 (36.20)	29.4 (39.86)	37.4 (50.70)	34.7 (47.04)	26.7 (36.20)
	SAE Grade 5 ASTM A449	26.2 (35.52)	31.4 (42.57)	34.9 (47.32)	38.4 (52.06)	48.9 (66.30)	45.4 (61.55)	34.9 (47.32)
	SAE Grade 7	32.3 (43.79)	38.8 (52.60)	43.1 (58.44)	47.4 (64.26)	60.4 (81.89)	56.1 (76.06)	43.1 (58.43)
	SAE Grade 8 ASTM A354 Grade BD	36.9 (50.02)	44.3 (60.06)	49.2 (66.70)	54.1 (73.35)	68.9 (93.41)	64.0 (86.77)	49.2 (66.70)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium-Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
7/16 - 14	SAE Grade 1 ASTM A307	14.0 (18.98)	17.0 (23.04)	19.14 (25.95)	21.0 (28.47)	27.0 (36.60)	25.0 (33.89)	19.0 (25.76)
	SAE Grade 2	24.0 (32.54)	28.8 (39.05)	32.0 (43.39)	35.2 (47.72)	44.8 (60.74)	41.6 (56.40)	32.0 (43.39)
	SAE Grade 4	28.3 (38.37)	34.0 (46.10)	37.7 (51.11)	41.5 (56.27)	52.8 (71.59)	49.1 (66.57)	37.7 (51.11)
	SAE Grade 5 ASTM A449	37.1 (50.30)	44.5 (60.33)	49.5 (67.11)	54.4 (73.76)	69.3 (93.96)	64.3 (87.18)	49.5 (67.11)
	SAE Grade 7	45.9 (62.23)	55.1 (74.70)	61.3 (83.11)	67.4 (91.38)	85.8 (116.33)	79.6 (107.92)	61.3 (83.11)
	SAE Grade 8 ASTM A354 Grade BD	52.5 (71.18)	63.0 (85.41)	70.0 (94.90)	77.0 (104.40)	98.0 (132.87)	91.0 (123.38)	70.0 (94.90)
	ASTM A354 Grade BC	45.7 (61.96)	54.9 (74.43)	61.0 (82.70)	67.1 (90.97)	85.4 (115.79)	79.3 (107.52)	61.0 (82.70)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
7/16 - 20	SAE Grade 1 ASTM A307	16.0 (21.70)	19.2 (26.03)	21.3 (28.88)	23.5 (31.86)	29.9 (40.54)	27.7 (37.56)	21.3 (28.88)
	SAE Grade 2	26.9 (36.48)	32.2 (43.66)	35.8 (48.54)	39.4 (53.42)	50.1 (67.93)	46.6 (63.18)	35.8 (48.54)
	SAE Grade 4	31.6 (42.84)	37.9 (51.39)	42.1 (57.08)	46.3 (62.77)	59.0 (79.99)	54.7 (74.16)	42.1 (57.08)
	SAE Grade 5 ASTM A449	41.4 (56.13)	49.7 (67.38)	55.2 (74.84)	60.8 (82.43)	77.3 (104.80)	71.8 (97.35)	55.2 (74.84)
	SAE Grade 7	51.3 (69.55)	61.5 (83.38)	68.4 (92.74)	75.2 (101.96)	95.7 (129.75)	88.9 (120.53)	68.4 (92.74)
	SAE Grade 8 ASTM A354 Grade BD	58.2 (78.90)	69.9 (94.77)	77.7 (105.35)	85.4 (115.78)	108.7 (147.37)	101.0 (136.94)	77.7 (105.35)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1/2 - 13	SAE Grade 1 ASTM A307	22.0 (29.83)	26.0 (35.25)	29.38 (39.83)	32.0 (43.39)	41.0 (55.59)	38.0 (51.52)	29.0 (39.32)
	SAE Grade 2	36.6 (49.62)	43.9 (59.52)	48.8 (66.16)	53.6 (72.67)	68.3 (92.60)	63.4 (85.96)	48.8 (66.16)
	SAE Grade 4	43.1 (58.44)	51.8 (70.23)	57.5 (77.96)	63.3 (85.82)	80.5 (109.14)	74.8 (101.42)	57.5 (77.96)
	SAE Grade 5 ASTM A449	56.7 (76.87)	68.1 (92.33)	75.6 (102.5)	83.2 (112.80)	105.9 (143.58)	98.3 (133.27)	75.6 (102.50)
	SAE Grade 7	69.8 (94.64)	83.8 (113.62)	93.1 (126.23)	102.4 (138.84)	130.4 (176.80)	121.1 (164.19)	93.1 (126.23)
	SAE Grade 8 ASTM A354 Grade BD	79.7 (108.05)	95.6 (129.62)	106.3 (144.12)	116.9 (158.50)	148.8 (201.75)	138.1 (187.24)	106.3 (144.12)
	ASTM A354 Grade BC	69.8 (94.64)	83.8 (113.62)	93.1 (126.23)	102.4 (138.84)	130.4 (176.80)	121.1 (164.19)	93.1 (126.23)

All values in foot pounds and (Newton meters)

Nominal bolt size	Standard and Grade Designation	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1/2 - 20	SAE Grade 1 ASTM A307	24.8 (33.62)	29.8 (40.40)	33.1 (44.88)	36.4 (49.35)	46.4 (62.91)	43.1 (58.44)	33.1 (44.88)
	SAE Grade 2	41.3 (56.00)	49.5 (67.11)	55.0 (74.57)	60.5 (82.02)	77.0 (104.40)	71.5 (96.94)	55.0 (74.57)
	SAE Grade 4	48.8 (66.16)	58.5 (79.32)	65.0 (88.13)	71.5 (96.94)	91.0 (123.38)	84.5 (114.57)	65.0 (88.13)
	SAE Grade 5 ASTM A449	63.8 (86.50)	76.5 (103.72)	85.0 (115.24)	93.5 (126.77)	119.0 (161.34)	110.5 (149.82)	85.0 (115.24)
	SAE Grade 7	78.8 (106.84)	94.5 (128.12)	105.0 (142.36)	115.5 (156.60)	147.0 (199.30)	136.5 (185.07)	105.0 (142.36)
	SAE Grade 8 ASTM A354 Grade BD	90.0 (122.02)	108.0 (146.43)	120.0 (162.70)	132.0 (179.00)	168.0 (277.78)	156.0 (211.51)	120.0 (162.70)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
9/16 - 12	SAE Grade 1 ASTM A307	32.0 (43.39)	38.0 (51.52)	42.19 (57.20)	46.0 (62.37)	59.0 (80.00)	55.0 (74.57)	42 (56.94)
	SAE Grade 2	52.7 (71.45)	63.3 (85.82)	70.3 (95.31)	77.3 (104.80)	98.4 (133.41)	91.4 (123.92)	70.3 (95.31)
	SAE Grade 4	62.2 (84.33)	74.7 (101.28)	83.0 (112.53)	91.3 (123.79)	116.2 (157.55)	107.9 (146.30)	83.0 (112.53)
	SAE Grade 5 ASTM A449	81.7 (110.77)	98.1 (133.00)	109.0 (147.78)	119.9 (162.56)	152.6 (206.90)	141.7 (192.17)	109.0 (147.78)
	SAE Grade 7	100.7 (136.53)	120.9 (163.92)	134.3 (182.09)	147.7 (200.25)	188.0 (254.89)	174.6 (236.73)	134.3 (182.09)
	SAE Grade 8 ASTM A354 Grade BD	115.0 (155.92)	138.0 (187.10)	153.3 (207.85)	168.6 (228.59)	214.6 (290.96)	199.3 (270.21)	153.3 (207.85)
	ASTM A354 Grade BC	100.7 (136.53)	120.9 (163.92)	134.3 (182.09)	147.7 (200.25)	188.0 (254.89)	174.6 (236.73)	134.3 (182.09)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
9/16 - 18	SAE Grade 1 ASTM A307	35.3 (47.86)	42.4 (57.49)	47.1 (63.86)	51.8 (70.23)	66.0 (89.48)	61.2 (82.98)	47.1 (63.86)
	SAE Grade 2	59.1 (80.13)	70.9 (96.13)	78.8 (106.84)	86.6 (117.41)	110.3 (149.55)	102.4 (138.84)	78.8 (106.84)
	SAE Grade 4	69.6 (94.36)	83.5 (113.21)	92.8 (125.82)	102.1 (138.43)	129.9 (176.12)	120.7 (163.65)	92.8 (125.85)
	SAE Grade 5 ASTM A449	91.2 (123.65)	109.5 (148.46)	121.6 (164.87)	133.8 (181.40)	170.3 (230.90)	158.1 (214.36)	121.6 (164.87)
	SAE Grade 7	112.3 (152.26)	134.8 (182.76)	149.8 (203.10)	164.7 (223.30)	209.7 (284.32)	194.7 (263.98)	149.8 (203.10)
	SAE Grade 8 ASTM A354 Grade BD	128.7 (174.61)	154.4 (209.34)	171.6 (232.66)	188.7 (255.84)	240.2 (325.67)	223.0 (302.35)	171.6 (232.66)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
5/8 - 11	SAE Grade 1 ASTM A307	44 (59.66)	52 (70.50)	58.2 (78.90)	64 (86.77)	81 (109.82)	76 (103.04)	58 (78.64)
	SAE Grade 2	72.7 (98.57)	87.2 (118.23)	96.9 (131.38)	106.6 (144.53)	135.6 (183.85)	125.9 (170.70)	96.9 (131.38)
	SAE Grade 4	86.1 (116.74)	103.4 (140.19)	114.8 (155.65)	126.3 (171.24)	160.8 (218.02)	149.3 (202.42)	114.8 (155.65)
	SAE Grade 5 ASTM A449	112.5 (152.53)	135.0 (183.04)	150.0 (203.37)	165.0 (223.71)	210.0 (284.72)	195.0 (264.38)	150.0 (203.37)
	SAE Grade 7	138.9 (188.32)	166.6 (225.88)	185.2 (251.10)	203.7 (276.18)	259.2 (351.43)	240.7 (326.35)	185.2 (251.10)
	SAE Grade 8 ASTM A354 Grade BD	158.8 (215.30)	190.5 (258.28)	211.7 (287.03)	232.9 (315.77)	296.4 (401.86)	275.2 (373.12)	211.7 (287.03)
	ASTM A354 Grade BC	139.2 (188.73)	167.0 (226.42)	185.5 (251.50)	204.1 (276.72)	259.8 (352.24)	241.2 (327.02)	185.5 (251.50)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
5/8 - 18	SAE Grade 1 ASTM A307	49.5 (67.11)	59.4 (80.54)	66.0 (89.48)	72.6 (98.43)	92.4 (125.27)	85.8 (116.33)	66.0 (89.48)
	SAE Grade 2	82.6 (112.00)	99.1 (134.36)	110.2 (149.41)	121.2 (164.33)	154.2 (209.07)	143.2 (194.15)	110.2 (149.41)
	SAE Grade 4	97.3 (131.92)	116.7 (158.22)	129.7 (175.85)	142.7 (193.48)	181.6 (246.22)	168.6 (228.59)	129.7 (175.85)
	SAE Grade 5 ASTM A449	127.7 (173.14)	153.3 (207.85)	170.3 (230.90)	187.3 (253.95)	238.4 (323.23)	221.4 (300.18)	170.3 (230.90)
	SAE Grade 7	157.6 (213.68)	189.1 (256.39)	210.2 (285.00)	231.2 (313.47)	294.2 (398.88)	273.2 (370.41)	210.2 (285.00)
	SAE Grade 8 ASTM A354 Grade BD	179.9 (243.91)	215.9 (292.72)	239.8 (325.13)	263.8 (357.66)	335.8 (455.28)	311.8 (422.74)	239.8 (325.13)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
3/4 - 10	SAE Grade 1 ASTM A307	77 (104.40)	93 (126.09)	103.1 (139.78)	113 (153.20)	144 (195.24)	134 (181.68)	103 (139.65)
	SAE Grade 2	129.4 (175.44)	155.3 (210.55)	172.5 (233.88)	189.8 (257.33)	241.5 (327.43)	224.3 (304.11)	172.5 (233.88)
	SAE Grade 4	152.6 (206.90)	183.1 (248.25)	203.4 (275.77)	223.8 (303.43)	284.8 (386.14)	264.5 (358.61)	203.4 (275.77)
	SAE Grade 5 ASTM A449	199.7 (270.76)	239.6 (324.85)	266.3 (361.05)	292.9 (397.12)	372.8 (505.45)	346.1 (469.25)	266.3 (361.05)
	SAE Grade 7	246.8 (334.62)	296.2 (401.60)	329.1 (446.20)	362.0 (355.22)	460.7 (624.63)	427.8 (580.02)	329.1 (446.20)
	SAE Grade 8 ASTM A354 Grade BD	282.0 (382.34)	338.3 (458.67)	375.9 (509.65)	413.5 (560.63)	526.3 (713.57)	488.7 (662.59)	375.9 (509.65)
	ASTM A354 Grade BC	246.4 (334.07)	295.7 (400.92)	328.6 (445.53)	361.5 (490.13)	460.0 (623.67)	427.2 (579.20)	328.6 (445.53)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
3/4 - 16	SAE Grade 1 ASTM A307	86.5 (117.28)	103.8 (140.73)	115.3 (156.33)	126.8 (171.92)	161.4 (218.83)	149.9 (203.24)	115.3 (156.33)
	SAE Grade 2	144.1 (195.37)	173.0 (234.56)	192.2 (260.59)	211.4 (286.62)	269.1 (364.85)	249.8 (338.68)	192.2 (260.59)
	SAE Grade 4	170.2 (230.76)	204.2 (276.86)	226.9 (307.64)	249.6 (338.41)	317.6 (430.61)	294.9 (399.15)	226.9 (307.64)
	SAE Grade 5 ASTM A449	222.9 (302.21)	267.5 (362.68)	297.2 (402.95)	326.9 (443.22)	416.1 (564.16)	386.3 (523.75)	297.2 (402.95)
	SAE Grade 7	275.6 (373.66)	330.8 (448.50)	367.5 (498.26)	404.3 (548.16)	514.5 (697.57)	477.8 (647.81)	367.5 (498.26)
	SAE Grade 8 ASTM A354 Grade BD	315.0 (427.08)	378.0 (512.50)	420.0 (569.44)	462.0 (626.39)	588.0 (797.22)	546.0 (740.28)	420.0 (569.44)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
7/8 - 9	SAE Grade 1 ASTM A307	124.7 (169.07)	149.6 (202.83)	166.3 (225.47)	182.9 (247.98)	232.8 (315.63)	216.1 (293.0)	166.3 (225.47)
	SAE Grade 2	124.7 (169.07)	149.6 (202.83)	166.3 (225.47)	182.9 (247.98)	232.8 (315.63)	216.1 (293.00)	166.3 (255.47)
	SAE Grade 4	246.1 (333.67)	295.3 (400.37)	328.1 (444.84)	360.9 (489.32)	459.4 (622.86)	426.6 (578.40)	328.1 (444.84)
	SAE Grade 5 ASTM A449	322.4 (437.11)	386.9 (524.57)	429.8 (582.73)	472.8 (641.03)	601.8 (815.93)	558.8 (757.63)	429.8 (582.73)
	SAE Grade 7	397.9 (539.48)	477.4 (647.27)	530.5 (719.26)	583.5 (791.12)	742.7 (1007.00)	689.6 (935.00)	530.5 (719.26)
	SAE Grade 8 ASTM A354 Grade BD	454.5 (616.22)	545.3 (739.33)	605.9 (821.49)	666.5 (903.65)	848.3 (1150.14)	787.7 (1067.98)	605.9 (821.49)
	ASTM A354 Grade BC	397.9 (539.48)	477.4 (647.27)	530.5 (719.26)	583.5 (791.12)	742.7 (1007.00)	689.6 (935.00)	530.5 (719.26)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
7/8 - 14	SAE Grade 1 ASTM A307	137.8 (186.83)	165.4 (224.25)	183.8 (249.20)	202.1 (274.01)	257.3 (348.85)	238.9 (323.90)	183.8 (249.20)
	SAE Grade 2	137.8 (186.83)	165.4 (224.25)	183.8 (249.20)	202.1 (274.01)	257.3 (348.85)	238.9 (323.90)	183.8 (249.20)
	SAE Grade 4	271.5 (368.11)	325.8 (441.73)	362.0 (490.80)	398.2 (539.89)	506.8 (687.13)	470.6 (638.05)	362.0 (490.80)
	SAE Grade 5 ASTM A449	355.2 (481.59)	426.2 (577.85)	473.6 (642.12)	521.0 (706.38)	663.0 (898.91)	615.7 (834.78)	473.6 (642.12)
	SAE Grade 7	438.0 (593.85)	525.7 (712.75)	584.1 (791.93)	642.5 (871.11)	817.7 (1108.65)	759.3 (1029.47)	584.1 (791.93)
	SAE Grade 8 ASTM A354 Grade BD	501.2 (679.54)	601.5 (815.53)	668.3 (906.09)	735.1 (996.66)	935.6 (1268.50)	868.8 (1177.94)	668.3 (906.09)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for:					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1 - 8	SAE Grade 1 ASTM A307	187.5 (254.22)	225.0 (305.06)	250.0 (338.95)	275.0 (372.85)	350.0 (474.54)	325.0 (440.64)	250.0 (338.95)
	SAE Grade 2	187.5 (254.22)	225.0 (305.06)	250.0 (338.95)	275.0 (372.85)	350.0 (474.54)	325.0 (440.64)	250.0 (338.95)
	SAE Grade 4	369.4 (500.84)	443.3 (601.03)	492.5 (667.74)	541.8 (734.58)	689.5 (934.84)	640.3 (868.13)	492.5 (667.74)
	SAE Grade 5 ASTM A449	482.8 (654.59)	579.4 (785.56)	643.8 (872.88)	708.1 (960.05)	901.3 (1222.00)	836.9 (1134.69)	643.8 (872.88)
	SAE Grade 7	596.3 (808.47)	715.5 (970.09)	795.0 (1077.88)	874.5 (1185.66)	1113.0 (1509.03)	1033.5 (1401.24)	795.0 (1077.88)
	SAE Grade 8 ASTM A354 Grade BD	681.6 (924.13)	817.9 (1108.92)	908.8 (1232.17)	999.6 (1355.28)	1272.3 (1725.00)	1181.4 (1601.77)	908.8 (1232.17)
	ASTM A354 Grade BC	596.7 (809.01)	716.1 (970.90)	795.6 (1078.69)	875.2 (1186.61)	1113.9 (1510.25)	1034.3 (1402.32)	795.6 (1078.69)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1 - 12	SAE Grade 1 ASTM A307	205.3 278.35	246.4 (334.07)	273.8 (371.22)	301.1 (408.24)	383.3 (519.69)	355.9 (482.54)	273.8 (371.22)
	SAE Grade 2	205.3 (278.35)	246.4 (334.07)	273.8 (371.22)	301.1 (408.24)	383.3 (519.69)	355.9 (482.54)	273.8 (371.22)
	SAE Grade 4	404.1 (547.88)	484.9 (657.44)	538.8 (730.52)	592.6 (803.46)	754.3 (1022.70)	700.4 (949.62)	538.8 (730.52)
	SAE Grade 5 ASTM A449	528.8 (716.96)	634.5 (860.27)	705.0 (955.85)	775.5 (1051.44)	987.0 (1338.19)	916.5 (1242.61)	705.0 (955.85)
	SAE Grade 7	652.5 (884.67)	783.0 (1061.60)	870.0 (1179.56)	957.0 (1297.52)	1218.0 (1651.39)	1131.0 (1533.42)	870.0 (1179.56)
	SAE Grade 8 ASTM A354 Grade BD	746.3 (1011.85)	895.5 (1214.14)	995.0 (1349.04)	1094.5 (1483.49)	1393.0 (1888.66)	1293.5 (1753.73)	995.0 (1349.04)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1 - 14	SAE Grade 1 ASTM A307	210.0 (284.72)	252.0 (341.66)	280.0 (379.63)	308.0 (417.60)	392.0 (531.48)	364.0 (493.52)	280.0 (379.63)
	SAE Grade 2	210.0 (284.72)	252.0 (341.66)	280.0 (379.63)	308.0 (417.60)	392.0 (531.48)	364.0 (493.52)	280.0 (379.63)
	SAE Grade 4	413.4 (560.50)	496.1 (672.62)	551.3 (747.46)	606.4 (822.17)	771.8 (1046.42)	716.6 (971.58)	551.3 (747.46)
	SAE Grade 5 ASTM A449	540.9 (733.36)	649.1 (880.06)	721.3 (977.95)	793.4 (1075.70)	1009.8 (1369.10)	937.6 (1271.22)	721.3 (977.95)
	SAE Grade 7	668.4 (906.23)	802.1 (1087.50)	891.3 (1208.44)	980.4 (1329.25)	1247.8 (1691.79)	1158.6 (1570.85)	891.3 (1208.44)
	SAE Grade 8 ASTM A354 Grade BD	764.1 (1035.98)	916.9 (1243.15)	1018.8 (1381.31)	1120.6 (1519.33)	1426.3 (1933.80)	1324.4 (1795.65)	1018.8 (1381.30)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-1/8 • 7	SAE Grade 1 ASTM A307	265.8 (360.37)	318.9 (432.37)	354.4 (480.50)	389.8 (528.50)	496.1 (672.62)	460.7 (624.63)	354.4 (480.50)
	SAE Grade 2	265.8 (360.37)	318.9 (432.37)	354.4 (480.50)	389.8 (528.50)	496.1 (672.62)	460.7 (624.63)	354.4 (480.50)
	SAE Grade 4	523.1 (709.23)	627.8 (851.18)	697.5 (945.68)	767.3 (1040.32)	976.5 (1323.96)	906.8 (1229.46)	697.5 (945.68)
	SAE Grade 5 ASTM A449	595.9 (807.93)	715.1 (969.55)	794.5 (1077.20)	874.0 (1184.99)	1112.3 (1508.07)	1032.9 (1400.43)	794.5 (1077.20)
	SAE Grade 7	844.8 (1145.40)	1013.8 (1374.53)	1126.4 (1527.20)	1239.0 (1679.86)	1577.0 (2138.13)	1464.3 (1985.33)	1126.4 (1527.20)
	SAE Grade 8 ASTM A354 Grade BD	966.1 (1309.86)	1159.3 (1571.80)	1288.1 (1746.43)	1416.9 (1921.06)	1803.4 (2445.08)	1674.6 (2270.46)	1288.1 (1746.43)
	ASTM A354 Grade BC	844.8 (1145.40)	1013.8 (1374.53)	1126.4 (1527.20)	1239.0 (1679.86)	1577.0 (2138.13)	1464.3 (1985.33)	1126.4 (1527.20)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-1/8 • 12	SAE Grade 1 ASTM A307	297.4 (403.22)	356.9 (483.89)	396.6 (537.72)	436.2 (591.40)	555.2 (752.75)	515.5 (698.93)	396.6 (537.72)
	SAE Grade 2	297.4 (403.22)	356.9 (483.89)	396.6 (537.72)	436.2 (591.40)	555.2 (752.75)	515.5 (698.93)	396.6 (537.72)
	SAE Grade 4	586.4 (795.05)	703.7 (954.09)	781.9 (1060.12)	860.1 (1166.14)	1094.6 (1484.08)	1016.4 (1378.06)	781.9 (1060.12)
	SAE Grade 5 ASTM A449	667.6 (905.14)	801.1 (1086.15)	890.2 (1206.95)	979.2 (1327.62)	1246.2 (1689.62)	1157.2 (1568.95)	890.2 (1206.95)
	SAE Grade 7	948.2 (1285.58)	1137.8 (1542.65)	1264.2 (1714.02)	1390.6 (1855.40)	1769.9 (2399.66)	1643.5 (2228.30)	1264.2 (1714.02)
	SAE Grade 8 ASTM A354 Grade BD	1083.2 (1468.62)	1299.8 (1762.30)	1444.2 (1958.07)	1588.6 (2153.85)	2021.9 (2741.33)	1877.5 (2545.55)	1444.2 (1958.07)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-1/4 • 7	SAE Grade 1 ASTM A307	375.0 (508.43)	450.0 (610.11)	500.0 (677.91)	550.0 (745.70)	700.0 (949.07)	650.0 (881.28)	500.0 (677.91)
	SAE Grade 2	375.0 (508.43)	450.0 (610.11)	500.0 (677.91)	550.0 (745.70)	700.0 (949.07)	650.0 (881.28)	500.0 (677.91)
	SAE Grade 4	738.3 (1001.00)	885.9 (1201.12)	984.4 (1334.67)	1082.8 (1468.08)	1378.1 (1868.45)	1279.7 (1735.04)	984.4 (1334.67)
	SAE Grade 5 ASTM A449	840.2 (1139.16)	1008.3 (1367.07)	1120.3 (1518.93)	1232.3 (1670.78)	1568.4 (2126.47)	1456.4 (1974.62)	1120.3 (1518.93)
	SAE Grade 7	1191.8 (1615.87)	1430.2 (1939.09)	1589.1 (2154.53)	1748.0 (2369.97)	2224.7 (3016.30)	2065.8 (2800.85)	1589.1 (2154.53)
	SAE Grade 8 ASTM A354 Grade BD	1362.9 (1847.85)	1635.5 (2217.44)	1817.2 (2463.80)	1998.9 (2710.15)	2544.1 (3449.34)	2362.3 (3202.85)	1817.2 (2463.80)
	ASTM A354 Grade BC	1192.4 (1616.68)	1430.9 (1940.04)	1589.8 (2155.48)	1748.8 (2371.05)	2225.8 (3017.78)	2066.8 (2802.20)	1589.8 (2155.48)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-1/4 • 12	SAE Grade 1 ASTM A307	414.8 (562.40)	497.8 (674.93)	553.1 (749.90)	608.4 (824.88)	774.4 (1049.95)	719.1 (974.97)	553.1 (749.90)
	SAE Grade 2	414.8 (562.40)	497.8 (674.93)	553.1 (749.90)	608.4 (824.88)	774.4 (1049.95)	719.1 (974.97)	553.1 (749.90)
	SAE Grade 4	816.8 (1107.43)	980.2 (1328.97)	1089.1 (1476.62)	1198.0 (1624.27)	1524.7 (2067.22)	1415.8 (1919.57)	1089.1 (1476.62)
	SAE Grade 5 ASTM A449	930.5 (1261.60)	1116.6 (1513.90)	1240.6 (1682.03)	1364.7 (1850.29)	1736.9 (2354.92)	1612.8 (2186.66)	1240.6 (1682.03)
	SAE Grade 7	1320.7 (1790.63)	1584.8 (2148.70)	1760.9 (2387.46)	1937.0 (2626.22)	2465.3 (3342.50)	2289.2 (3103.74)	1760.9 (2387.46)
	SAE Grade 8 ASTM A354 Grade BD	1509.4 (2046.47)	1811.3 (2455.80)	2012.5 (2728.59)	2213.8 (3001.51)	2817.5 (3820.02)	2616.3 (3547.23)	2012.5 (2728.58)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-3/8 • 6	SAE Grade 1 ASTM A307	491.1 (665.84)	589.4 (799.12)	654.8 (887.79)	720.3 (976.60)	916.8 (1243.00)	851.3 (1154.21)	654.8 (887.80)
	SAE Grade 2	491.1 (665.84)	589.4 (799.12)	654.8 (887.79)	720.3 (976.60)	916.8 (1243.00)	851.3 (1154.21)	654.8 (887.80)
	SAE Grade 4	968.1 (1312.57)	1161.7 (1575.06)	1290.8 (1750.10)	1419.9 (1925.13)	1807.1 (2450.10)	1678.0 (2275.07)	1290.8 (1750.09)
	SAE Grade 5 ASTM A449	1102.1 (1494.25)	1322.6 (1793.20)	1469.5 (1992.38)	1616.5 (2191.68)	2057.3 (2789.33)	1910.4 (2590.16)	1469.5 (1992.38)
	SAE Grade 7	1563.6 (2119.96)	1876.4 (2544.06)	2084.8 (2826.61)	2293.3 (3109.30)	2918.8 (3957.37)	2710.3 (3674.68)	2084.8 (2826.61)
	SAE Grade 8 ASTM A354 Grade BD	1786.6 (2422.30)	2144.0 (2906.88)	2382.2 (3229.83)	2620.4 (3552.79)	3335.1 (4521.80)	3096.8 (4198.70)	2382.2 (3229.83)
	ASTM A354 Grade BC	1563.6 (2119.96)	1876.4 (2544.06)	2084.8 (2826.61)	2293.3 (3109.30)	2918.8 (3957.37)	2710.3 (3674.68)	2084.8 (2826.61)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-3/8 • 12	SAE Grade 1 ASTM A307	559.5 (758.58)	671.3 (910.16)	745.9 (1011.30)	820.5 (1112.45)	1044.3 (1415.88)	969.7 (1314.74)	745.9 (1011.30)
	SAE Grade 2	559.5 (758.58)	671.3 (910.16)	745.9 (1011.30)	820.5 (1112.45)	1044.3 (1415.88)	969.7 (1314.74)	745.9 (1011.30)
	SAE Grade 4	1102.1 (1494.25)	1322.6 (1793.21)	1469.5 (1992.38)	1616.5 (2191.68)	2057.3 (2789.33)	1910.4 (2590.16)	1469.5 (1992.38)
	SAE Grade 5 ASTM A449	1254.3 (1700.60)	1505.1 (2040.64)	1672.3 (2267.34)	1839.6 (2494.16)	2341.3 (3174.38)	2174.0 (2947.55)	1672.3 (2267.34)
	SAE Grade 7	1780.2 (2413.63)	2136.2 (2896.30)	2373.6 (3218.17)	2611.0 (3540.04)	3323.0 (4505.39)	3085.7 (4183.65)	2373.6 (3218.17)
	SAE Grade 8 ASTM A354 Grade BD	2034.1 (2757.87)	2441.0 (3309.56)	2712.2 (3677.25)	2983.4 (4044.95)	3797.1 (5148.18)	3525.8 (4780.35)	2712.2 (3677.25)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-1/2 • 6	SAE Grade 1 ASTM A307	652.5 (884.67)	783.0 (1061.60)	870.0 (1179.56)	957.0 (1297.52)	1218.0 (1651.39)	1131.0 (1533.43)	870.0 (1179.56)
	SAE Grade 2	652.5 (884.67)	783.0 (1061.60)	870.0 (1179.56)	957.0 (1297.52)	1218.0 (1651.39)	1131.0 (1533.43)	870.0 (1179.56)
	SAE Grade 4	1283.9 (1740.74)	1540.7 (2088.91)	1711.9 (2321.03)	1883.1 (2553.14)	2396.6 (3249.36)	2225.4 (3017.24)	1711.9 (2321.03)
	SAE Grade 5 ASTM A449	1462.5 (1982.88)	1755.0 (2379.46)	1950.0 (2643.85)	2145.0 (2908.23)	2730.0 (3701.39)	2535.0 (3437.00)	1950.0 (2643.85)
	SAE Grade 7	2074.2 (2812.24)	2489.1 (3374.77)	2765.6 (3749.66)	3042.2 (4124.67)	3871.9 (5249.60)	3595.3 (4874.58)	2765.6 (3749.66)
	SAE Grade 8 ASTM A354 Grade BD	2370.9 (3214.51)	2845.1 (3857.44)	3161.3 (4286.15)	3477.4 (4714.73)	4425.8 (6000.58)	4109.6 (5571.88)	3161.3 (4286.15)
	ASTM A354 Grade BC	2074.9 (2813.20)	2489.9 (3375.85)	2766.6 (3751.01)	3043.2 (4126.03)	3873.2 (5251.36)	3596.5 (4876.20)	2766.6 (3751.01)

All values in foot pounds and (Newton meters)

Nominal bolt size	Grade Designation and Standard	Zinc or Cadmium Plated	If instructions call for :					
			Loctite 222 or 262	Loctite 242	Loctite 271	Loctite 272	Loctite 277	Bare
1-1/2 • 12	SAE Grade 1 ASTM A307	734.1 (995.30)	880.9 (1194.34)	978.8 (1327.07)	1076.6 (1459.67)	1370.3 (1857.88)	1272.4 (1725.14)	978.8 (1327.07)
	SAE Grade 2	734.1 (995.30)	880.9 (1194.34)	978.8 (1327.07)	1076.6 (1459.67)	1370.3 (1857.88)	1272.4 (1725.14)	978.8 (1327.07)
	SAE Grade 4	1445.6 (1959.97)	1734.8 (2352.07)	1927.5 (2613.34)	2120.3 (2874.33)	2698.5 (3658.68)	2505.8 (3397.41)	1927.5 (2613.34)
	SAE Grade 5 ASTM A449	1645.3 (2230.73)	1974.4 (2676.93)	2193.8 (2974.40)	2413.1 (3271.73)	3071.3 (4164.13)	2851.9 (3866.66)	2193.8 (2974.40)
	SAE Grade 7	2334.4 (3165.02)	2801.3 (3798.06)	3112.5 (4219.99)	3423.8 (4642.05)	4357.5 (5907.98)	4046.3 (5486.05)	3112.5 (4219.99)
	SAE Grade 8 ASTM A354 Grade BD	2667.7 (3616.92)	3201.2 (4340.25)	3556.9 (4822.51)	3912.6 (5304.78)	4979.6 (6751.44)	4623.9 (6269.17)	3556.9 (4822.51)
	ASTM A354 Grade BC	—	—	—	—	—	—	—

Other Fastener Torque Specifications

All values in foot-pounds and (Newton-meters)

Nominal bolt size	18 - 8 Stainless Steel	316 Stainless Steel	Brass	Aluminum 2024 - T4
1/4 - 20	6.3 (8.54)	6.6 (8.95)	5.1 (6.91)	3.8 (5.15)
1/4 - 28	7.8 (10.57)	8.3 (11.25)	6.4 (8.67)	4.8 (6.50)
5/16 - 18	11.0 (14.90)	11.5 (15.60)	8.9 (12.06)	6.7 (9.08)
5/16 - 24	11.8 (16.00)	12.3 (16.67)	9.7 (13.15)	7.2 (9.76)
3/8 - 16	19.7 (26.71)	20.6 (27.93)	16.0 (21.70)	11.9 (16.13)
3/8 - 24	21.6 (29.28)	22.6 (30.64)	17.7 (24.00)	13.1 (17.76)
7/16 - 14	31.3 (42.44)	32.8 (44.47)	26.4 (35.80)	19.0 (25.76)
7/16 - 20	33.3 (45.15)	34.8 (47.18)	27.3 (37.00)	20.2 (27.38)
1/2 - 13	43.1 (58.43)	45.2 (61.28)	35.2 (47.72)	26.1 (35.38)
1/2 - 20	45.1 (61.14)	47.1 (63.86)	36.9 (50.00)	27.3 (37.00)
9/16 - 12	56.8 (77.00)	59.4 (80.53)	46.5 (63.04)	34.4 (46.64)
9/16 - 18	62.7 (85.00)	65.6 (88.94)	51.3 (69.55)	38.0 (51.52)
5/8 - 11	92.5 (125.41)	96.7 (131.10)	75.6 (102.50)	59.6 (80.80)
5/8 - 18	103.7 (140.60)	108.4 (146.97)	84.7 (114.84)	66.5 (90.16)
3/4 - 10	127.5 (172.86)	131.8 (178.70)	104.1 (141.14)	81.7 (110.77)
3/4 - 16	124.2 (168.39)	129.8 (175.98)	101.7 (137.88)	79.8 (108.19)

Other Fastener Torque Specifications

All values in foot-pounds and (Newton-meters)

Nominal bolt size	18 - 8 Stainless Steel	316 Stainless Steel	Brass	Aluminum 2024 - T4
7/8 - 9	194.0 (263.03)	202.5 (274.55)	158.8 (215.30)	124.6 (168.93)
7/8 - 14	193.2 (261.94)	201.7 (273.47)	157.9 (214.08)	124.2 (168.40)
1 - 8	286.7 (388.71)	299.6 (406.20)	234.6 (318.07)	183.8 (249.20)
1 - 14	259.2 (351.43)	270.8 (367.16)	212.1 (287.57)	166.3 (225.47)
1-1/8 • 7	413.0 (559.95)	432.0 (585.71)	337.0 (456.91)	265.0 (359.29)
1-1/8 • 12	390.0 (528.77)	408.0 (553.17)	318.0 (431.15)	251.0 (340.31)
1-1/4 • 7	523.0 (709.09)	546.0 (740.28)	428.0 (580.30)	336.0 (455.55)
1-1/4 • 12	480.0 (650.80)	504.0 (683.33)	394.0 (534.19)	308.0 (417.60)
1-1/2 • 6	888.0 (1203.97)	930.0 (1260.91)	727.0 (985.68)	570.0 (772.82)
1-1/2 • 12	703.0 (953.14)	732.0 (992.46)	575.0 (779.60)	450.0 (610.12)

DESCRIPTION OF SINGLE MOTOR DRIVE TRAIN

Cylinder Speeds

Machines covered by this section have two cylinder speeds. Slowest to fastest, these are *wash* speed, and *extract* speed.

Wash speed occurs during washing and rinsing bath steps. The cylinder reverses direction approximately twice per minute as explained in "How the Machine Reverses" in this section. For efficient extraction, distribution of goods occurs during the last thirty seconds of each wash and rinse step.

Extract speed is used to extract the maximum possible moisture from the goods before the formula ends.

Drive Train Components and Operating Sequences

A microprocessor timer controller directs the machine through the required steps for each program. Controllers are fully described elsewhere. Major drive train components include one motor with two windings to generate two speeds, a v-belt and a pulley.

How the Machine Reverses

The wash/extract motor periodically stops and reverses direction during washing and rinsing. Machines are equipped with *three-phase motors.* Two relays (CRWAC and CRWAA) operate to change the cylinder direction. These relays are actuated so that only one operates at a time. CRWAC causes clockwise rotation, CRWAA causes counterclockwise rotation. Rotation is selected by exchanging two of three phased leads to the low speed motor winding. Relays CRWAC and CRWAA automatically swap leads through a switching process, thus changing rotational direction. There is a brief dwell period (generally less than three seconds) during each change of direction. The cylinder is stationary during this time.

DESCRIPTION OF DUAL MOTOR DRIVE TRAIN

See the drive chart drawing (see Table of Contents) for part numbers and mechanical relationships among all drive train components.

Cylinder Speeds

Machines covered by this section have four cylinder speeds. Slowest to fastest, these are *wash, drain, low extract speed (E1),* and *high extract speed (E2).*

Wash speed occurs during washing and rinsing bath steps. The cylinder reverses direction approximately twice per minute as explained in "How the Machine Reverses" in this section.

Drain speed initiates water removal and distributes the goods evenly in the cylinder for efficient extraction. Drain speed ranges from 69 to 81 RPMs, depending on the model.

Low extract speed ranges from 183 to 250 RPMs, depending on the model. Low extract speed occurs when an extract precedes a wash, and before the machine accelerates to high extract speed.

High extract speed is used to extract the maximum possible moisture from the goods before the formula ends. Range is 400 to 739 RPMs, depending on the model.

Drive Train Components and Operating Sequences

A microprocessor controller directs the machine through the required steps for each program. Controllers are *fully described elsewhere.* Major drive train components include two motors (E1/wash and E2/drain), two clutches (wash and extract), a jack shaft, and a system of V-belts and pulleys. To achieve various speeds, motors energize and clutches actuate in the combinations shown in the following table:

Drive Train Component States

Action	E1/Wash Motor	E2/Drain Motor	Wash Clutch	Extract Clutch
Wash/Rinse	energized	not energized	engaged	not engaged
Drain	not energized	energized	engaged	not engaged
Low extract (E1)	energized	not energized	not engaged	engaged
High extract (E2)	not energized	energized	not energized	engaged
Slow down (Coast time determined by software or centrifugal switch)	not energized	not energized	not engaged until cylinder slows sufficiently for a safe return to wash speed	engaged until cylinder slows sufficiently for a safe return to wash speed
Stop (Door open)	not energized	not energized	engaged	engaged

Drive Train Precautions

Do not subject the drive train to stress by instantaneous transitions from stop or wash to extract speeds, nor from extract to wash speeds. To avoid damaging the mechanical components and hazardous conditions, the motors and clutches gradually accelerate and decelerate the cylinder. These gradual speed changes are inherent in all control systems and must not be bypassed through manual operation or programming modifications.

How Clutches Work

⚠ CAUTION ⚠

NEVER LUBRICATE CLUTCHES!

☞ **Lubrication prevents clutches from transmitting sufficient torque.**

Wash and extract clutches operate on 12VDC from a clutch circuit described in this section. The wash clutch is engaged whenever the clutch relay K0 is energized (wash or drain). The extract clutch is engaged whenever the relay K0 is not energized (low and high extract). Clutches have two major parts, a stationary coil (bolted to the motor frame), and a rotating pulley assembly (bolted to motor shaft). Clutches are magnetically actuated and have metal faces without friction material. **Clutches are not serviceable.**

The Clutch Circuit

The clutch circuit uses transformers and rectifiers to convert alternating current control circuit voltage to direct current for clutches. Service voltage is first converted to control circuit voltage (240VAC for most models, 120 VAC for M4P, M5P, M6P, and M7P models). This voltage is fed to the clutch circuit transformer, where it is converted to 16.5VAC, then delivered to the clutch rectifiers. There is one rectifier for each clutch, providing 12VDC. Fuses protect all components. Rectifiers and transformers are extremely reliable, and require no maintenance. However, because rectifiers are sensitive to excessive voltage, in the unlikely event of burned fuses, check for component damage before returning the machine to service. As a safety feature, the clutch circuit also prevents cylinder rotation with the door open. Both clutches engage, locking the jackshaft when the door is open and power is supplied to the machine.

Malfunctioning Clutches or Clutch Circuits

The low speed (*wash* speed) drive train is disengaged during extract. At the end of extract, the extractor is designed to slow down before the low speed drive train engages. **Although extremely unlikely in a properly maintained machine, a malfunction could cause the low speed drive to engage prematurely** (a possibility common to all types of industrial machines which have both a high speed and low speed operating cycle).

⚠ CAUTION ⚠

SEVERE MACHINE DAMAGE—Severe machine damage can result if the low speed drive engages during or at the end of extract.

Immediately lock OFF and tag out power at the wall disconnect if any of the following occur:

- ☞ **The machine makes a sound like skidding automobile tires as it comes out of extract;**
- ☞ **The wash or drain clutch does not disengage or prematurely engages during extract;**
- ☞ **The wash, drain, extract, or main drive belts jump off at the start of, during, or at the end of extract;**
- ☞ **Strange sounds occur during extract.**
- ☞ **DO NOT permit the machine to operate until the cause is found and remedied.**

How the Centrifugal Switch Works

The *centrifugal switch* (used on Mark II machines) opens at speeds above drain. After E2 terminates, the switch closes as soon as the cylinder slows sufficiently, enabling the controller to engage the wash clutch.

How the Machine Reverses

The wash/E1 motor periodically stops and reverses direction during washing and rinsing. Machines are equipped with either *single-phase* or *three-phase* motors, each using a different method to reverse rotation. Two relays (CRWAC and CRWAA) operate to change the cylinder direction. These relays are actuated so that only one operates at a time. CRWAC causes clockwise rotation, CRWAA causes counterclockwise rotation.

Cylinder Reversal for Single-Phase Machines—Rotation of single-phase motors is selected by changing the polarity of the start winding. Relays CRWAC and CRWAA perform this action automatically.

Cylinder Reversal for Three-Phase Machines—Rotation of three-phase motors is selected by exchanging two of three phased leads. Relays CRWAC and CRWAA automatically swap leads through a switching process, thus changing rotational direction. There is a brief dwell period (generally less than three seconds) during each change of direction. The cylinder is stationary during this time.

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DRIVE TRAIN SERVICE FOR ALL 30015 AND 30022 RIGID MOUNT WASHER-EXTRACTORS

Provide part number, model and serial number of the machine when ordering replacement parts from Milnor®. Part numbers for clutches, belts, and pulleys are located on the machine drive chart drawings (if provided), see the Table of Contents. When ordering motors, provide the motor nameplate description. Clutches should be purchased from Milnor® to ensure optimum performance and service life.

⚠ WARNING ⚠

ENTANGLE AND CRUSH HAZARD—Belts and pulleys can entangle and crush body parts.

☞ **Lock OFF and tag out power at the wall disconnect before servicing.**

Replacing Belts

B
C

Remove *single motor* (FIGURE 1) or *dual motor* (FIGURE 2) drive belts by loosening the threaded jacking rods that determine the belt tension for that pulley. **Do not force belts off by prying and turning pulley.** Check belt tension and pulley alignment after replacing the belts. When replacing belts on dual motor drive machines, observe the following:

1. Replace both the *drain belt* and *extract belt* (FIGURE 2) if either is worn.
2. **Do not replace individual belts of multiple-belt sets.** Replace these belts as a set. Replacement belts must be of the same type and style. **Do not use belts from different manufacturers in multiple-belt drive sets.**

D

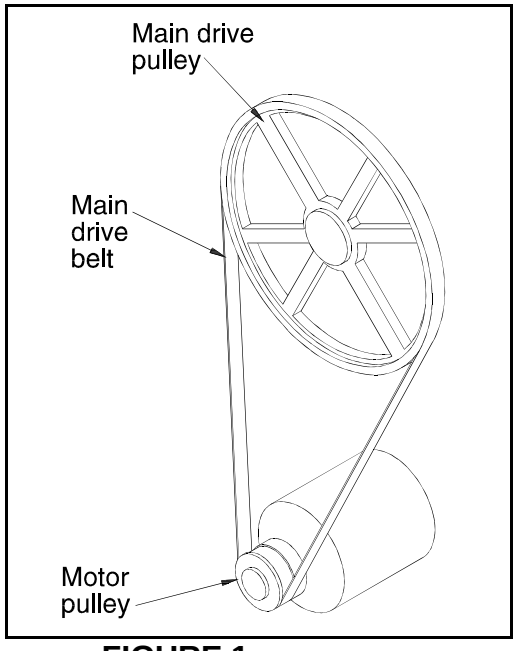

FIGURE 1 (MSSM0706BE)
Single Motor Drive

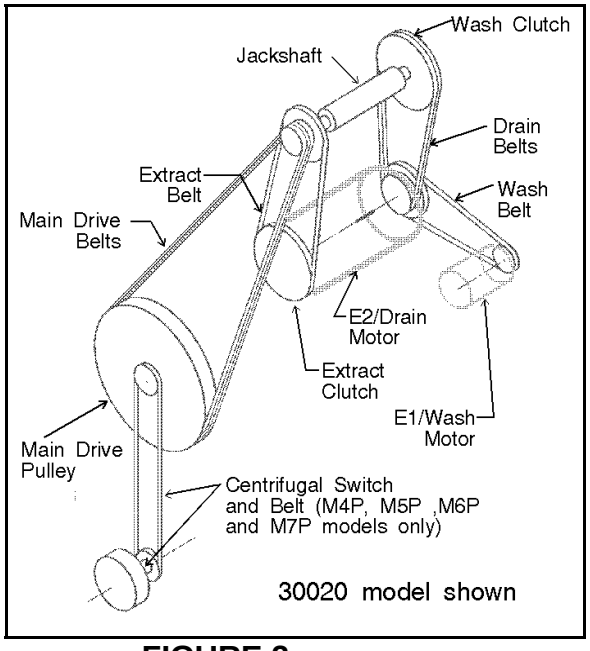

FIGURE 2 (MSSM0706BE)
Dual Motor Drive

NOTE: Some manufacturer's v-belts are more suitable for certain applications than others. Consequently, it is best to purchase replacement belts from the original manufacturer of the equipment, or at least purchase the exact style and type belt the machine was originally equipped with. If you are dissatisfied with the performance of the original belts, ask the equipment manuafacturer if a better belt is available for that application.

Testing Belt Tension

NOTE: Use the "Initial Tension" column (Table A or B below) when adjusting belts that have never been used. Use the "Final Tension" column when adjusting belts that have been used.

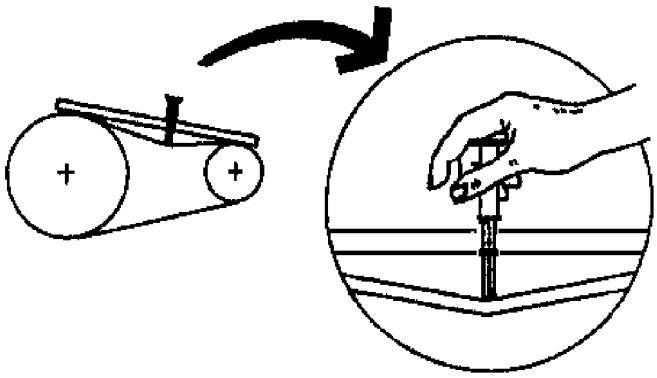

FIGURE 3 (MSSM0706BE)
Testing Belt Tension

Check belt tension (FIGURE 3) when replacing and adjusting drive train components. Belt tension testing tool (Milnor® part number 30T001), straight edge, and Belt Tension Tables are required when setting belt tensions. **Do not refer to instruction sheet provided with tension testing tool.** Check tensions for new belts according to the following schedule:

- **After 24 hours of operation (three eight-hour days)**
- **After 80 hours of operation (ten eight-hour days)**
- **After 160 hours of operation (twenty eight-hour days)**

1. Move upper O-ring on the tension testing tool to the uppermost position (resting against the bottom edge of sliding cap).

2. Determine deflection for the tested belt (see FIGURES 1 and 2 for the belt location and Tables A and B for the setting range). Move lower O-ring to the correct setting (inches or centimeters) on scale. Read the bottom edge of the O-ring.

3. Place a straight edge along the top edge (pulley to pulley) of the belt to be tested (FIGURES 1 and 2). Depress the tension testing tool by sliding the cap against the middle of the belt span until the bottom edge of the lower O-ring aligns with the straight edge as shown in FIGURE 3.

4. Read the top edge of the upper O-ring position and determine if it is within the specified range. If the readings are below the specified range, tighten the belt. If the readings are above the specified range, loosen the belt. Adjust the belt and repeat steps one through four until tension is within the specified range.

C

Table A—Belt Tension Specifications—All Belts on Dual Motor Machines Except Main Drive Belts

Belt Application	Belt Deflection inches (millimeters)	Initial Tension pounds (kilograms)	Final Tension pounds (kilograms)
Wash	3/16 (4.76)	5.1-6.6 (2.5-3.0)	3.9-5.1 (1.7-2.5)
Drain	5/32 (3.97)	3.7-4.9 (1.6-2.1)	2.9-3.8 (1.0-1.7)
Extract	5/32 (3.97)	5.1-6.6 (2.5-3.0)	3.9-5.1 (1.7-2.5)
Centrifugal switch (M4P,M5P,M6P, and M7P only)	17/64 (6.75)	3.6 (1.5)	3.1 (1.1)

Table B—Main Drive Belt Tension Specifications

Model	Cycle	Belt Deflection inches (millimeters)	Initial Tension pounds (kilograms)	Final Tension pounds (kilograms)
30015, 30018, 30020, and 30022 (Single motor drive)	All	15/64 (5.9)	5.1-6.6 (2.5-3.0)	3.9-5.1 (1.7-2.5)
30015 (Dual motor drive)	All	1/4 (6.35)	5.1-6.6 (2.5-3.0)	3.9-5.1 (1.7-2.5)
30020 and 30022 (Dual motor drive)	50	15/64 (5.9)	4.3-5.6 (1.9-2.7)	3.3-4.3 (1.2-1.8)
	60	15/64 (5.9)	5.1-6.6 (2.5-3.0)	3.9-5.1 (1.7-2.5)

Removing Pulleys

Replace the pulleys if the side walls are chipped, broken, or excessively worn. Remove the console top and belt guards, then remove the appropriate belts, dirt, or paint from the shaft end. Determine the type of pulley to be removed and see the appropriate instructions below.

Straight Bore Pulleys

1. Loosen set screws at the bottom of the pulley groove and remove the pulley. Retaining compound was used during factory installation; it may be necessary to heat the shaft while applying pressure with a puller.
2. Determine that the shaft and inside bore are dry and free of dirt, burrs, and old adhesives.
3. Place the key in the shaft and pulley to check key fit. Key must fit snugly, if not, replace the key or pulley.
4. Apply retaining compound (Loctite 609) to the pulley bore and shaft, being careful not to over-apply. Turn the pulley back and forth while installing to evenly distribute Loctite. Align the pulley with the corresponding pulley (see "Aligning Pulleys" in this section) and wipe off any excess Loctite.
5. Tighten the set screws. Always use new set screws. To adjust the belt tension, see "Testing Belt Tension" in this section. **Allow Loctite to cure for six hours before placing the machine in service.**

Taper Lock Bushing Pulleys

⚠ CAUTION ⚠

DO NOT use lubricants, "Loctite" or other compounds on taper lock bushings, pulleys, or shafts.

1. Loosen and remove all three bushing screws. Thread two screws into the push-off holes in the bushing (FIGURE 4) and alternately tighten them until the bushing and pulley separate and can be removed from the shaft.
2. Remove the burrs from the shaft, then clean and polish shaft. Clean tapered surfaces of bushing and inside bore of pulley. Determine that inside bore of bushing is clean and clear.

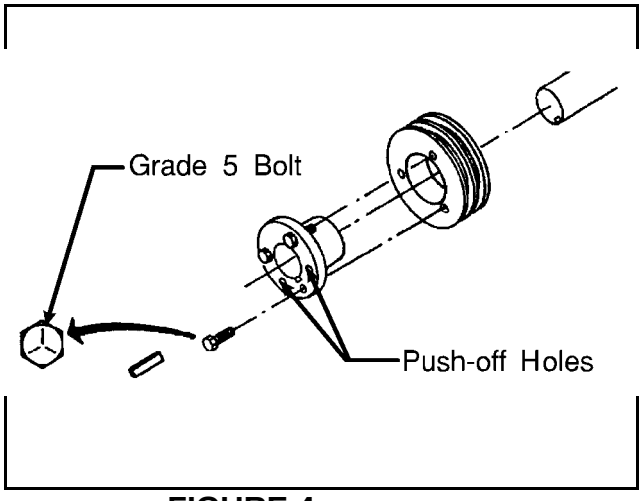

FIGURE 4 (MSSM0706BE)
Taper Lock Bushing

3. Place the key in shaft. Check for a proper fit. Key must fit snugly; if not, replace the key or bushing.
4. Insert the bushing loosely into the pulley and start all three screws. Install the pulley on the shaft and approximately align it with the corresponding pulley.
5. Gradually tighten the grade 5 bolts in an alternating pattern until the bushing is seated within the pulley (use the "Initial Torque" in Table C below). Rotate the pulley and check for wobble or runout.
6. Install the belt(s), adjust out all slack, and align the pulleys (see "Aligning Pulleys" in this section).
7. Tighten the bushing bolts to the "Final Torque" value in Table C below, and adjust the belt tension according to "Testing Belt Tension" in this section.

Table C—Bushing Bolt Torque Specifications

Size Code (Stamped on bushing)	Bolt Size	Initial Torque inch pounds (kilogram/meters)	Final Torque inch pounds (kilogram/meters)
H or **SD** (30015) (Dual motor drive)	1/4" x 20	54 (.62)	108 (1.24)
P1 (30020 and 30022) (Dual motor drive)	5/16" x 18	96 (1.10)	190 (2.18)
SD (All single motor drive)	1/4" x 20	54 (.62)	110 (1.26)

C

Electric Clutch Pulleys—Do not use a pulling tool to remove the clutch. Remove the clutch by removing the center mounting bolt and gently tapping the clutch off.

Aligning Pulleys

After replacing the drive train components, check the pulley alignment according to FIGURE 5.

Wash and Drain Belt Pulleys (Dual motor machines only)

1. Stretch a string from the wash clutch on the jackshaft to the rear pulley on E2/Drain (large) motor. Position the string similar to FIGURE 5, but with the string touching the pulley faces *on the motor side.*
2. Adjust E2 motor and/or rear pulley position, until the string touches points *A, B, C,* and *D*. Secure E2 motor and/or rear pulley. Now check the pulley on the E1/Wash (small) motor for alignment with E2 motor pulley.
3. Stretch a string from E1 motor pulley to E2 motor pulley. Adjust E1 motor and/or pulley position until the string touches *A, B, C,* and *D*. Secure E1 motor and/or pulley.

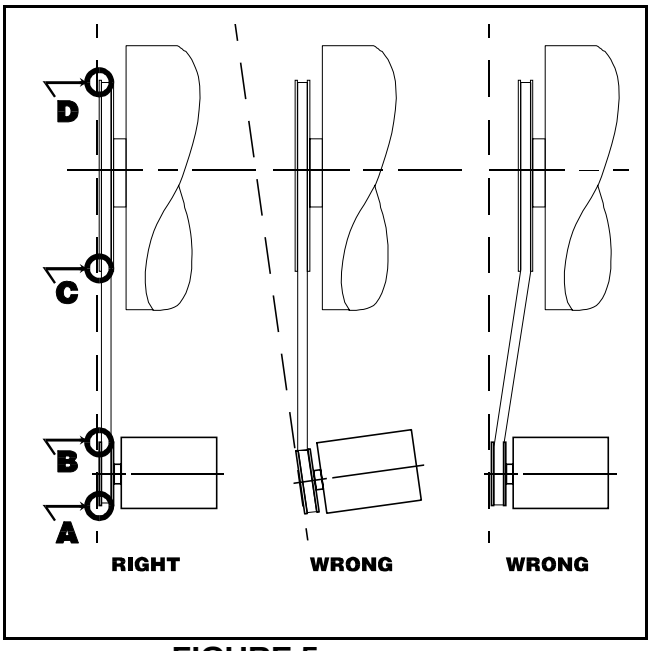

FIGURE 5 (MSSM0706BE)
Aligning Pulleys

C Main Drive and Centrifugal Switch Belt Pulleys For Single Motor Drive

B See FIGURE 5 during the following procedures:

1. Stretch a string from the motor pulley to the main drive pully as shown on FIGURE 5.
2. Adjust the position of the main drive pulley until the string touches *A, B, C,* and *D*. Secure the main drive pully.

C Extract, Main Drive, and Centrifugal Switch Belt Pulleys For Dual Motor Drive

See FIGURE 5 during the following procedures:

1. Stretch a string from the Extract Clutch on E2/Drain (large) motor to the pulley on the jackshaft as shown on FIGURE 5.
2. Adjust the position of the jackshaft pulley until the string touches *A, B, C,* and *D*. Secure the jackshaft pulley.
3. Check the main drive pulley for alignment with the jackshaft pulley. Stretch a string from the jackshaft pulley to the main drive pulley.
4. Adjust the main drive pulley position if necessary. Now check the centrifugal switch pulley (M4P, M5P, M6P, and M7P models only) alignment.

⚠ WARNING ⚠

CRUSH AND ENTANGLE HAZARD—Belts and pulleys can crush and entangle body parts.

☞ **Insure belt and pulley guards are in place before operating machine.**

Testing Belt Alignment—After aligning the belts, observe the belts with the machine operating. **If an adjustment is necessary, lock OFF and tag out power before proceeding.**

Section 2

Drive Assemblies

2 Groove Pulleys - Drive Chart

30015 & 30022 S4A, S4G, S4J, S4T

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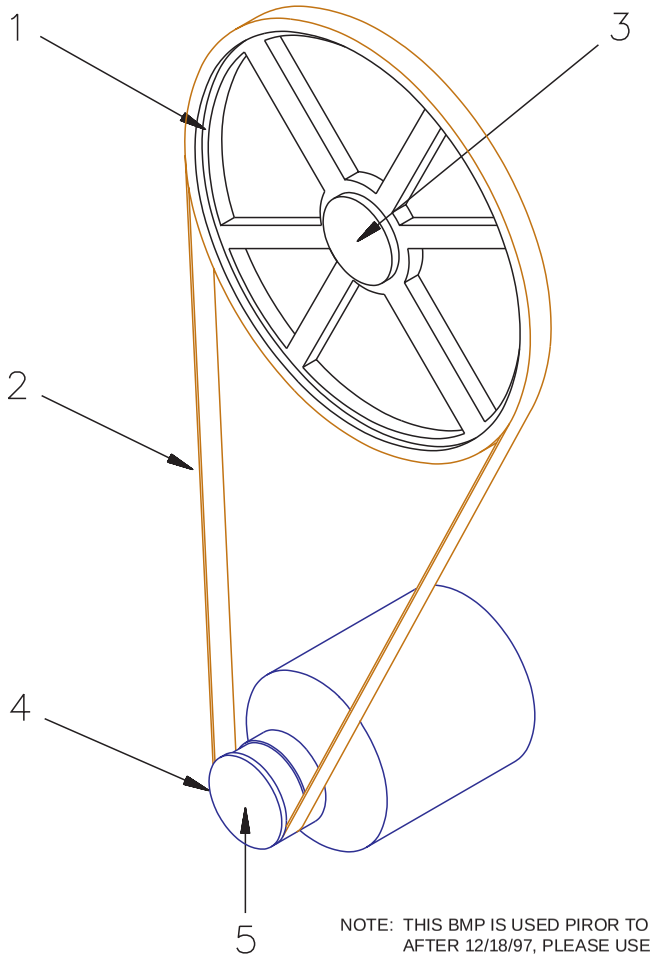
BMP930015/98383V (1 of 1)

Litho in U.S.A.



NOTE: THIS BMP IS USED PIROR TO 12/18/97.
AFTER 12/18/97, PLEASE USE BMP970086

Parts List—Drive Chart

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
00A		D33 03150	94000Z DRIVE CHART=3015/22S4 50CYC	3015/22S4X 50 CYCLE
00B		D33 03160	94000Z DRIVE CHART=3015/22S4 60CYC	3015/22S4X 60 CYCLE
			none	
			----------COMPONENTS----------	
all	001	560205R2SD	VPUL 2G3V20.5 (SD) MTO SPECIAL	
all	002	56VR0750M2	VBELT 3V750 MATCHSET=2 "EA"=1 BELT	
all	003	56Q1KSD	1+1/2" BUSHING VPUL QD TYPE "SD"	
all	004A	560280R2JA	VPUL 2G3V2.80 QD TYPE JA	00A
all	004B	560235R2JA	VPUL 2G3V2.35 QD TYPE JA	00B
all	005	56Q0RJA	7/8" BUSHING VPUL QD TYPE "JA"	

3 Groove Pulleys - Drive Chart

30015 & 30022 S4A, S4G, S4J, S4T

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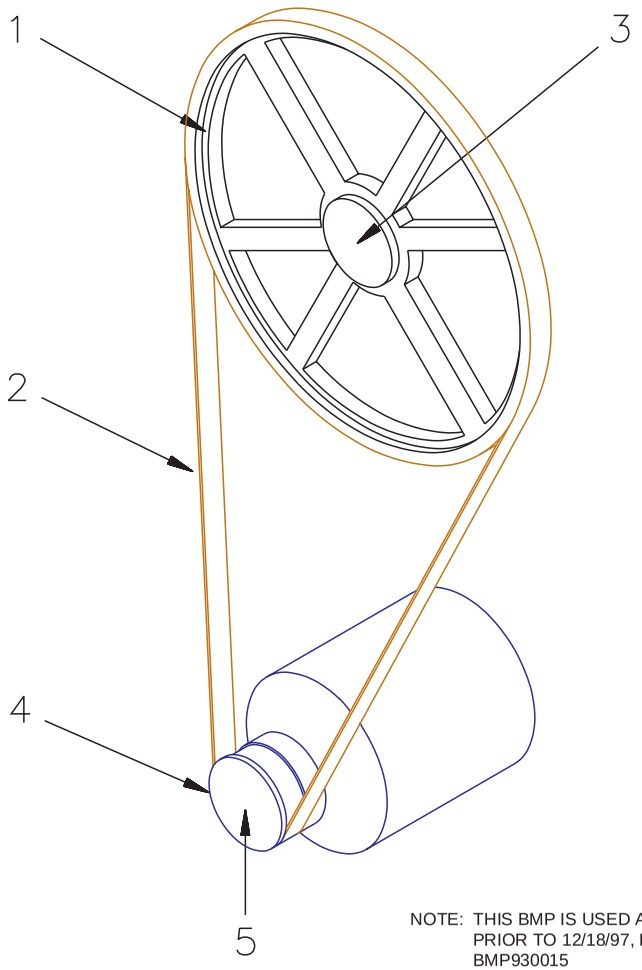

NOTE: THIS BMP IS USED AS OF 12/18/97.
PRIOR TO 12/18/97, PLEASE USE
BMP930015

Parts List—Drive Chart

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
00A		D33 03150	94000Z DRIVE CHART=3015/22S4 50CYC	3015/22S4X 50 CYCLE
00B		D33 03160	94000Z DRIVE CHART=3015/22S4 60CYC	3015/22S4X 60 CYCLE
			none	
			----------COMPONENTS----------	
all	001	562240R3SF	VPUL 3G3V22.4 (SF) MTO SPECIAL	
all	002	56VR080XB3	VBAND 3R3VX800 EA= 1 BELT	
all	003	56Q1KSF	1+1/2" BUSH VPUL QD TYPE SF	
all	004A	560295R3SH	VPUL 3G3V2.95 QD TYPE SH	00A
all	004B	560260R3JA	VPUL 3G3V2.60 QD TYPE JA	00B
all	005A	56Q0RSH	7/8" BUSHING VPUL QD TYPE "SH"	00A
all	005B	56Q0RJA	7/8" BUSHING VPUL QD TYPE "JA"	00B

Drive Chart - Rigid Mount Washer-Extractors

30015C4A,M4J,M4G,M4T,M6J,M6G 30022 C4A,M5J,M5G,M5T

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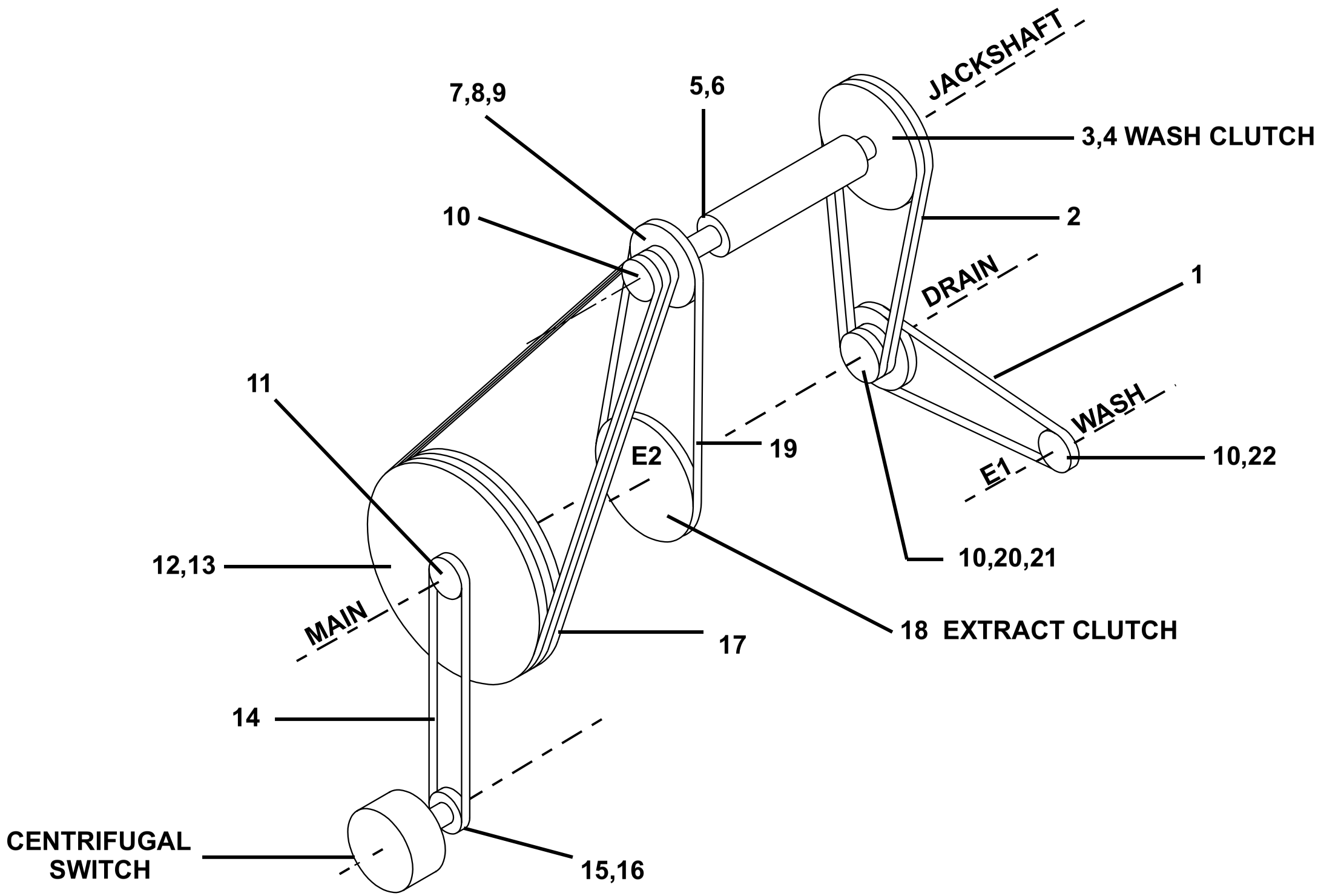

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Litho in U.S.A.

Parts List—Drive Chart

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	D33 01150	*DRIVECHART=C6M 50CYC	50C-3015M6P
	B	D33 01160	*DRIVECHART=C6M 60CYC	60C-3015M6P
	C	D33 01250	*DRIVECHART=C4M 50CYC	50C-3015M4P
	D	D33 01260	*DRIVECHART=C4M 60CYC	60C-3015M4P
	E	D33 01350	*DRIVECHART=CWE+3015N4S 50CYC	**50CYCLE 3015C4A,C4T** 3015M4A/G/J 3020C4A
	F	D33 01360	*DRIVECHART=CWE+3015N4S 60CYC	**60CYCLE 3015C4A,C4T** 3015M4A/G/J/T, M6A/T AND 3020C4A, M4J
	G	D33 01450	*DRIVECHART=3020C5M 50CYC	50C-3020M5P
	H	D33 01460	*DRIVECHART=3020C5M 60CYC	60C-3020/3022M5P
	J	D33 01550	*DRIVECHART=3020N4S 50CYC	**50CYCLE 3022C4A,C4T** 3020M4A, M5G, M5J, M5P
	K	D33 01560	*DRIVECHART=3020N4S 60CYC	**60CYCLE 3022C4A,C4T** 3020M4A, M5X, 3022M4X, C5X
	L	D33 01650	*DRIVECHART=N6E 50 CYC	50C-3015M6G, M6J
	M	D33 01660	*DRIVECHART=N6E 60CYC	60C-3015M6G, M6J
	N	D33 01750	*DRIVECHART=N5E 50CYC	50C-3020M5G, M5J, 3022M5J
	P	D33 01760	*DRIVECHART=N5E 60CYC	60C-3020M5G, M5J AND 3022M5X, M5G
			----------COMPONENTS----------	
A, B, C, D, L, M	1	56VA034X	VBELT AX34 DAYCO RAWEDGE COG	
G, H	1	56VA037X	VBELT AX37 DAYCO RAWEDGE COG	
E, F	1	56VA035X	VBELT AX35 DAYCO RAWEDGE COG	
G, H, J, K, N, P	1	56VA038X	V-BELT AX38.1 RAWEDGE COG	

Parts List, cont.—Drive Chart

Used In	Item	Part Number	Description	Comments
A-F, L, M	2	56VA035X	VBELT AX35 DAYCO RAWEDGE COG	
J, K, N, P	2	56VA038X	V-BELT AX38.1 RAWEDGE COG	
G, H, J, K, N, P	3	02 03624	VPUL=CLUTCH A2G8.5	
A-F, L, M	4	54H160A	CLUTCH 12VDC MA-7+3/8A-2G	
G, H, J, K, N,P	4	54H164A	CLUTCH 12VDC MAPM02	
G, H, J, K, N, P	5	15K041B	SKCPSCR 1/4-20X1"BLK GR8	
G, H, J, K, N, P	6	15U180	LOCKWASHER MEDIUM 1/4 ZINCPL	
G, N	7	02 03623A	VPUL=JACKSHFT A3G3.72A1G3.53	
H, P	7	02 03623	VPUL=JACKSHAFT A3G3.1A1G3.53	
J	7	02 03717	VPUL=JACKSHFT A3G3.72+A1G4.3	
K	7	02 03716	VPUL=JACKSHAFT A3G3.1+A1G4.3	
A, L	7	02 03552A	VPUL=JACKSHFT A2G3.0+A1G2.80	
B, M	7	C2 03552	VPUL=JACKSHFT A2G2.6+A1G2.96	
C, E	7	02 03449A	VPUL=JACKSHFT A2G3.12+A1G4.3	
D, F	7	C2 03449	VPUL=JACKSHFT A2G2.6+A1G4.30	
alL	8	15E210	SQMACHKEY 1/4X2 NOTAPER-NOHEAD	
alL	9	15Q072	SOKSETSCR CUP1/4-20X1/4BLKALLE	
A, C-H, J-N, P	10	20C011C	RETAIN CMPD 250CC LCT#609-41	
alL	10	56Q0MHS	627" BUSH VPUL TYPE H,D,OR QT	
A-D, G, H	11	02 03656A	VPUL=CENT SW W/2+1/8 PILOT	
alL	12	56180A2SDA	VPUL 2A18.0 (SD) TYPE QD CWE	3015-C4X, M4AGJT, M6AGJT, BO22-C5X
alL	12	56180A2SDB	VPUL 2A18.0(SD) BACKFACE CWM	3015-M4P, M6P
alL	12	02 03625	PULLEY=FLATFACE 21.44PD CAST	3022-M4X, M5X
A, B, G, H, J, K, N, P	13	56Q1KP1	1+1/2" BUSH VPUL BROWNING P1	
C-F, L, M	13	56Q1KSD	1+1/2" BUSH VPUL QD TYPE SD	

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Parts List, cont.—Drive Chart

Used In	Item	Part Number	Description	Comments
A-D, G, H	14	56V40470S	FHP VBELT 4L470 A-SECTION	
A-D, G, H	15	56030A1H	VPUL 1A3.0/L2.66 AK32H R EQUAL	
A-D, G, H	16	56Q0MHS	627" BUSH VPUL TYPE H,D,OR QT	
G, J, N	17	56VA079P	VBELT A79 DAYCO	
H, K, P	17	56VA078X	VBELT AX78 DAYCO RAWEDGE COG	
A-F, L, M	17	56VA071X	VBELT AX71 DAYCO RAWEDGE COG	
alL	18	54H160A	CLUTCH 12VDC MA-7+3/8A-2G	
G, H, N, P	19	56VA037X	VBELT AX37 DAYCO RAWEDGE COG	
J, K	19	56VA038X	V-BELT AX38.1 RAWEDGE COG	
A, L	19	56VA036X	VBELT AX36 DAYCO RAWEDGE COG	
B, M	19	56VA036S	VBELT A36	
C-F	19	56VA0383	VBELT AX38.3 COGGED	
G, H, J, K, N, P	20	02 03622B	VPUL=.875BORE A2G2.4+A1G6.25	
A-F, L, M	20	02 03312A	VPUL=.875BORE A2G2.0+A1G5.00	
G, H, J-N, P	21	15Q072	SOKSETSCR CUP1/4-20X1/4BLKALLE	
A, B, G, H, J, K, N, P	22	56028A10R	VPUL 1A2.8/L2.46 7/8ID AK30	
L, M	22	56025A10R	VPUL 1A2.5/L2.16 7/8ID AK27	
C-F	22	56025A10M	VPUL 1A2.5/L2.16 5/8ID AK27	
G, H, J, N, P	23	20C011C	RETAIN CMPD 250CC LCT#609-41	

Motor Mount Assembly

30015, 30020 & 30022 Rigid Mount Washer-Extractors

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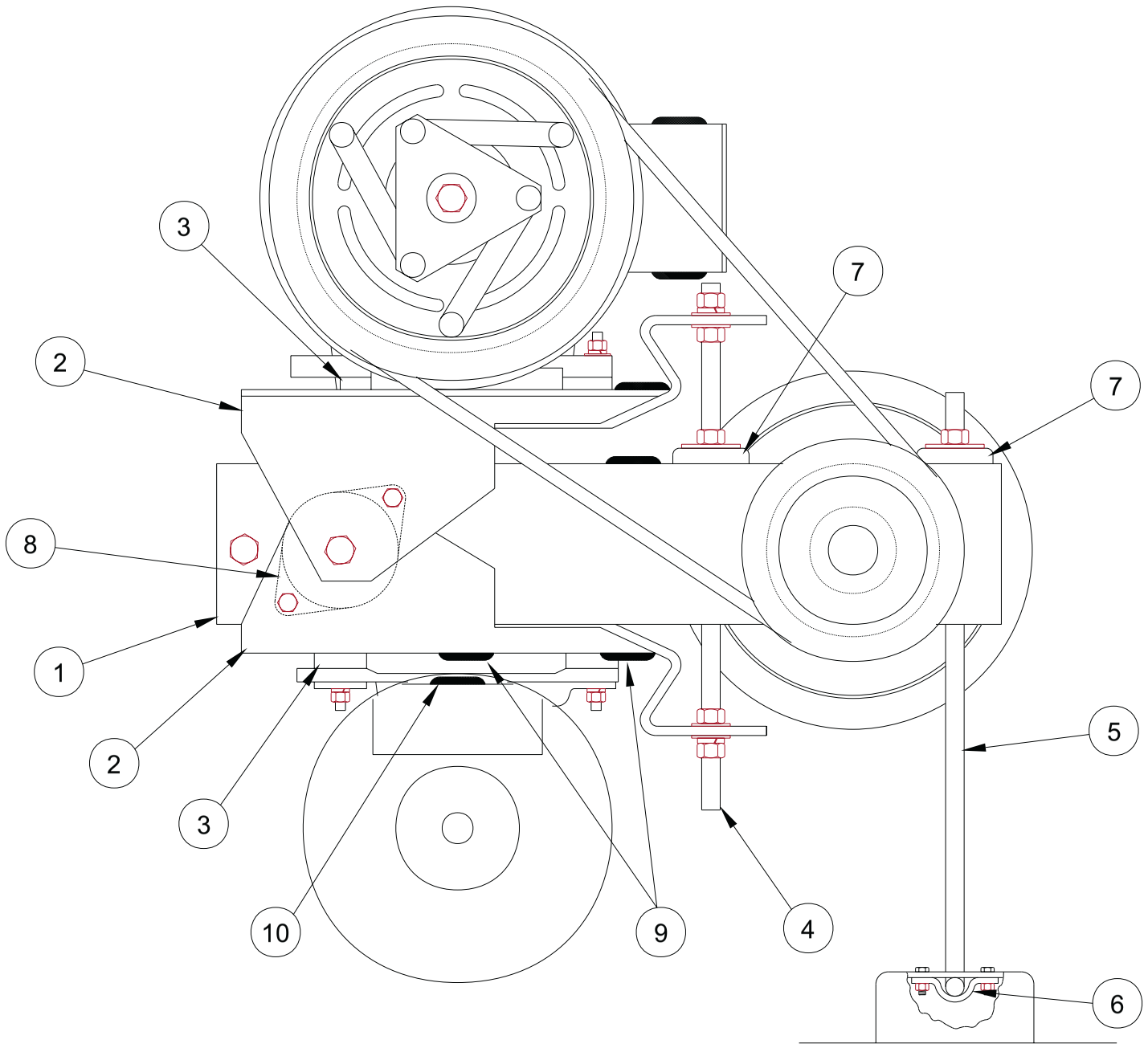

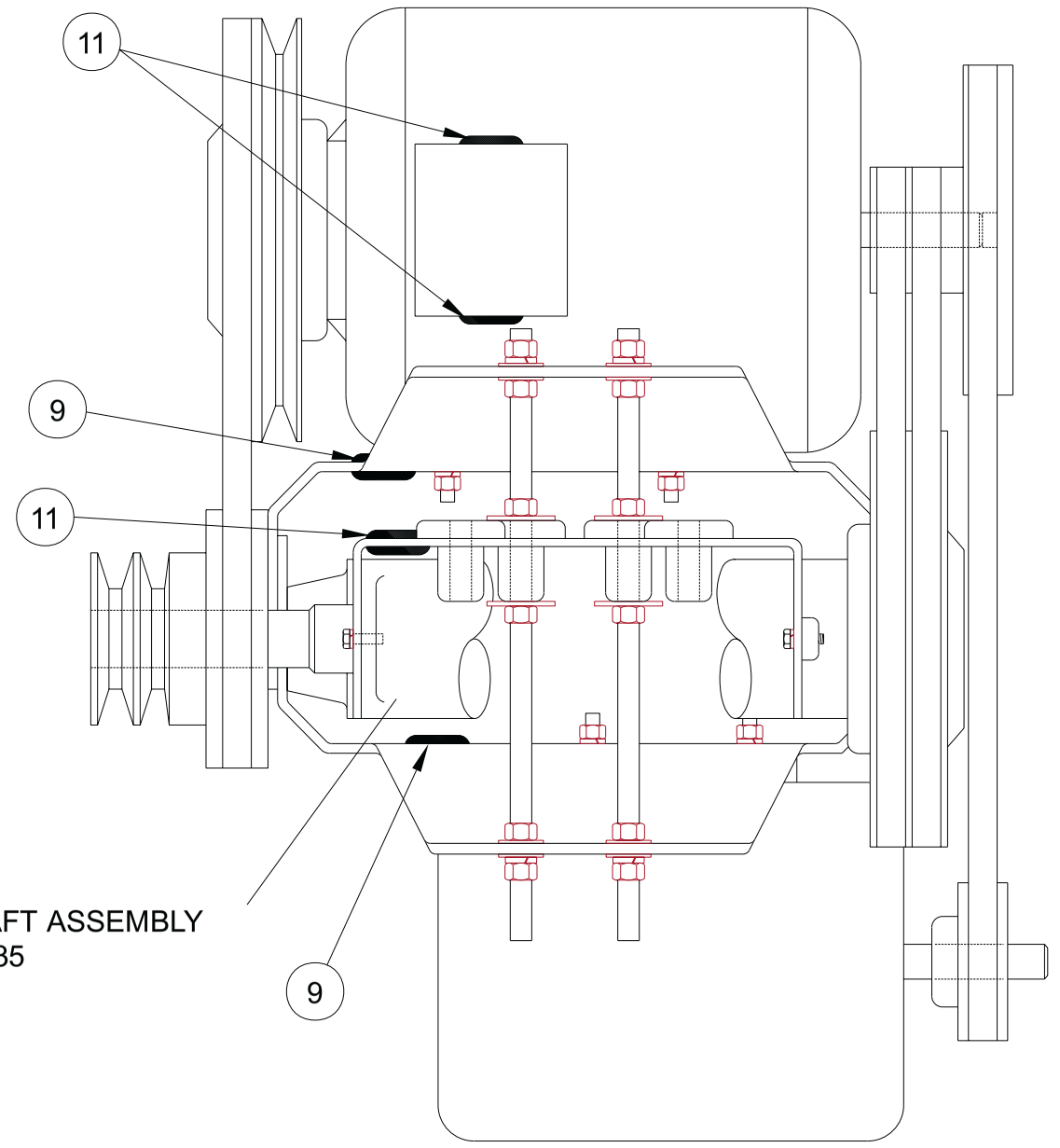

FOR JACKSHAFT ASSEMBLY
SEE BMP910035

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Parts List—Motor Mount Assembly

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	A33 08100	*MOTOR MOUNT 3P C5M	30020M5P,M7P 3P+30022M5P
all	B	A33 08100A	*MOTOR MOUNT 3P N5E+N4S/3020	30020M5G/J,M7G/J, M4X(3P50C+3P60C24V& UNDER) 30022M4X,M5A,M5G, M5J,M5T
all	C	A33 08171	*MOTOR MOUNT 1P CWE+N4E+N4S1	30015M4A/G/J,C4A 1P
all	D	A33 08171A	*MOTOR MOUNT 1PH CWM	30015M4P 1P
all	E	A33 08174	*MOTOR MOUNT 3P C4M	30015M4P 3P
all	F	A33 08174A	*MOTOR MOUNT 3P C6M	30015M6P 3P
all	G	A33 08174B	*MOTOR MOUNT=3P N6E	30015M6G/J 3P
all	H	A33 08174C	*MOTOR MOUNT 3P CWE+N4E+N4S1	30015M4A/G/J, **30015C4A,C4T** 3020C4A, M4X(3P60C380V&UP) **30022C4A,C4T** C5T+30015M4T, M6A,M6T
			----------COMPONENTS----------	
All	1	02 03503A	MOTOR MOUNT	
all	2	02 03549	MOTORMOUNT=E2 MOTOR	
EH	3	02 13156	SPACER-MOTOR MOUNTING	
All	4	02 03551	ADJROD=MOTOR (3/8-16X12")ZNC	
all	5	02 03394	TEEROD=MTRMOUNTADJ11+5/8ZINC	
all	6	02 03409	ADJ STRAP MTRMOUNT	
all	7	60B065	RUBBER MNT CTR BONDED 40 DURO	
A-B,F,G CDEH	8 8	60B055 60B070	VIBRO ISOLATER REINFORCED 70 D VIBRO-ISOLATOR REINFORCED 40 D	
all	9	12P1APSB	SNAPBUSH .75"MHX.627 T=.25	
all	10	12P1ARSB	SNAPBUSH 7/8MHX3/8 T=1/8 HEYCO	
all	11	12P1ARNB	SHORTY BUSH 7/8"MH X .75"ID	

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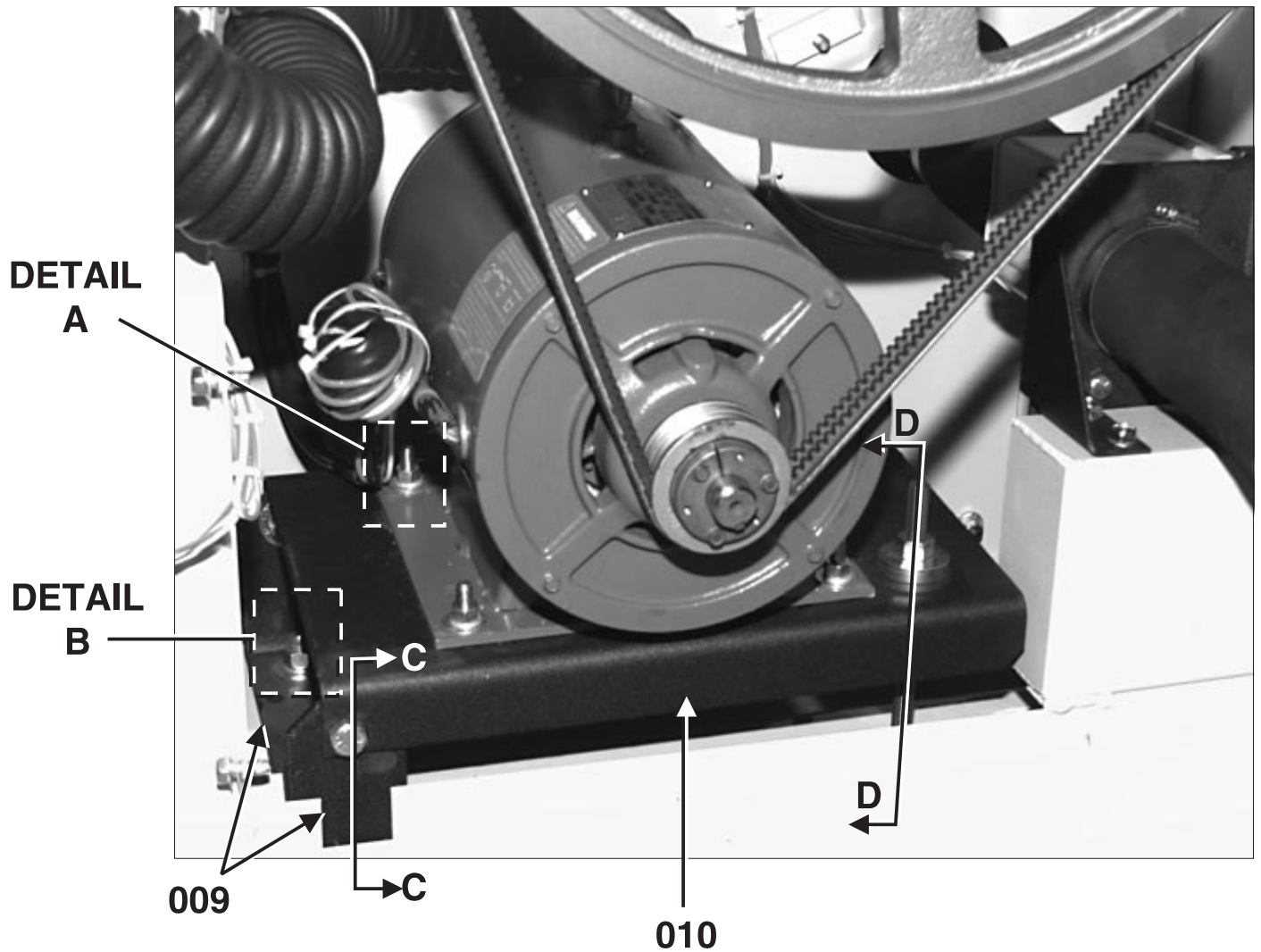
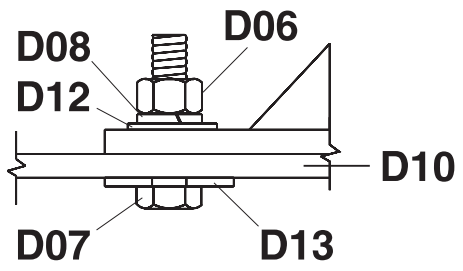
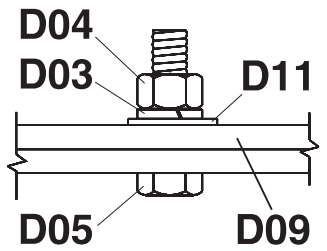
DRAWING
(See other page for parts list, if applicable.)

MOTOR MOUNT
30015 & 30020 S4A,S4G,S4J,S4T

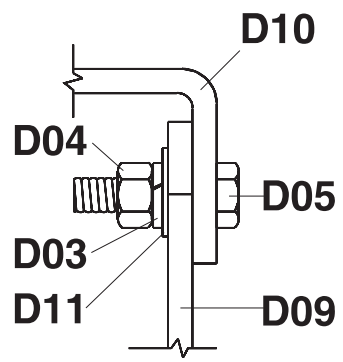




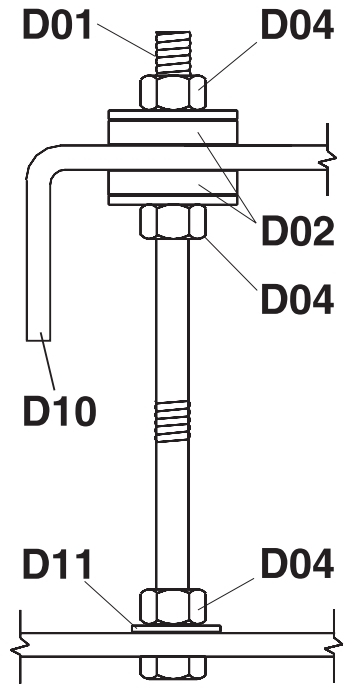
DETAIL A
TYPICAL
4 PLACES



DETAIL B
TYPICAL
2 PLACES



VIEW C-C
TYPICAL
2 PLACES



VIEW D-D
TYPICAL
2 PLACES

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PARTS LIST
(See other page for drawing.)

MOTOR MOUNT
30015 & 30020 S4A,S4G,S4J,S4T

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
D01	17R022A08A	THRD ROD 1/2-13UNCX8" LG ZN PL GR 2	
D02	17W025	03Z SPHERICAL WASHER SET 9/16 M/F	
D03	15U300	LOKWASHER REGULAR 1/2 ZINC PLT	
D04	15G230	HXNUT 1/2-13UNC2B SAE ZINC GR2	
D05	15K162	HXCAPSCR 1/2-13UNC2AX1.5 GR5 PLATED	
D06	15G205	HXNUT 3/8-16UNC2B ZINC GR2	
D07	15K095	SKSCR 3/8-16UNC2AX1"GR5 ZNC/CAD	
D08	15U255	LOCKWASHER MEDIUM 3/8 ZINCPL	
D09	02 03792B	93501C PIVOT BRKT SINGLE MTR TALL	
D10	02 03791A	93201C MOTOR MOUNTING PLT SNGL MTR	
D11	15U280	01Z FL+WASHER(USS STD)1/2 ZNC PL+D	
D12	15U240	FLATWASHER(USS STD) 3/8" ZNC PLT	
D13	15U241	FLATWASHER 13/32IDX1+3/4ODX14GA ZNC	
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

If more than one reference item appears, this usually means this drawing applies to more than one assembly (and thus to more than one range of machines).

Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

LITHO IN USA

REPLACING MAIN BEARINGS AND SEALS ON 30015, 30020, 30022Cxx, Kxx, Sxx, AND Mxx MODELS

⚠ DANGER ⚠

ELECTROCUTION HAZARD—High voltage is present inside electric boxes, motors, and many other components, even when Master switch is off and/or any emergency stop is off. You can be killed or seriously injured on contact with high voltage.

- ☞ **Lock OFF and tag out power at the wall disconnect before servicing.**
- ☞ **Maintenance must be performed by qualified, authorized service personnel.**

Oil or water dripping from the leak-off, or water in the bearing oil indicates leaking seals. Bearing oil containing metal particles indicates damaged bearings. Ordinarily, only the shell front and cylinder need to be removed to replace the seals and bearings. Replacing the entire bearing housing assembly or a major bearing housing component requires removal of the shell.

Maintenance procedures require:

- Cylinder puller kit P/N PK33-008 (or equivalent) available from Milnor® on a rental or purchase basis.
- Loctite 242, 271, and 504 adhesives, Dow Corning RTV 732, and Permatex 2 (or equivalents).
- Shell clamps.

Removing the Shell Front and Cylinder

Refer to "CYLINDER + SHELL + BEARING + CONSOLE INSTALLATION . . . " (see Table of Contents) and proceed as follows:

1. Remove the door interlock housing cover. Mark the terminal position of the wires and remove the wires from the *interlock switch.* Loosen the two conduit connections and move the conduit so the shell front can be removed.
2. Remove all shell attachments including pipes, hoses, and optional equipment. Drain oil from the bearing housing and inspect.
3. Remove the shell mount ring clip guard located on the top of the shell clamp ring, then mark the position of the shell front with respect to the shell.
4. Support the shell front and remove the bolts, shell clamp ring, rubber extrusion, and shell front.
5. Remove the shaft retainer bolt, cover, spacer, and the two allen screws covering the puller mounting holes. Mount the puller and remove the cylinder.

Replacing Seals with Bearing Housing In Place

NOTE: See the appropriate bearing assembly drawing.

If no water or metal particles are present in drained oil, replace seals and o-rings as follows. If bearing oil contains water or metal particles, see "Replacing Bearings with Bearing Housing in Place" below.

1. Remove front shaft seal holder (push-off holes are provided).
2. Inspect the shaft seal sleeve for nicks, gouges, or excessive wear. If a replacement is necessary, heat and tap the damaged sleeve off of the shaft. Before installing the new sleeve, ensure that the shaft and sleeve are clean and free from oil. Apply Loctite 271 to the inside of the sleeve, tap sleeve onto the shaft, then remove excess Loctite.
3. Replace the seals and o-rings. Apply Loctite 271 to the outside of the seals and install in shaft seal holder. Ensure that the new seals are parallel within the shaft seal holder. Use Loctite 242 when re-installing the front seal holder bolts.

Replacing Bearings with Bearing Housing In Place

NOTE: Set bearing clearances only if major components of the original bearing housing (front shaft seal holder, rear seal/bearing holder, shaft, or shims) are replaced. See "Setting Clearances" in this section after replacing major components.

Often, the bearing housing does not need to be removed to change the bearings. Remove the shell and bearing housing only if insufficient space exists for the following procedures, or if the bearing housing (or housing major components) must be replaced:

1. Remove the front shaft seal holder and rear seal/bearing holder (containing the rear bearing). Note the position and number of shims under the rear seal/bearing holder. **The shims must be installed exactly as removed.**
2. Remove the main shaft, front bearing, and bearing cup through the front of the bearing housing. Remove and discard used bearings, cups, seals, and o-rings.
3. Install a new seal, bearing, and cup in the rear seal/bearing holder. Install the shims and rear seal/bearing holder.
4. Press a new front bearing on the shaft then guide the shaft into the rear seal/bearing holder. **Do not scrape the new bearings against the inside of the bearing housing.**
5. Center the shaft within the housing, then gently tap in the front bearing cup. Install the front shaft seal holder. The shaft should turn in the housing.

Setting Clearances

NOTE: This procedure is required only when a major bearing housing component is replaced. See "Removing and Re-installing the Shell and Bearing Housing" below.

1. Remove all shims from the rear seal/bearing holder. Install the rear seal/bearing holder. Leave a small gap between the bearing housing and the rear seal/bearing holder.
2. Insert a lead wire (e.g., soldering wire) in the gap between flanges. Tighten each bolt slowly while turning the shaft. Stop tightening when the shaft just begins to drag or bind. Remove the rear seal/bearing holder, **being careful not to mark or damage the lead wire.**
3. Using a micrometer, measure the thickness of the lead wire. Add .002" (.050 millimeters) to the thickness of the lead wire and install the rear seal/bearing holder using this amount of shims. The shaft should turn in the housing.

Removing and Re-installing the Shell and Bearing Housing

Replacing the entire bearing housing assembly or a major bearing housing component requires removal of the shell.

Removing the Shell

NOTE 1: 30015 front bearing housing bolts are provided with self-locking nuts.

NOTE 2: 30020 and 30022 shell back clamp rings have three push-off holes to aid in removal. Replace the three plastic set screws with three bolts then tighten evenly to separate the ring from the shell.

1. Clamp the shell to the frame before removing the shell bolts (as shown in FIGURE 1).
2. Remove the self-locking nut and clamp used to secure the level switch sensor hose to the shell mounting screw. Remove all shell bolts, front bearing housing bolts (do not remove the rear bearing housing bolts), and shell back clamp ring, then remove the shell (and bearing housing reinforcing plate if so equipped) from the frame.
3. Remove the belt guard and the top console cover by prying out the four plugs and removing the bolts. Loosen and remove the main drive belts (and *centrifugal switch* if so equipped), and the main drive pulley. For further information see "DRIVE TRAIN SERVICE" (see Table of Contents).

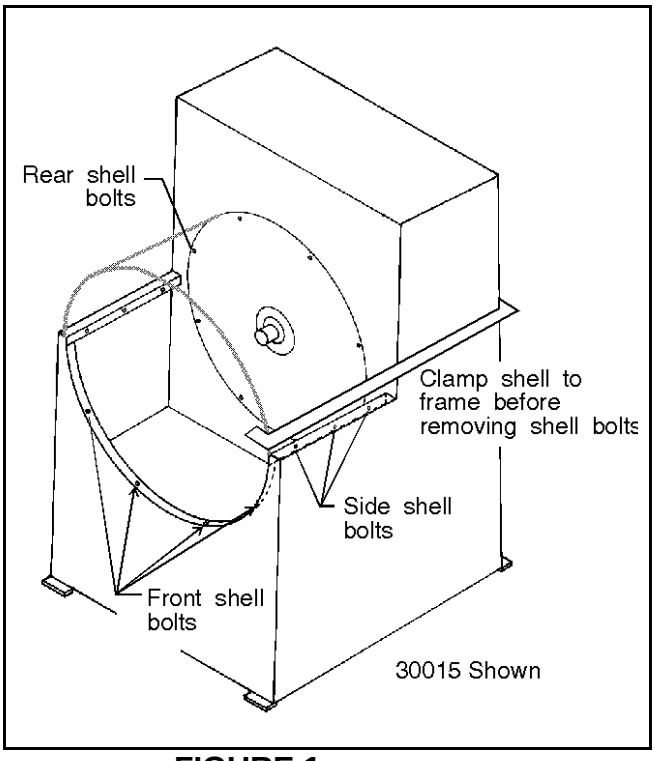


FIGURE 1 (MSSM0708BE)
Clamping the Shell

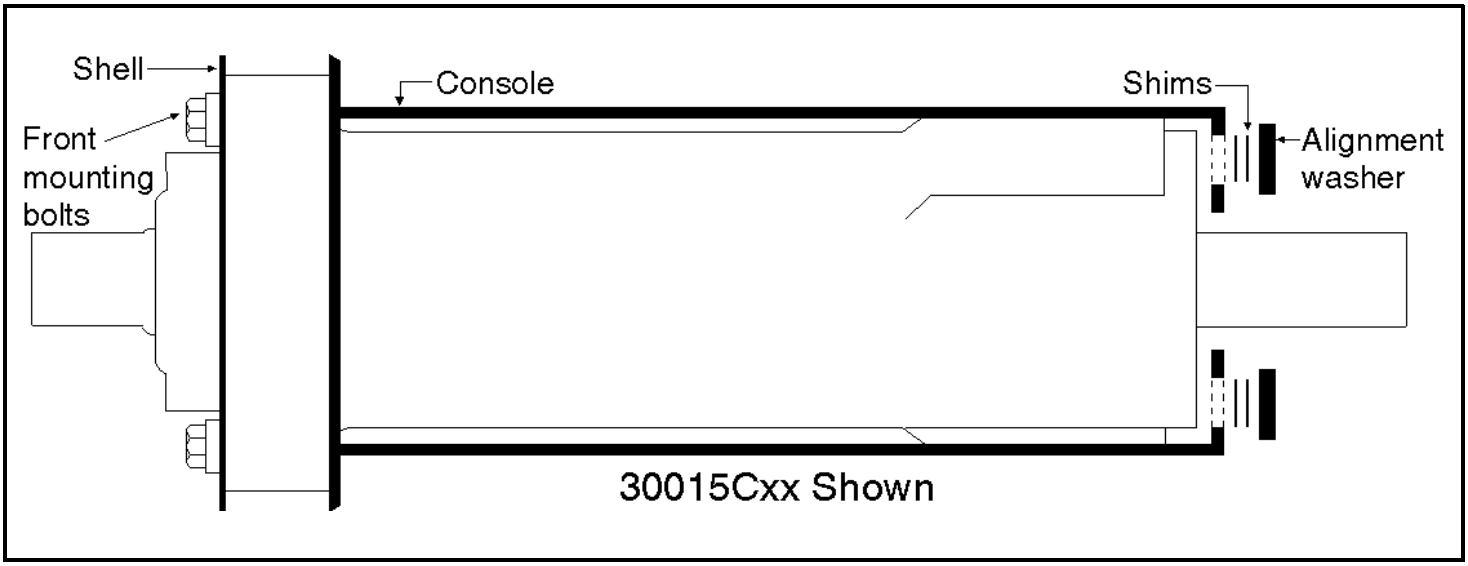


FIGURE 2 (MSSM0708BE)
Typical Main Bearing Mounting

Removing the Bearing Housing

NOTE 1: Shims (shown in FIGURE 2) are factory installed between the bearing housing and the alignment washers. **These shims must be removed and replaced in their exact original positions.**

NOTE 2: 30015M6 models are equipped with a rear reinforcing plate (see FIGURES 4 and 6). Use 30020 and 30022 instructions when removing and installing the bearing housings on these models.

Drain the oil from the bearing housing and remove all fittings and connections from the top and bottom of the bearing housing; then follow the procedure for your machine.

On 30015 Machines—Considerably loosen, **but do not fully remove** the two rear bearing housing mounting bolts.

1. Pry the bearing housing out of the console until the rear mounting bolts bottom out.
2. Remove the rear mounting bolts one at a time and catch the shims with your fingers through the holes in the rear console member (next to the bearing housing). **Note the position of the shims; they must be replaced in the same position.**
3. Remove the bearing housing from the frame. Grind off the alignment washers as shown in FIGURE 3 and discard old alignment washers.
4. Grind the rear console smooth in preparation for main bearing re-installation.

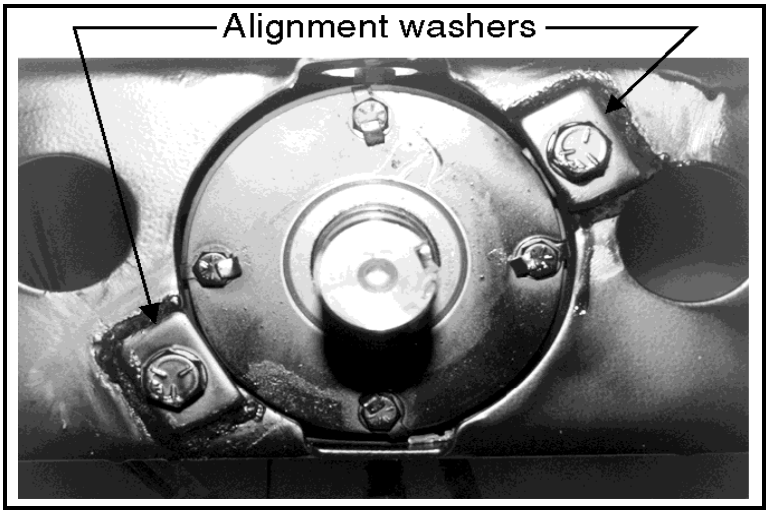


FIGURE 3 (MSSM0708BE)
Alignment Washers
30015 Models (see Note 2 above)

On 30020 and 30022 Machines—Remove the rear bearing housing and rear reinforcing plate mounting bolts.

1. Remove the rear reinforcing plate very carefully, noting the position of bearing support tap strips and shims. **Note the position of the shims; they must be replaced in the same position.**
2. Remove the bearing housing from the frame. Remove plate and grind off the alignment washers (as shown in FIGURE 4). and discard old alignment washers.
3. Grind rear reinforcing plate smooth in preparation for main bearing re-installation.

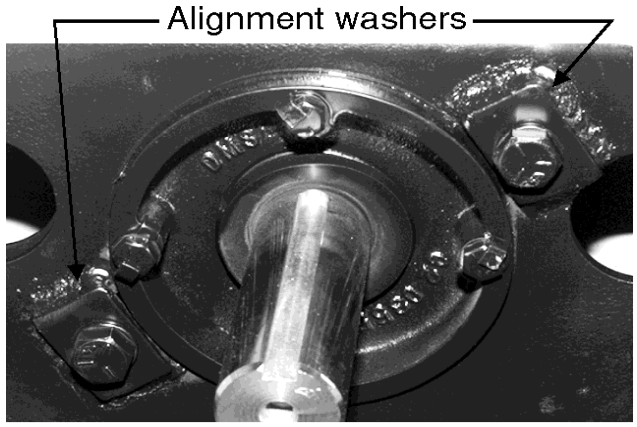


FIGURE 4 (MSSM0708BE)
Alignment Washers
30020 and 30022 Models

Installing the Bearing Housing and Shell

NOTE 1: Use new bolts when reassembling the machine.

NOTE 2: Apply Permatex 2C adhesive (or equivalent) to both sides of the new bearing housing gaskets.

NOTE 3: Install a new NYLTITE washer and nut gasket on each new shell bolt (see FIGURE 5).

On 30015 Machines—Replace the four J-type nuts along the rim of the front console with new clips.

1. Determine that all threaded holes are clean and in good condition by screwing a new bolt into each hole (if necessary, tap out any damaged threads).
2. Position the bearing housing in the console.
3. Mount the gasket on the front of the bearing housing.
4. Determine that the shell is clean and free from any old gasket material, then mount the shell onto the console using new shell bolts (FIGURE 5).
5. Using drift pins, install the rear shell bolts first (FIGURE 1), then tighten to draw the shell into place.
6. Install all other shell bolts and tighten evenly. Liberally apply Dow Corning RTV 732 sealant over the inside shell bolts and washers.

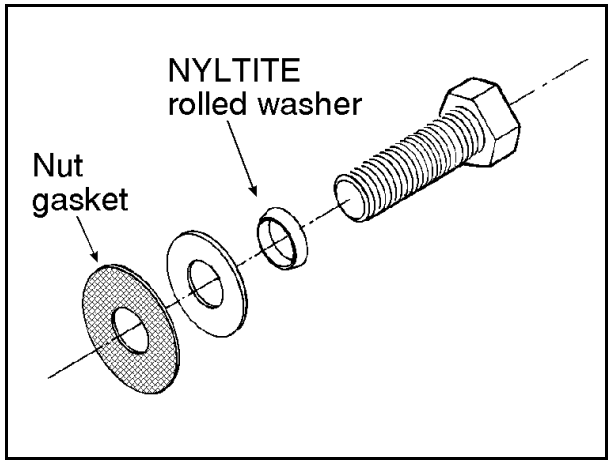


FIGURE 5 (MSSM0708BE)
Shell Bolt

7. Mount the gasket and the new ring to the inside of the shell.
8. Install the front bearing mounting bolts through the ring and bearing housing, and tighten front bolts. Install new alignment washers and original shims on rear mounting bolts (FIGURE 2). **Replace the shims on rear mounting bolts exactly as removed.**

9. Tighten bolts. Insure there is approximately .0625 inch (1.6 mm) clearance between the alignment washers and the console as shown in FIGURE 7. Add or subtract shims as required to obtain the specified clearance. Weld the new alignment washers to the console.

10. Install all of the original lubrication fittings and connections to the new bearing housing.

11. Secure the level switch sensor hose using a new clip and self-locking nut.

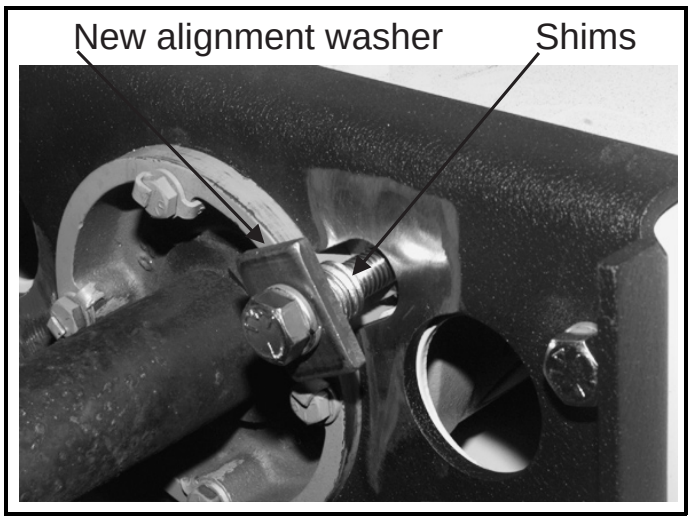


FIGURE 6 (MSSM0708BE)
Installing New Alignment Washers

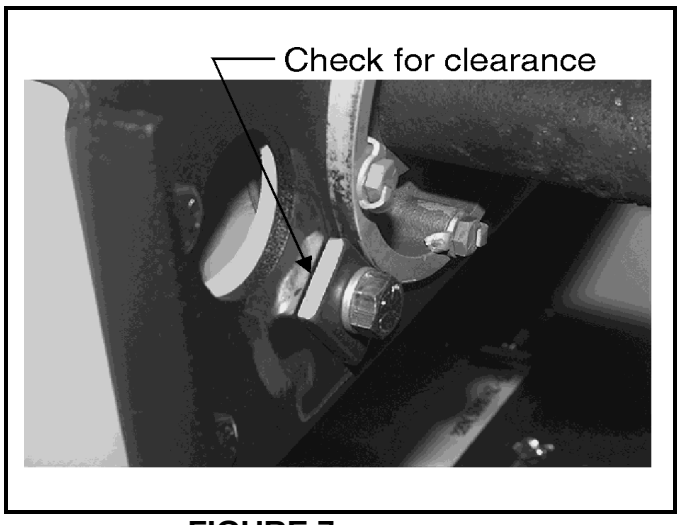


FIGURE 7 (MSSM0708BE)
Alignment Washer to Console

On 30020 and 30022 Machines—Replace the four J-type nuts and determine that all threaded holes are clean and in good condition.

1. Position the bearing housing in the console.

2. Mount the gasket, housing reinforcing plate, and second gasket.

3. Determine that the shell is clean and free from any old gasket material, then using new shell bolts (FIGURE 5), mount the shell onto the console.

4. Mount the gasket and ring to the inside of the shell.

5. Using Loctite 504, install the front bearing housing bolts and lockstraps through the ring and the bearing housing. Tighten the bolts and bend the lockstraps as applicable.

6. Pre-position the two bearing support tap strips, then install the rear reinforcing plate. Install new alignment washers and original shims on rear mounting bolts (FIGURE 6). **Replace the shims on rear mounting bolts exactly as removed.**

7. Tighten bolts. Insure there is approximately .0625 inch (1.6 mm) clearance between the alignment washer and the reinforcing plate as shown in FIGURE 7. Add or subtract shims as required to obtain specified clearance. Weld the new alignment washers to the reinforcing plate.

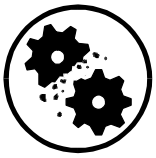
8. Install all of the original lubrication fittings and connections to the new bearing housing.

9. Secure the level switch sensor hose.

Installing the Cylinder and Shell Front

1. Screw two new allen screws into the cylinder puller mounting holes; **do not obstruct the shaft retainer spacer seat.**
2. Determine that the main shaft is clean and free from any foreign material and that the key is properly seated.

⚠ CAUTION ⚠



Failure to properly install cylinder may cause it to loosen during machine operation. This will cause damage to the cylinder, shell, and main bearing shaft surfaces.

☞ **Carefully follow cylinder installation step below.**

3. Slide the cylinder onto the shaft, and install a new 3/4" inch long 3/4-10 grade 8 zinc plated bolt and washer. Carefully tighten this bolt, using it to pull the cylinder up the tapered main bearing shaft. After cylinder is in place, torque the bolt to 282 foot pounds (382 Newton meters).

   Remove the grade 8 bolt and replace with a new 3/4" inch 18-8 stainless steel retainer bolt and washer with the original cover and spacer. Torque the retainer bolt to 150 foot pounds.

4. Determine that the shell front and front lip of the shell is clean and free from burrs, sharp edges, or sealants.

⚠ CAUTION ⚠

A metal hammer can crack stainless steel components.

☞ **Do not use a metal hammer to seat the shell front or install the ring.**

5. Using clamps, mount and support the shell front in place (align it with the mark made before it was removed). If necessary, use a rubber or rawhide maul to strike the shell front so it seats within the shell. After the shell front is seated properly on the shell, check the gap between the shell front and the lip on the shell. If necessary, use a rubber or rawhide maul on the shell lip to close the gap.
6. Pack a small amount of Permatex 2 adhesive (or similar) into the top center gap of the shell front and shell, two inches on both sides of the shell weld.
7. Install the new rubber extrusion starting at the 10 o'clock position. Trim off any excess.
8. Install the shell clamp ring on the shell front with the ring gap at the top center of the shell. Tap around the ring (bottom to top) with a rubber maul until a clamp can be installed on the ends of the shell clamp ring. Repeat this procedure and tighten the clamp until the bolt can be installed. Tap around the ring again, and tighten the bolt. Install the shell mount ring clip guard.
9. Reconnect door interlock conduit and wires.
10. See "DRIVE TRAIN SERVICE" (see Table of Contents) to replace pulleys, belts, and to set belt tension.

Section 3

Bearing Assemblies

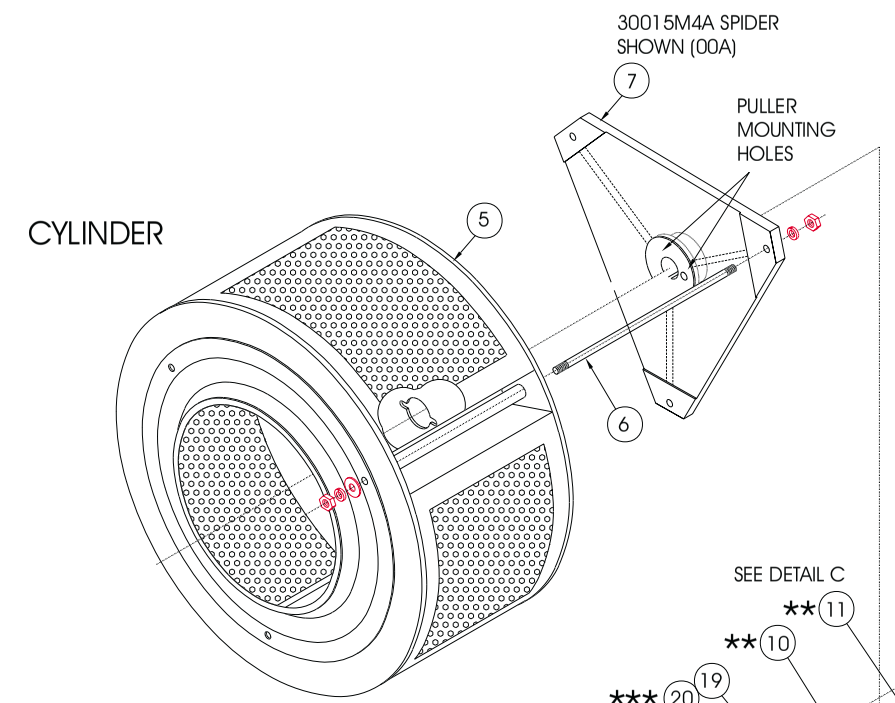
Cylinder, Shell, Bearing, and Console Installation

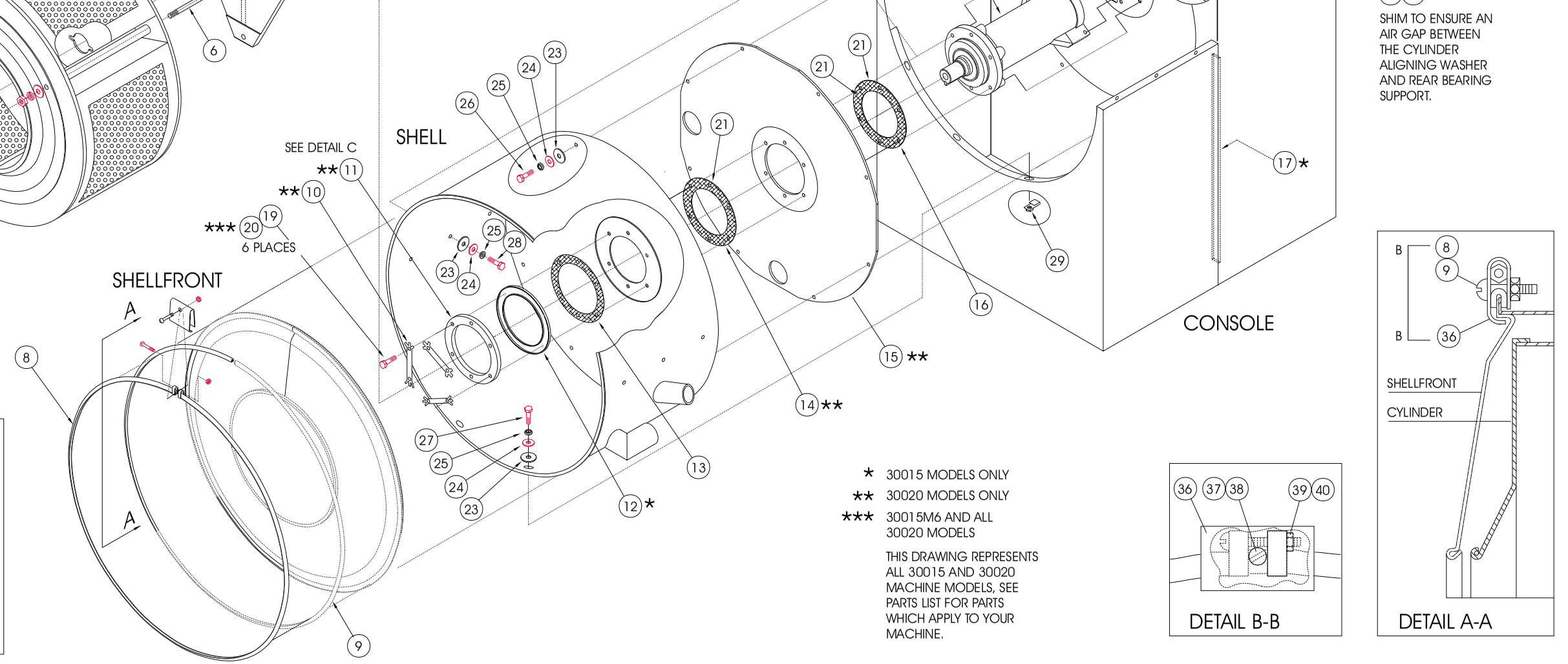
30015, 30020, & 30022 Rigid Mount Washer Extractors

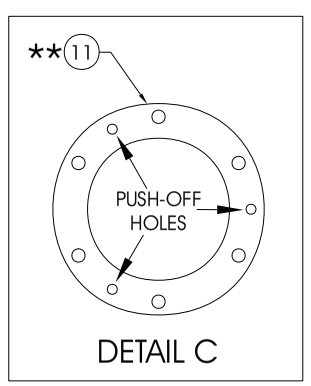
BMP910037/2001036V
(Sheet 1 of 2)

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.







DETAIL C

* 30015 MODELS ONLY
** 30020 MODELS ONLY
*** 30015M6 AND ALL 30020 MODELS

THIS DRAWING REPRESENTS ALL 30015 AND 30020 MACHINE MODELS, SEE PARTS LIST FOR PARTS WHICH APPLY TO YOUR MACHINE.

DETAIL B-B

DETAIL A-A

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

Parts List—Cylinder,Shell,Bearing,Console Installation

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	ACA02CWE	CYL ASSY=3015CWE/NMA/C4M/OE	30015C4A,M4X,C4T, K5X,S5X,**30015T5J,T5E**
	B	ACA33C6M	* CYL ASSY=3015C6M	**30015V7J** 30015M6X
	C	ACA33C5M	* CYL ASSY=3020C5M	30020M4A,C4A,M5X
	D	ACA3020M7	CYL ASSY=3020 M7J/G/P	30020M7X
	E	ACA3022M5	*CYL ASSY=3022 M5/C/K/S	30022M4X,M5X,K5X,C5X **30022V6J,30022T5J**
	F	ASH33023	SHELL+CONSOLE 3015M4A	30015M4A,M4T
	G	ASH33008	SHELL+CONSOLE 3015C4-MICRO	30015C4A,C4T
	H	ASH33015	SHELL+CONSOLE 3015M4	30015M4G,M4J,M4P
	I	ASH33007	SHELL+CONSOLE 3015 M6-MICRO	30015M6A,M6G,M6J, M6P,M6T
	J	ASH33030	SHELL+CONSOLE 3015K4	30015K5A,K5T
	K	ASH33031	SHELL+CONSOLE 3015S5	30015S5A,S5G,S5J,S5T
	L	ASH33024	SHELL+CONSOLE 3020M4A	30020M4A
	M	ASH33010	SHELL+CONSOLE 3020C4A-MICRO	30020C4A
	N	ASH33009	SHELL+CONSOLE 3020M5-MICRO	30020M5G,M5J,M5P
	O	ASH33019	SHELL+CONSOLE 3020M7-MICRO	30020M7G,M7J,M7P
	P	ASH33032	SHELL+CONSOLE 3022K4	30022K5A,K5T
	Q	ASH33033	SHELL+CONSOLE 3022S5	30022S5A,S5G,S5J,S5T
	R	ASH33034	SHELL+CONSOLE 3022M5	30022M4X,M5X
	S	ASH33035	SHELL+CONSOLE 3022C4	30022C5X
	T	ASH3022V5	ASSY=SHELL+CONSOLE, 3022V5	**30022V5J,T5J**
	U	ASH33040	SHELL+CONSOLE 3015V7	**30015V7J,30015T5J**
			----------COMPONENTS----------	
all	1	15B200	HEXCAPSCR 3/4-10X1+3/4 SS18-8	
all	2	15U350	LOCKWASHER 3/4 MED SS18-8	
all	3	02 11196	COVER=SHAFT RETAINER=304S/S	
all	4	02 14359	SPACER SHT RETNR-LG OUR MATL	
all	4	02 14359A	SHAFT RETNR SPACER 2+3/4" SQ	
A	5	ACA02CWE	CYL ASSY=3015CWE/NMA/C4M/OE	
B	5	ACA33C6M	* CYL ASSY=3015C6M	
C	5	ACA33C5M	* CYL ASSY=3020C5M	
D	5	ACA3020M7	CYL ASSY=3020 M7J/G/P	
E	5	ACA3022M5	*CYL ASSY=3022 M5/C/K/S	
all	6	02 02138A	CYLTIEROD-3/3015W+CWU 18-8SS	PART OF 005A & 005B
all	6	02 03703	CYLINDER TIE ROD C5M SU$30	PART OF 005C
all	6	02 03703A	CYLINDER TIE ROD 3020M7	PART OF 005D
all	6	02 03703J	CYLINDER TIE ROD 3022S5	PART OF 005E
all	7	X2 02758	SPIDER=1/CWU+25W	PART OF 005A
all	7	X2 03561	SPIDER=C6M ONLY-CASTIRON	PART OF 005B
all	7	X2 03561A	SPIDER C5M	PART OF 005C & 005E
all	7	X2 03561B	SPIDER=FABRICATED 3020M7	PART OF 005D
all	8	Y2 02059	*SHELL CLAMP RING=30" MACHINE	
all	9	02 02087C	EXTRUS*ION-SHELL=30"MACHINES (	
all	10	02 03629	LOCKSTRAP=BEAR HOUS S/S	30020+30022
all	11	X2 03576	RING=SHELL BACK CLAMP=1/C6M	30020+30022
all	12	02 03444	RING=SHELL BACK CLAMP	30015
all	13	02 03446	1 GASKET=SHELBACK CLAMPRING	30015
All	13	02 03575	GASKET=SHELLBAKCLAMPRING=CWM	30020+30022
all	14	02 03574	GASKET=MAIN BEARINGHOUSE=CWM	30020+30022
all	15	02 03568	PLATE-BG HOUSING REINFORCING	30020+30022
all	16	02 03574	GASKET=MAIN BEARINGHOUSE=CWM	30020+30022
all	16	02 03335	GASKET BEARING HOUSING CWE	30015
all	17	02 03749	BAR=REINF STRIP 3015	30015
all	18	02 03560	TAPSTRIP=BEARING SUPPORT	30020+30022
all	19	15K126	HEXCAPSCR 3/8-16NCX2+1/2SS18-8	30015
all	19	15K196	HEXCAPSCR 1/2-13UNC2X3 18-8SS	30020+30022
All	20	20C013C	GSKT ELIM.250CC LCT#504-41	
all	21	20C036A	PERMATEX NO 2C IN 11 OZ TUBES	
all	22	15K182	HEXTAPSCR 1/2-13X2ZINC GR5 FUL	
all	23	02 02293	DOOR HANDLE NUT GASKET	
all	24	15U245	FLTWASH 3/8 STD COMM 18-8 SS	
all	25	24G030N	ROLLED WASH.379ID NYLTITE 37W	
all	26	15K096	HEXCAPSCR 3/8-16UNC2X1SS18-8	30015C4A,M4A
all	26	15K100	HEXCAPSCR 3/8-16X1+1/4 SS18-8	30015M6X, 30020+30022
all	27	15K086	HXCAPSCR 3/8-16NCX3/4 SS18-8	
all	28	15K086	HXCAPSCR 3/8-16NCX3/4 SS18-8	30015C4A,M4A
all	29	17N071	NUT J-TYPE T#C33952-3816-3B 3/	
all	30	15G218	HXLOKNUT NYL 3/8-16 STL/ZNC	30015MODELS ONLY
all	31	15U245	FLTWASH 3/8 STD COMM 18-8 SS	
all	32	15U312	FLAWASHER 3/4ODX33/64IDX11GA Z	
all	33	02 03397	CYLINDER ALIGNING WASHER	
all	34	15U300	LOKWASHER REGULAR 1/2 ZINC PLT	
all	35	15K182	HEXTAPSCR 1/2-13X2ZINC GR5 FUL	
all	36	02 02181	GUARD=SHELL MOUNT RING CLIP	
all	37	15K046S	HEXCAPSCR 1/4-20UNC2A X 2.25 S	
all	38	15G168	SQNUT 1/4-20UNC2 SS18-8	
all	39	15N146	RDMACHSCR 10-24UNC2X1 SS18-8	
all	40	15G130	HEXMACHSCRNUT 10-24UNC2 SS18-8	
all	41	02 03559	SUPPORT=REAR BRG HOUSE	
All	42	W2 03770B	WLMT=REAR CONSOLE, 3022V5	

Main Bearing Assembly

30015C4A, C4T, C4E, M4x, K5x, S5x

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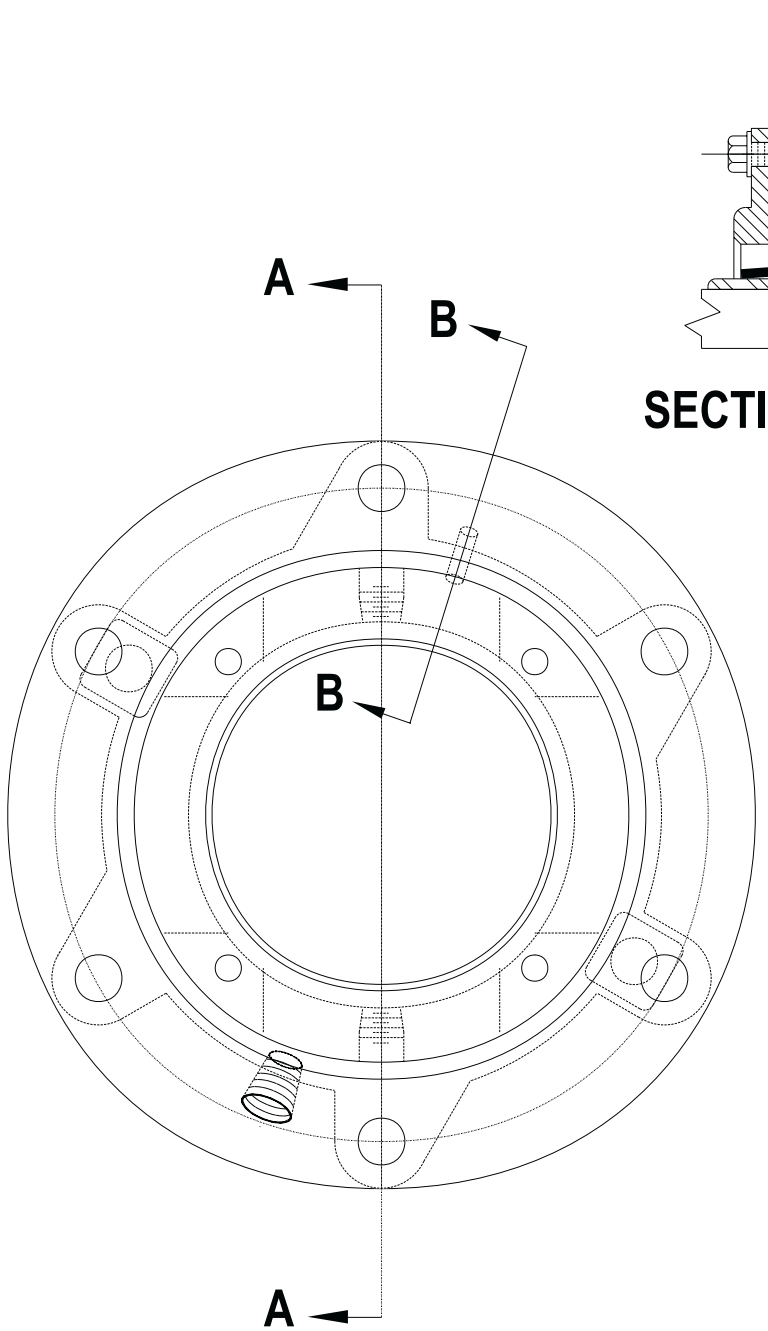
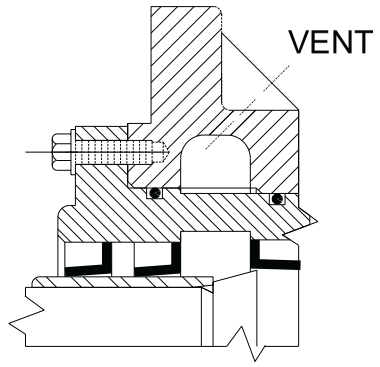
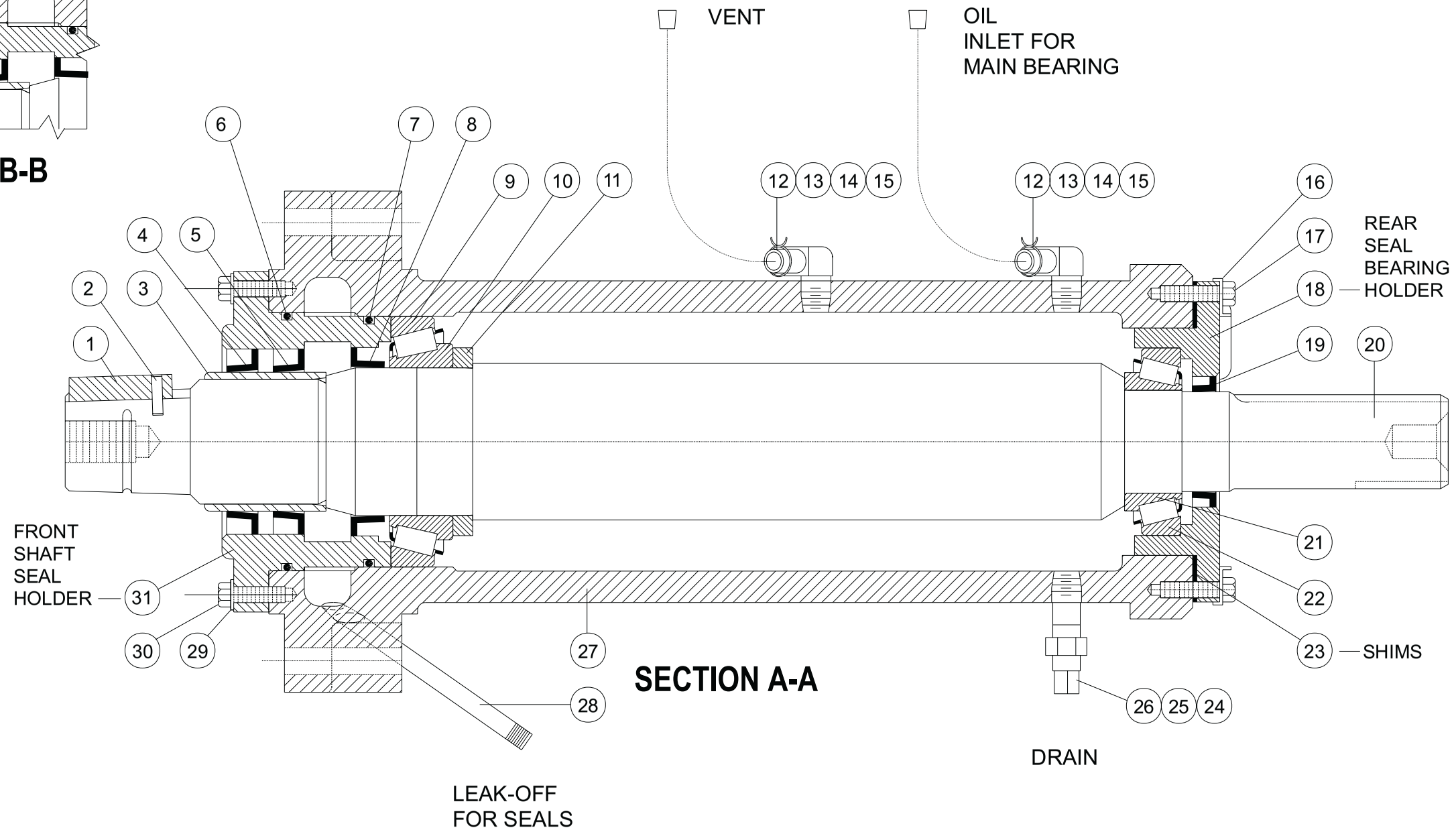




SECTION B-B



SECTION A-A

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

Parts List—Main Bearing Assembly

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
----------ASSEMBLIES----------				
	A	SA 33 030	* MAIN BEARASY 3015CWE+NMA+C4	
	B	SA 33 030V	MAIN BEARASY 3015C4/M4-VITON	VITON
----------COMPONENTS----------				
all	1	02 02294A	SHAFT KEY 3/8 X 3/8	
all	2	15H089S	SPRINGPIN 1/8"DIA X 5/8" LONG	
all	3	02 03311	SEAL SLEEVE OUR MATL	
A	4	24S005	SEAL 2.25 X 3.0 X .375 SS BUNA	
B	4	24S005V	SEAL2.25X3.0X.375#022510289LUP	
A	5	24S005	SEAL 2.25 X 3.0 X .375 SS BUNA	
B	5	24S005V	SEAL2.25X3.0X.375#022510289LUP	
all	6	60C151	ORING 3+7/8ID1/8CS BUNA70#241	
all	7	60C150	ORING 3+3/4ID1/8CS BUNA70 #240	
all	8	24S015	SEAL 2.265X3.256X.433 CR#23678	
all	9	54A319	CUP 28920 TIMKN 2-24 1/BX+PT#	
all	10	54A320	CONE 28985 TIMKN 2-51 1/BX+PT#	
all	11	02 03392	BEARING BACKUP WASR OILCOAT	
all	12	5SL0EBEC	NPTELB 90DEG STRT 1/4 BRASS125	
all	13	03 01142	NIPPLE 1/4X1+1/4 BRASS	
all	14	27A043A	HOSECLAMP.562"DIA.SPRG#HC9STZD	
all	15	60E005P	PVC TUBING 1/2"ID X 5/8"OD	
all	16	02 03407	LOCKING WASHER ZINC PLATE	
all	17	15K095	HXCPSCR 3/8-16UNC2AX1 GR5 ZINC	
all	18	X2 03660	HOUSE=SEAL+BRG-24S048AAA CWU	
all	19	24S048AAA	SEAL 1.625X2.375X.375 CS/BUNA	
all	20	X2 03314	MAIN SHT=3015CWE NMA C4M C6M	
all	21	54A306	CONE 24780 TIMKN 2-51 1/BX+PT#	
all	22	54A305	CUP 24720 TIMKN 2-24 1/BX+PT#	
all	23	02 03323	SHIM=.003 CRS GREEN	AS REQUIRED
all	23	02 03323A	SHIM=.005 CRS BLUE	AS REQUIRED
all	23	02 03323B	SHIM=.010 CRS RED	AS REQUIRED
all	23	02 03323C	SHIM=.0075 CRS BLACK	AS REQUIRED

Parts List, cont.—Document Name

Used In	Item	Part Number	Description	Comments
all	23	02 03323D	SHIM=,020 CRS WHITE	
all	23	02 03323E	SHIM=.050 CRS CLEAR	
all	24	5SP0EFFSSM	NPT PLUG 1/4 SQSLDMAGNET BLKST	
all	25	5N0E01KBE2	NPT NIP 1/4X1.5TBE BRASS STD.	
all	26	5SCC0EBE	NPT COUP 1/4 BRASS 125# W/HEX	
all	27	X2 03436	HOUSING-MAIN BEARING=1/CWU	
all	28	5N0E05AG42	NPT NIP 1/4X5 TBE GALSTL SK40	
all	29	02 03564	BOLT LOCKING TAB 1/4 BOLT	
all	30	15B080	HEXCAPSCR 5/16 X1+1/4 SS-18-8	
all	31	X2 03437	HOLDER=SHAFT SEAL=1/CWU	

Main Bearing Assembly
30020 & 30022

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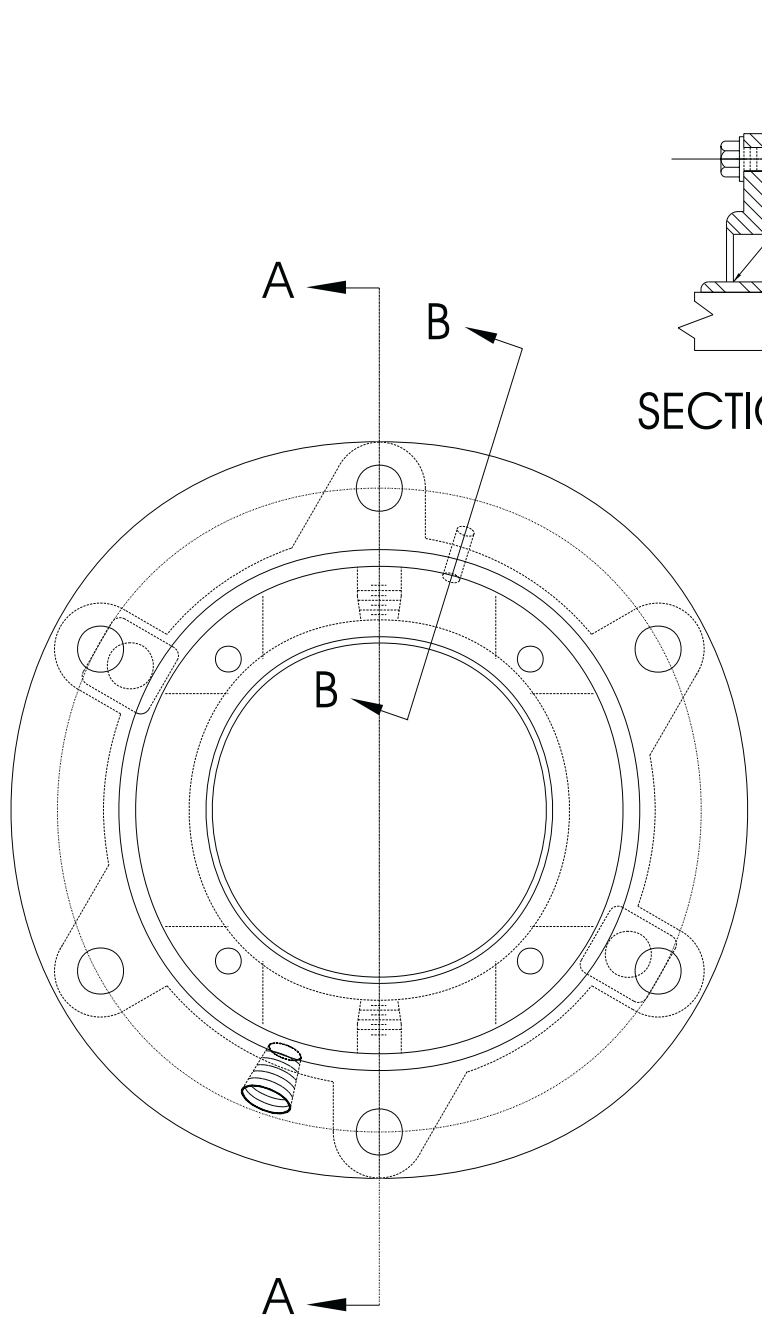
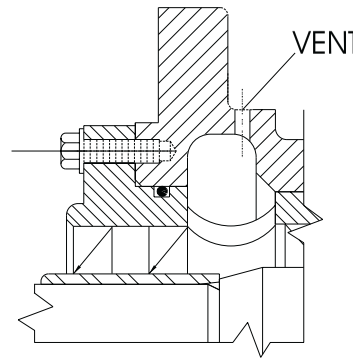
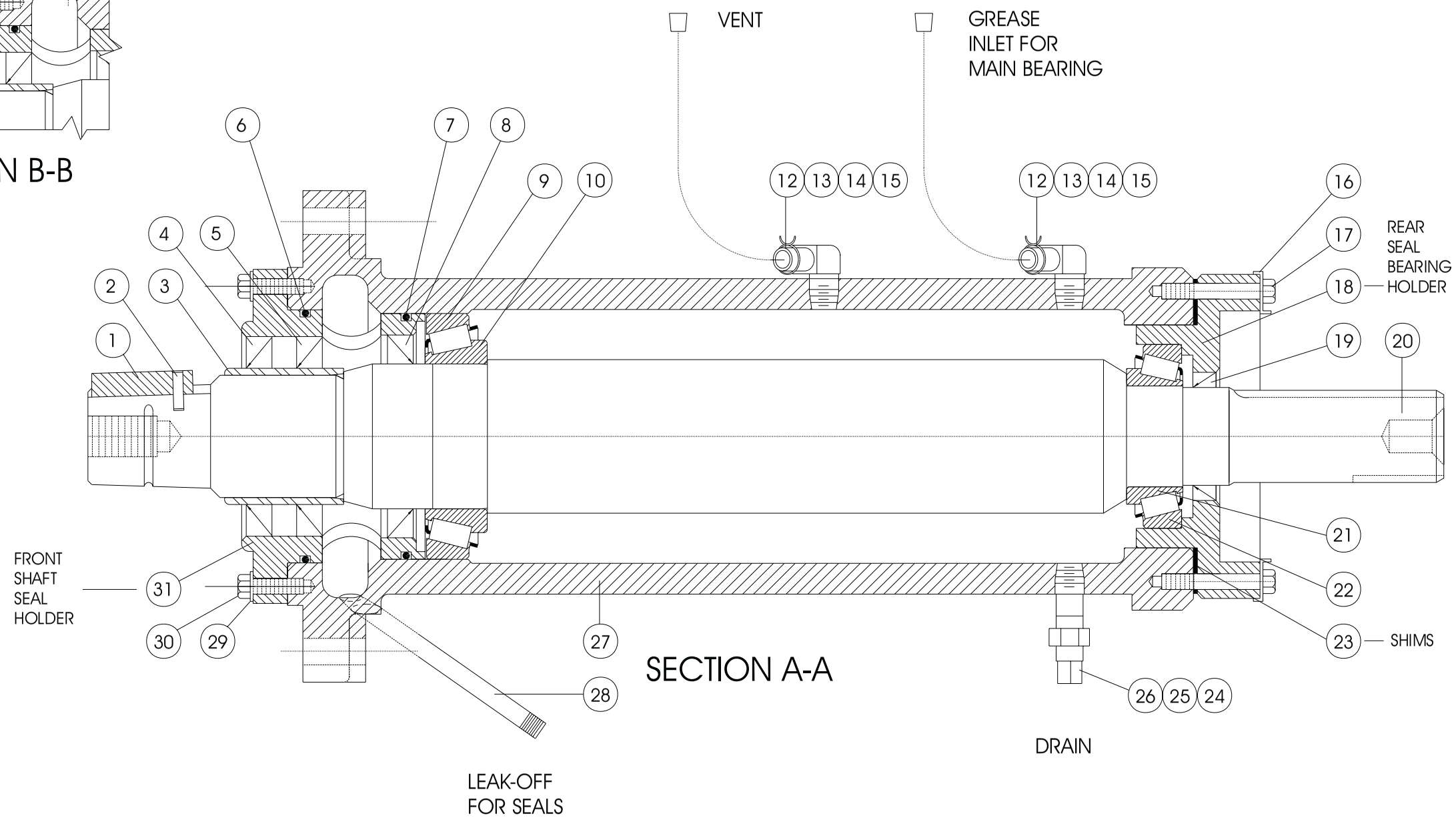




SECTION B-B



SECTION A-A

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

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Parts List—Main Bearing

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	A33 09901	* BEARING ASSY=C5M + N4M	30020M4A,C4A,C4E M5X+30022M4X,M5X, C5X,S5X,K5X
	B	ABM33001	BEARING ASSY=3020M7	30020M7X
	CC	A33 09901V	MAIN BEARASY 3020C4/M5-VITON	30020M4A,C4A,C4E M5X+30022M4X,M5X, C5X,S5X,K5X OPTIONAL VITON
			----------COMPONENTS----------	
all	1	15H089S	SPRINGPIN 1/8"DIA X 5/8" LONG	
all	2	02 02294A	SHAFT KEY 3/8 X 3/8	
all	3	02 13143	SEALSLEEVE=SWE-1/SWE	
AB	4	24S053	SEAL 2.625X3.625X.437#10050LUP	
C	4	24S053V	SEAL 2.625X3.625X.437#10050LUP	
AB	5	24S053	SEAL 2.625X3.625X.437#10050LUP	
C	5	24S053V	SEAL 2.625X3.625X.437#10050LUP	
all	6	60C151	ORING 3+7/8ID1/8CS BUNA70#241	
all	7	60C151	ORING 3+7/8ID1/8CS BUNA70#241	
all	8	24S052A	SEAL 2.559X3.55X.315 CR#25430	
all	9	54A916	CUP TIMKN#JLM710910 1/BX+PT#	
all	10	54A915	CONE TIMKN#JLM710949C 1/BX	
all	12	5SL0EBEC	NPTELB 90DEG STRT 1/4 BRASS125	
all	13	03 01142	NIPPLE 1/4X1+1/4 BRASS	
all	14	27A043A	HOSECLAMP.562"DIA.SPRG#HC9STZD	
all	15	60E005P	PVC TUBING 1/2"ID X 5/8"OD	
all	16	02 03407	LOCKING WASHER ZINC PLATE	
all	17	15K127	HEXFLGSCR 3/8-16X2 GR8 CS	
all	18	X2 03659A	HOUSE=SEAL+BRG 30M,V7	
all	19	24S048AAA	SEAL 1.625X2.375X.375 CS/BUNA	
all	20	X2 13103A	SHAFT,MAIN FOR 3020C5M+N4M	
all	21	54A308	CONE M802048 TIM 2-24 1/BX+PT#	
all	22	54A307	CUP M802011 TIMK 2-24 1/BX+PT#	

Parts List, cont.—Main Bearing

Used In	Item	Part Number	Description	Comments
all	23	02 03323	SHIM=.003 CRS GREEN	AS REQUIRED
all	23	02 03323A	SHIM=.005 CRS BLUE	AS REQUIRED
all	23	02 03323B	SHIM=.010 CRS RED	AS REQUIRED
all	23	02 03323C	SHIM=.0075 CRS BLACK	AS REQUIRED
All	23	02 03323D	SHIM=,020 CRS WHITE	
all	23	02 03323E	SHIM=.050 CRS CLEAR	
all	24	5SP0EFFSSM	NPT PLUG 1/4 SQSLDMAGNET BLKST	
all	25	5N0E01KBE2	NPT NIP 1/4X1.5TBE BRASS STD.	
all	26	5SCC0EBE	NPT COUP 1/4 BRASS 125# W/HEX	
AC	27	X2 03573A	HOUSING BEARING C5M	
B	27	X2 13105A	HOUSING=MAIN BEARING 3020M7	
all	28	5N0E05AG42	NPT NIP 1/4X5 TBE GALSTL SK40	
all	29	02 03564	BOLT LOCKING TAB 1/4 BOLT	
all	30	15B080	HEXCAPSCR 5/16 X1+1/4 SS-18-8	
all	31	X2 13144A	HOLDER=SHFT SEAL(05=24S052A)	

Main Bearing Assembly

30015V7J, T5J, T5E, M6x

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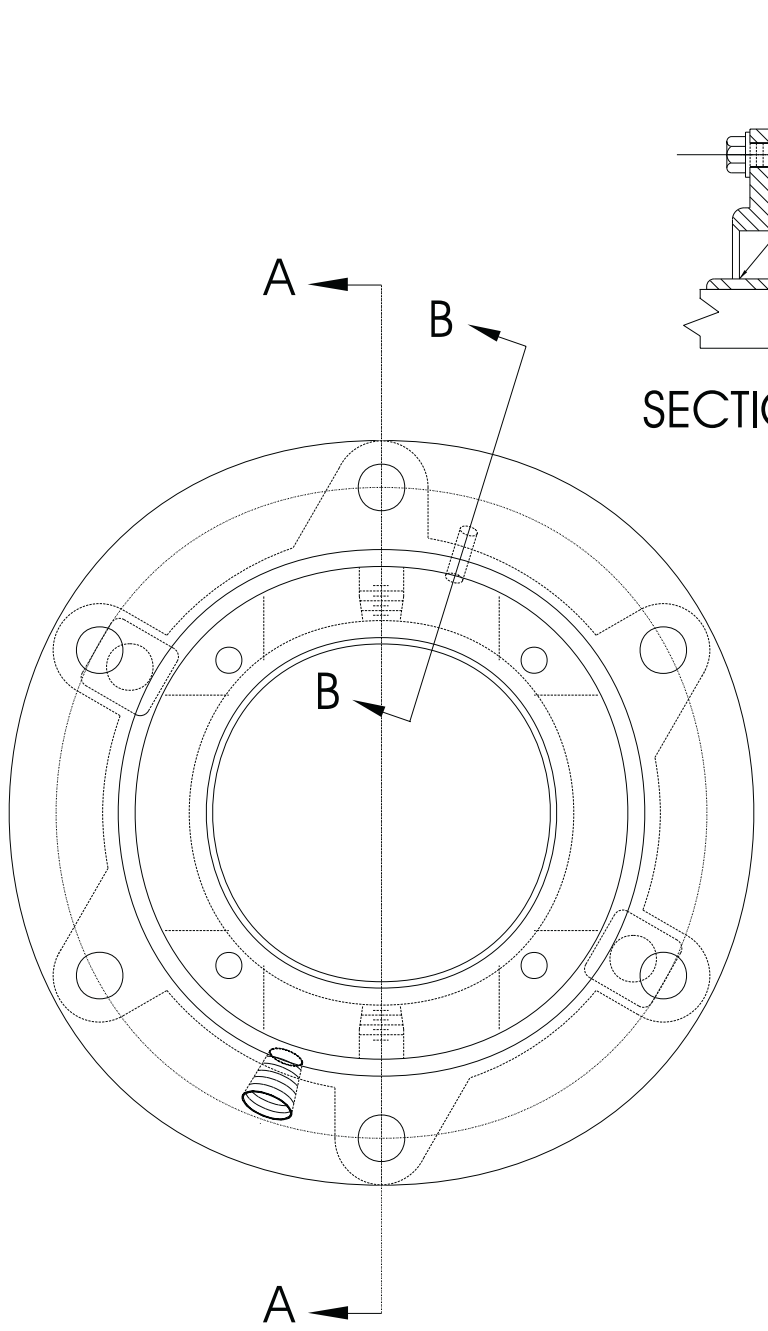
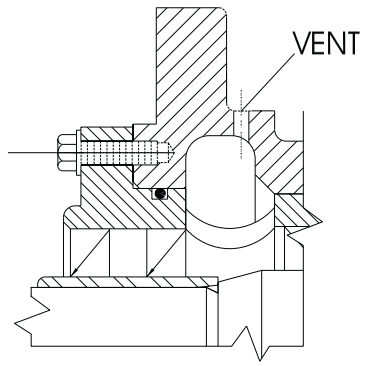
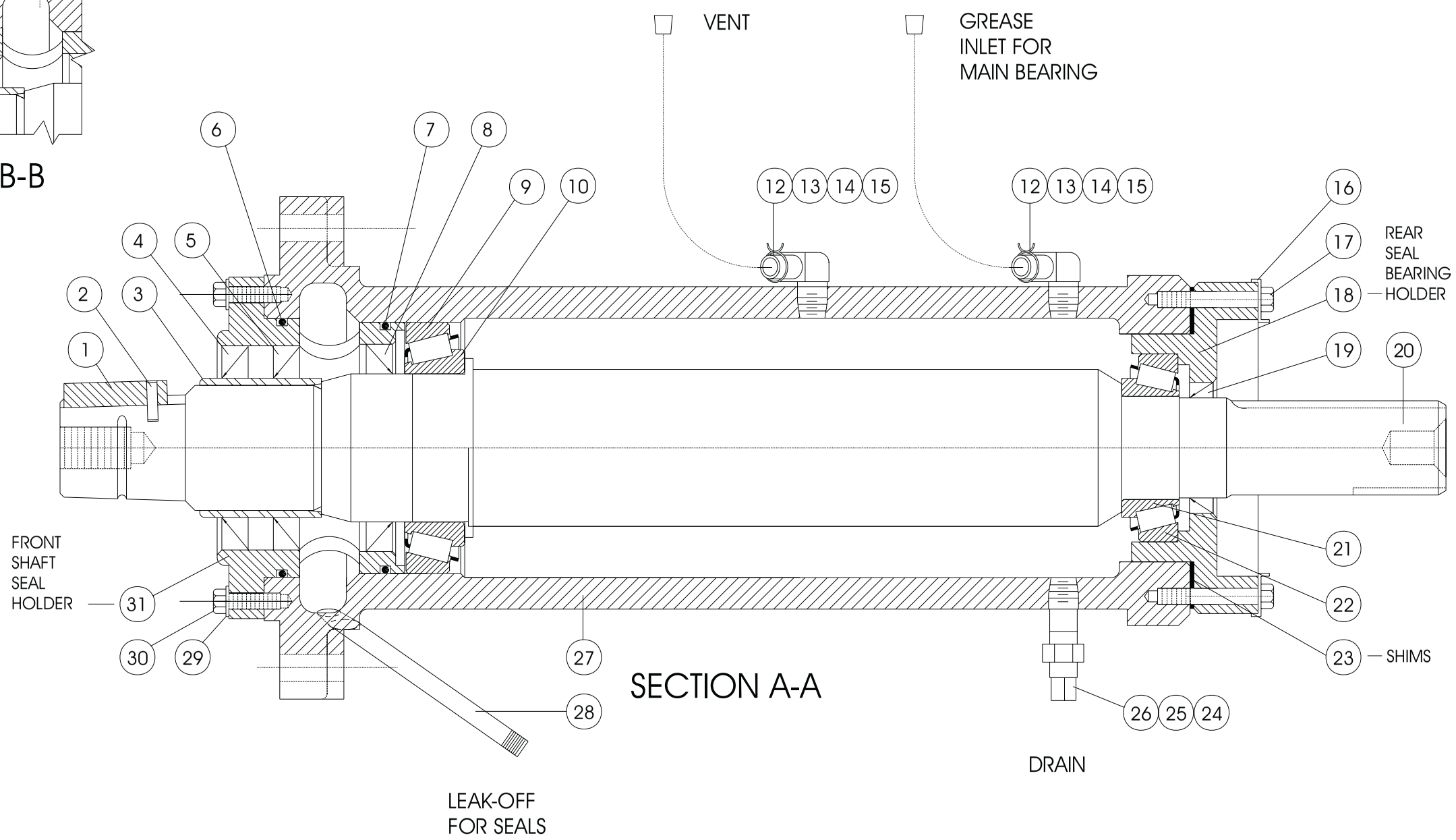




SECTION B-B



SECTION A-A

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

Parts List—Main Bearing Assembly

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	SA 33 048	* BEARING ASSY 3015C6M ONLY	**30015V6J, T5J**,**T5E**, M6x
			----------COMPONENTS----------	
all	1	02 02294A	SHAFT KEY 3/8 X 3/8	
all	2	15H089S	SPRINGPIN 1/8"DIA X 5/8" LONG	
all	3	02 03311	SEAL SLEEVE OUR MATL	
all	4	24S005	SEAL 2.25 X 3.0 X .375 SS BUNA	
all	5	24S005	SEAL 2.25 X 3.0 X .375 SS BUNA	
all	6	60C151	ORING 3+7/8ID1/8CS BUNA70#241	
all	7	60C150	ORING 3+3/4ID1/8CS BUNA70 #240	
all	8	24S015	SEAL 2.265X3.256X.433 CR#23678	
all	9	54A319	CUP 28920 TIMKN 2-24 1/BX+PT#	
all	10	54A320	CONE 28985 TIMKN 2-51 1/BX+PT#	
all	12	5SL0EBEC	NPTELB 90DEG STRT 1/4 BRASS125	
all	13	03 01142	NIPPLE 1/4X1+1/4 BRASS	
all	14	27A043A	HOSECLAMP.562"DIA.SPRG#HC9STZD	
all	15	60E005P	PVC TUBING 1/2"ID X 5/8"OD	
all	16	02 03407	LOCKING WASHER ZINC PLATE	
all	17	15K127	HEXFLGSCR 3/8-16X2 GR8 CS	
all	18	X2 03659A	HOUSE=SEAL+BRG 30M,V7	
all	19	24S048AAA	SEAL 1.625X2.375X.375 CS/BUNA	
all	20	X2 03314A	MAIN SHAFT=3015N6E+C6M	
all	21	54A308	CONE M802048 TIM 2-24 1/BX+PT#	
all	22	54A307	CUP M802011 TIMK 2-24 1/BX+PT#	
all	23	02 03320B	SHIM .003 ARTUS GREEN	
all	23	02 03320C	SHIM .005 ARTUS BLUE	
all	23	02 03320D	SHIM .010 ARTUS BROWN	
all	23	02 03320G	SHIM .0075 ARTUS TRANSMATTE	
all	24	5SP0EFFSSM	NPT PLUG 1/4 SQSLDMAGNET BLKST	
all	25	5N0E01KBE2	NPT NIP 1/4X1.5TBE BRASS STD.	
all	26	5SCC0EBE	NPT COUP 1/4 BRASS 125# W/HEX	
all	27	X2 03573	BEARHOUSE=C6M ONLY	
all	28	5N0E05AG42	NPT NIP 1/4X5 TBE GALSTL SK40	
all	29	02 03564	BOLT LOCKING TAB 1/4 BOLT	
all	30	15B080	HEXCAPSCR 5/16 X1+1/4 SS-18-8	
All	31	X2 03437	HOLDER=SHAFT SEAL=1/CWU	

JACKSHAFT BEARING REPLACEMENT

Removing the Jackshaft

⚠ DANGER ⚠

ELECTROCUTION HAZARD—High voltage is present inside electric boxes, motors, and many other components. Power switches on machine control panels disable only control circuit power in certain boxes. You can be killed or seriously injured on contact with high voltage.

☞ **Lock OFF and tag out power at the wall disconnect before servicing.**

B Dual motor drive 30015, 30020, and 30022 machines are equipped with jackshafts. Replace worn bearings as described below.

See "JACKSHAFT ASSEMBLY" (see Table of Contents) during the following procedures:

1. With the power locked OFF, remove the top console cover by prying out the four plugs and unscrewing the four bolts. Remove the rear belt guard.
2. Loosen and remove the belts from the jackshaft. Remove the straight bore pulley, electric clutch and coil from the jackshaft (for further information see "DRIVE TRAIN SERVICE" in the Table of Contents).
3. Remove the four jackshaft mounting screws.

Replacing the Bearing

NOTE: Provide enough clearance around the bottom of the housing (FIGURE 1) as the bearing will come out with the shaft.

1. Remove and discard the shaft clip and place the assembly in a press with the tapered shaft end pointing up as shown in FIGURE 1. Press the shaft down. When the lower bearing clears the housing, the shaft will drop out with the lower bearing remaining on the shaft.
2. Place the shaft in the press and remove the bearing from the shaft. Remove the outer retaining ring from the housing and discard. Place the housing in the press with the bearing facing downward, then press the bearing out. Remove the inner retaining ring and discard all retaining rings.

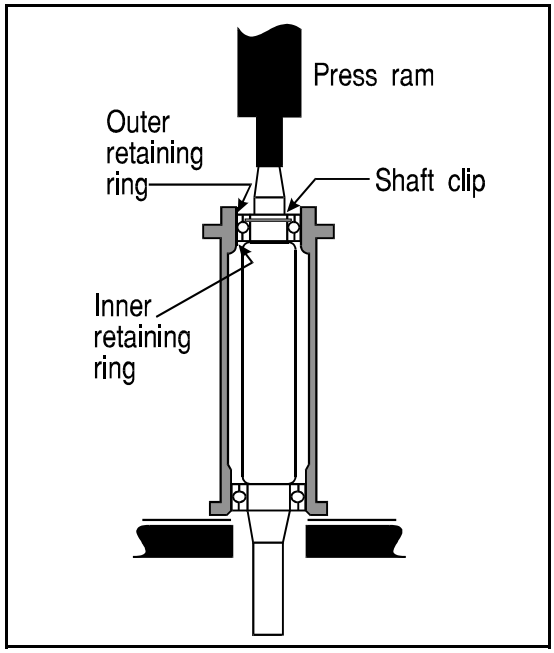


FIGURE 1 (MSSM0709BE)
Removing Jackshaft Bearings

3. Thoroughly clean all parts with solvent. **The bearing housing and shaft must be absolutely clean and free of dirt and adhesives.**

4. Install a new inner retaining ring inside the housing and apply a small amount of retaining compound (Loctite 271 or similar) around the bearing seating surface of the bearing housing as shown in FIGURE 2. Press the new bearing in the housing, applying equal force to the inner and outer bearing races**.** Install a new outer retaining ring in the housing.

5. Slide the other new bearing onto the shaft and place the shaft inside the housing with the tapered end into the installed bearing. Place the assembly under the press with the housing completely supported by the inner and outer race of the bearing as shown in FIGURE 2. Simultaneously press the bearing onto the shaft and into the housing until the bearing bottoms out, applying equal force to both inner and outer bearing races. Install a new shaft clip (tapered end only).

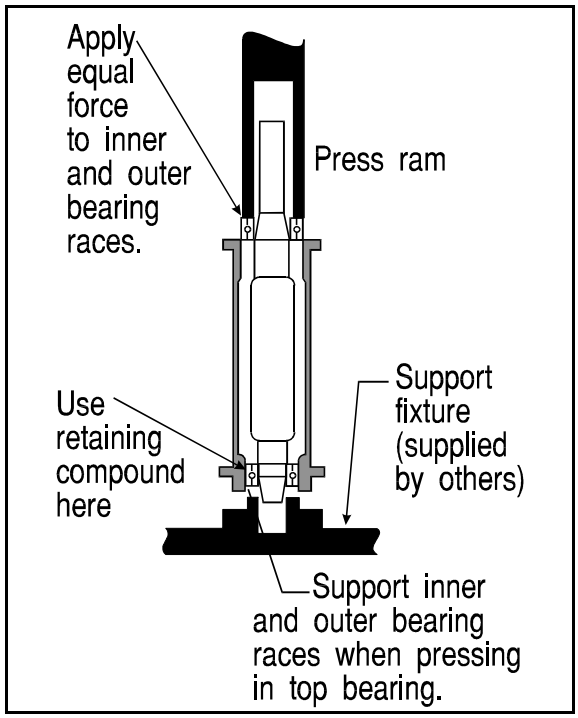


FIGURE 2 (MSSM0709BE)
Replacing Jackshaft Bearings

Installing the Jackshaft

1. Replace the jackshaft and all related components in reverse order of disassembly.

2. Align pulleys and set belt tension as explained in “DRIVE TRAIN SERVICE”.

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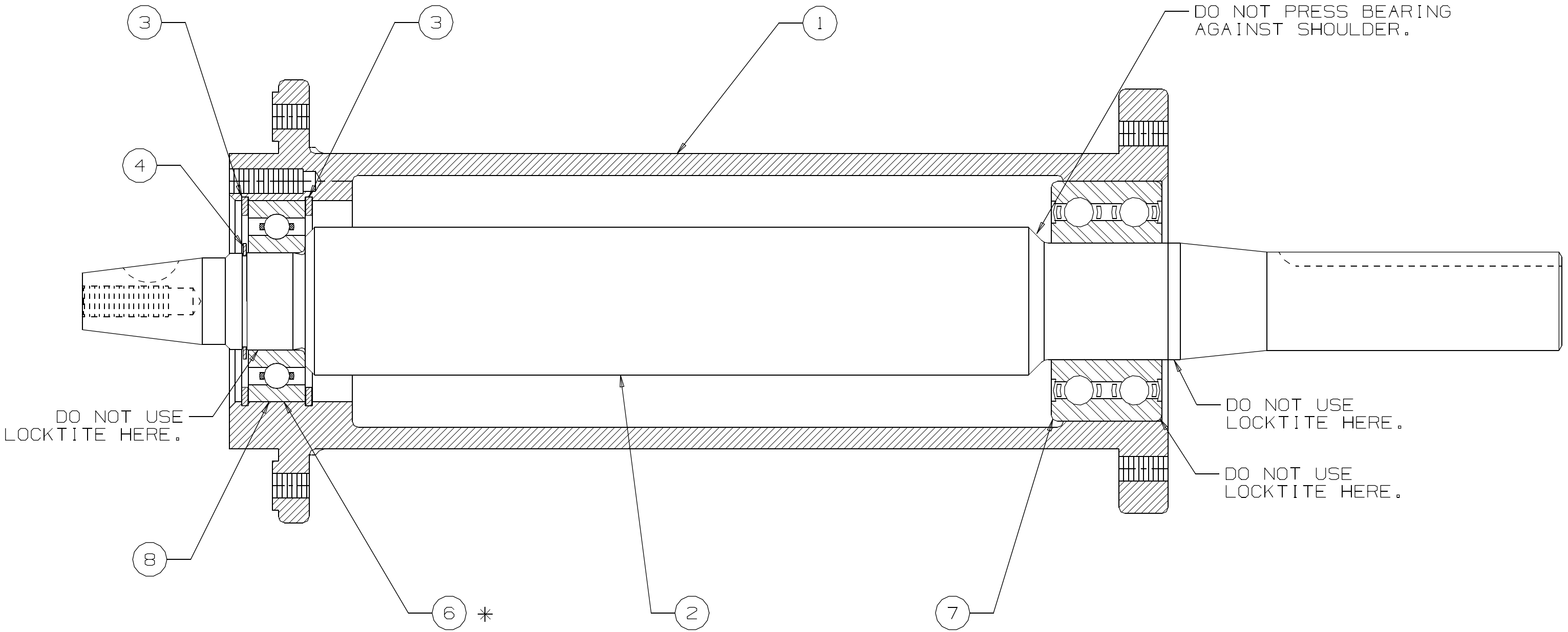
DRAWING
(See other page for parts list, if applicable.)

JACKSHAFT ASSEMBLY
30015,30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

BMP910035/93251V (Page 1)



* USE LOCKTITE (BEARING MOUNT GRADE) BETWEEN FRONT BEARING AND HOUSING ONLY.

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PARTS LIST
(See other page for drawing.)

JACKSHAFT ASSEMBLY
30015,30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	SA 13 013	85242D$ JKSHAFT ASSY DBLROW=	30020M4X,M5X,M7X+3022M4X,M5X
00B	SA 33 034	85251D$ JKSHAFT ASSY SGLROW=CWE+C4	30015C4X,M4X,M6X+30020C4A,M4X+3022C5X
001	X2 03308	91212C HSG-JACKSHAFT=1/CWU+3626SWE	
002	02 13163	92233D JACKSHAFT=3626SWE	
003	17B135	EXT. RET RING 4000-200-ST-ZD	
004	17B155	EXTERNAL RETAINING RING	
006	54A070	BALLBEAR FAFNIR P205PP FA52908 1/BX	
007A	54A926	BALLBEAR DOUBLE ROW TYPE 5206	00A (DOUBLE ROW BEARING)
007B	54A080	BALLBEAR FAFNIR P206PP FA52908 1/BX	00B (SINGLE ROW BEARING)
008	20C005C	ADH/SEALANT 250 CC LOCTITE #271-41	
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

If more than one reference item appears, this usually means this drawing applies to more than one assembly (and thus to more than one range of machines).

Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the

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Section 4

Shell and Door Assemblies

Shellfront Assembly, Conduit, & Interlock

3010 / 3015 G5E,G5X,CGE

30015 V7J,T5J,C4A,C4E & 30022 V6J,T5J,C4A,C4E

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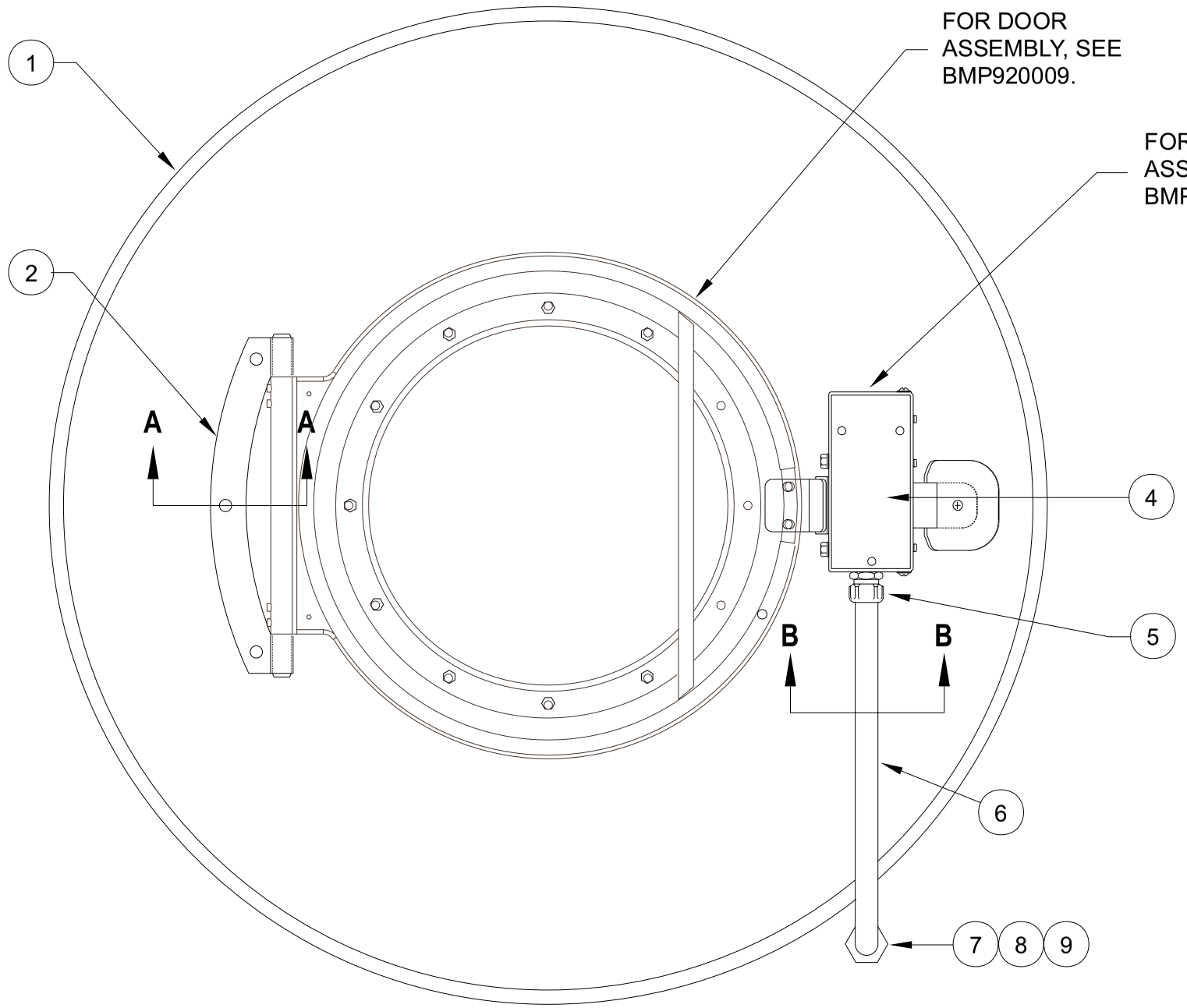
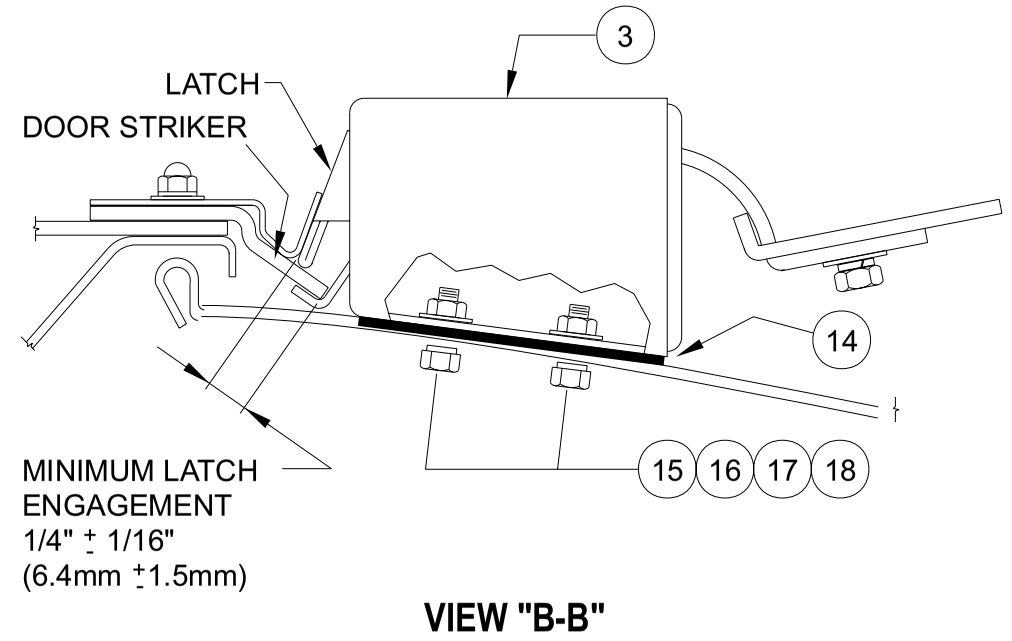
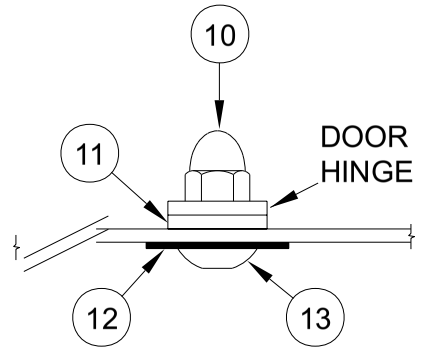




VIEW "B-B"



VIEW "A-A"

ADJUSTMENTS:

1. ADJUST DOOR STRIKER SO THAT IT TOUCHES THE LATCH SQUARELY AND EVENLY.
2. ADJUST THE LATCH SO THAT THE MINIMUM ENGAGEMENT WITH THE DOOR FULLY CLOSED EQUALS 1/4" ± 1/16" (6.4mm ± 1.5mm).

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Parts List—Shellfront, Conduit & Interlock

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	A33 10100C	*SHLASSY (IDNT) UNLOK N4P	3015M4G/J/P, M6J,D4A 3022M5G/J
	B	A33 10100H	SHELL FRONT ASSY 3015/20M4A	3015M4A,C4T,M4T,M6A,M6T 3022M5T,3022C4T
	C	A33 10100M	SHLASSY N/LOCK 3015/22S#G/J	3022S4J,S4G,S5J 3015K4A,S4J,S5G,S5J
	D	A33 10100N	SHLASSY N/LOCK 3015/22V/T	**3010G5E,G5X 3015G5E,G5X,V7J,T5E,T5J,T5X 3022V6J,T5E,T5J,T5X**
	E	A33 10100F	*SHLASSY (IDNT) UNLOK C4A	**3015C4A, 3022C4A**
	F	A33 10100G	SHLFRTASY N/O ILOK W/PROX	**3010CGE,3015CGE,30015C4E 30022C4E**
			----------COMPONENTS----------	
ABCDE	1	X2 02361B	SHELLFRONT,30",ELECTRIC LOCK	
F	1	X2 02361C	2002296D SHELLFRT=30" ILOC W/PROX	
A.C,D	2	A33 07100C	*DRASSY(INDNT)LK,LOGO N4,5,6P	
B	2	A33 07100H	95027 DOOR ASY 3015/3020M4A	
EF	2	A33 07100F	95027# DRASSY (INDNT)LK,LOGO C4A	
A,B	3	EDL00171	INTRLKHSG ASSY=N/UNLOCK 240V	
C	3	EDL00371	INTERLKHSG=N/LOCK+SWITCH240V	
D	3	EDL00271	INTRLKHSG ASSY=N/LOCK 220V	
F	3	EDL00171C	INTRLKHSG ASSY=N/O W/ PROX 240	
all	4	01 10422	NPLATE:DOOR ILOC->N4,5,6 P	
all	5	12K040	1/2"COND.EMT COND. PECO #260B	
All	6	03 01446	1/2 EMT CONDUIT 900D=DR INTR	
all	7	10Y71M4GEX	*M4G EXTERNAL CONNECTIONS	
all	8	12K040	1/2"COND.EMT COND. PECO #260B	
all	9	12P1ASSB	SNAPBUSH 7/8"MH X 11/16	
all	10	15G200C	HXCPNUT HI 3/8-16 BRASS NIK PL	
all	11	02 02819C	SPACER-SHELLFRONT/HINGE	
all	12	02 02293	DOOR HANDLE NUT GASKET	
all	13	15K084	TRUSS HXSOK 3/8-16 X 23/32SS	
ABCDE	14	02 03669	GASKET=INTRLK HOUSING	
F	14	02 03669C	GASKET=INTRLK HOUSING 8" LONG	
all	15	15N174	HXCAPSCR 1/4-20UNC2X5/8SS18-8	
all	16	15U180	LOCKWASHER MEDIUM 1/4 ZINCPL	
all	17	24G020N	ROLLED WASH.252ID NYLTITE 25W	

Parts List, cont.—Shellfront, Conduit & Interlock

Used In	Item	Part Number	Description	Comments
All	18	15G168	SQNUT 1/4-20UNC2 SS18-8	

Door Assembly

30015 & 30022 Rigid Mount

BMP920009/2001036V
(Sheet 1 of 2)

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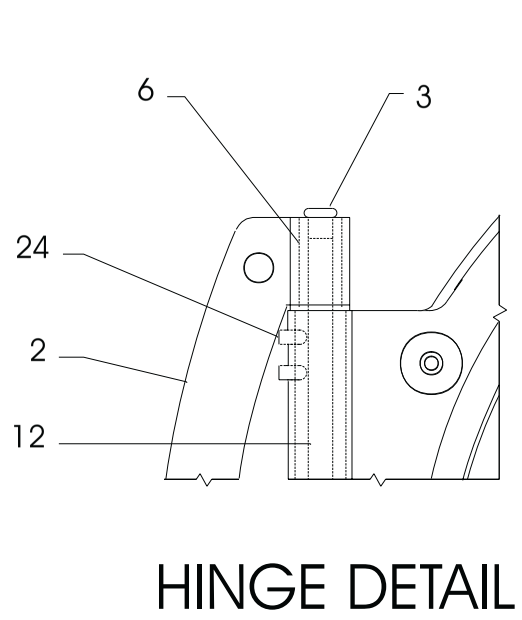
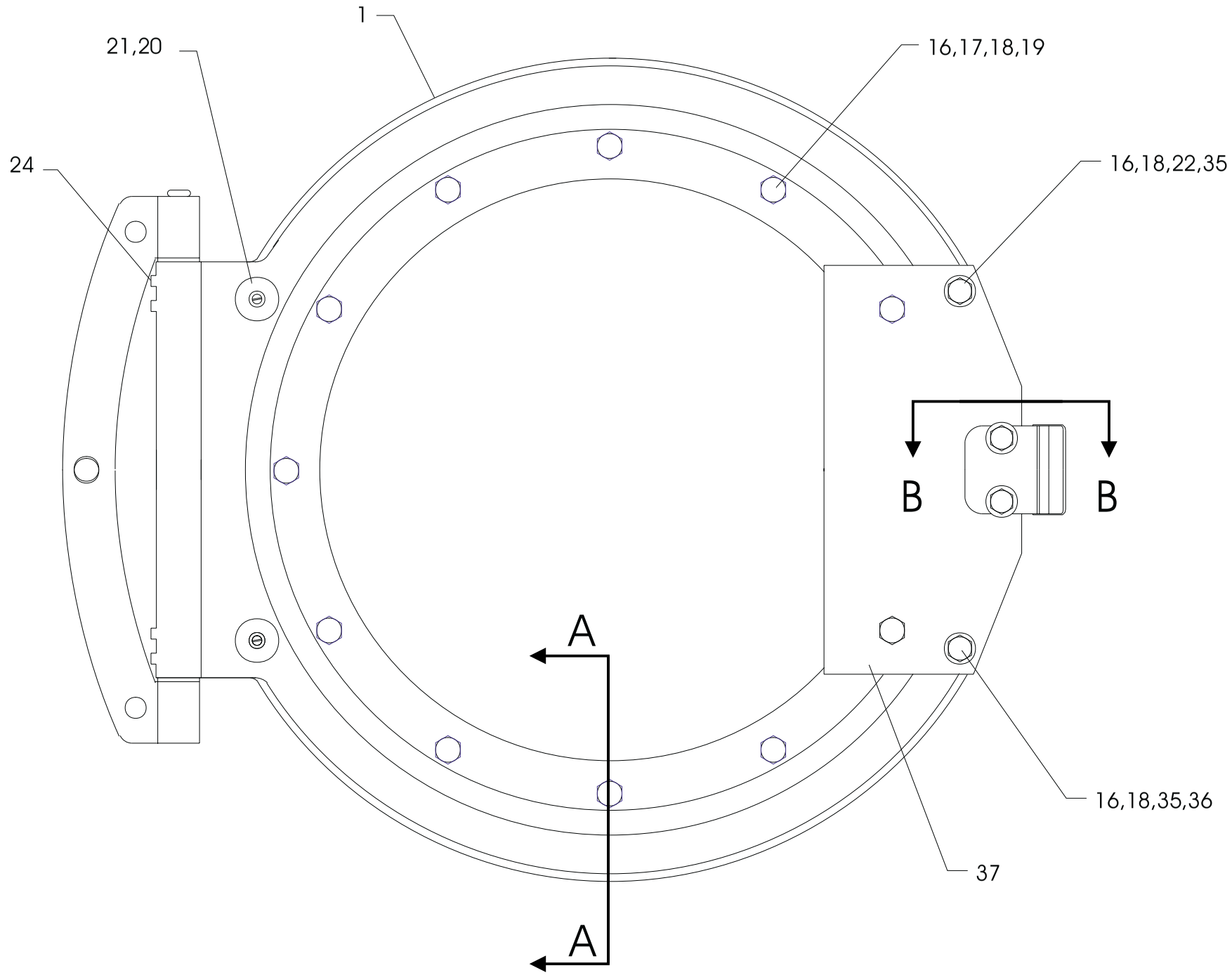
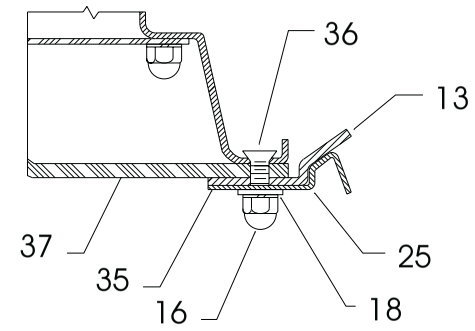
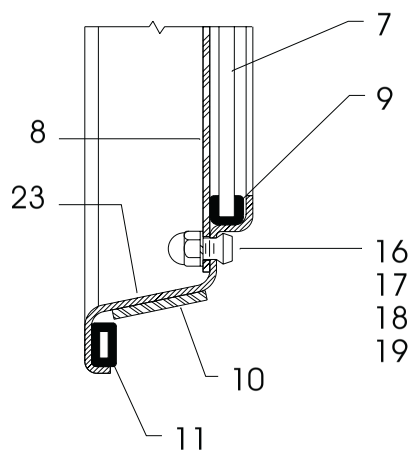


HINGE DETAIL





VIEW B-B



VIEW A-A

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Parts List—Door Assembly

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	A33 07100C	*DRASSY(INDNT)LK,LOGO N4,5,6P	**30015V7J,T5J,T5E** **3022V6J,T5J,T5E** 3015V7G/V7J;3022V7G/V7J 3015M4G/J/P,M6J,D4A 3022M5G/J 3022S4J,S4G,S5J 3015K4A,S4J,S5G,S5J
	B	A33 07100H	DOOR ASY 3015/3020M4A	30015M4A+30020M4A ONLY
	C	A33 06900F	ASSY=DOOR W/MLOGO DKRED 3022	3022F8J/F8P/F8W
			----------COMPONENTS----------	
all	1	X2 02814C	DOOR=SHELL W/1LOK-3020	
all	2	02 02819	HINGE=STAMPED DOOR 25#	
all	3	12P1AGHP1	HOLEPLUG 3/8"BLACK LPE	
all	6	02 02817	FLANGE BRG=DOOR HINGE-NYLON	
A	7	02 09215D	DR GLASS=N4,5,6P W/MIL LOGO	
B	7	02 09215A	DORGLAS=DRAW W/MILNOR LOGO	
C	7	02 09215E	DOOR GLASS W/MIL LOGO (RED)	
all	8	02 09021	RING=DOOR GLASS PRESSURE	
all	9	02 02366	GASKET DOORGLAS GTR52-5220-3	
all	10	02 10545	EXTR BAND-STAMPED SS CYLDOOR	
all	11	02 10342A	GASKET=15" DOOR	
all	12	02 02764	HINGEPIN=SHELLDOOR L=10+5/8"	
all	13	03 01420C	DOOR STRIKER=ILOC	
all	16	15G140	HXCPNT 1/4-20 #C250=20 NKLPLT	
all	17	15K031	BUTSOKCAPSCR 1/4-20X1/2 SS18-8	
all	18	15U181	LOCKWASHER MEDIUM 1/4 SS18-8	
all	19	24G020N	ROLLED WASH.252ID NYLTITE 25W	
all	20	60C080	RECESS BUMPER RUBBERLAVELLE #7	
all	21	15P103	TRDCUT-F RDHDSLOT 8-32UNCX1/2	
all	22	15N173A	FLTMACSCR 1/4-20 UNCX5/8 UCUTS	
all	23	20C044	ADHESIVE 3M EC-1300 IN PINT CO	
all	24	15Q077	SOKSETSCR 1/4-20X1/4 ZINC ALLE	
all	25	03 01423C	LATCH GUARD ILOC 3015-20	
all	35	15U188	FLTWASH 1/4 STD COMM SS18-8	
all	36	15N191	FLATMACHSCR 1/4-20X7/8 SS18-8	
all	37	03 01420D	DOOR HANDLE=ILOC 3015-20	

Interlock Assembly

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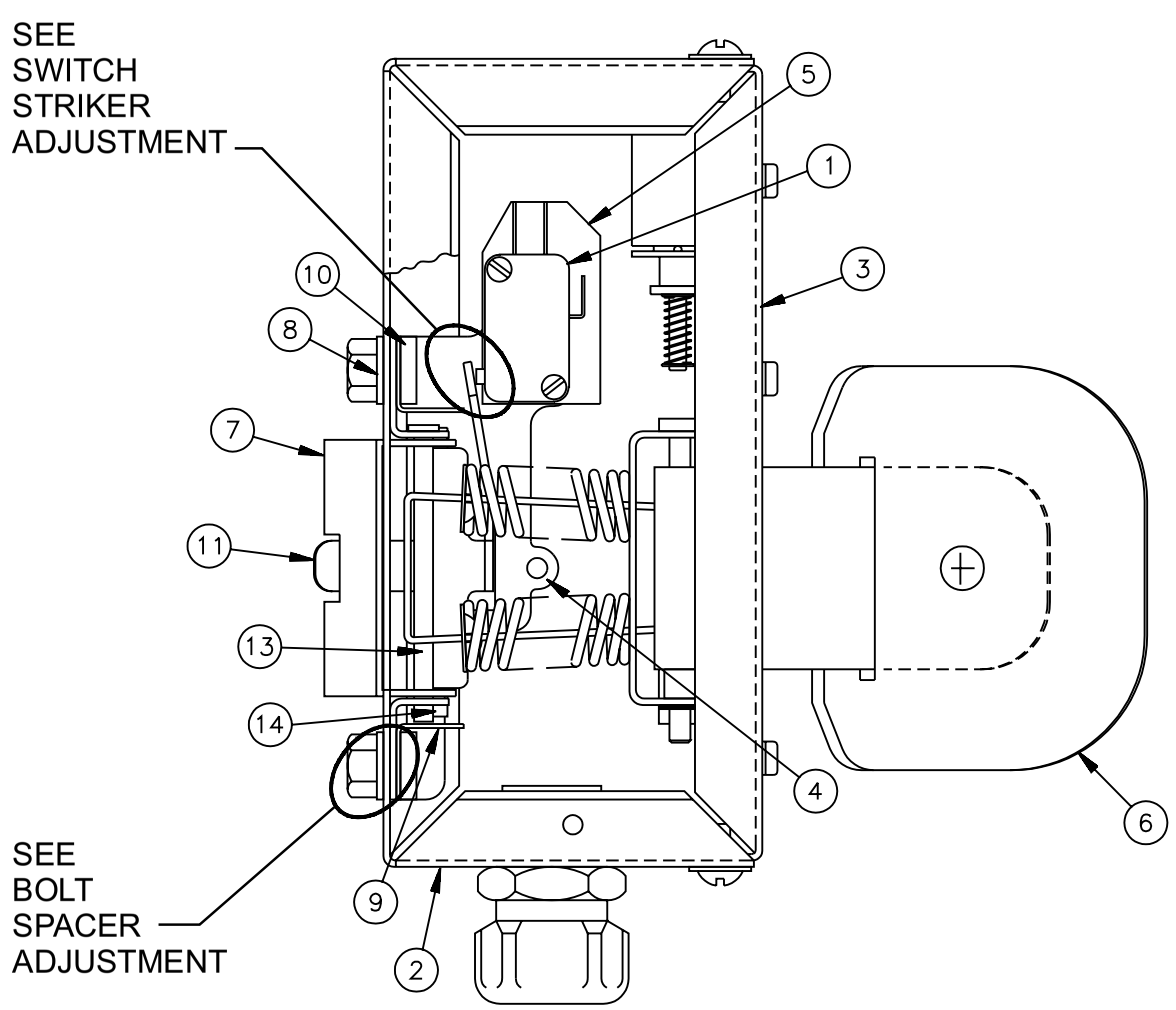
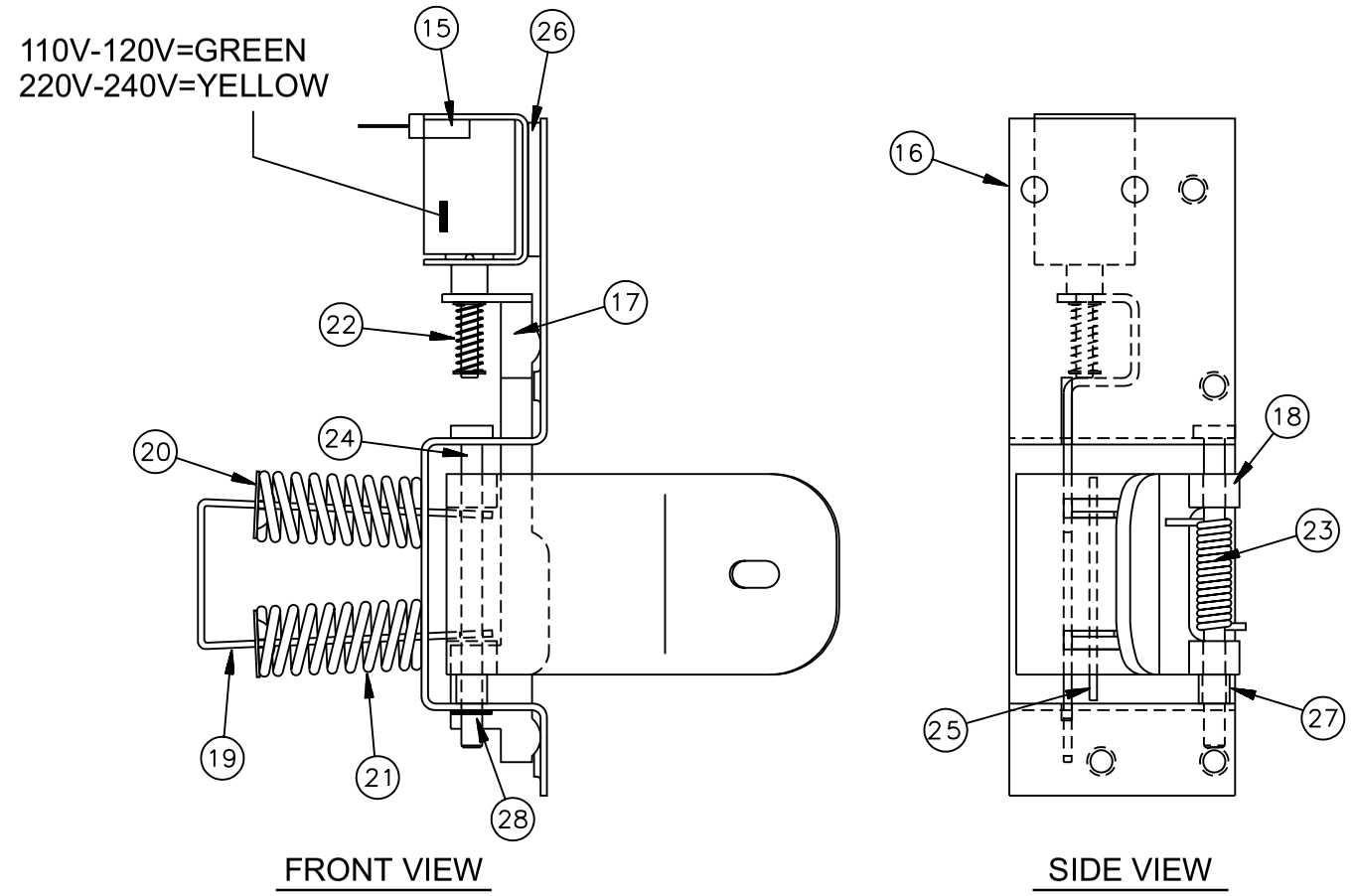
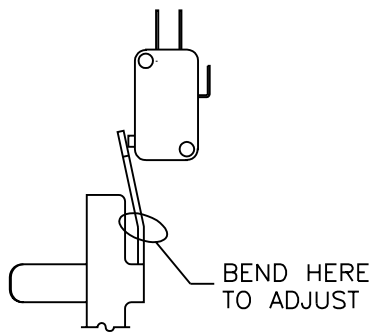




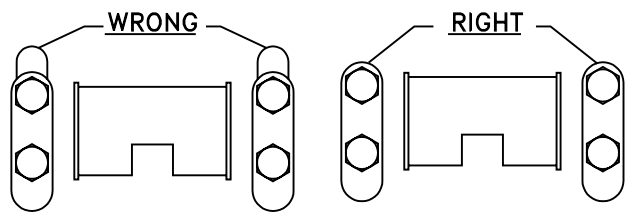
ASSEMBLIES 00AA,00BB,00CC,00DD

SWITCH STRIKER ADJUSTMENT



Adjust the switch striker arm by bending as shown so that :
1) The switch is activated when the door is closed
2) The switch does not actuate when the unlatching lever is fully depressed with the door open
3) The arm does not over travel and hit the switch housing when the door is closed and the switch is actuated.

BOLT SPACER ADJUSTMENT



Bolt Spacer Adjustment
1) On a new machine the slots on the front housing should not show a gap past the bolt spacers.
2) The spacers should be installed with the long side toward the shellfront

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Parts List—Interlock Assembly

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	EDL00171	88093# INTRLKHSG ASSY=N/UNLOCK 240V	**30015V7J,T5J,T5E** 3015/20/22 Mxx,Cxx,Vxx
	AA	EDL00171A	93207@ RR PIVOT PL ASSY=N/UNLOK240V	USED ON 00A (CONTAINS ITEMS 15-28)
	B	EDL00221	96411 INTRLKHSG ASSY=N/LOCK 220V	3022F8J/P/W 3630F8J/P/W/S
	BB	EDL00271A	93207#*RR PIVOT PL ASSY=N/LOCK 220V	USED ON 00B (CONTAINS ITEMS 15-28)
	C	EDL00337	88093#*INTRLKHSG ASSY=N/LOCK 120V	36&42QXX,BWP 3015D4A **36021V6J, 36026V5J** **36026V7J, 42026V6J**
	CC	EDL00337A	93207# RR PIVOT PL ASSY=N/LOCK 120V	USED ON 00C (CONTAINS ITEMS 15-28)
	D	EDL00371	94000Z INTERLKHSG=N/LOCK+SWITCH240V	**3022V6J,T5J** 3022S4J,S4G,S5J 3015K4A,S4J,S5G,S5J
	DD	EDL00271A	93207#*RR PIVOT PL ASSY=N/LOCK 220V	USED ON 00D & 00E (CONTAINS ITEMS 15-28)
	E	EDL00271	88093#INTRLKHSG ASSY=N/LOCK 220V	**30022T5E**
			----------COMPONENTS----------	
all	1	09R014A	05ZMIMI-SW SPDT STAKON #V15G1C26K	
all D only	2 2	03 01426 03 01426A	77201D HOUSING=FRONT=ILOC 94186D HOUSING=FRONT= ILOC W/UNLATC	
all D only	3 3	03 01427A 03 01427B	77181C HOUSING=REAR=ILOC (C-7) 94186D HOUSING=REAR=ILOC W/UNLATCH	
all	4	03 01429	75479C PLATE=FNT PIVOT=ILOC	
all	5	03 01335	INSULATOR=AUTOSPOT	
all	6	03 01425A	92683C DOOR HANDLE EXTENSION	
all	7	03 01423	75736B LATCH = INTERLOCK	
all	8	03 01417	75100B PLATE=SPACER=ILOC	
all	9	03 01418B	75194B KEEPER=LATCH PIN/NOTCH	
all	10	03 01418	75100B TAP STRIP=ILOC	

Parts List, cont.—Interlock Assembly

Used In	Item	Part Number	Description	Comments
all	11	03 01424A	90501B STRIKER=SWITCH=LONG TAB	
all	12	03 01442	92697B SOLENOID INSULATION=DR INTRK	(NOT SHOWN)
all	13	03 01443	84251AFLATHDRIVET 5/32X2+5/16 ZINC	
all	14	15H091	01Z STRGHTPIN 5/32"X2.25 LG ZINC	
AA,BB,DD CC	15 15	09K062B71 09K062B37	04Z SOLENOID 240/60--220/50 = ILOC 03Z SOLENOID(C-7)120/60--110/50	
all	16	03 01428A	93207C PLATE=REAR PIVOT=ILOC (C-7)	
AA BB,DD CC	17 17 17	03 01421B 03 01421A 03 01421D	93207B SLIDE=NORMALLY OPEN(C7 SOL) 75736B SLIDE=NORMALLY LOCKED=ILOC 77341B SLIDE=NORMALLY LOCKED(C7-S)	
all	18	03 01425	75479B HANDLE=ILOC	
all	19	03 01422	94256C KEEPER=SPRING=ILOC	
all	20	03 01444A	77503B SPRING CUP = ILOC	
all	21	03 01444	82293ASPRING .51/1.69/46+CADPL	
all	22	03 01445	88481ASPRING .2/.625/.319+CADPL	
all	23	03 01445B	75935B TORQUE SPRING (.53 IN-#)CDPL	
all	24	03 01443	84251AFLATHDRIVET 5/32X2+5/16 ZINC	
all	25	15H090I	STRAIGHT PIN 5/32"DIAX1.75"LG ZINC	
AA only	26	03 S1X1	88172B SHIM:DOOR INTLK SOLENOID N4P	
all B	27 27	27B205080Z 27B205080E	SPCRROLL.177ID.218L.027T STLZC 01ZSPCRROLL.177ID.25L.027TK CSZNC	
BB,CC,DD	28	03 01418C	75736B KEEPER=NORMLOCKED SLIDE=ILOC	

Section 5

Control and Sensing Devices

REPLACING AND ADJUSTING THE POWER SUPPLY

B

In the unlikely event of a power supply failure, see the replacement and adjustment instructions for the machine in this section. Use a high quality digital voltmeter (Fluke model 77 or similar) for measuring voltages.

For C4A, M4A, System 7®, and E-P Plus® Models

⚠ DANGER ⚠

ELECTROCUTION HAZARD—High voltage is present inside electric boxes, motors, and many other components. Power switches on machine disable only control circuit power in certain boxes. You can be killed or seriously injured on contact with high voltage.

☞ **Lock OFF and tag out power at the wall disconnect before servicing.**

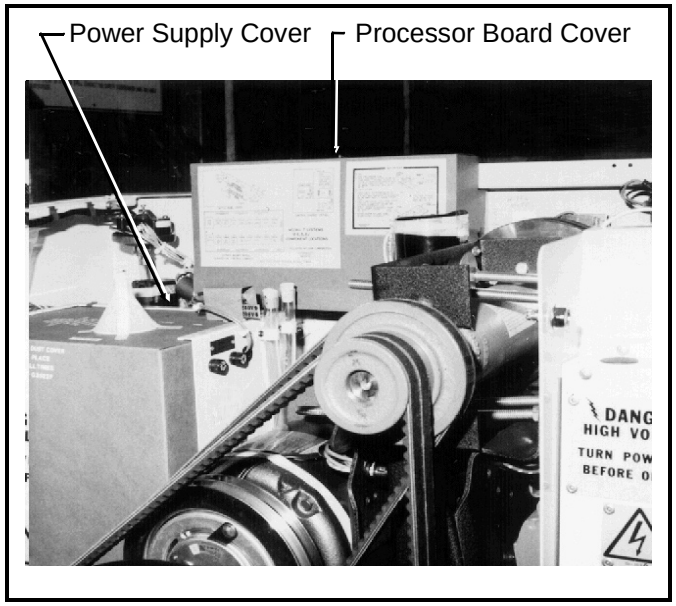


FIGURE 1 (MSSM0711AE)
Location of Power Supply and Processor Board (E-P Plus® shown)

Replacing the Power Supply—See FIGURE 1 during the following procedures:

1. Remove the console top and belt guard.
2. Remove the power supply and processor board covers.
3. After replacing the power supply, see "Adjusting Output Voltage" in this section.

Adjusting Output Voltage

⚠ DANGER ⚠

CRUSH AND ENTANGLE HAZARD—Machine power is ON and covers are removed for the following procedures. Rotating machinery can entangle and crush body parts.

☞ **Before turning power ON, open shell door to prevent machine rotation.**

⚠ DANGER ⚠

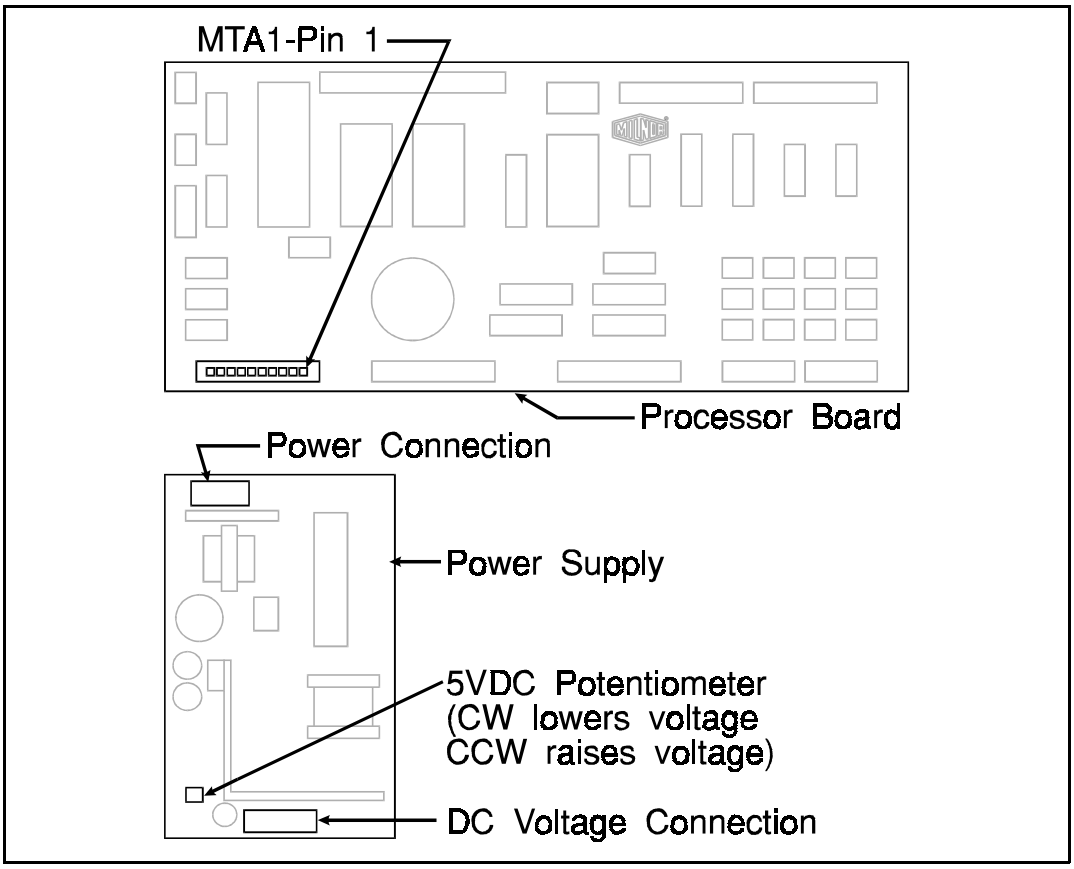
ELECTROCUTION HAZARD—Machine power is ON and covers are removed for the following procedures. You can be killed or severely injured by contact with exposed components which are energized at 120VAC or higher.

☞ **DO NOT touch any components while adjusting output voltage.**

See FIGURE 2 during the following procedures:

1. Restore power at the wall disconnect.
2. Locate connector MTA1 on the processor board. Touch the negative meter probe to the rear of pin 9 (ground connection).
3. Touch the positive meter probe to the rear of pin 3 (+5VDC).

Voltage must be between 4.95 and 5.06VDC. If not, turn the 5VDC potentiometer **slowly** (clockwise to lower, counterclockwise to raise) until the meter displays the correct value. **The microprocessor will not operate if this voltage is not within tolerance.** After setting 5VDC output voltage, with the negative meter probe still touching the rear of pin 9 (ground connection):



1. Touch the positive meter probe to the rear of pin 5. The voltage must be between +11.5 to +13.5VDC .

2. Touch the positive meter probe to the rear of pin 7. The voltage must be between -11.5 to -13.5VDC.

FIGURE 2 (MSSM0711AE)
Location of Output Voltage Potentiometer and Connector MTA1

For MARK II Models

Replacing the Power Supply

The Mark II power supply mounts inside of the Mark II control box atop the machine. After replacing the power supply, see "Adjusting Output Voltage" in this section.

⚠ DANGER ⚠

ELECTROCUTION HAZARD—High voltage is present inside electric boxes, motors, and many other components. Power switches on machine disable only control circuit power in certain boxes. You can be killed or seriously injured on contact with high voltage.

☞ **Lock OFF and tag out power at the wall disconnect before servicing.**

Adjusting Output Voltage

⚠ DANGER ⚠

ELECTROCUTION HAZARD—High voltage is present inside electrical box during the following procedure. You can be killed or seriously injured by contact with exposed components which are energized at 120VAC or higher.

☞ **DO NOT touch any components while adjusting output voltage.**

See FIGURES 3 and 4 during the following procedures:

NOTE 1: The 5VDC potentiometer (power supplies prior to Mildate 92753) can be seen through the perforations in the metal case.

NOTE 2: On some machines it may be necessary to remove the mounting screws and tilt the power supply to reach the 5VDC potentiometer.

Locate connector 1MTA31 on the processor board.

1. Restore power at the wall disconnect.

2. Touch the negative meter probe to the rear of pin 9 (this is a ground and has no wire connection to it).

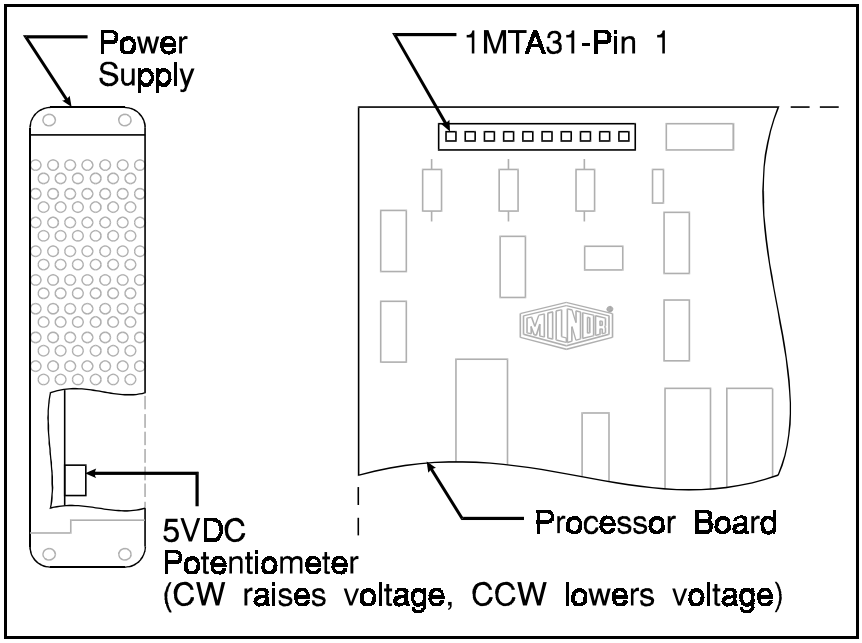


FIGURE 3 (MSSM0711AE)
Location of Output Voltage Potentiometer and Connector 1MTA31(prior to Mildate 92753)

2. Touch the positive meter probe to the rear of pin 3 (+5VDC).

Voltage must be between 4.95 and 5.06VDC. If not, turn the 5VDC potentiometer slowly until the meter displays the correct value. **The microprocessor will not operate if this voltage is not within tolerance.**

After setting 5VDC output voltage, (with the negative meter probe still touching pin 9):

1. Touch the positive meter probe to pin 5. The voltage must be between +11.5 to +13.5VDC.

2. Touch the positive meter probe to pin 7. The voltage must be between -11.5 to - 13.5VDC.

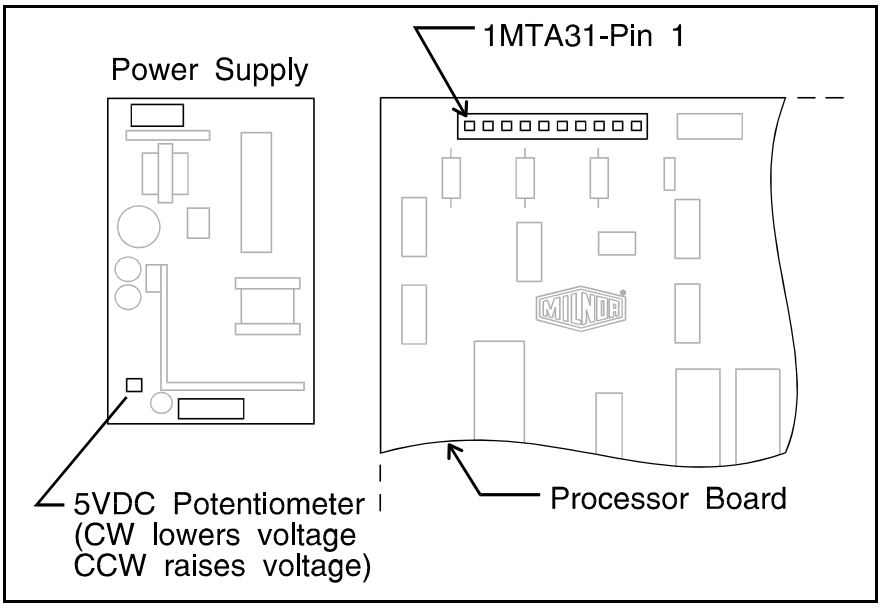
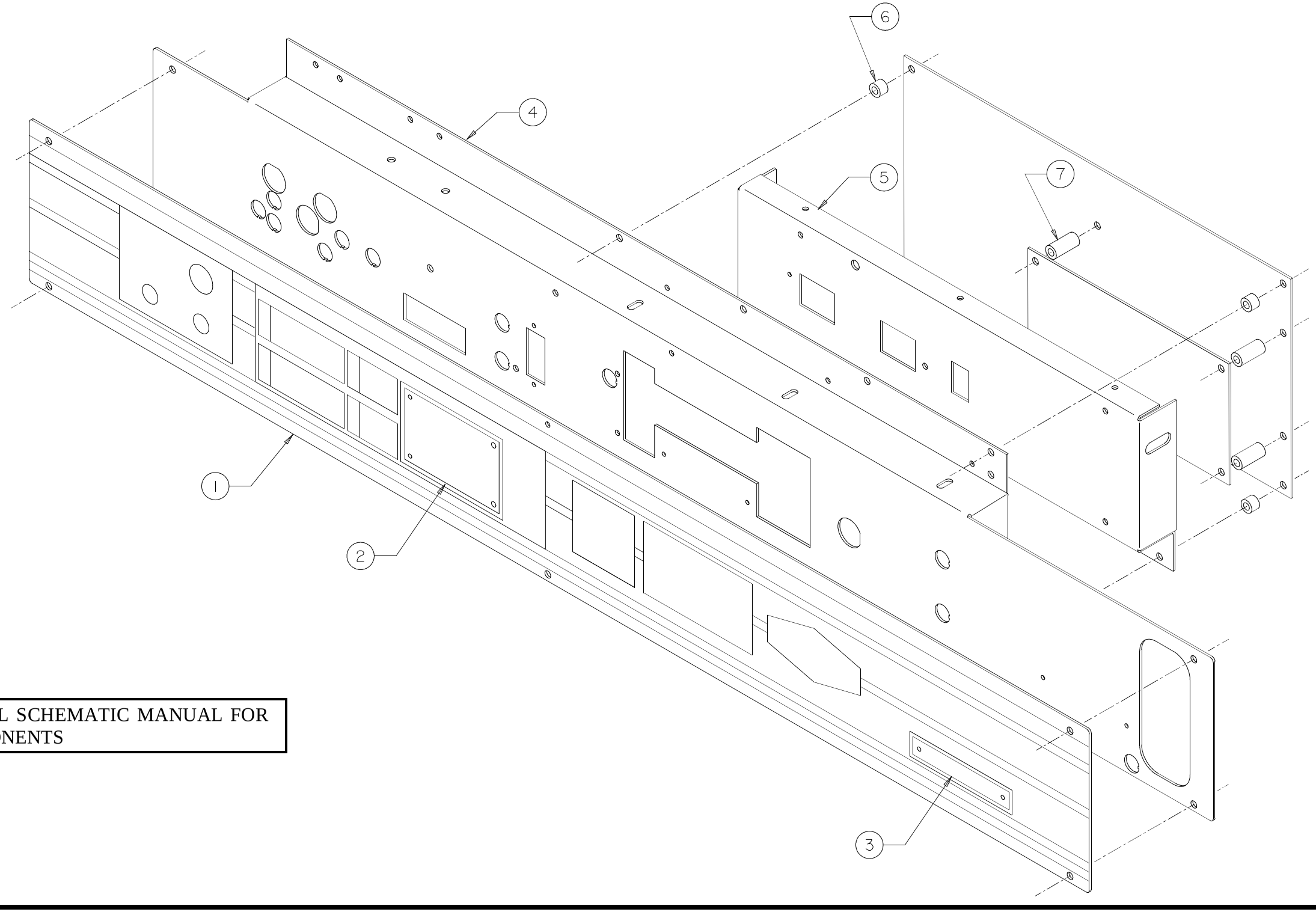


FIGURE 4 (MSSM0711AE)
Location of Output Voltage Potentiometer and Connector 1MTA31 (After Mildate 92753)

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

DRAWING
(See other page for parts list, if applicable.)

SWITCH PANEL ASSEMBLY
30015, 30020 & 30022 MxG, MxJ, Cxx, K5x



NOTE: SEE ELECTRICAL SCHEMATIC MANUAL FOR ALL ELECTRICAL COMPONENTS

PARTS LIST

(See other page for drawing.)

SWITCH PANEL ASSEMBLY
30015, 30020 & 30022 MxG, MxJ, Cxx, K5x

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00P	ESP71CME	89421N SWPNL 3015/20 MIC1 COIN MACH	REFERENCE
00Q	ESP71EP1PL	91171N SWPNL:3015/20 M4,5,6J EPPLUS	REFERENCE
00R	ESP71M1ME	88403N SWPNL 3015/20 SYS7HOTEL-MOT	REFERENCE
00S	ESP71M1HE	88403N SWPNL 3015/20 SYS7HLTHCARE	REFERENCE
00T	ESP71M1RE	88403N SWPNL 3015/20 SYS7RESTAURNT	REFERENCE
00U	ESP71M1AE	88403N SWPNL 3015/20 SYS7ATHLETIC	REFERENCE
00V	ESP71M1SE	88403N SWPNL 3015/20 SYS7SHIRT LAN	REFERENCE
00W	ESP71M1CE	88403N SWPNL 3015/20 SYS7COMMERCIL	REFERENCE
00X	ESP71M1OE	89131N SWPNL 3015/20 SYS7OFFSHORE	REFERENCE
00Y	ESP71M1JE	89392N SWPNL 3015/20 SYS7CORRECTIN	REFERENCE
00Z	ESP71M1FE	90436N SWPNL 3015/20 SYS7FAIRFIELD	REFERENCE
001A	01 10531X	96143B NPLT 3015/22 M J-EP-PLUSISO	00Q
001B	01 10440	94297E GRAPHIC PANEL SYS 7 M4,5,6G	00R-00Z
001C	01 10457	94356E GRAPHIC PNL SYSTEM 7 COIN	OOP
002A	01 10441A	90436C GPX PNL SYS7 HOTEL-MOTEL PRG	00R,00Y
002B	01 10441B	90436# GPX PNL SYS7 HEALTHCARE PROG	00S
002C	01 10441C	90436# GPX PNL SYS7 RESAURANT-PROG	00T
002D	01 10441D	90436# GPX PNL SYS7 ATHLETIC-PROG	00U
002E	01 10441E	90436# GPX PNL SYS 7 SHIRT LNDY-PRG	00V
002F	01 10441F	90436# GPX PNL SYS 7 COMMERC-PROG	00W
002G	01 10441G	90436#GRAPHIC PNL OFFSHORE PROG	00X
002H	01 10441K	90436# GRAP.PNL FAIRFIELD INN PROG.	00Z
003A	01 10442A	91393C GPX PNL SYS 7 HOTEL-MOTEL	00R
003B	01 10442B	91393# GPX PNL SYS 7 HEALTHCARE	00S
003C	01 10442C	91393# GPX PNL SYS 7 RESTAURANTS	00T
003D	01 10442D	91393# GPX PNL SYS 7 ATHLETIC	00U
003E	01 10442E	91393# GPX PNL SYS 7 SHIRT LAUNDRY	00V
003F	01 10442F	91393# GPX PNL SYS 7 COMMERCIAL	00W
003G	01 10442G	91393#GRAPHIC PNL OFFSHORE	00X
003H	01 10442J	91393# GPX PNL SYS 7 CORRECTIONAL	00Y
003I	01 10442K	91393# GRAPHIC PNL FAIRFIELD INN	00Z
004	03 E5X34	92356D ENCL:SYSTEM 7 GRAPHIC PNLMTG	00Z
005A	03 BU413U	92356D+BRKT:M4,5,6J LCD FILTER-EP10	00Q
005B	03 BU4X13	92356C BRKT:SYSTEM 7 LED FILTER	00P,00R-00Z
006	27B175I	01Z SPACER PLASTIC1/4ODX.175IDX1/4	
007	27B17514SN	01Z SPACER .171IDX1/4ODX7/8LG NYLON	NOT USED ON 00P
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

If more than one reference item appears, this usually means this drawing applies to more than one assembly (and thus to more than one range of machines).

Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

ABOUT THE COIN COUNTER

Description

NOTE: Ensure that the machine is level for proper coin counter operation.

The coin counter can be adjusted to count from 1 to 63 coins without tools or extra parts (for further information see "HOW TO SET REQUIRED NUMBER OF COINS" in the "PROGRAMMING, OPERATING AND TROUBLESHOOTING" manual). A coin depressing the *coin switch actuator* (FIGURES 1 and 2) causes an input to the microprocessor. Operation begins when the microprocessor receives the correct number of inputs.

Each coin is analyzed as it passes through the coin counter. Valid coins are counted, invalid coins are automatically ejected or held in the rejector channel (the bent-coin release returns the coin). The furnished U.S. coin rejector (foreign coin rejectors optional) accepts quarters only, smaller coins are rejected, and larger coins will not fit in the slot.

Four notches hold the coin rejector. One notch secures the coin rejector in place. To release the coin rejector, bend this notch slightly open with a screwdriver (see FIGURE 1). Position the bent coin release lever as shown. The coin rejector normally does not require any adjustment, but periodically wash the coin rejector in hot soapy water and remove metal filings from the coin reject solenoid.

Coins are accepted only when the coin return solenoid is energized (whenever the machine is idle with the power ON and the door closed). When de-energized (power OFF, door open, or machine operating) the coin reject solenoid inserts a pin in the coin path, automatically ejecting coins to the return slot. The solenoid momentarily de-energizes as each coin depresses the *coin switch actuator*, preventing uncounted coins. Any excess coins deposited (coins in excess of the proper amount) are rejected.

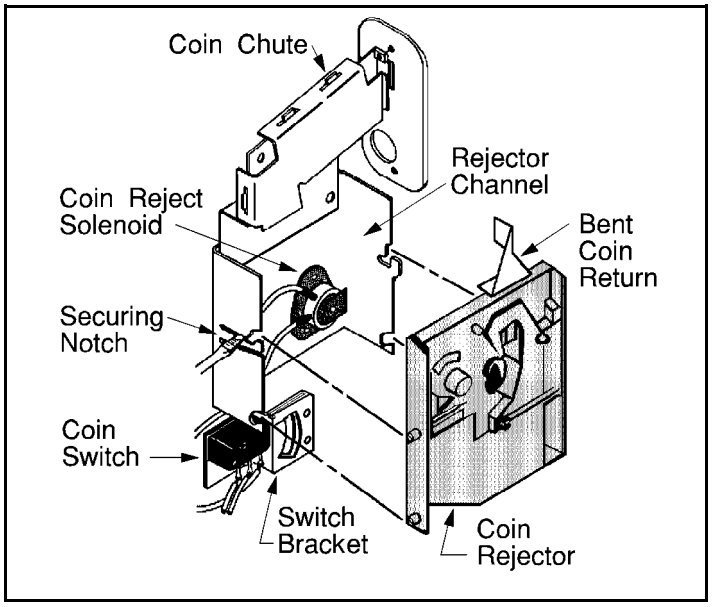


FIGURE 1 (MSFD0501BE)
The Coin Counter

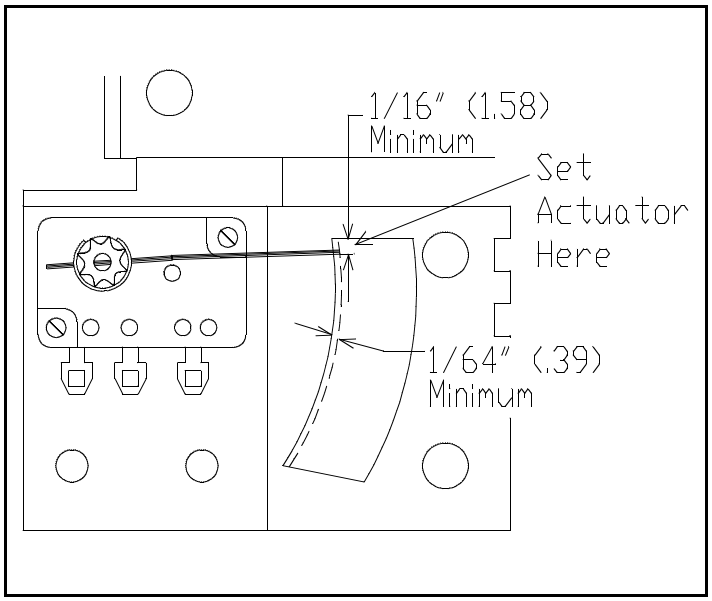


FIGURE 2 (MSFD0501BE)
Correct Coin Switch Actuator Position

Troubleshooting

If the coin reject solenoid buzzes when energized, dirt is preventing it from seating fully. If the coin counter mechanism is rejecting all coins, the solenoid should be replaced. The *coin switch* is factory adjusted and does not require field adjustment. If miscounts occur, check the *coin switch* alignment (FIGURE 2). Ensure that the actuator is properly seated on the shaft before attempting alignment. Note the minimum 1/64 inch (.39 millimeter) clearance between the inside coin slot arc and the actuator. Set the *coin switch* to click OFF at least 1/16 inch (1.5 millimeter) before the actuator reaches the top of the coin slot arc. Bend the actuator slightly, if necessary, for proper adjustment. To reposition the switch, loosen both screws on the switch and move as necessary. Avoid all three conditions shown in FIGURES 3, 4, and 5.

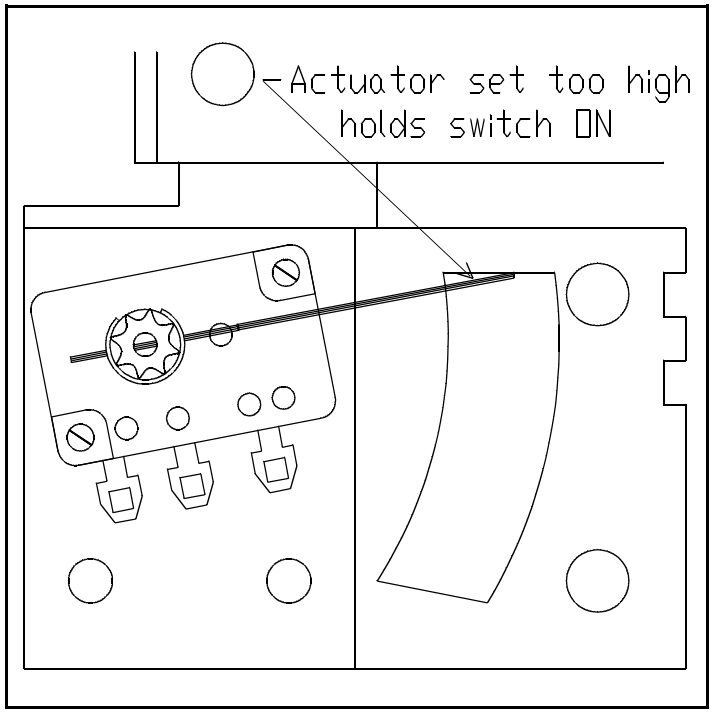


FIGURE 3 (MSFD0501BE)
Coin Switch Actuator Too High

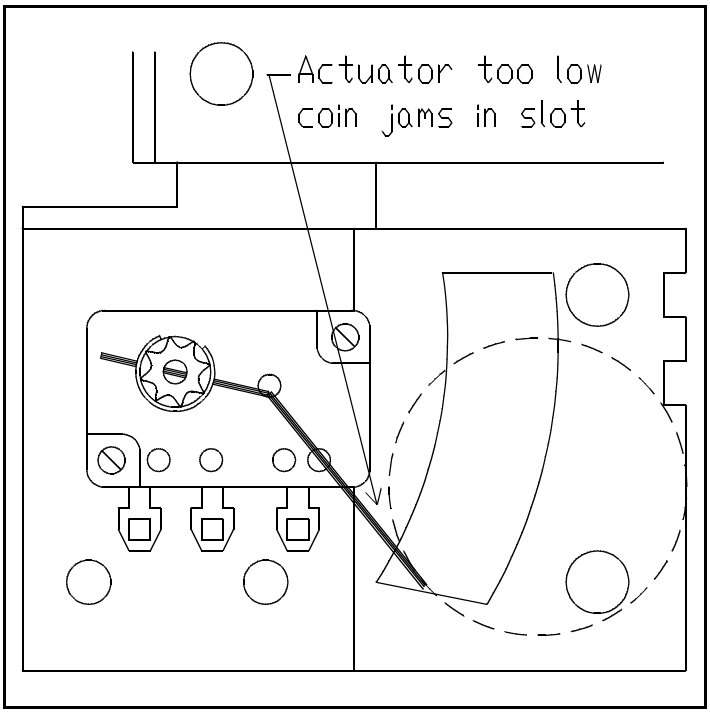


FIGURE 4 (MSFD0501BE)
Coin Switch Actuator Too Low

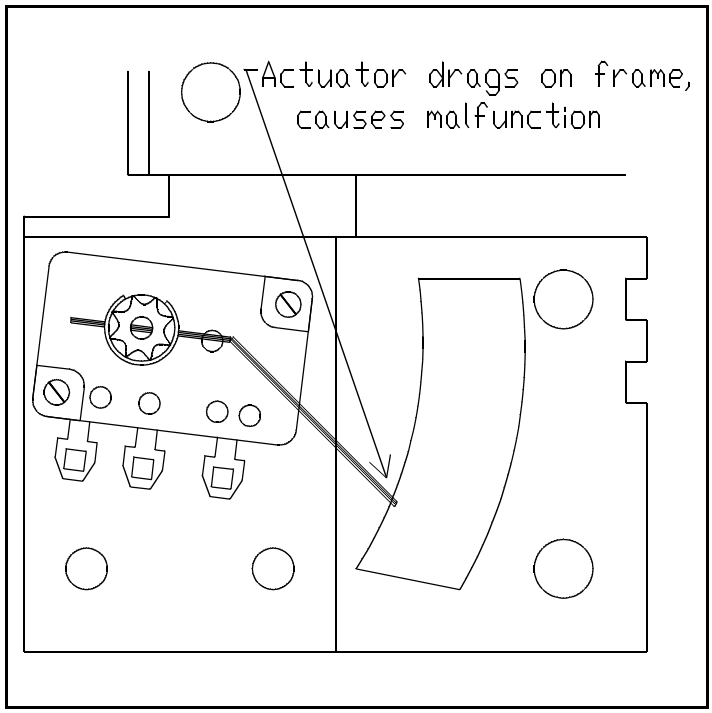


FIGURE 5 (MSFD0501BE)
Coin Switch Dragging Frame

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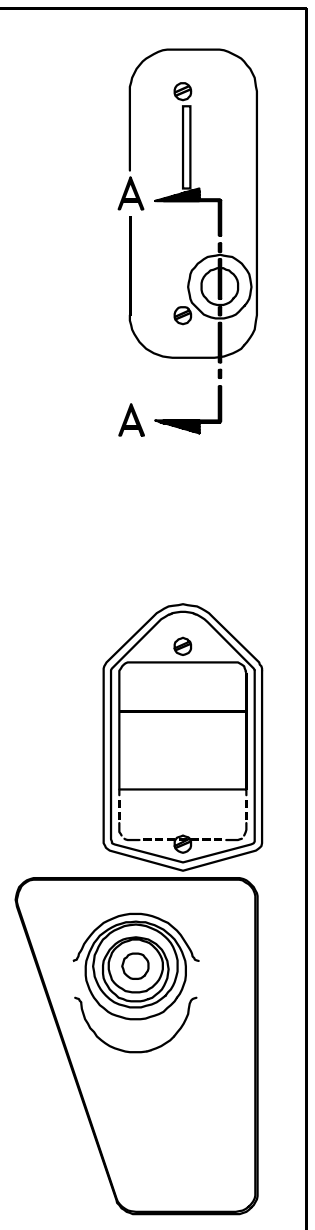
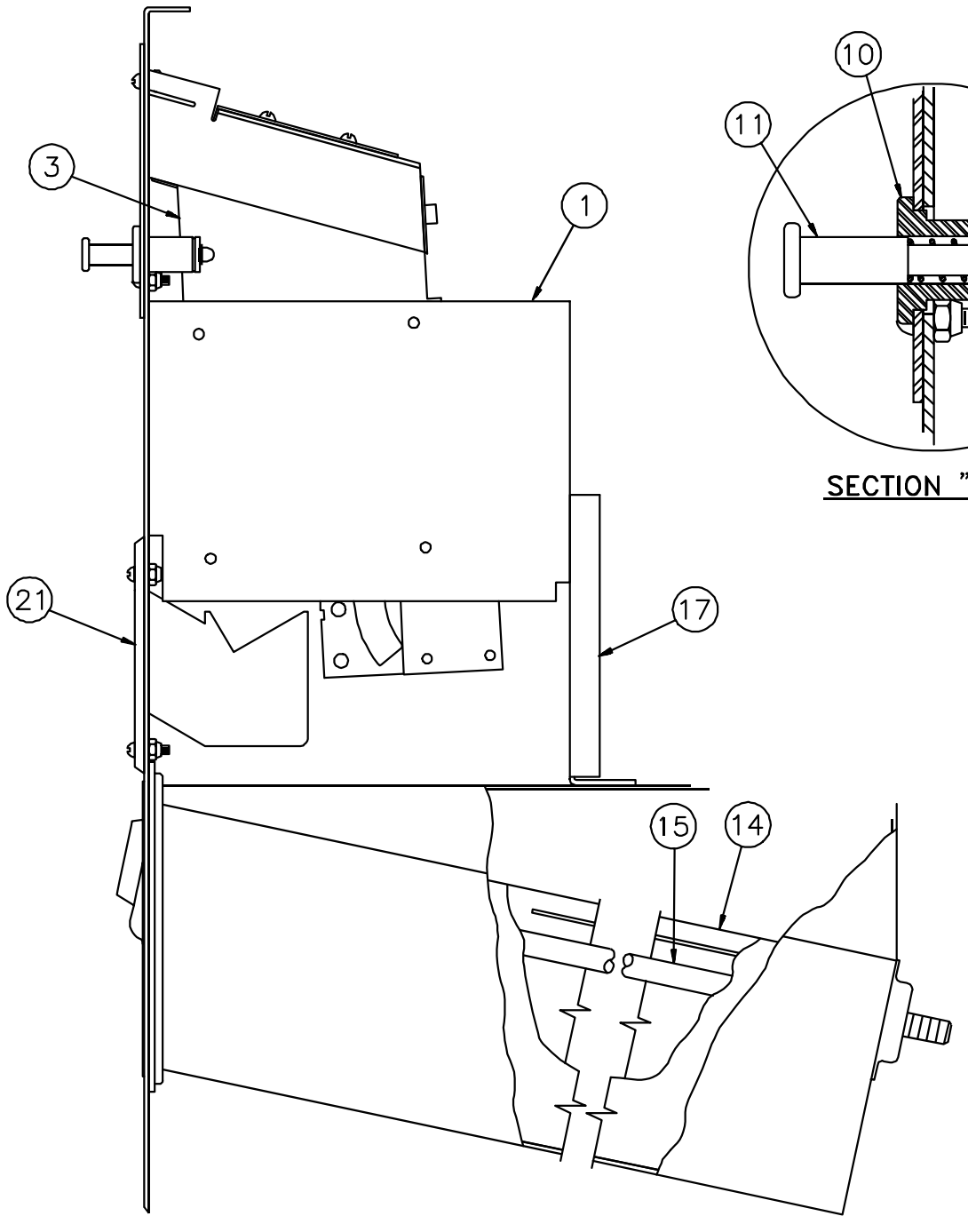
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

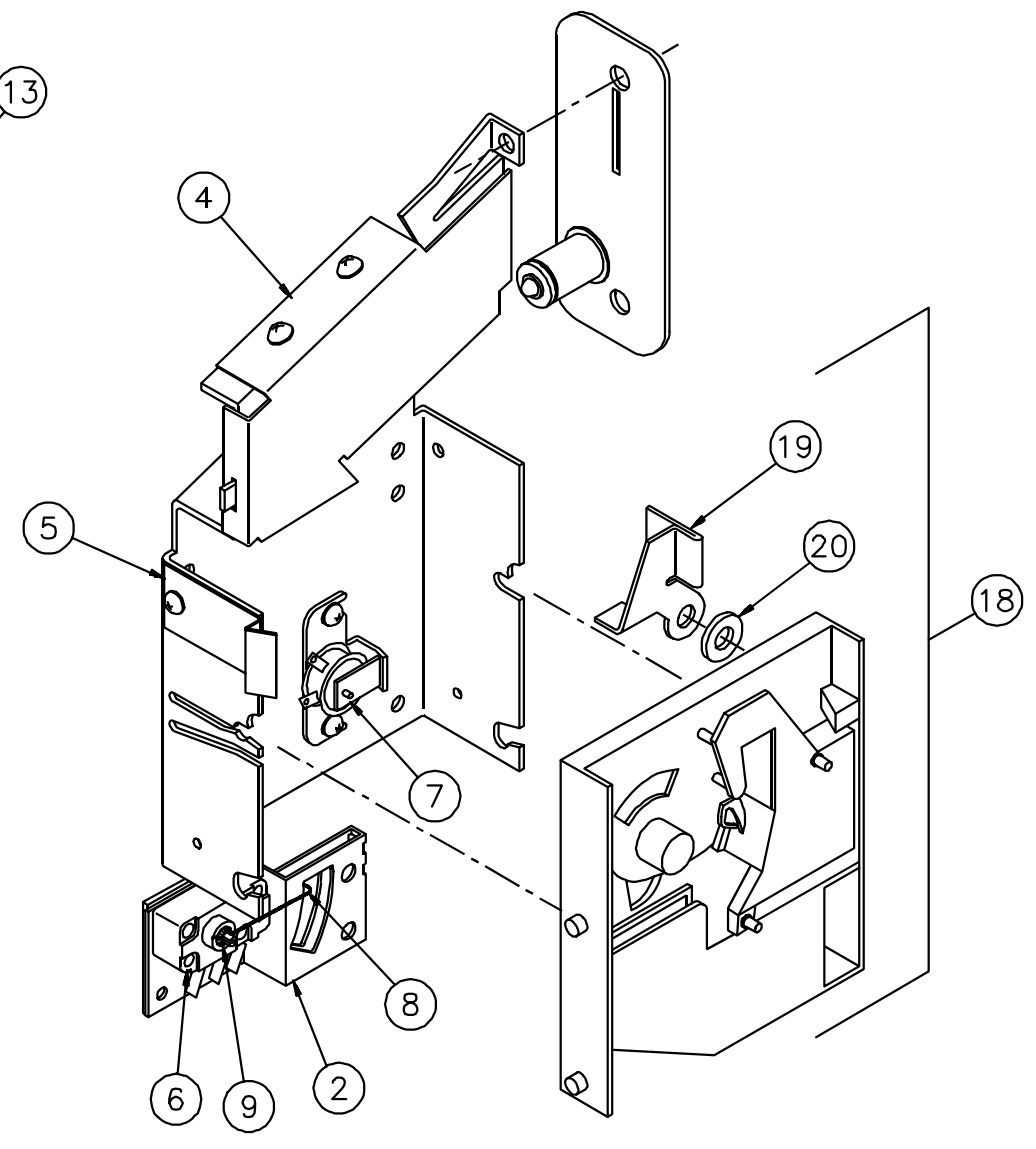
DRAWING
(See other page for parts list, if applicable.)

COIN ASSEMBLY INSTALLATION-240V
30015, 30020 & 30022 COIN MACHINES





SECTION "A–A"



REAR ISOMETRIC VIEW OF ASSEMBLIES
38C062M AND ACM33001A

(ITEM 1 NOT SHOWN IN THIS VIEW FOR CLARITY)

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700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

PARTS LIST
(See other page for drawing.)

COIN ASSEMBLY INSTALLATION-240V
30015, 30020 & 30022 COIN MACHINES

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	GCM33001A	90281Z COIN ASSY INSTALL 240V	REFERENCE INSTALLATION COIN MACHINES
00B	ACM33001A	90281Z*COIN ASSY 240V	CONTAINS ITEMS 1-9
00C	38C062M	91237B*COIN INSERT ASSEMBLY US25	CONTAINS ITEMS 10-13
00D	A33 08500	85443C COIN BOX ASSY-13.5"LONG	CONTAINS ITEMS 14-16
00E	SA 33 068	84507B$ COINREJECTOR ASS=NEW CAN.25	CONTAINS ITEMS 18B,19-20
001	02 03761	90012C COIN REJECTOR BRKT SUPT 3621	
002	03 01472	76457B BRACKET=COIN SW ACTUATOR	
003	03 01473B	89293D BRKT=COIN REJECTOR MTG SLIM	
004	02 03348B	85324C GUIDE=COINCHUTE-CAD SLIME	
005	02 03759	85324B CLIP FOR COIN REJECTOR	
006	38C058	02Z ROTARY COIN SW CHERRY #E51-98R	
007	38C071	03Z ELECMAGNT 240V60C #CR15-1100F	
008	38C056	75729C WIRE=ROTARY SW-US.25 COIN	
009	17B002	EXT.RET RING 6100-12-ST-PA	
010	38C062J	85324B PLATE+SCAVENGING P/N ASSY	
011	38C062A	78342B SCAVENGING PIN	
012	38C062D	78342B SCAVENGING PIN SPRING	
013	17B005	EXTRETRING IND#1000-X18-ST-ZD ZINC	
014	W2 03654	89527C* BOX=13.5"X12DEG=COIN WELD	
015	38C152A	10Z LOCK+2KEY CONSEC NO.15+1/8"LG	
017	02 03761A	91047C REAR SUPT=COIN REJECTOR BKT	
018A	38C050AMET	METAL COIN ACCEPTOR 25J (COIN-MECH)	CONTAINS ITEMS 19-20
018B	38C049A	REJECTOR NEW CANADA 25J SEE SA33-68	OPT CANADIAN COIN REJECT
019	02 03302A	87211B INSERT CRANK =SLIMLINE	
020	02 03361	68020A CRANKWASHER CADPLATE	
021	X2 03363	87262A COIN RETURN RECEPTACLE	
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

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Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

LITHO IN USA

VIBRATION SAFETY SWITCH ADJUSTMENTS

B What the Vibration Safety Switch Does

The *vibration safety switch* pictured below is an important safety feature. If properly adjusted, the switch will momentarily actuate as a result of repeated machine movement caused by an out-of-balance condition. Table A B below illustrates the effect of the *vibration safety switch* actuation.

Table A—Effect of Tripping Vibration Safety Switch

Machine Model	Function of Vibration Safety Switch
30015, 30020, and 30022	Disables high speed extract
All microprocessor-controlled washer-extractors not listed above, and all dye machines	De-energizes three-wire relay, effectively terminating machine operation

Adjustments

When the machine leaves Milnor®, the actuator arm is B tie-wrapped to prevent damage (except on 30015, 30020, and 30022 models). **This tie wrap must be removed after the machine is set into position but before the machine is operated.**

Adjustment of this switch from the factory setting is not recommended; however, it should be checked for proper functioning and adjusted if its proper setting is lost.

As shown at right in FIGURE 1, the unit consists of a *sensitive micro-switch* with an extended actuating arm supporting an eccentric weight. The weight may be adjusted by moving it up and down on the arm and by rotating it on the arm. In addition, the *micro-switch* itself may be tilted from side to side.

The sensitivity of the switch increases as the eccentricweight is raised on the actuating arm and decreases as the weight is lowered.

The unit should be adjusted so that the actuating arm will always reset by itself, this being accomplished by rotating either the switch or the weight to give just enough bias to cause the switch to reset. Check the adjustment by moving the arm to the left then slowly releasing it. Make sure the microswitch clicks when the arm is **slowly** released, thus indicating

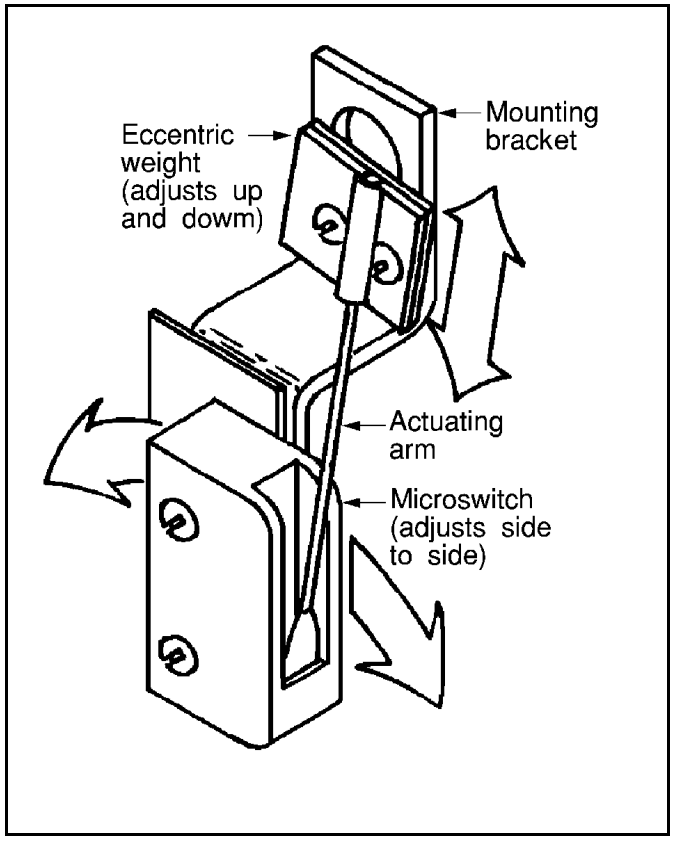

FIGURE 1 (MSSMA408BE)
Vibration Switch

that it has reset. In the released position the arm should rest **lightly** but definitely against the stop on the *micro-switch* case that prevents any further arm movement to the left.

For machines with rigid mounted shells, where the machine is bolted to a very substantial foundation, very little machine movement will occur for a given degree of out-of-balance. Under such conditions it may be better to adjust the switch to be very sensitive. With less substantial foundations (e.g., ones where the sub-soil is mushy or springy or otherwise not as desirable), considerably greater machine movement will occur for a given degree of out-of-balance, in which case a less sensitive *vibration switch* setting may be indicated.

Vibration Safety Switch

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

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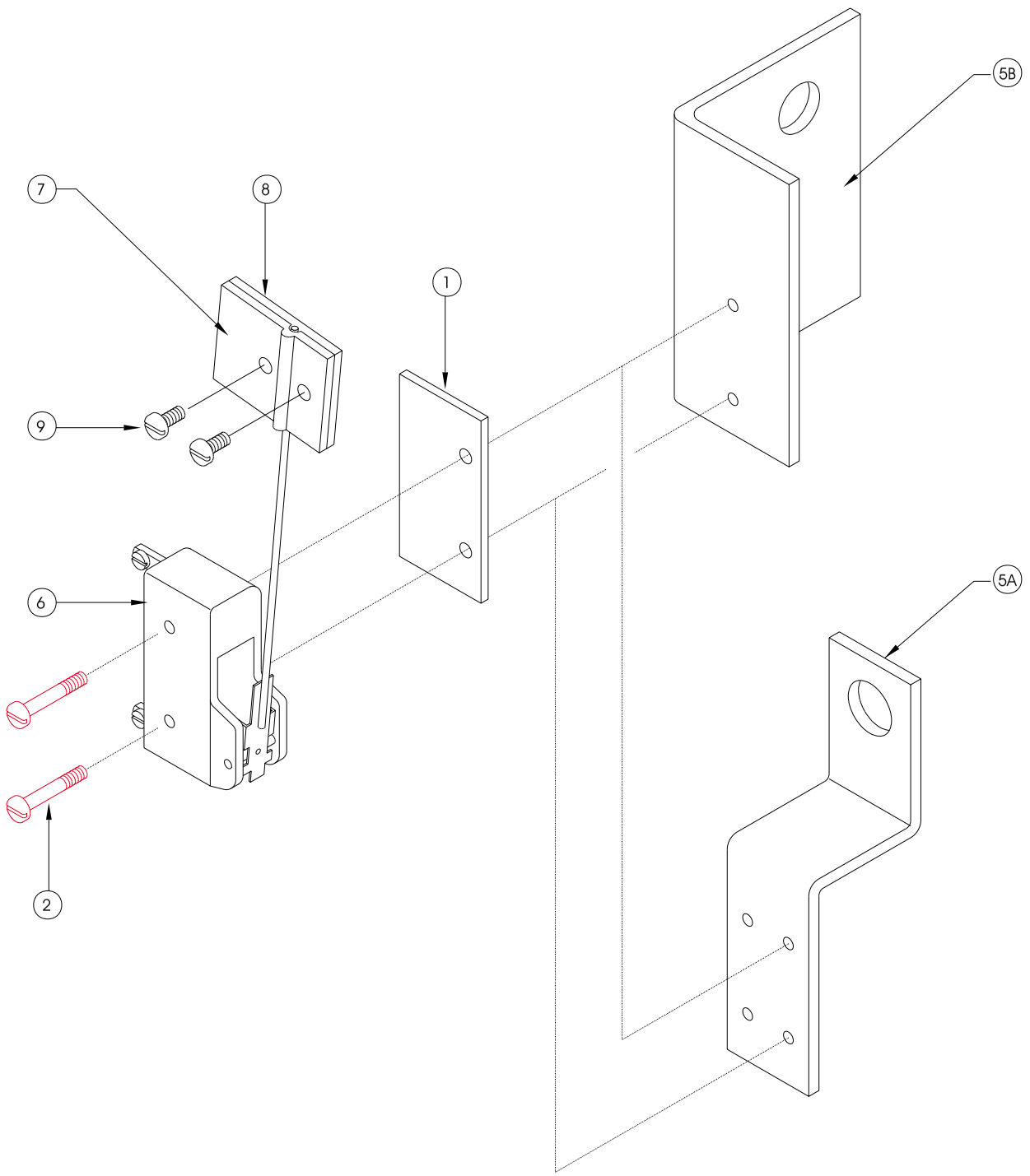


Parts List—Vibration Safety Switch

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	SAE03 151	* ASSY-VIBRATION SWT=LG CONTR	(ALL MODELS EXCEPT BWP,CPE) CONTAINS 001,002, 005A-009
	B	SAE03 151A	*ASSY-VIBRATION SWT=BALCOM	(MODELS 3621BWP,CPE ONLY) CONTAINS 001,002, 005B-009
			----------COMPONENTS----------	
all	1	02 02038	PLATE INSULATING SMALL9NOV51	
all	2	15P008	TRDCUT PANHD 6-32X1 NIKSTL +WA	
A	5	02 15119	BRACKET=VIBSW CAD	
B	5	02 10264	BRACKET=SAFESW CAD	
all	6	09R020	SWITCH NC VIBR#WZ-2RW84429-P52	
all	7	03 01059	VIBSWITCH CLAMP CADSTL	
all	8	03 01058	VIBSWITCH WEIGHT-CADSTL	
all	9	15P101	TRDCUT-F PANHD 8-32X3/8 NIKSTL	

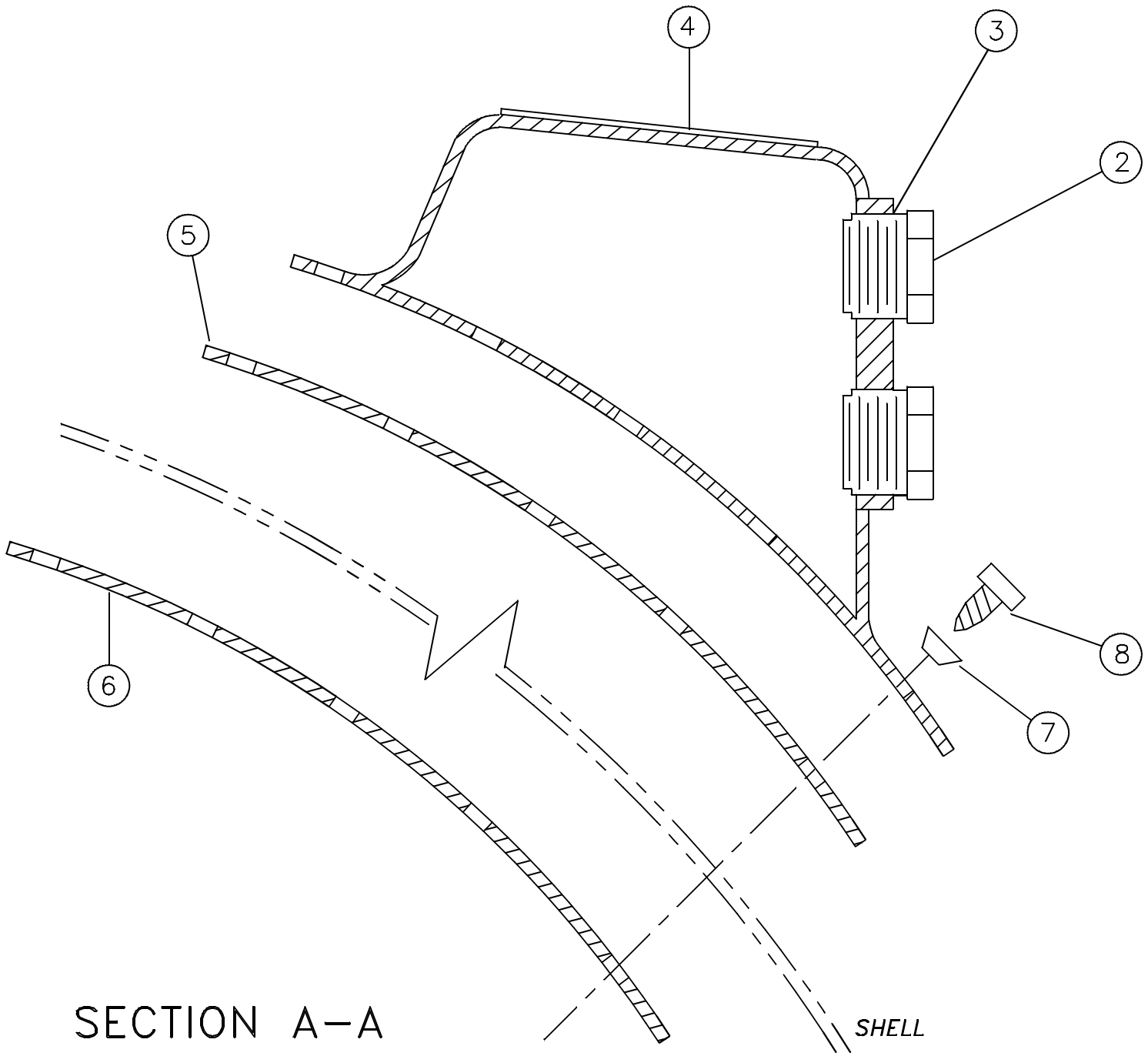
Section 6

Chemical Supply Devices

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

DRAWING
(See other page for parts list, if applicable.)

LIQUID SUPPLY INLET SIDE MOUNT

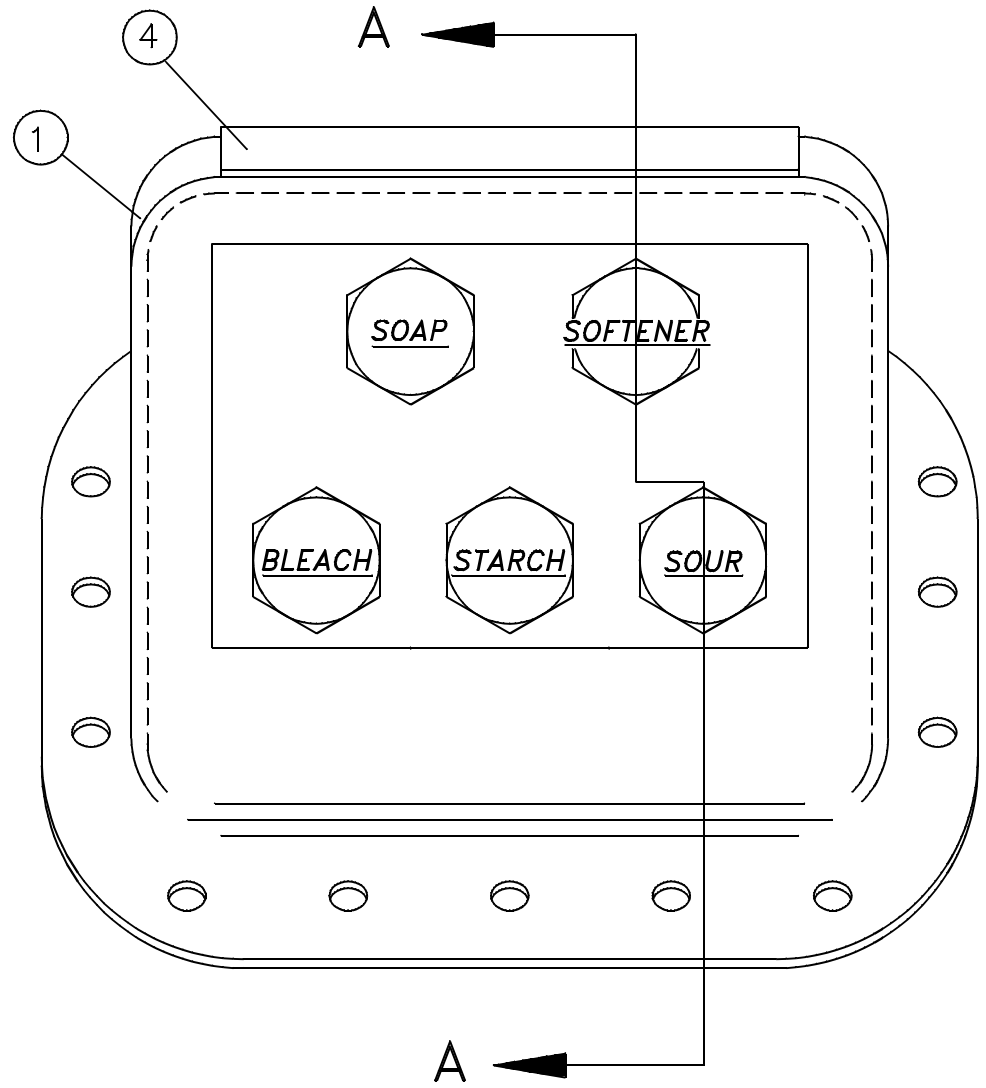


SECTION A–A

FOR INFORMATION ON :

1) HOW PUMPED CHEMICAL SYSTEMS CAN INTERNALLY DAMAGE THE WASHER EXTRACTOR
2) LOCATING CHEMICAL SYSTEM COMPONENTS TO REDUCE THE RISK OF INTERNAL DAMAGE
3) PREVENTING LEAKS WHICH CAN INJURE PERSONNEL AND CAUSE EXTERNAL DAMAGE

SEE INSTRUCTION "B2TAG86033" ON MACHINE.



110

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700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

PARTS LIST
(See other page for drawing.)

LIQUID SUPPLY INLET SIDE MOUNT

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	SA 33 058K	94091D ASSY=SH MNT PERSTL SDINLT HS	REFERENCE ASSEMBLY
001	W2 03589Y	94121D*WLMT=SH MT PERSTL NPT SDINLT	
002	5SP0KXFHS	01Z HEX HEAD PIPE PLUG 1/2"	
003	20C040	SIL SEAL RTV BLACK 85GR #59330	
004	B2TAG89067	94146V SYS7 CHEM INJ INST & LOC	
005	02 03304A	90493C GASKET=SOAP CHUTE 1/8"EPDM	
006	02 03589J	89183C TAP PLATE=PERISTALTIC SUPPLY	
007	24G018N	ROLLED WASHER .194"ID NYLTITE #10W	
008	15P010	12Z PHILPAN TRDCUTSCRTYP10-24X1/2SS	
		******** END OF PARTS LIST ********	

How to Read Parts List

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2. The range of machine models this drawing applies to.

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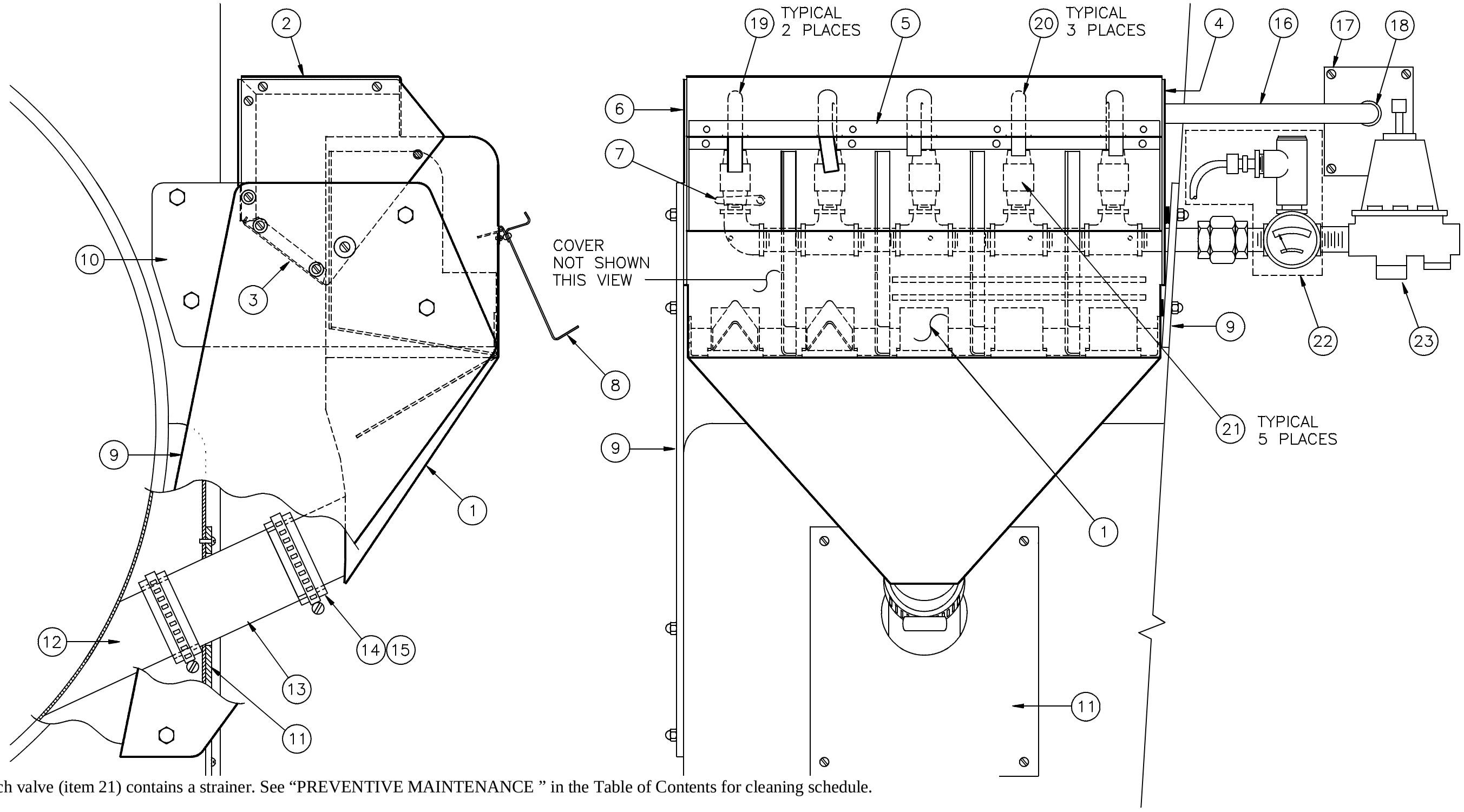
Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

LITHO IN USA

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

DRAWING
(See other page for parts list, if applicable.)

SUPPLY INJECTOR AND INSTALLATION
30015, 30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS



NOTE: Each valve (item 21) contains a strainer. See “PREVENTIVE MAINTENANCE ” in the Table of Contents for cleaning schedule.

LITHO IN USA

PARTS LIST

(See other page for drawing.)

SUPPLY INJECTOR AND INSTALLATION
30015, 30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	AD 33 027C	85032#*SUPPLY INJECT INSTALL C46P	INSTALLATION PARTS 30015
00B	AD 33 027B	85032#* SUPPLY INJECTOR INSTAL C5P	INSTALLATION PARTS 30020 & 30022
00C	SA 33 059A	85032J*SUPPLY ASSY=C6P+C5P+C4P	MAJOR ASSEMBLY
00D	SA 02 039D	91017# PIPING/5FLSHSUP=30"UNI(240V)	PART OF 00C(SEE 19,20,21)
00E	AVW33001	81482B$PRESSGUAGE+REGULATOR ASSY CM	PART OF 00C(SEE 22,23)
001	W2 03611	75392D* SUP-CHUTE 5-FLUSH=30"C456M	00C (WELDMENT)
002	02 02646	87261C ENCLOSURE=VALVE SUP INJ.	00C
003	02 02664	87522C ENCLOSURE=VALVE-LOWER SIDE	00C
004	02 02648	ENCLOSURE-REAR=SUPPLY INJECTOR	00C
005	02 02701	87286B BAFFLE-CONDENSATION=SUPINJ	00C
006	02 02647	ENCLOSURE-FRONT=SUPPLY INJECTOR	00C
007	27A017	1/2"PIPESTRAP 1HOLE R.COND TB#1276	00C
008	SA 02 066	70297B*COVER ASSY=SUPPINJ	00C
009	02 03617	89406D PLATE=SUPPINJ MT-FRONT	00A,00B
010	02 03613	77361C PLATE-REAR MOUNT-SUPPINJ-CWM	00A,00B
011	02 03612	92202B PLATE=COVER SUPINJ CWM	00A,00B
012	02 03615	78073A TUBE=2+1/2ODX062S/S 5"LG	00A,00B(WELDED TO CYL.)
013	02 15773	86356B PINCHVALVE TUBE-HYPALON	00A,00B
014	02 03427	83197A DRAIN SUMP CLAMP PAD	00A,00B
015	27A082	HOSECLAMP,2+9/16-3.5" CADSCR HS-48	00A,00B
016A	03 CL2X2	85027C 1/2 CONDUIT=90DEG 1.62X1.75	00A
016B	03 CL2X5	85027# 1/2 CONDUIT 5X1.75	00B
017	03 01471	87371B PLATE=ADAPT TO 3/8 OR 1/2FIT	00A,00B
018	12K040	1/2" COND.EMT CONDUIT PECO #260B	00A,00B
019	02 02730	75832A NIPPLE=SUP INJ 215DEG	00D
020	02 02703	70089A NIPPLE=SUPINJ 180DEG	00D
021	96P011A71	07Z 1/4" 2 WAY 240V60 220V50	00D
022	SA 14 039	75627B$ PRESSGAGE,FLUSHSUP 30+36	00E
023	96J030D	1/2" PRESREGULTR SET 28# FEM-UNION	00E
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

If more than one reference item appears, this usually means this drawing applies to more than one assembly (and thus to more than one range of machines).

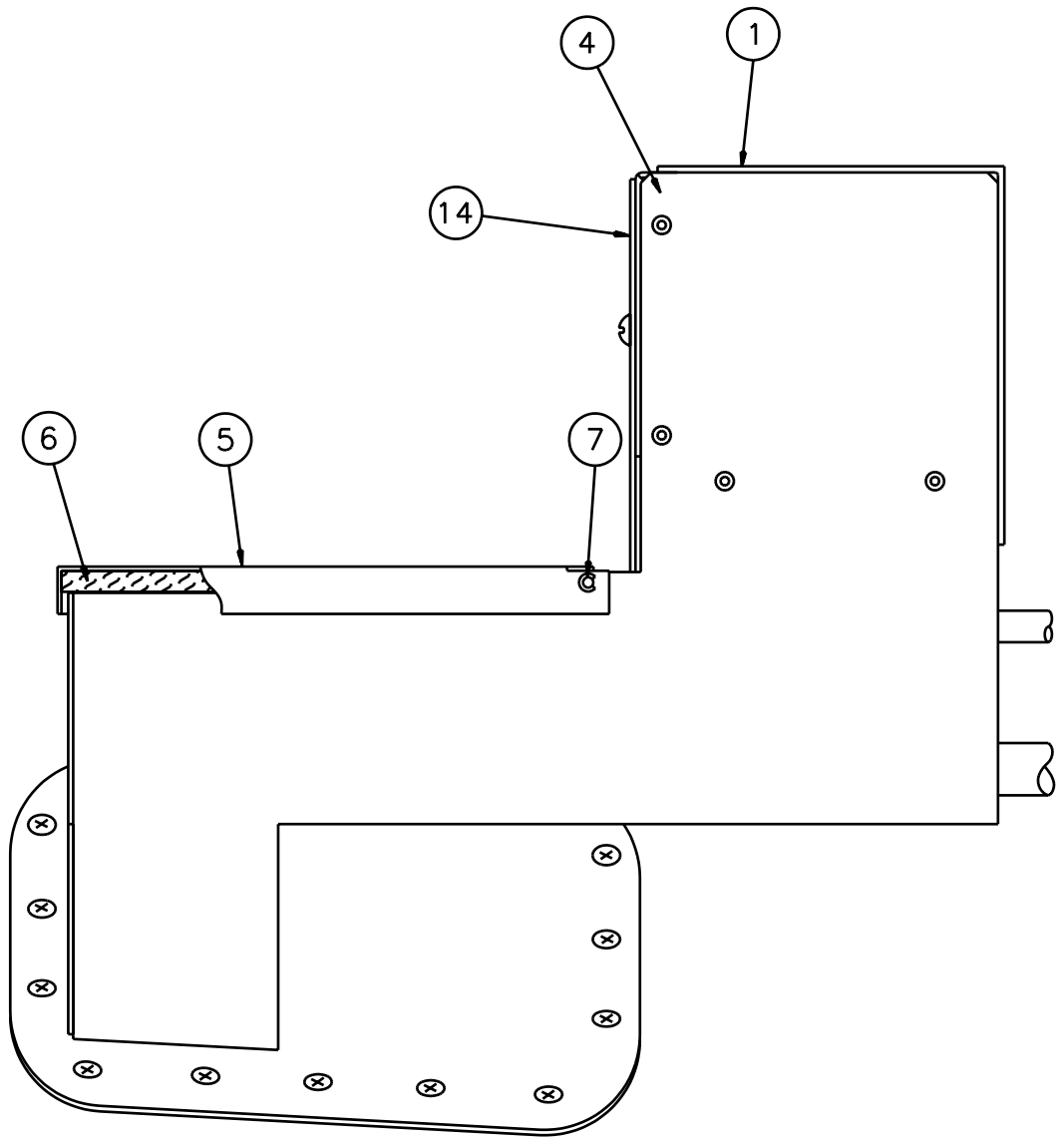
Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

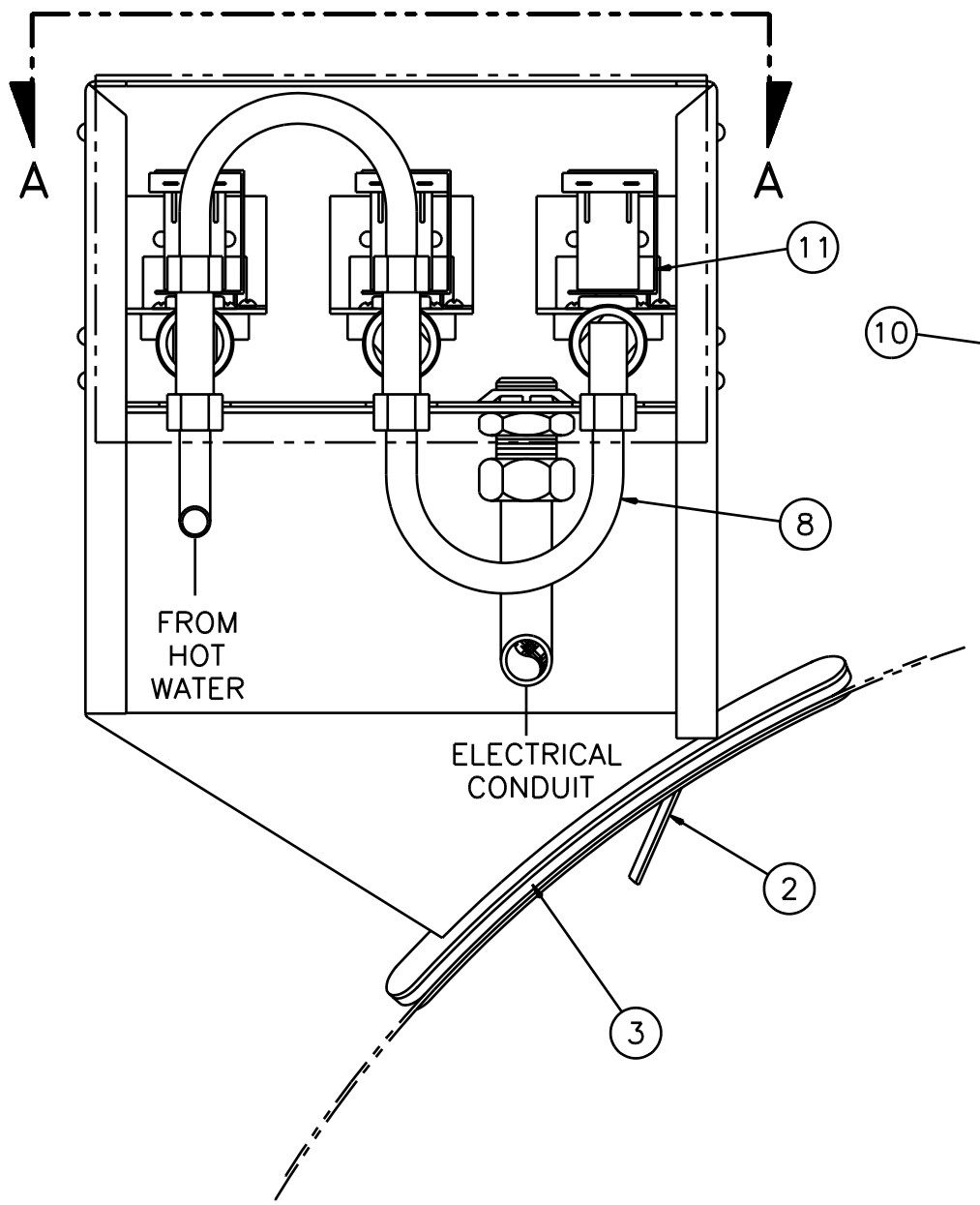
LITHO IN USA

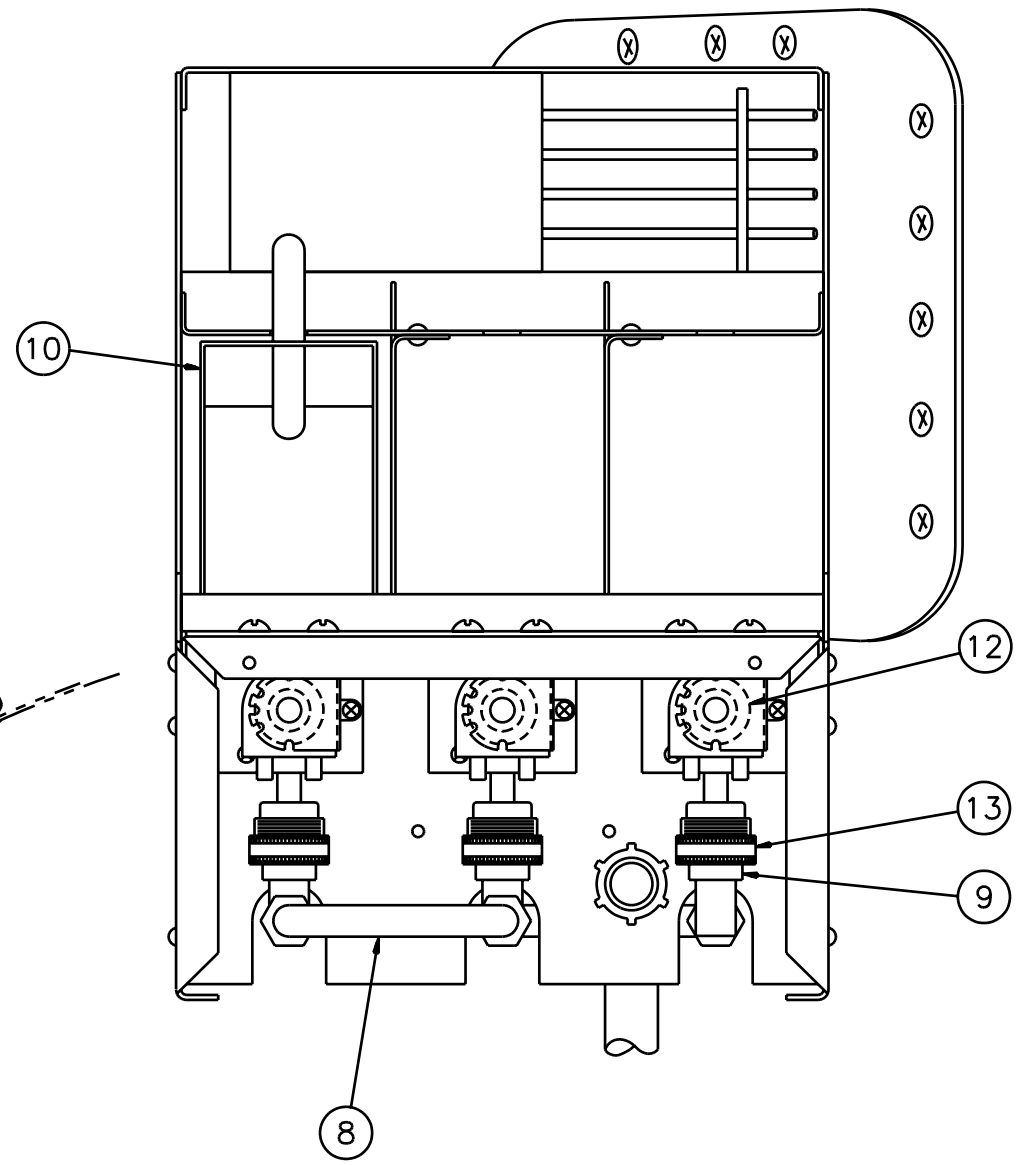
3 Compartment Supply Injector

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.







VIEW "A–A"

ITEMS 1, 5–7 LEFT OFF
THIS VIEW FOR CLARITY

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
Litho in U.S.A.

Parts List—3 Compartment Supply Injector

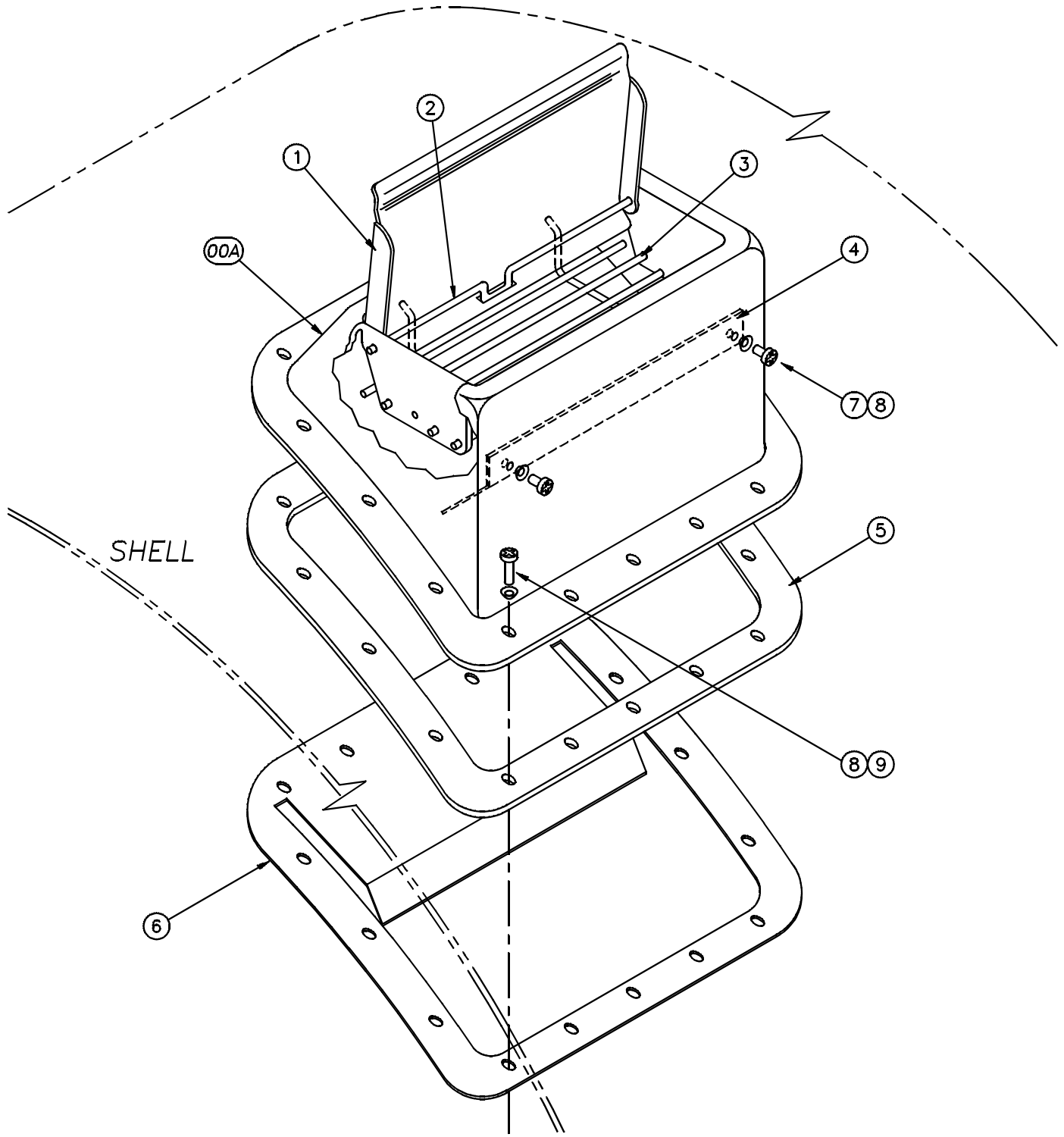
Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	GWS33001B	89241@ INSTALL 4SUP INJ SYSTEM 7	3 COMPARTMENT SUPPLY INSTALLATION
	B	AWS33001B	89241D*ASSY=3FLUSH SUP INJ SYSTEM 7	CONTAINS ITEMS 4-13
			----------COMPONENTS----------	
all	1	02 03732B	94031B COVER 4 COMP SUPPLY VALVES	
all	2	02 03732F	90346C TAPPED PLATE=SUPPLY MOUNT	
all	3	02 03304A	94493C GASKET=SOAP CHUTE 1/8"EPDM	
all	4	W2 03732	93102D* SUPPLY INJECTOR 4 COMP SUPP	
all	5	02 03732G	87501C LID=4 COMPARTMENT SUPPLY	
all	6	02 03732U	78302B GASKET=LID 4 COMP SUPPLY	
all	7	02 03732S	78132B HINGE PIN=LID 4 COMP SUPPLY	
all	8	02 03732T	77411B TUBE COPPER-VALVE CONN. 3/8	
all	9	02 03732Z	83446B ADAPTER HOSETHD 3/4"X1/4 NPT	
all	10	W2 03732A	93303B* SUPPLY CUP WLMT 4 COMP SUPP	
all	11	96P013B71	04Z 3/4" 2WAY PLASTIC VALVE 240V60C	
all	12	60C007	RUBGROM #2861 1/2ID-13/16X1/8PNL MT	
all	13	53A060H	KNURLED HOSENUT 3/4-HOSE PH#94GH-12	
all	14	01 10438X	95072B NPLT:3POCK SUPPLY SYSTEM7ISO	SYS 7 - HOTEL
all	14	01 10438Y	95072B NPLT:3POCK SUPPLY EP-PLUSISO	EP PLUS
all	14	01 10438L	92343C NPLT:M4A 3 COMPARTMENT SUPPY	M4A

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

DRAWING AND PARTS LIST
(See other page for more, if applicable.)

SOAP CHUTE + INSTALLATION
30015, 30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS



ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	SA 33 058	81343C SOAPCHUTE-STAINLESS STEEL	ASSEMBLY
001	02 03593	LID=SOAPCHUTE=CWU(STAINLESS STEEL)	PART OF 00A
002	02 03595	90193A PIN SOAP CHUTE HINGE=CWU	PART OF 00A
003	02 03594	70109B GUARD SOAP CHUTE=CWU	PART OF 00A
004	02 03630A	90452B SPLASH GUARD= SOAP CHUTE	PART OF 00A
005	02 03304A	90493C GASKET=SOAP CHUTE 1/8"EPDM	
006	02 03732F	90346C TAPPED PLATE=SUPPLY MOUNT	
007	15P050AB	02Z TRDFRM-AB PANHD10-16X3/4 SS 410	PART OF 00A
008	24G018N	ROLLED WASHER .194"ID NYLTITE #10W	
009	15P010AB	01Z TRDFRM-AB PANHD10-16X1/2 SS410	
		******** END OF PARTS LIST ********	

How to Read Parts List

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LITHO IN USA

Section 7

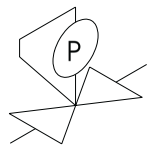
Water and Steam Piping and Assemblies

Schematic Symbols Key

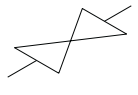
Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

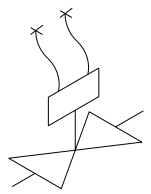
ISOMETRIC SYMBOLS



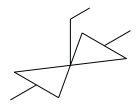
REGULATOR



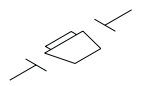
2-WAY VALVE



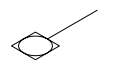
ON/OFF MODULATING VALVE



GAS STOP VALVE



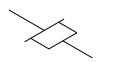
GAS COCK



PRESSURE SWITCH

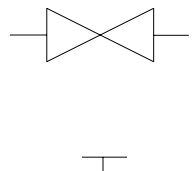
PIPE PLUG

REDUCER

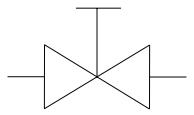


MALE CONNECTOR

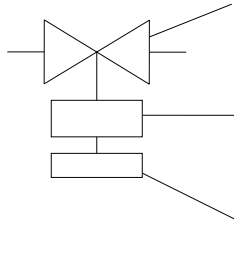
STANDARD SYMBOLS



INLINE VALVE NON-SPECIFIC



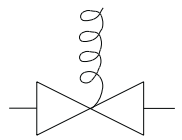
MANUAL BALLVALVE



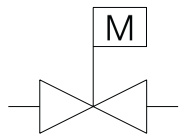
BALLVALVE (THERMAL)

PNEUMATIC ACTUATOR

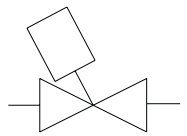
ELECTRIC VALVE POSITIONER



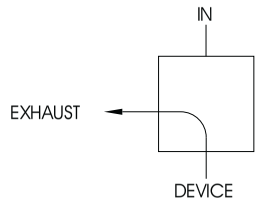
ELECTRICALLY OPERATED 2-WAY VALVE



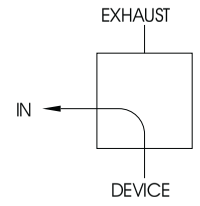
MOTOR OPERATED VALVE



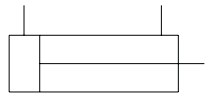
STEAM VALVE



3-WAY N/C AIR PILOT VALVE

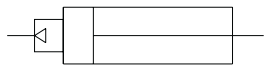


3-WAY N/O AIR PILOT VALVE

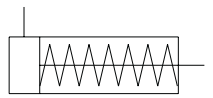


CYLINDER (DOUBLE ACTING)

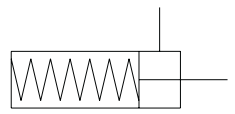
CYLINDER (SINGLE ACTING)



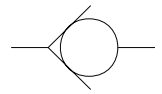
CYLINDER W/QUICK EXHAUST VALVE



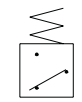
CYLINDER AIR EXTEND SPRING RETRACT



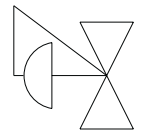
CYLINDER AIR RETRACT SPRING EXTEND



CHECK VALVE



PRESSURE SWITCH

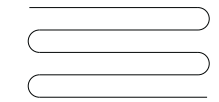


PRESSURE REGULATOR

RELIEF VALVE

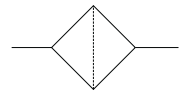
GAUGE

FLOW SENSOR

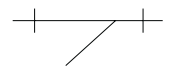


COIL

AIR LINE FILTER-AUTO

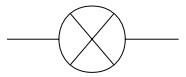


SPECIAL PURPOSE FILTER/STRAINER



Y-STRAINER

VACUUM BREAKER

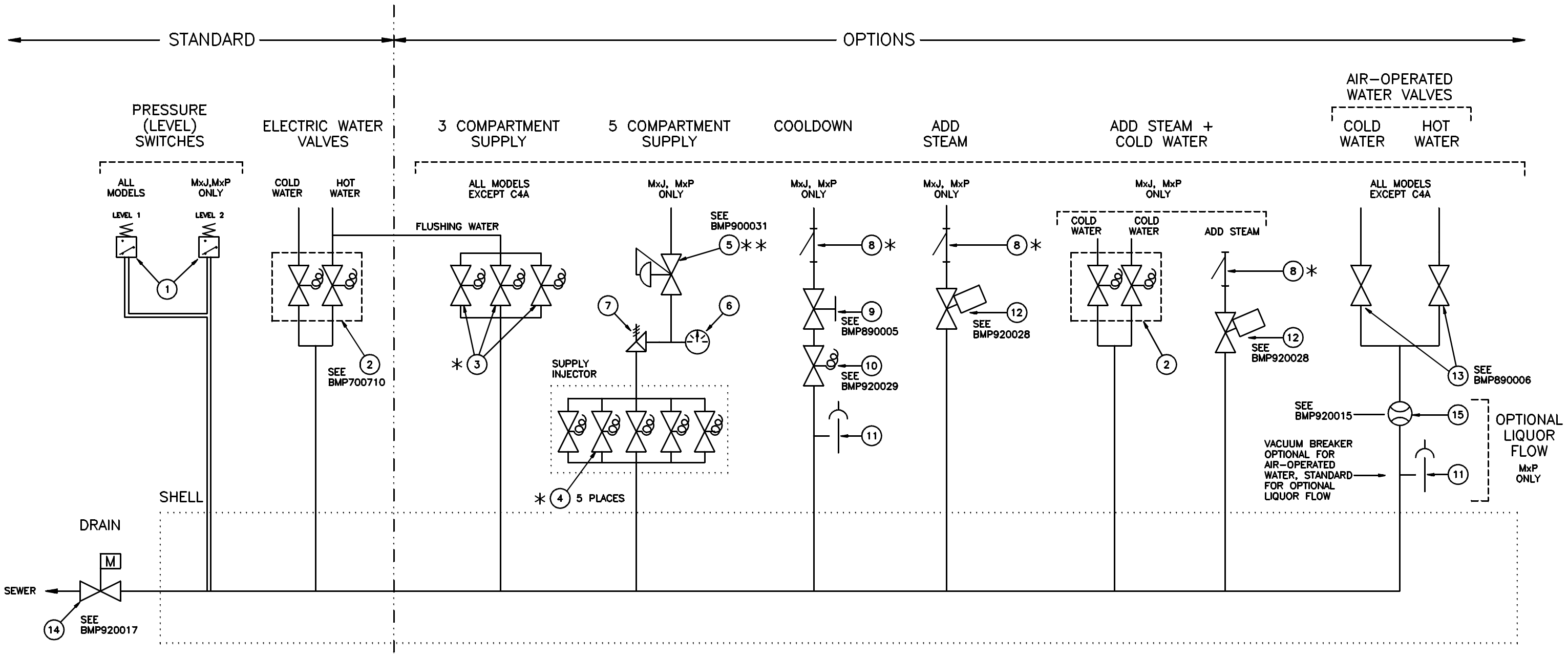


STEAMTRAP

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

DRAWING
(See other page for parts list, if applicable.)

WATER / STEAM / DRAIN SCHEMATICS
30015,30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS



∗ – STRAINER MUST BE CLEANED, SEE "PREVENTIVE MAINTENANCE" IN THE TABLE OF CONTENTS.

∗∗ – PRESSURE REGULATOR MUST REMAIN SET AT THE FACTORY SETTING OF 28 P.S.I. SEE BMP900031 FOR MAINTENANCE PROCEDURES.

LITHO IN USA

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

PARTS LIST
(See other page for drawing.)

WATER / STEAM / DRAIN SCHEMATICS
30015,30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	AD 33 011D	92426# FILL TUBE & DRAIN ASSY 240V	REFERENCE-STANDARD ALL
00B	AWS33001B	89241D*ASSY=3FLUSH SUP INJ SYSTEM 7	REFERENCE-3 FLUSH SUPPLY
00C	SA 02 039D	91017# PIPING/5FLSHSUP=30"UNI(240V)	REFERENCE-5 FLUSH SUPPLY
00D	AVW33001	81482B*PRESSGUAGE+REGULATOR ASSY CM	REFERENCE-5 FLUSH SUPPLY
00E	SA 14 039	75627B* PRESSGAGE,FLUSHSUP 30+36	00D(CONTAINS 006&007)
00F	SA 33 054A	91107B*INLET ASSY=CLDN M4567J/P CWM	REFERENCE-COOLDOWN
00G	A33 10700A	90482#*STEAM INLET ASSY 120V60C+	REFER-STEAM 3015/3020MXP
00H	A33 10700B	90482# STEAM INLET ASSY 240V50/60	REFER-STEAM 3015/3020MXJ
00J	A33 01200	91221C* ASSY WATERIN ONE 1" BALVALV	REFER-AIR OPERATED WATER
00K	AVW33002	92126M ASSY=FLOWMETER 3015/3020MXP	REFERENCE-LIQUOR FLOW
001	09N086A	05Z PRESS SWITCH EATON #738-761	00A
002	96P016A71	05Z 1/2" DUOVAL 240V HAYS3108-6121	00A
003	96P013B71	04Z 3/4" 2WAY PLASTIC VALVE 240V60C	00B
004	96TBC2AA71	03Z 1/4" N/C 2WAY 240V50/60C	00C
005	96J030D	01Z 1/2" PRESREGULTR SET 28# FEM-UN	00D
006	30N100	07Z PRESSGUAGE 1/8"BACKCONN 0-30PSI	PART OF 00E
007	96M001	02Z 1/2" X 3/8" RELIEF VAL. SET 31#	PART OF 00E
008	51T025	01Z Y-STRAINER 1/2" CAST IRON	00F,00G,00H
009	96D034	04Z BALLVALVE 1/2" WATTS #6400-SS	00F
010	96TDC2AA71	04Z 1/2" N/C 2WAY 240V50/60C VALVE	00F
011	96M021	1/2"VACBREAK	
012A	96P039A37	01Z 1/2"STEMVALVE 120V50/60C 150PSI	00G
012B	96P039A71	01Z 1/2" STEMVALVE 240V50/60 150PSI	00H
013	96D085BCSR	93513S 1.00WAT BVAL+ACT/BR/NC/ST/RH	00J
014	96D350A71	07Z DRAINVAL 3"MTRDRIVE 240V 50/60C	00A
015	30F515	FLOW SENSOR SIGNET P51530-P0	00K
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

If more than one reference item appears, this usually means this drawing applies to more than one assembly (and thus to more than one range of machines).

Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

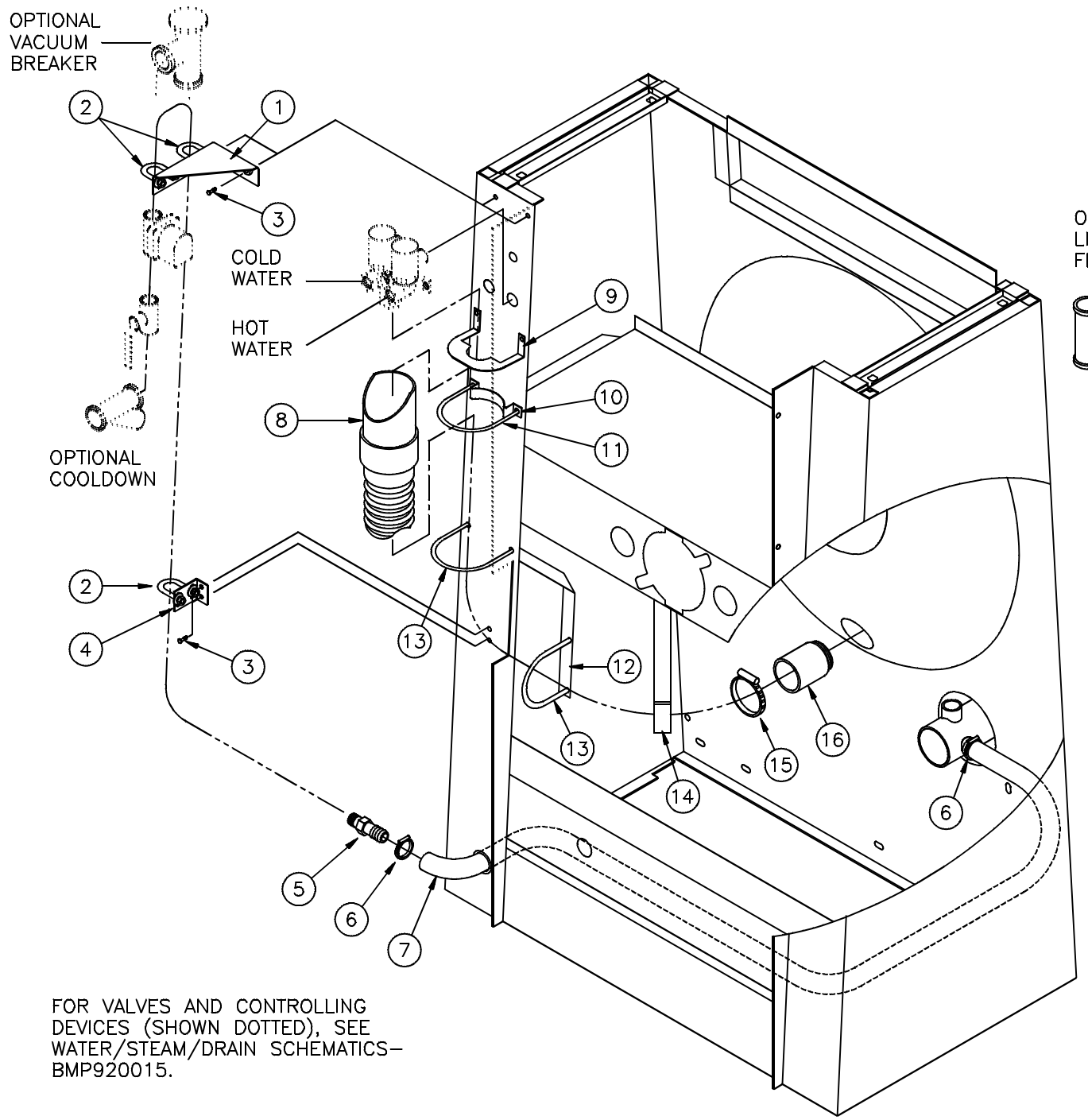
LITHO IN USA

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

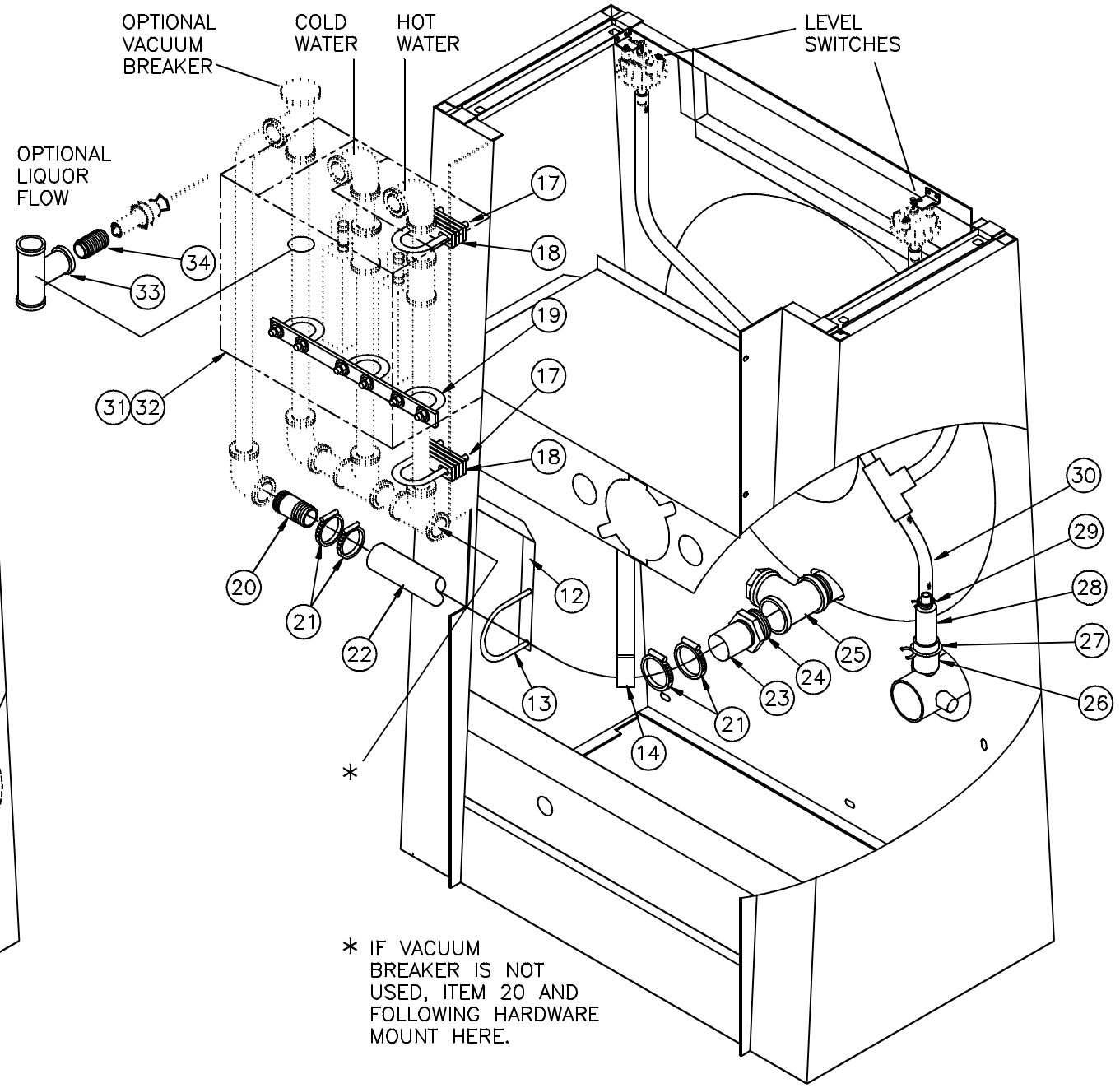
DRAWING
(See other page for parts list, if applicable.)

WATER INLET AND LEVEL SWITCH INSTALLATION & MOUNTING HARDWARE 30015, 30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

BMP920016/93251V (Page 1)



STANDARD ELECTRIC WATER VALVES & OPTIONAL COOLDOWN INSTALLATION



OPTIONAL AIR–OPERATED WATER VALVES, OPTIONAL LIQUOR FLOW, & STANDARD LEVEL SWITCH INSTALLATION

121

LITHO IN USA

PARTS LIST
(See other page for drawing.)

WATER INLET AND LEVEL SWITCH INSTALLATION & MOUNTING HARDWARE
30015, 30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
00A	AD 33 023A	91107C INSTL=COOLDN CWM M4567J/P	REFERENCE-COOLDOWN INSTL
00B	SA 33 054A	91107B*INLET ASSY=CLDN M4567J/P CWM	REFERENCE-COOLDOWN ASSY
00C	AD 33 011D	92426# FILL TUBE & DRAIN ASSY 240V	REFERENCE-ELECTRIC WATER
00D	G33 03800C	84512ZINST CWP MICRO H2O 1 1"BALVLV	REFERENCE-AIROP VLV INSTL
00E	A33 01200	91221C$ ASSY WATERIN ONE 1" BALVALV	REFERENCE-AIROP VLV ASSY
00F	AVW33002	92126L ASSY=FLOWMETER 3015/3020MXP	REFERENCE-LIQUOR FLOW
001	02 03602	91131C+BKT=SUP TOP CLDN CWM M4567JP	00A
002	27A030A	U-BOLT 1/2 PIPE 1/4-20 THD	00A
003	12M035	3/8" SCREW IN CONN. PECO #939	00A
004	02 03606	91107B+BKT=SUP BOT CLDN CWM M4567JP	00A
005	51E507N	HOSESTEM NYLON 1/4MPTX1/2 HOSE I.D.	00B
006	27A057	HOSECLAMP, 7/16"-1" CADSCREW #HS-8	00A
007	60E085	07Z H0SE WATER 1/2" DAY 7192-50250*	00A
008	SA 33 008	71254B* FILL HOSE ASSY = CWU	00C
009	02 03723	76303C SPLASHSHIELD=CWU INLET	00C
010	02 03487	APR62B2 FILLPIPE SADDLE+CAD	00C
011	27A034	04Z UBOLT 3.625"BETWN LEGS ZINC PLT	00C
012	02 03475	70093A STRAP=FILL PIPE SUPPORT	00C
013	27A034	04Z UBOLT 3.625"BETWN LEGS ZINC PLT	00C
014	02 03478	87366A HANGER=FILL HOSE	00C
015	27A074	HOSECLAMP 2+1/16-3"CADSCR+1/25 BAND	00C
016	02 03447	91247B FILL TUBE NIPPLE (2X3TOE)GAL	00C
017	27A031A	02Z BOLT 1+1/4PIPE 3/8-16THD ZINC	00E
018	02 10539	71010A SPACER FOR PIPE	QUANTITY 4 PER BRACKET
019	27A031B	01Z UBOLT 1" PIPE 5/16-18 ZINC PLAT	
020	06 20468	87091B HOSE ADAPTER 1+1/4"H X 1"NPT	00E
021	27A060	HOSECLAMP,1+5/16-2.25"CADSCR HS-28	00E
022	60E096	STEAM HOSE 1.25"ID 2WIREBRAID BY FT	00E
023	51LQ1KH03A	NIPPLE PIPE 1+1/2 X 3 TOE GALSTL	
024	51A053	HEXPIPBUSH 2X1+1/2 GALV 125# CI	
025	A33 10600A	77427M*TEE ASSY-STEAM 3 MOTOMETER	
026	60E014A02A	79087N HOSE 1.25IDX2"LG PVC	00C
027	27A052	HOSECLAMP 1.5"DIA SPRINGTYPE #R24HC	00C
028	02 03332C	78361B AIRCHAMBER=PRESSWITH-CWU	00C
029	27A044A	HOSECLAMP .687D ROTORCLIP#HC-11ST-R	00C
030	A33 12000J	91466# PRES TUBE "T" ASSY MXJ	00C
031A	02 03725	81482B BALVAL COVER SIDE	COVER-AIROP HOT+COLD
031B	02 03726	92281C COVER=BALVAL SIDE 3020	COVER-AIROP W/VACUUM BRK
032	02 03725A	92302B BALVAL COVER TOP	
033	51V086C	TEE PIPE 1+1/2X1+1/2X1+1/4GALMA 150	00F

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
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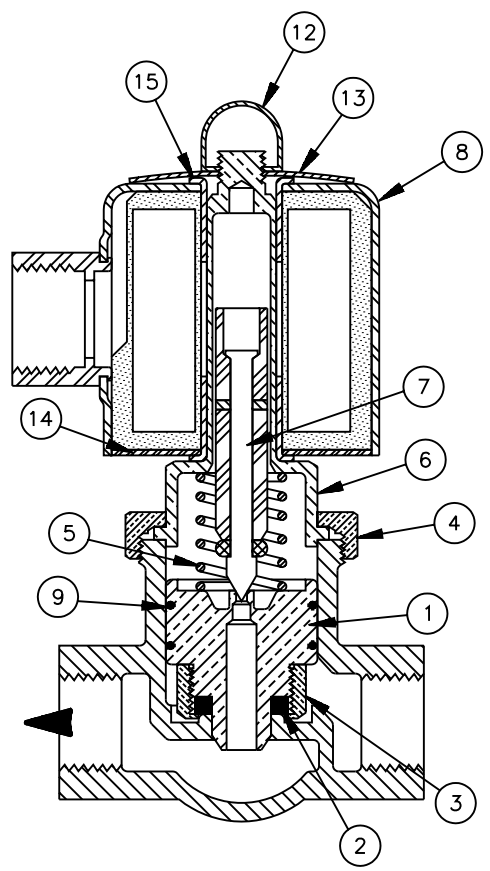
LITHO IN USA

Hays Electric Inlet Valves

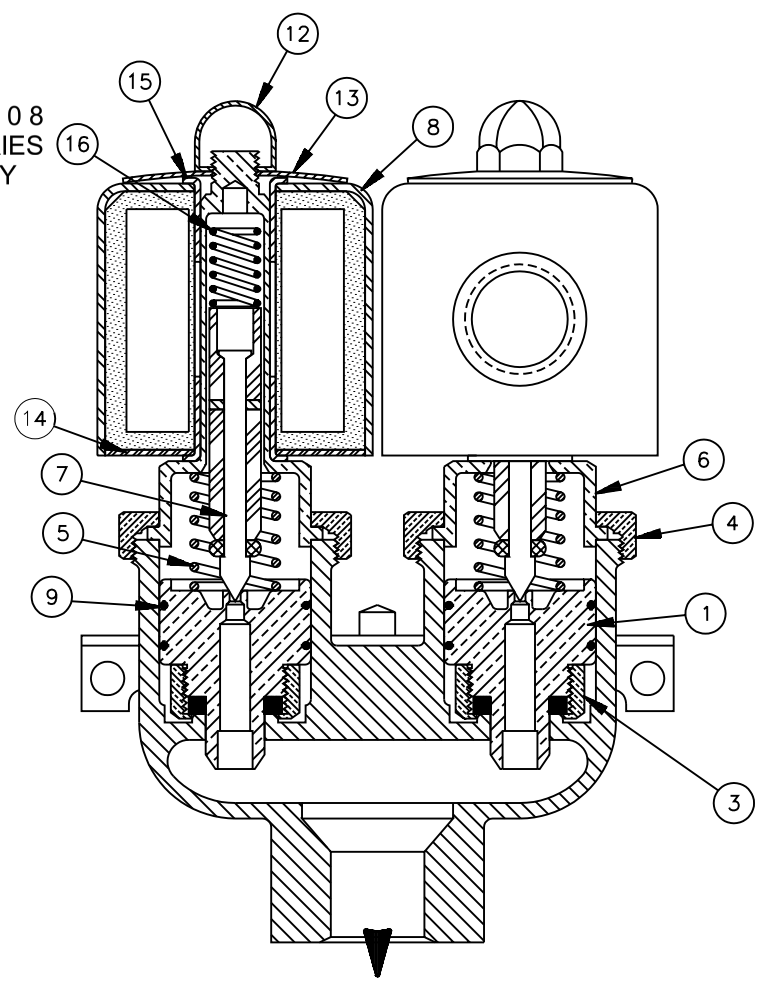
Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

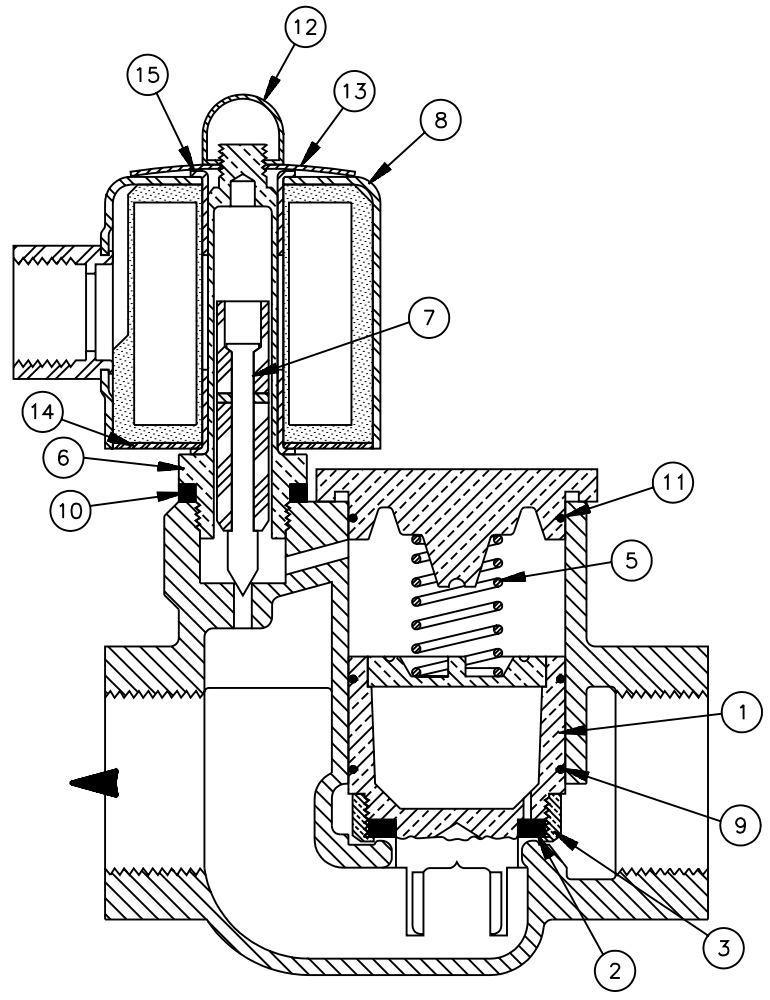
NOTE:
HAYS 4108 SERIES DUOVALVE IS REPLACED BY THE 3108 SERIES(SHOWN). IF REPLACEMENT PARTS ARE NEEDED FOR THE OBSOLETE 4108 SERIES SEE PARTS LIST ON REVERSE SIDE.



00S,00W,00X,00XX
3/8" BALANCING & 3/4" VALVES



00T,00U,00V
1/2" DUO VALVES



00Y,00Z,00ZZ
1-1/4" VALVES

GENERAL MAINTENANCE:

1) THOSE VALVES WITH COUPLING NUTS MUSTY NOT BE EXCESSIVELY TIGHTENED. USE A STEADY PULL WITH A 14" OR SMALLER WRENCH. DO NOT HAMMER ON NUT OR WRENCH. LIMIT MAXIMUM TORQUE ON COUPLING NUT TO 600LB/INCH. EXCESSIVE THIGHTENING OF COUPLING NUT WILL DISTORT VALVE BODY CAUSING THE PISTON BODY TO JAM AND THE VALVE WILL NOT SHUT OFF.

2) IF THE VALVE LEAKS BETWEEN THE BODY AND BONNET, LOOSEN THE COUPLING NUT AND TURN THE BODY SLIGHTLY, THEN TIGHTEN THE COUPLING NUT. IF THE VALVE STILL LEAKS, REPEAT THE OPERATION. IN NO CASE MUST THE NUT BE TIGHTENED EXCESSIVELY.

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

Parts List—Hays Electric Inlet Valves

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	S	96P014	02Z 3/8" VALVE 120V HAYS 2195-0055	
	T	96P016	10Z 1/2" DUOVAL 120V HAYS3108-6021	
	U	96P016A24	08Z 1/2" DUOVAL 24V HAYS3108-6421	
	V	96P016A71	05Z 1/2" DUOVAL 240V HAYS3108-6121	
	W	96P053	05Z 3/4"VAL 24V HAYS 2110-6421IS	
	X	96P053A37	06Z 3/4"VAL 110V HAYS #2110-6021IS	
	XX	96P053A71	3/4" HAYS VALVE 240V60/50C FACTMADE	
	Y	96P151	09Z 1+1/4" VAL 24V HAYS 2110-6421IS	
	Z	96P151A37	05Z 1+1/4" VAL 110V HAYS2110-6021IS	
	ZZ	96P151A71	1.25" HAYSVALVE 240V60/50C FACTMADE	
			----------COMPONENTS----------	
S	1	96V245	PISTON ASSY HAYS #7735505	
T-V	1	96V216	PISTON-TEFLON FOR HAYS STYLE 3108	
W-XX	1	96V222	PISTON ASSY HAYS 7730004 FOR 96P053	
Y-ZZ	1	96V224B	PISTON ASSY HAYS #7643101=96P151	
all	1	96V216A	PISTON-TEFLON FOR HAYS STYLE 4108	OBSOLETE 4108 DUOVALVE
S-V,	2	96V247	SEATWASHER HAYS #8222301 96P014+16	OBSOLETE 4108 DUOVALVE ALSO
W-XX	2	96V225	SEAT WASHER HAYS #8249801	
Y-ZZ	2	96V225A	SEAT WASHER HAYS #84048 FOR 96P151	
S-V,	3	96V248	SEATWASHER NUT HAYS#82222 96P014+16	OBSOLETE 4108 DUOVALVE ALSO
W-Z	3	96V226	SEAT WASHER NUT HAYS #86030 =96P053	
S-V	4	96V246	COUPLING NUT HAYS #76303 96P014+16	
W-Z	4	96V254	COUPLING NUT HAYS #76028 = 96P053	
S-V,Y-ZZ	5	96V244	PISTON SPRING FOR HAYS STYLE 3108	
W-XX	5	96V222A	PISTON SPRING HAYS 82488	
all	5	96V244A	PISTON SPRING HAYS 4108 HAYS #88108	OBSOLETE 4108 DUOVALVE
S-V	6	96V242	BONNET FOR HAYS 3108 HAYS#83021	
W-XX	6	96V258	BONNET HAYS #73026 FOR 96P053	
Y-Z	6	96V260	BONNET HAYS #83192 FOR 96P151	
S onlY	7	96V243	PLUNGER ASSY TEFLON TIP HAYS #74327	
T-ZZ	7	96V223	PLUNGER HAYS #7319503	
all	7	96V223A	PLUNGER ASSY FOR HAYS STYLE 4108	OBSOLETE 4108 DUOVALVE

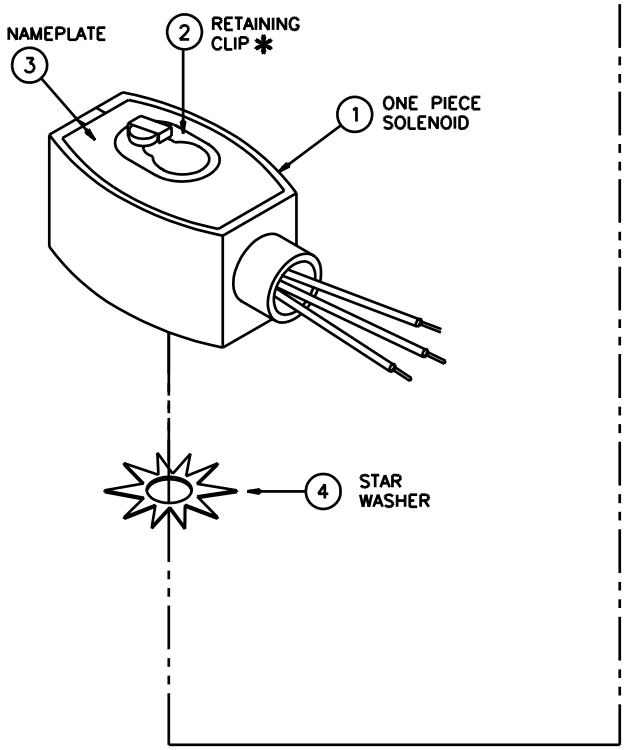
Parts List, cont.—Hays Electric Inlet Valves

Used In	Item	Part Number	Description	Comments
S-T,X,Z	8	96V211	COIL 120V50/60C FOR HAYS STYLE 3108	
U,W,Y,ZZ	8	96V210	COIL 24V50/60C FOR HAYS STYLE 3108	
V,XX	8	96V212	COIL 240V50/60C FOR HAYS STYLE 3108	
S-V,	9	96V217	TEFLON SPLIT RING 1/2" HAYS#8502901	OBSOLETE 4108 DUOVALVE ALSO
W-XX	9	96V222T	TEFLON SPLIT RING HAYS #8503002	
Y-ZZ	9	96V224T	TEFLON SPLITRING 1 1/4"HAYS#8503102	
Y-ZZ onlY	10	96V229	BONNET GASKET HAYS #82224= 96P151	
Y-Z onlY	11	96V261	O-RING (SEAL CAP) HAYS#87407=96P151	
all	12	96V250	PALNUT HAYS #3069-PC	
all	13	96V251	SPRING WASHER HAYS #83600	
all	14	96V264	BOTTOM PLATE (COIL) HAYS#8223601	
all	15	96V262	FERRULE (COIL SLEEVE) HAYS #82239	
all	16	96V244PS	PLUNGER SPRING FOR HAYS STYLE 4108	OBSOLETE 4108 DUOVALVE ONLY
all	17	96V250A	COIL RETAINER HAYS4108 HAYS #82958	(NOT SHOWN) OBSOLETE 4108 DUOVALVE

2-Way Electric Water Valve

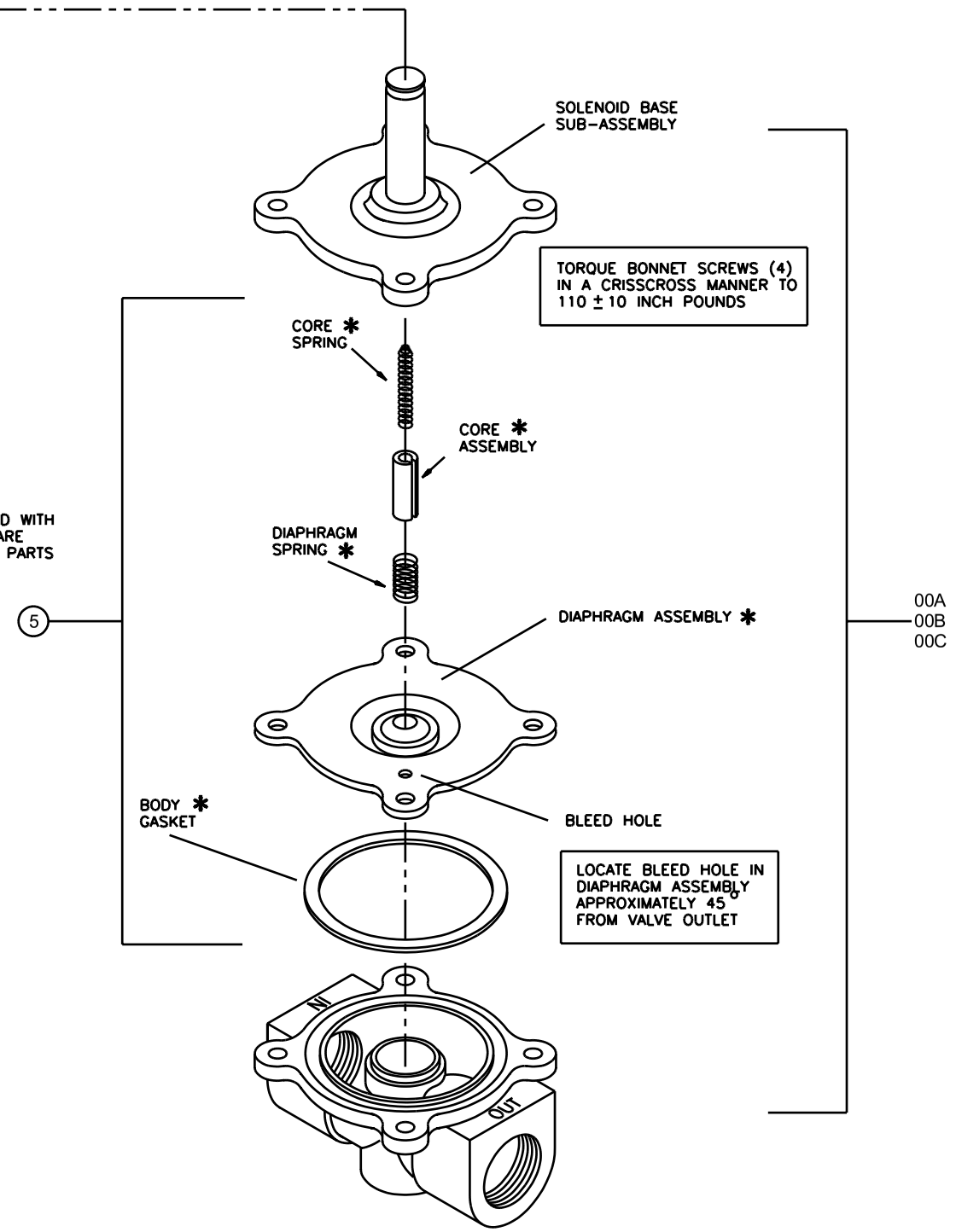
Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.



SOLENOID ASSEMBLY

NOTE:
ONLY PARTS MARKED WITH AN ASTERICKS (•) ARE INCLUDED IN VALVE PARTS KIT, ITEM 4.



VALVE ASSEMBLY

Identification and Description

Check nameplate for correct catalog number, pressure, voltage, and service.

Safety Instructions

⚠ DANGER ⚠

SHOCK HAZARD will cause death or severe injury.

☞ **Lock OFF and tag out power at wall disconnect before servicing. Power switches on machine and control box disable only control circuit power in electrical boxes.**

⚠WARNING⚠

EXPLOSION HAZARD may cause serious injury.

☞ **Release pressure to valve before disassembly.**

⚠ CAUTION ⚠

BURN HAZARD Solenoid enclosures become too hot to touch when energized for a long period. This will not damage the solenoid, but may cause a painful burn.

☞ **Allow solenoids to cool before servicing the valves.**

Maintenance

READ ALL SAFETY STATEMENTS ABOVE BEFORE PROCEEDING ANY FURTHER!

Coil Replacement

1. Remove retaining clip. NOTE: Whe metal retaining clip disengages, it springs upwards.
2. Slip yoke containg coil and sleeves off solenoid base sub-assembly.
3. Replace coil.
4. Reassemble in reverse order.

Valve Disassembly and Reassembly

1. Remove retaining clip.
2. Slip entire solenoid enclosure off the solenoid base sub-assembly.
3. Remove solenoid base sub-assembly, core assembly and core spring.
4. Remove diaphragm spring, diaphragm assembly and gasket.
5. Replace all worn or damaged parts.
6. Reassemble in reverse order.

Troubleshooting

Control Circuit: Listen for a metallic click when energizing the solenoid. Absence of the click indicates loss of power to the solenoid. Check for loose connections, blown fuses, open or grounded coil circuit, and broken lead wires.
Faulty coil: Check for open circuit in coil. Replace coil if necessary.
Low voltage: Voltage across coil leads must be at least 85% of nameplate rating for proper operation.
Incorrect pressure: Pressure to valve must be within range specified on nameplate.
Excess leakage: Disassemble valve and clean all parts. Replace all worn parts for best results.

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
Litho in U.S.A.

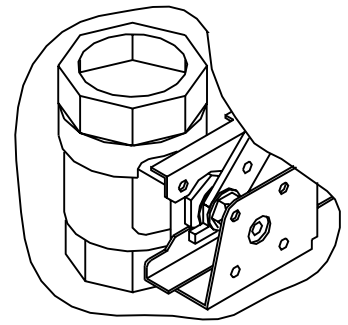
Parts List—2-Way Electric Water Valve

Used In	Item	Part Number	Description	Comments
.				
	00A	96TDC2AA24	03Z 1/2” N/C 2WAY 24V50/60C VALVE	VALVE ASSEMBLY
	00B	96TDC2AA37	03Z 1/2” N/C 2WAY 120V50/60C VALVE	VALVE ASSEMBLY
	00C	96TDC2AA71	03Z 1/2” N/C 2WAY 240V50/60C VALVE	VALVE ASSEMBLY
	001A	96T1001A24	SOLENOID 24V50/60C ASCO#260283-001	USED WITH 00A
	001B	96T1001A37	SOLENOID 120V50/60C ASCO#260283-002	USED WITH 00B
	001C	96T1001A71	SOLENOID 240V50/60C ASCO#260283-003	USED WITH 00C
	002	96V1001CLP	METAL CLIP M6	USED IN 00A, 00B, 00C
	003	96V1001PLT	NAMPLATE, BLANK REDHAT II COIL M6	USED IN 00A, 00B, 00C
	004	96V1001WSH	STAR WASHER REDHAT II COIL M6	USED IN 00A, 00B, 00C
	005	96V235B	PARTKIT ASCO #K258-120 FOR 8210D2	REPAIRS 00A, 00B, 00C

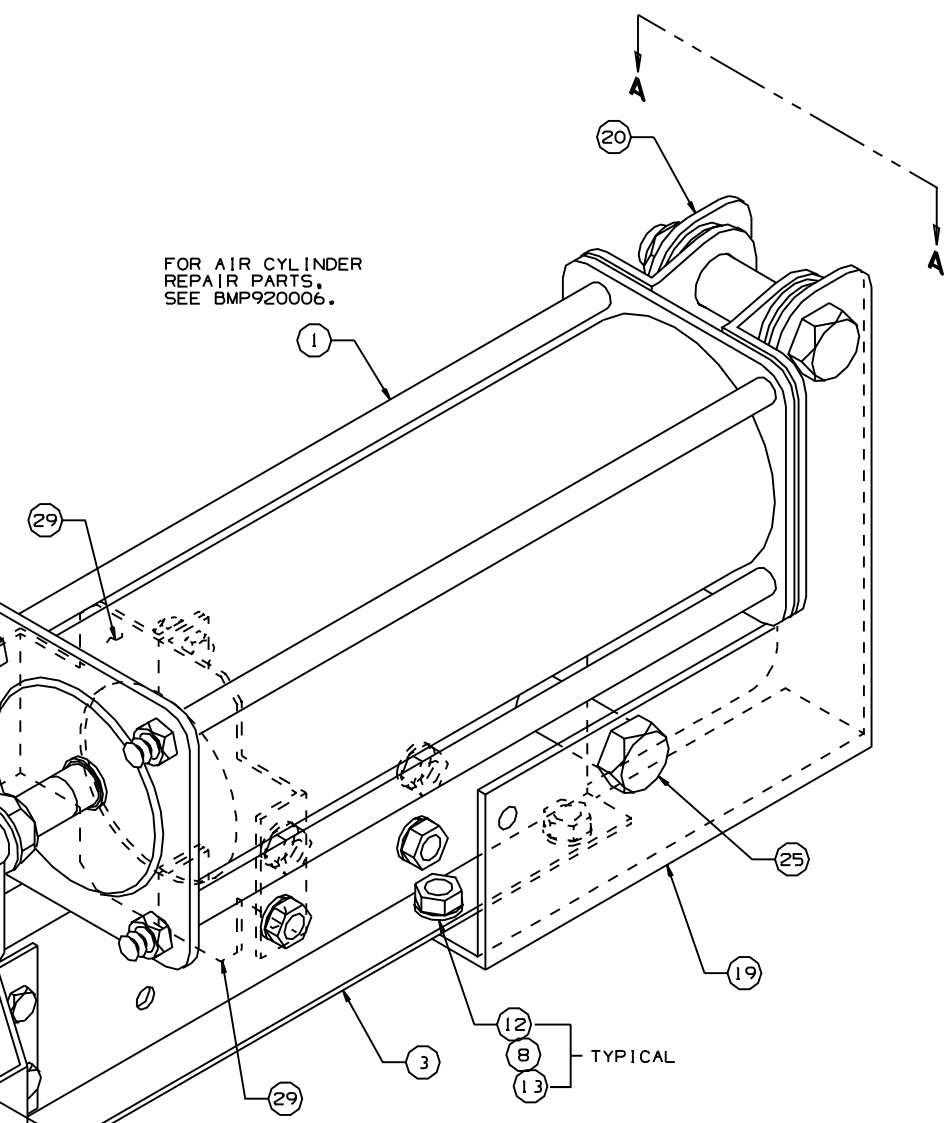
Universal Actuators & Mounting Hardware for Watts Ball Valves - New Pivot

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

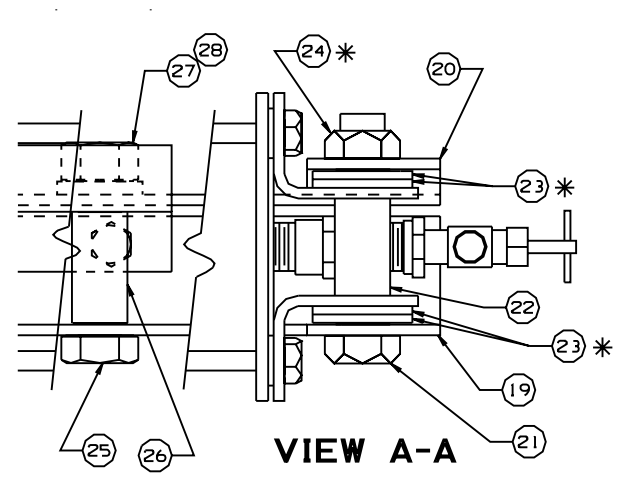


90° VALVE SET

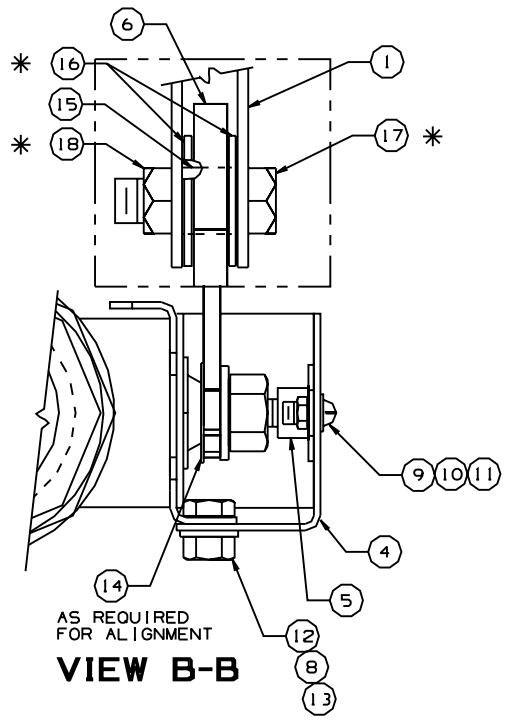


FOR PROPER ALIGNMENT OF ASSEMBLY:

1. WITH THE BALL IN ITS FULLY CLOSED POSITION AND THE ACTUATOR IN ITS FULLY RETRACTED POSITION, ADJUST ALIGNMENT NUT UNTIL THE CRANK ALIGNMENT HOLE IS 100% IN LINE WITH THE BEARING SUPPORT ALIGNMENT HOLE AND THE SOCKET HEXHEAD SCREW. THEN LOCK WITH LOCKNUT. THE ASSEMBLY MUST CLOSE 100%.

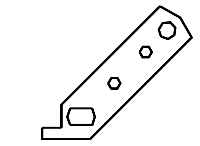


VIEW A-A

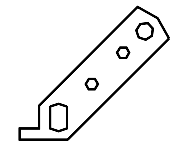


AS REQUIRED FOR ALIGNMENT

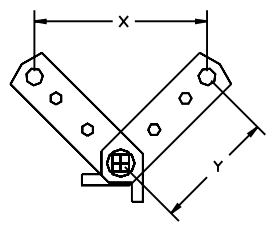
VIEW B-B



NORMALLY OPEN CRANK (ITEM 6)



NORMALLY CLOSED CRANK (ITEM 6)



STROKE DIMENSIONS

SIZE	X	Y
2" VALVES	3.89	2.75

NOTES:

1)RIGHT HAND ASSEMBLY IS SHOWN, LEFT HAND ASSEMBLY IS OPPOSITE.

2) FOR 90 DEGREE VALVE SET, VALVE IS ROTATED 90 DEGREES.

3) ASSEMBLE SO THAT THE LINKAGE IS FREE TO MOVE IN THE SPACER, THIS MEANS THAT THERE SHOULD BE DAYLIGHT BETWEEN THE CRANK AND EACH ADJACENT WASHER WITHOUT EXCESSIVE CLEARANCE.

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

Parts List—Actuators & Mounting Hardware for Watts Ball Valves

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	AA	96D085BCSL	92000Z 1.00WAT BVAL+ACT/BR/NC/ST/LH	
	AB	96D085BCSR	93513S 1.00WAT BVAL+ACT/BR/NC/ST/RH	
	AC	96D085BOSL	93513S 1.00WAT BVAL+ACT/BR/NO/ST/LH	
	AD	96D085BOSR	93513S 1.00WAT BVAL+ACT/BR/NO/ST/RH	
	AE	96D085SOSR	92000Z 1.00WAT BVAL+ACT/SS/NO/ST/RH	
	AF	96D085SCSR	92000Z 1.00WAT BVAL+ACT/SS/NC/ST/RH	
	BA	96D086BCSL	93513S 1.25WAT BVAL+ACT/BR/NC/ST/LH	
	BB	96D086BCSR	93513S 1.25WAT BVAL+ACT/BR/NC/ST/RH	
	BC	96D086BOSL	93513S 1.25WAT BVAL+ACT/BR/NO/ST/LH	
	BD	96D086BOSR	93513S 1.25WAT BVAL+ACT/BR/NO/ST/RH	
	BE	96D086SCNR	92000Z 1.25WAT BVAL+ACT/SS/NC/90/RH	
	BF	96D086SCSL	92000Z 1.25WAT BVAL+ACT/SS/NC/ST/LH	
	BG	96D086SCSR	92000Z 1.25WAT BVAL+ACT/SS/NC/ST/RH	
	BH	96D086SOSL	92000Z 1.25WAT BVAL+ACT/SS/NO/ST/LH	
	BJ	96D086SOSR	92000Z 1.25WAT BVAL+ACT/SS/NO/ST/RH	
	CA	96D087BCSL	93513S 1.50WAT BVAL+ACT/BR/NC/ST/LH	
	CB	96D087BCSR	93513S 1.50WAT BVAL+ACT/BR/NC/ST/RH	
	CC	96D087BOSR	93513S 1.50WAT BVAL+ACT/BR/NO/ST/RH	
	CD	96D087SCNR	92000Z 1.50WAT BVAL+ACT/SS/NC/90/RH	
	CE	96D087SCSR	92000Z 1.50WAT BVAL+ACT/SS/NC/ST/RH	
	CF	96D087SOSR	92000Z 1.50WAT BVAL+ACT/SS/NO/ST/RH	
	DA	96D088BCSR	92177S 2.00WAT BVAL+ACT/BR/NC/ST/RH	
	DB	96D088BCNR	92177S 2.00WAT BVAL+ACT/BR/NC/90/RH	
	DC	96D088BCSL	92177S 2.00WAT BVAL+ACT/BR/NC/ST/LH	
	DD	96D088BOSR	92177S 2.00WAT BVAL+ACT/BR/NO/ST/RH	
	DE	96D088SCNR	92177S 2.00WAT BVAL+ACT/SS/NC/90/RH	
	DF	96D088SCSR	92177S 2.00WAT BVAL+ACT/SS/NC/ST/RH	
	DG	96D088SOSR	92177S 2.00WAT BVAL+ACT/SS/NO/ST/RH	
	DH	96D088BCNL	92177S 2.00WAT BVAL+ACT/BR/NC/90/LH	
	DJ	96D088BOSL	92177S 2.00WAT BVAL+ACT/BR/NO/ST/LH	
	DK	96D088SCSL	92177S 2.00WAT BVAL+ACT/SS/NC/ST/LH	
	DL	96D088SOSL	92177S 2.00WAT BVAL+ACT/SS/NO/ST/LH	
			----------COMPONENTS----------	
AA-AD, BA-BD, CA-CC	1	SA 10 056F	92000Z AIRCYL=2.38ODX2.70STX20.5#CD	
AE-AF, BE-BJ, CD-CF	1	SA 10 056G	92000Z*AIRCYL=2.38ODX2.70STX20.5#SS	
DA-DD, DH-DJ	1	SA 10 057C	95222D AIRCYL=3.0ODX3.89ST171/176CD	
DE-DG, DK-DL	1	SA 10 057D	95222# AIRCYL=3.0ODX3.89ST171/176SS	
AA-AE	2	96D085WEXS	07Z BALVAL 1" BRZ WATTS#B6400SSZ107	
AF	2	96D085WSS	07Z BALVAL 1" SS WATTS S8000-Z107	
BA-BD	2	96D086WEXS	08Z BAVAL 1+1/4BRZ WATS#B6400SSZ107	
BE-BJ	2	96D086WSS	08Z BAVAL 1+1/4"SS WATTS S8000-Z107	
CA-CC	2	96D087WEXS	09Z BAVAL 1+1/2BRZ WATS#B6400SSZ107	

Parts List, cont.—Actuators & Mounting Hardware for Watts Ball Valves

Used In	Item	Part Number	Description	Comments
CD-CF	2	96D087WSS	08Z BAVAL 1+1/2"SS WATTS S8000-Z107	
DA-DD, DH-DJ	2	96D088WEXS	09Z BALVAL 2" BRZ WATTS#B6400SSZ107	
DE-DG, DK-DL	2	96D088WSS	09Z BALVAL 2" SS WATTS S8000-Z107	
AA,AC	3	03 01634A	94053# ACTUATOR CHANNL SUPPORT-LEFT	
AB,AD,AE, AF	3	03 01634	94053C ACTUATOR CHANNL SUPPORT 1.0"	
BA,BC,BF, BH,CA	3	07 20700L	88512# ACTUATOR ZEE SUPPORT-LEFT	
BB,BD,BE, BG,BJ,CB, CC,CE, CF	3	07 20700	88512D ACTUATOR ZEE SUPPORT	
CD	3	03 01633	92651C ACTUATOR SUPPORT BRKT 1.0"	
DA,DB, DD-DG	3	03 01628	92126D ACTUATOR ZEE SUP 3"AIRCYL	
DC,DH-DL	3	03 01628L	92126# ACT ZEE SUP 3" AIRCYL-LEFT	
AA,AC	4	03 01632A	90507# ACTUATOR BEARING SUPPRT-LEFT	
AB,AD-AF, CD	4	03 01632	90507C ACTUATOR BEARING SUPPORT-1"	
BA,BC,BF, BH,CA	4	07 20702L	88512# ACTUATOR BEARING SUPPORT-LFT	
BB,BD,BE, BG,BJ,CB, CC,CE, CF	4	07 20702A	88512C ACTUATOR BEARING SUPPORT	
DA,DB, DD-DG	4	03 01629	92023C ACTUATOR BEARING SUPPORT 3	
DC,DH-DL	4	03 01629L	92023# ACT BEARING SUPPORT 3"-LEFT	
AA-AF,CD	5	54E001PABA	89281B ASSY=1/4"PRESSBEARING	
BA-BJ, CA-CC,CF, DA-DL	5	54E002PABA	89281B ASSY=5/16"PRESSBEARING	
AA,AB,AF, CD	6	03 01631	91507B+VALVE CRANK N.C.WATTS 1.0"	
AC-AE	6	03 01631A	88381B VALVE CRANK N.O.WATTS-1.0"	
BA,BB,BE, BF,BG,CA, CB,CE	6	07 20703A	91507B VALVE CRANK N.C.WATTS 1.5"	
BC,BD,BH, BJ	6	07 20703B	88153B VALVE CRANK N.O.WATTS 1.5"	
DA,DC,DF, DK	6	03 01624B	92061B CRANK=NC 2"BALVAL .626 STEM	
DB,DD,DE, DG,DH,DJ, DL	6	03 01624C	92061B CRANK=NO 2"BALVAL .626 STEM	
all except CC,CD	7	15K031	BUTSOKCAPSCR 1/4-20X1/2 SS18-8	
CC,CD	7	15N117	RDMACSCR 10-24UNC2X3/8SS18-8	
all	8	15U181	LOCKWASHER MEDIUM 1/4 SS18-8	
all	9	15N130	RDMACHSCR 10-24UNC2A X 1/2 SS18-8	
all	10	15U135	FLATWASH#10 .4370DX.203IDX.04TSS188	

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Parts List, cont.—Universal Actuators & Mounting Hardware for Watts Ball Valves

Used In	Item	Part Number	Description	Comments
all	11	15G126	01Z HXLOCKNUT NYLON 10-24 UNC SS NM	
all	12	15N159	HEXCAPSCR 1/4-2OUNC2AX7/16 18-8SS	
all	13	15G170	HEXNUT 1/4-20UNC2 SS18-8	
AA-AF,BE, CD,DA-DL	14	07 20703D	89354B WASHER=2.00"WATTS CRANK	
BA-BD, BF-BJ, CA-CC,CE, CF	14	07 20703C	89354B WASHER=1.25-1.50 WATTS CRANK	
all	15	02 15893	92683B SPACER=BALL VALVE CRANK STEM	
all	16	15U188	01Z FLTWASH 1/4 STD COMM SS18-8	
all	17	15N186	HXCAPSCR 1/4-20UNC2X3/4SS18-8	
all	18	15G164	01Z HX THIN LOCKNUT NYL1/4-20 SS	
BA,BB,BE, BJ,CE	19	03 01661A	92271B BRKT=RHT AIR CYL SUPT-S/S	
DA,DB, DD-DG	19	03 01625A	92271B 3" AIR-CYL SPT BRK R-SIDE RT	
DC,DH-DL	19	03 01625B	92271# 3" AIR-CYL SPT BRK R-SIDE LT	
BE,BG,BJ, CE-CF	20	03 01662A	92271B BRKT=LFT AIR CYL SUPT-S/S	
DA,DB, DD-DG	20	03 01625C	92271B 3" AIR-CYL SPT BRK L-SIDE RT	
DC,DH, DJ-DL	20	03 01625D	92271# RIGHT=3"AIR CYL SUPT BRKT	
all	21	15K190S	HXCAPSCR 1/2-13UNC2AX2.5 FLTHRD SS	
all	22	27B24S0K1P	SPACER ROLL.5ID1.75L.062T 304 SS	
all	23	15U318S	FLATWASH 1.12ODX.656IDX.09T 304 SS	
AB,DA-DL	24	15G234NS	HXLOCKNUT NYL 1/2-13UNC2 SS18-8	
all	25	15K180S	HXCAPSCR 1/2-13UNCAX2 18-8SS	
all	26	27B24SSK1F	SPACER ROLL.5ID1.25L.062T S/S	
all	27	15U310	LOKWASHER REGULAR 1/2 SS18-8	
all	28	15G231S	HXFINJAMNUT 1/2-13UNC2B SS18-8	
AA-AF	29	03 01633	92651C ACTUATOR SUPPORT BRKT 1.0"	
BA-BJ	29	07 20771	88407C ACTUATOR SUPPORT BRKT 1.25"	
CA-CF	29	07 20770	88243B ACTUATOR SUPPORT BKT 1+1/2	
DA-DL	29	03 01626	89473B ACTUATOR SUPPORT BRKT 2"VAL	

Air Cylinders for 2" Watts Ball Valves

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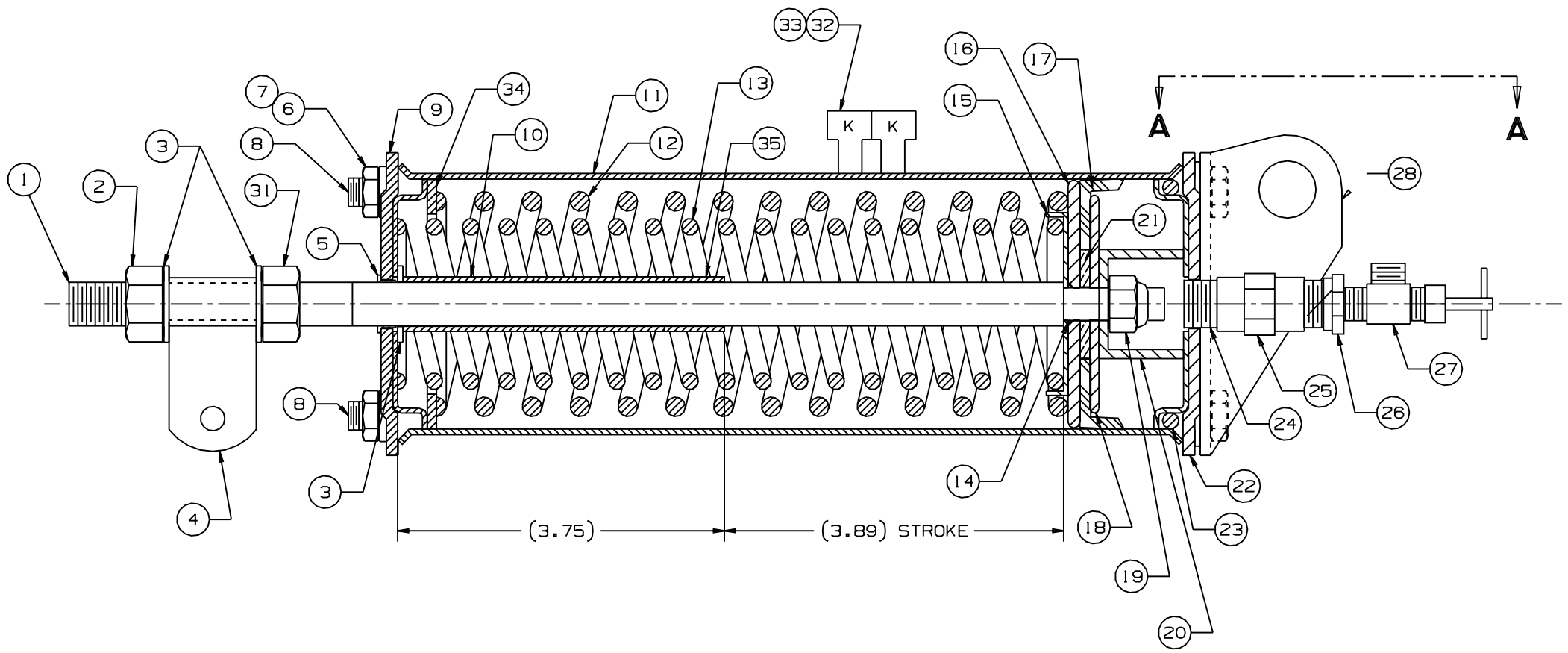

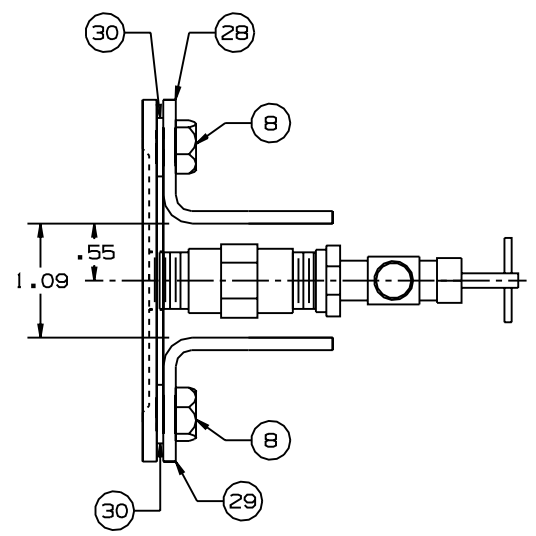

VIEW A-A

NOTES:

1. LUBRICATE SPRINGS WITH A LAYER OF GREASE BUT NOT SO MUCH AS TO CAUSE EXCESS TO LEAK OUT.
2. DO NOT GREASE THE CUP, ITEM 17! DOING SO WOULD BLOCK THE AIR LINES.

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Parts List—Air Cylinders for 2" Watts Ball Valves

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	SA 10 057C	95222D AIRCYL=3.0ODX3.89ST171/176CD	
	B	SA 10 057D	95222# AIRCYL=3.0ODX3.89ST171/176SS	STAINLESS
	C	SA 10 056F	92000Z AIRCYL=2.38ODX2.70STX20.5#CD	
	D	SA 10 056G	92000Z AIRCYL=2.38ODX2.70STX20.5#SS	STAINLESS
			----------COMPONENTS----------	
A,B	1	03 01615	94191B PISTON STEM 3"AIRCYL	
C,D	1	02 18650	96461B STEM=2 WAY AIRCYLINDER BRAKE	
all	2	15G234NS	HXLOCKNUT NYL 1/2-13UNC2 SS18-8	
all	3	15U243S	FLAWASHER 7/8ODX33/64IDX16GA 18-8SS	
all	4	03 01209A	92536B STEMCLIP H=1.313 BALVAL S/S	
all	5	54E220	NYLINER 8L2FF BUSHING 1/2X9/16X.140	
A	6	15G191	HXFINJAMNUT 5/16-24UNC2 ZINC GR2	
B,C,D	6	15G190	HEXFINJAMNUT 5/16-18NC2 SS18-8	
A	7	15U210	LOKWASHER MEDIUM 5/16 ZINCPL	
B,C	7	15U205	LOCKWASHER MEDIUM 5/16" 18-8SS	
D	7	15U200S	FLATWASHER US STD 5/16 SS18-8	
A	8	02 10585H	91142# TIE BOLT=5/16-18X10LNG PLTD	
B	8	02 10585G	91142# TIE BOLT=5/16-18X10LG (SS)	
C	8	02 10585E	91142# TIE BOLT=5/16-18X8.25LG PLTD	
D	8	02 10585A	91142# TIE ROD-5/16-18X8+1/4 (SS)	
A	9	03 01623	90351C CYLINDER HEAD 3"AIRCYLINDER	
BI	9	03 01623A	90351# CYLHEAD 3"AIRCYLINDER-S/S	
C	9	02 02546	87341C CYLHEAD=SLIDESTEM	
D	9	02 02546S	87341# CYLINDER HEAD=SLIDE STEM SS	
all	10	27B32024SS	SPACER ROLL .51IDX.6250DX1.5L STN S	
A,B	11	03 01621	94266BTUBE 2+7/8 AIR CYLINDER 9"	
C,D	11	02 02068	94266A AIRCYL-STAINLESS=DUMPVALVE	
A,B	12	03 01617C	92133B SPRING=FL11.5SR23.5#MD2.368	
C	12	02 15881	96471# SPRING=BRAKE2.1OD11FL15.5#/"	
D	12	02 15881A	85504Z SPRING,02 -15881+HEAVY PAINT	
A,B	13	03 01616C	92133B SPRING=FL11.35SR20.5MD1.811	
C	13	02 15880	96471B SPRING=BRAKE1.5OD10.3FL17#/"	
D	13	02 15880A	85504Z SPRING,02-15880 +HEAVY PAINT	
all	14	60C106	ORING 5/16ID 1/16CS BN 70 DURO #011	
A,B	15	03 01620A	92133B 3"AIR CYL=SPRING RETAINER	
C,D	15	02 18651	73171A WASHER=2 WAY BRAKE CYL	

Parts List, cont.—Air Cylinders for 2" Watts Ball Valves

Used In	Item	Part Number	Description	Comments
A,B	16	X3 01619A	92066# MACH=3"ACYL BRASS PISCUP WSH	
C,D	16	02 02105B	92253B 2.38"ACYL BRASS PISCUP WASHR	
A,B	17	02 19302	93356B PISTON CUP 2+7/81D CYLINDER	
C,D	17	02 02194	93217B PISTONCUP=DUMPVALVE 2+3/8"	
A,B	18	03 01618	91522B PISTON CUP WASHER 3"AIRCYL	
C,D	18	02 02085	94092B UP WASHER=2"OD=PISTON CUP	
all	19	15G220	02Z LTHX THIN LOKNUT 3/8-24 SSNTE	
A,B,D	20	03 01313S	85506B+STOP=AIRCYL W/2+11/16STR.SS	
C	20	03 01313	70219A STOP=AIR CYL W/2+11/16STROKE	
A,B	21	03 01630	87506B 3"AIRCYL PSTN CUP COMPLMTWSH	
C,D	21	02 02185	79237A WASHER=PISTON CUP COMP LIMIT	
A	22	03 01622	88531# CYL HEAD TAPHOLE 3"AIRCYL SS	
B	22	03 01622A	88531# CYLHEAD TAPHOLE-3"ARCYL S/S	
C	22	02 02101	71334A CYLHEAD W/TAPPED HOLE	
D	22	02 02101S	88531B CYLINDER HEAD TAP HOLE (SS)	
A,BI	23	60C134	ORING 2.5 ID 3/16CS BN 70 DURO #333	
C,D	23	60C132	ORING 2"IDX3/16CS BUNA70 #32	
all	24	5N0ECLSBE2	NPT NIPPLE 1/4XCLS TBE BRASS 125#	
all	25	5SCC0EBE	NPT COUP 1/4 BRASS 125# #103	
all	26	5SB0E0CBEO	HEXPIPBUSH 1/4 X 1/8 BRASS 125#	
all	27	96H018	NEEDLE VALVE	
A,B	28	03 01627B	92023# LEFT=3"AIR CYL MNTG BRKT	
C	28	03 01660C93231B	BRKT=AIR CYL MONUT LEFT	
D	28	03 01660A	92271B BRKT=AIR CYL MNT LFT-S/S	
A,B	29	03 01627A	92023B RIGHT=3"AIR CYL MNTG BRKT	
C	29	03 01660D	BRKT=AIR CYL MOUNT RIGHT	
D	29	03 01660B	92271# BRKT=AIR CYL MNT RHT-S/S	
all	30	15U200	FLATWASHER(USS STD) 5/16"ZNC PLT	
all	31	15G231S	HXFINJAMNUT 1/2-13UNC2B SS18-8	
all	32	20L601K	ID TAG NAT'L #1614 ALUM EMB LET "K"	
all	33	27B2400K0N	SPACER ROLL.5ID .687L .062T STL/ZNC	
all	34	03 01620E	92136B.WASHER=2.86ODX2.06IDX.105THK	

Watts Ball Valves and Repair Kits

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
BMP920007/96067V (1 of 2)
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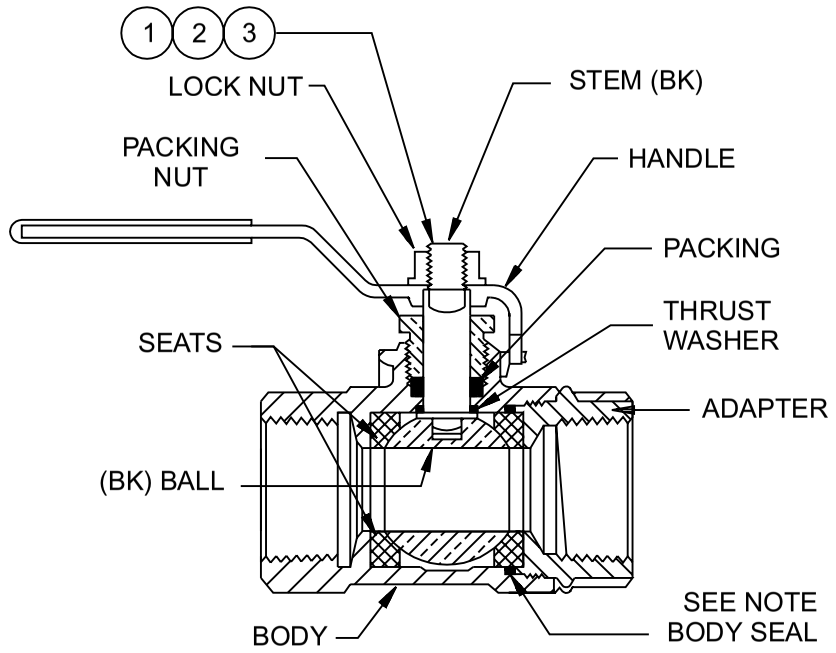
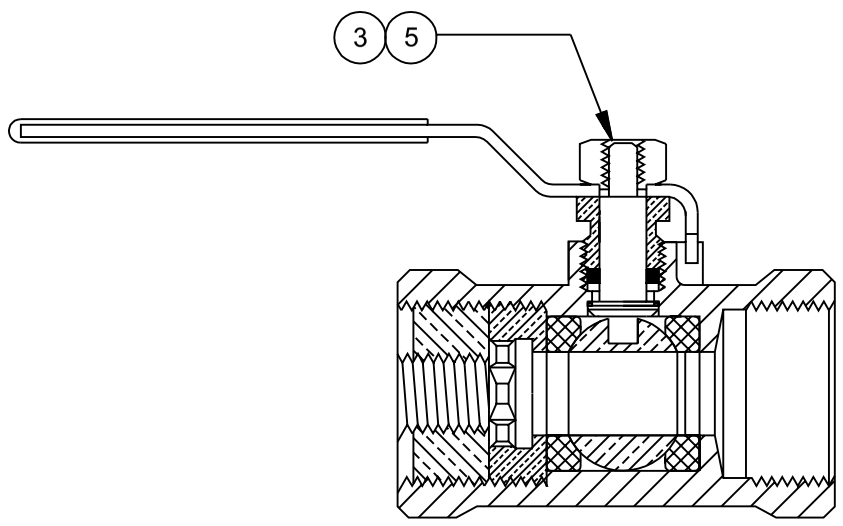
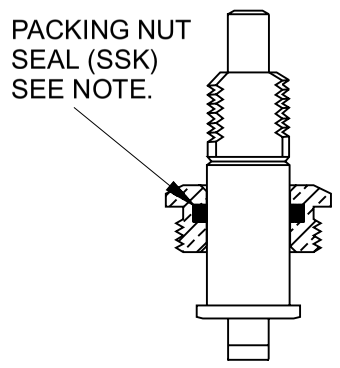
BALL VALVES WITHOUT ACTUATOR PADS FOR MANUAL OPERATION



1/2" BRONZE OR 1/2", 3/4" STAINLESS
NO REPAIR KITS

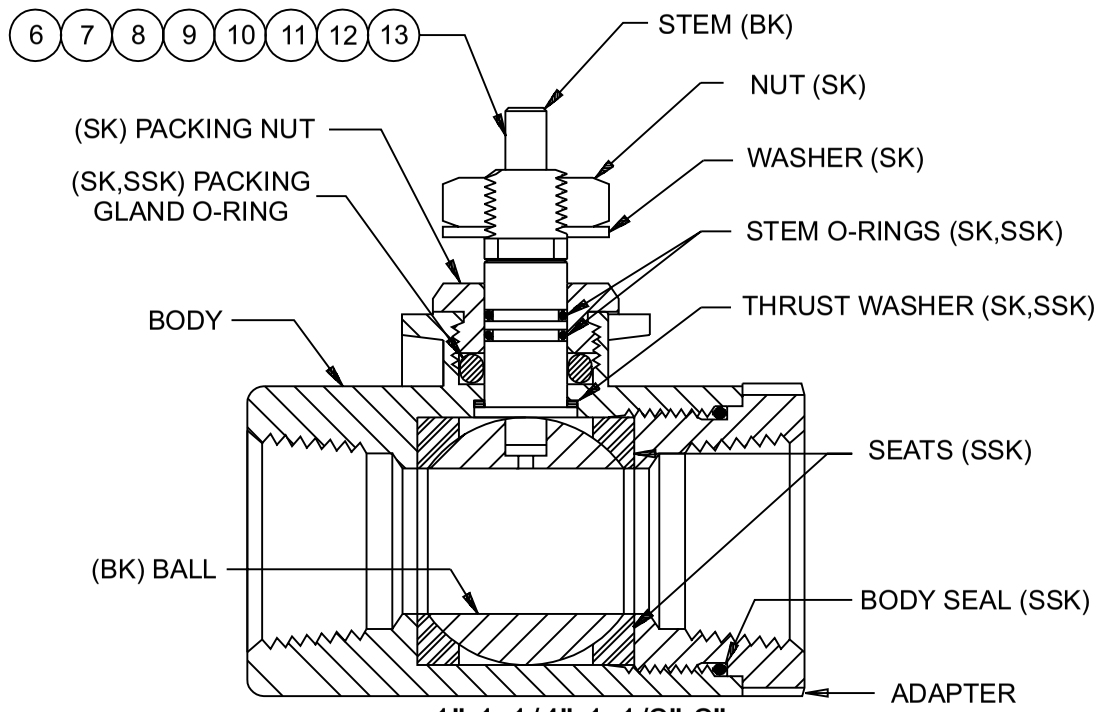


3/4",1"
BRONZE
NO REPAIR KITS



DETAIL
OLD STYLE STEM

AIR OPERATED BALL VALVES



1",1-1/4",1-1/2",2"
BRONZE & STAINLESS

(For Bracketry and Mounting Hardware, See BMP920005. For Air Cylinders that Operate Watts Ball Valves, See BMP920006.)

HOW TO USE THIS DRAWING:

The ball valves are separated by size, material, and type of operation. Find the cross section which shows your ball valve (example 1-1/2" bronze air operated). See the parts list for the item number which represents your ball valve (1-1/2" bronze air operated would be item 10 on the parts list). For valves that offer repair kits the internal parts are labled and marked as to which kit they are found in:
- (BK) part of Ball Kit
- (SK) part of Stem Kit
- (SSK) part of Seat/Seal Kit

For the part number of the Seat/Seal Kit for item 10 (1-1/2" bronze air operated valve) see the parts list and look for item 10SSK, likewise the Stem Kit will be 10SK.

NOTE:
AIR OPERATED VALVES: (SSK) kits for air operated ball valves include all parts required to repair either our old style or new style stems. A packing nut seal is provided to repair our old style stems which had a seal in the packing nut (see Detail). Our new style stem uses a double o-ring design.

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

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Parts List—Watts Ball Valves and Repair Kits

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
----------ASSEMBLIES----------				
			none	
----------COMPONENTS----------				
all	1	96D034	04Z BALLVALVE 1/2" WATTS #6400-SS	1/2"BRONZE-MANUAL, NO KITS
all	2	96D040WSS	01Z 1/2" BALLVALVE S/S WATTS#S-8000	1/2"STAINLESS-MANUAL
all	002BK	96V040BK	BALL KIT WATTS #BV4SSA6	
all	002SSK	96V040SSK	01Z REPKIT 1/2"VAL WATTS#3SSK-02-RK	
all	3	96D050A	01Z 3/4"BALLVALVE BRZ WATTS#B6100	3/4"BRONZE-MANUAL, NO KITS
all	4	96D055WSS	01Z 3/4"BALLVALVE S/S WATTS#S-8000	3/4"STAINLESS-MANUAL
all	004BK	96V055BK	BALL & STEM KIT WATTS #4BSK-SSRK	
all	004SSK	96V055SSK	01Z REPKIT 3/4"VAL WATTS#4SSK-02-RK	
all	5	96D084	01Z BALL VALVE 1" WATTS#B6100 BRZ	1" BRONZE-MANUAL , NO KITS
all	6	96D085WEXS	07Z BALVAL 1" BRZ WATTS#B6400SSZ107	1" BRONZE-AIR OPERATED
all	006BK	96V085BK	BALL KIT WATTS #1-BALL-RK-Z107	
all	006SK	96V085SK	02Z STEM KIT 1" WATTS#1-ST-RK-Z107	
all	006SSK	96V085SSK	02Z REPKIT 1"BALVAL#1SSK-02-KK-Z107	
all	7	96D085WSS	07Z BALVAL 1" SS WATTS S8000-Z107	1" STAINLESS-AIR OPERATED
all	007BK	96V085BK	BALL KIT WATTS #1-BALL-RK-Z107	
all	007SK	96V085SK	02Z STEM KIT 1" WATTS#1-ST-RK-Z107	
all	007SSK	96V085SSK	02Z REPKIT 1"BALVAL#1SSK-02-KK-Z107	
all	8	96D086WEXS	08Z BAVAL 1+1/4BRZ WATS#B6400SSZ107	1-1/4"BRONZE-AIR OPERATED
all	008BK	96V086BK	BALL KIT WATTS #1.25-BALL-RK-Z107	
all	008SK	96V086A7SK	02Z STEMKIT 1.25-1.5-ST-RK-Z107	

Parts List, cont.—Watts Ball Valves and Repair Kits

Used In	Item	Part Number	Description	Comments
all	008SSK	96V086SSK	02Z REPKIT 1.25BALVALSSK-02-RK-Z107	
all	9	96D086WSS	08Z BAVAL 1+1/4"SS WATTS S8000-Z107	1-1/4"STAINLESS-AIR OPER.
all	009BK	96V086BK	BALL KIT WATTS #1.25-BALL-RK-Z107	
all	009SK	96V086A7SK	02Z STEMKIT 1.25-1.5-ST-RK-Z107	
all	009SSK	96V086SSK	02Z REPKIT 1.25BALVALSSK-02-RK-Z107	
all	10	96D087WEXS	09Z BAVAL 1+1/2BRZ WATS#B6400SSZ107	1-1/2"BRONZE-AIR OPERATED
all	010BK	96V087BK	BALL KIT WATTS #1.5-BALL-RK-Z107	
all	010SK	96V086A7SK	02Z STEMKIT 1.25-1.5-ST-RK-Z107	
all	010SSK	96V087SSK	02Z REPAIR KIT 1.5" BALL VALVE	
all	11	96D087WSS	08Z BAVAL 1+1/2"SS WATTS S8000-Z107	1-1/2"STAINLESS-AIR/ OPER.
all	011BK	96V087BK	BALL KIT WATTS #1.5-BALL-RK-Z107	
all	011SK	96V086A7SK	02Z STEMKIT 1.25-1.5-ST-RK-Z107	
all	011SSK	96V087SSK	02Z REPAIR KIT 1.5" BALL VALVE	
all	12	96D088WEXS	09Z BALVAL 2" BRZ WATTS#B6400SSZ107	2"BRONZE-AIR OPERATED
all	012BK	96V088BK	BALL KIT WATTS #2-BALL-RK-Z28	
all	012SK	96V088SK	03Z STEM KIT 2" WATTS#2-ST-RK-Z107	
all	012SSK	96V088SSK	02Z REPKIT 2"VAL WAT2SSK-02-RK-Z107	
all	13	96D088WSS	09Z BALVAL 2" SS WATTS S8000-Z107	2"STAINLESS-AIR OPERATED
all	013BK	96V088BK	BALL KIT WATTS #2-BALL-RK-Z28	
all	013SK	96V088SK	03Z STEM KIT 2" WATTS#2-ST-RK-Z107	
all	013SSK	96V088SSK	02Z REPKIT 2"VAL WAT2SSK-02-RK-Z107	

Paddlewheel Flow Sensor

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
BMP920025/92662V (1 of 2)
Litho in U.S.A.

Identification and Description

The flow sensor is installed in a pipe line to measure flow rate. The flow passing by the flow sensor paddlewheel rotates the paddlewheel, moving the magnets past a coil in the transducer body. An AC voltage is induced in the coil by the rotating magnets of the paddlewheel.

Both frequency and amplitude of the output of the coil are directly proportional to the velocity of the fluid flow in the pipe. A complete cycle occurs every time two of the paddlewheel blades go by the coil; therefore, two entire cycles are generated for each paddlewheel rotation.

Safety Instructions

⚠ DANGER ⚠

SHOCK HAZARD will cause death or severe injury.

Lock OFF and tag out power to machine at wall disconnect. Power switches on machine and control box disable only control circuit power in electrical boxes.

⚠ CAUTION ⚠

Turn off fluids before removing flow sensor from pipe line.

Maintenance

The flow sensor requires minimal care. Check your flow sensor every three months until actual maintenance intervals can be determined. After removing flow sensor:

1. Paddlewheel must turn freely, if not, see troubleshooting below.
2. Inspect flow sensor electrical connections and cable.
3. Check O-rings and lubricate with G.E. Silcone Compound G660 or similar. Keep paddlewheel and pin free of lubrication (replacement paddlewheels and other parts are available from manufactuer).

Troubleshooting

The paddlewheel is designed to rotate on the shaft; the shaft should not rotate with respect to the housing. The paddlewheel must turn freely. If it does not, clean the paddlewheel assembly as follows:

1. Remove the flow sensor from the pipe and insert the plug into the pipe fitting. Clean any external debris from the paddlewheel.
2. Using a small flat-bladed screwdriver, gently pry one of the paddlewheel mounting ears away from the pin (see FIGURE 2).
3. When one end of the pin is free, gently work the paddlewheel and pin out of the remaining mounting ear.
4. Throughly clean the pin, paddle, and pin holes with a wire brush and/or toothpick along with alcohol and/or soap and water.
5. To reinstall the paddlewheel and pin, reverse steps 1, 2, and 3.
6. After cleaning, the paddlewheel should spin freely without binding or sticking.

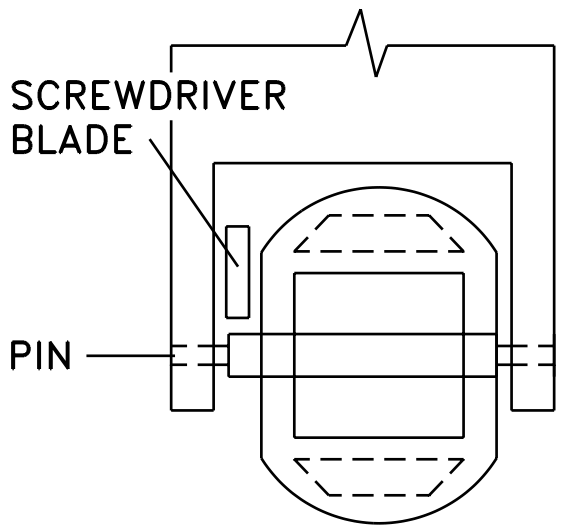

FIGURE 2: REMOVAL OF PADDLEWHEEL PIN

FIGURE 1: FLOW SENSOR

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.

Parts List—Paddlewheel Flow Sensor

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
	00A	30F515	FLOW SENSOR SIGNET #MK515-PO	COMPLETE FLOW SENSOR
	001	30F515R01	VITON O-RING FOR FLOW SENSOR SIGNET	REPAIR KIT O-RINGS (2PER)

Parts List, cont.—Paddlewheel Flow Sensor

Used In	Item	Part Number	Description	Comments

Steam Installation

30015, 30020, & 30022 Rigid Mount Washer Extractors

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P. O. Box 400, Kenner, LA 70063-0400

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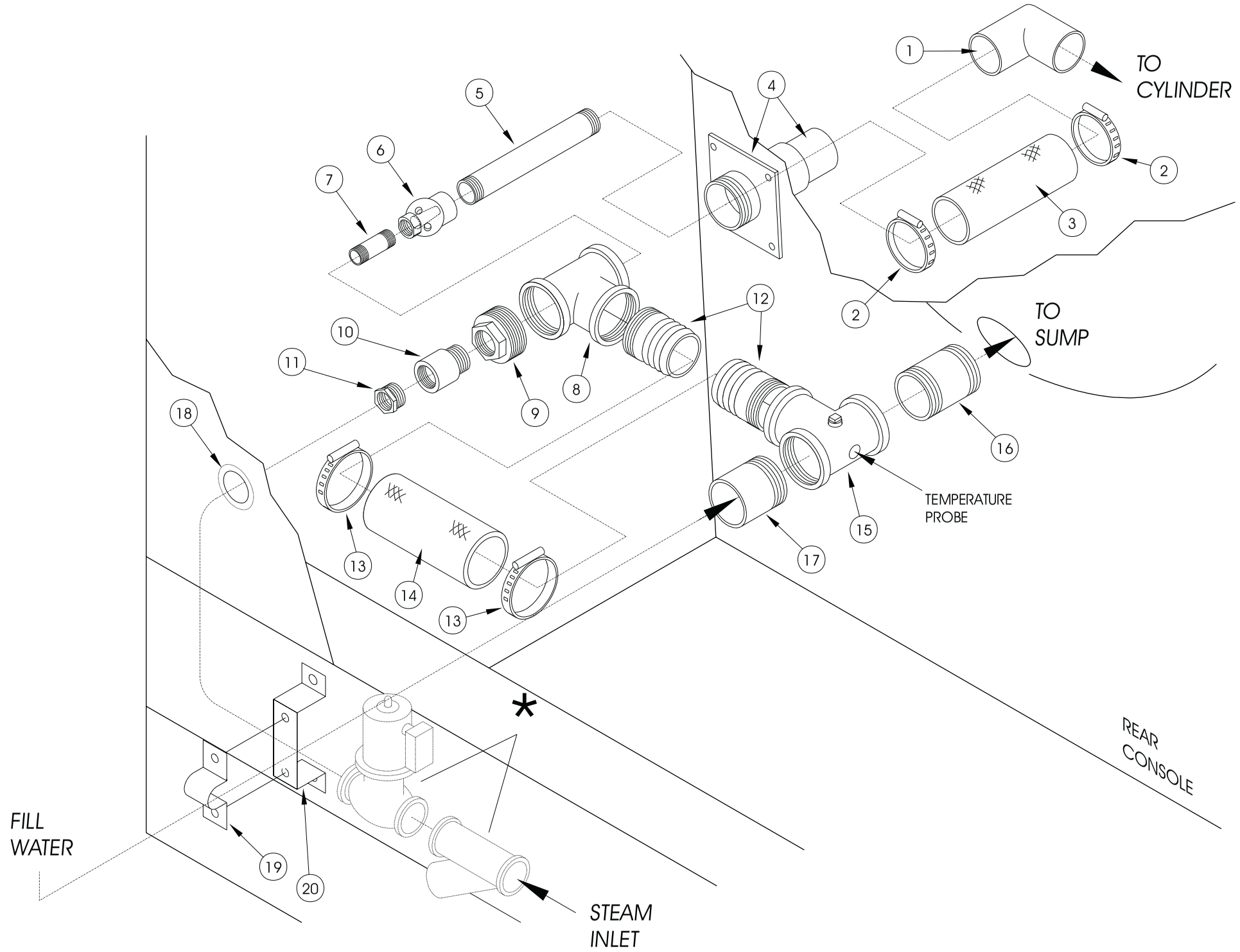

* FOR STEAM INLET ASSEMBLY REPAIR PARTS - SEE WATER/STEAM/DRAIN SCHEMATIC BMP920015.

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P. O. Box 400, Kenner, LA 70063-0400
Litho in U.S.A.

Parts List—Steam Installation

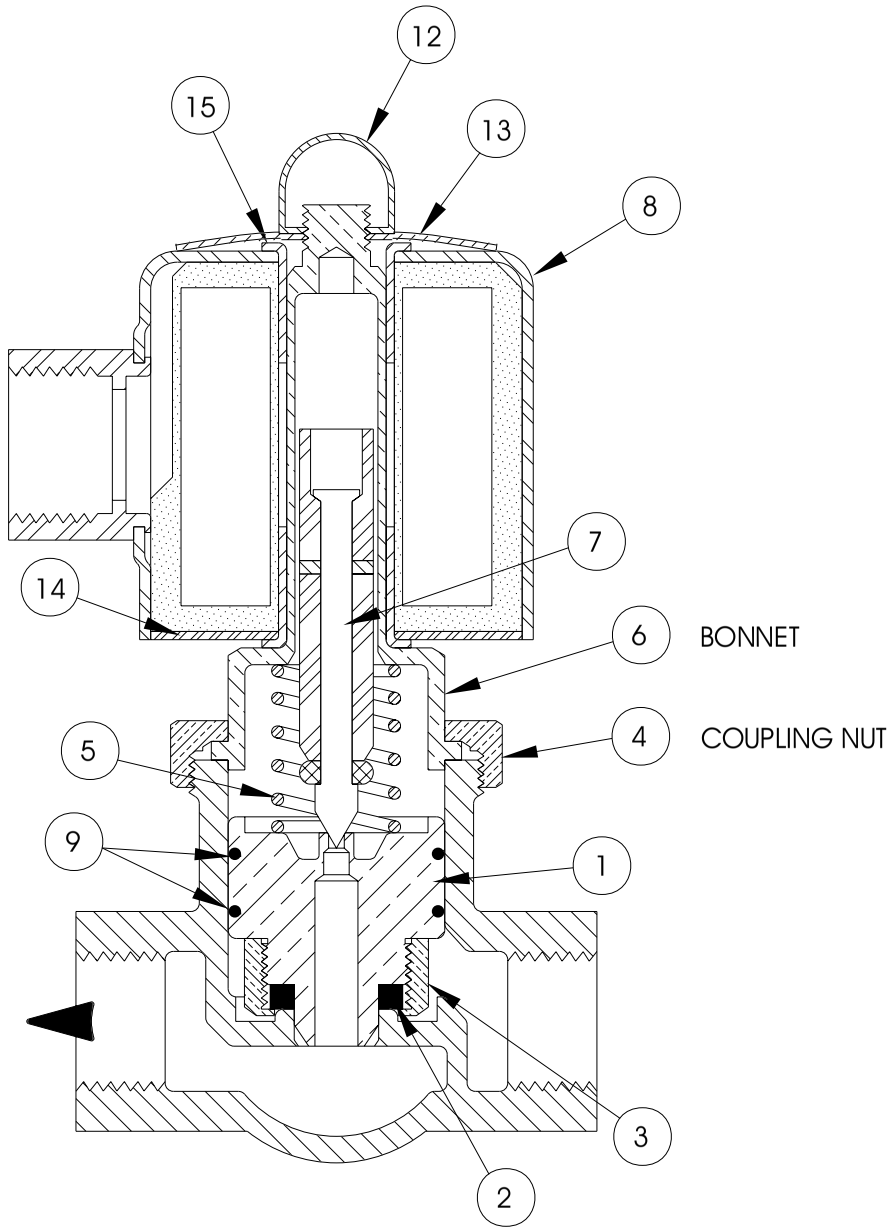
Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			---------- REFERENCE ASSEMBLIES----------	
	A	AD 33 028B	*STM INLET ASSY=N4S 3020 120V	30020M5P/M7P(120VOLT)
	B	AD 33 028C	*STM INLET ASSY=N4S 3015 120V	30015V7J,T5J (120VOLT) 30015M4P/M6P(120VOLT)
	C	AD 33 028D	STEAM INLET ASSY 3020 240V	30020M5P/M7P(240VOLT)
	D	AD 33 028E	STM INLET ASSY= 3015 240V	30015M4J/M6J(240VOLT)
B,D	E	A33 10500	* STEAM INJECTOR ASSY C4/C6M	(ITEMS 004-012)
A,C	F	A33 10500A	*STEAM INJECTOR ASSY C5M	(ITEMS 004-012)
all	G	A33 10600	*TEE ASSY-STEAM 2 MOTOMETER	(ITEMS 015-017)
all	H	A33 10600A	*TEE ASSY-STEAM 3 MOTOMETER	(ITEMS 015-017)
A,B	J	A33 10700A	*STEAM INLET ASSY 120V60C+	
C,D	K	A33 10700B	STEAM INLET ASSY 240V50/60	
			----------COMPONENTS----------	
all	1	W2 03608	* STEAM ELBOW=C4M+C6M ONLY	
all	2	27A075	T-BOLT HOSECLAMP 2.75"-3.06"	
all	3	60E301A10A	HOSE= *2.5"ID PE X10"	
all	4	W2 03609	* STEAMPIPE WLMT=3015CWM L=9"	
all	5	5N1A07AG42	NPT NIP 1X7 TBE GALSTL SK40	
all	6	27A500	STEAM HEATER 3/4" BRZ. PENB.#N	
all	7	5N0P03AG42	NPT NIP 3/4X3 TBE GALSTL SK40	
all	8	5S2KNFA2A	NPT TEE 2.5X2.5X2" GALMAL 150#	
all	9	5SB2K1ADEO	NPTHEXBUSH 2.5X1 GALCI 125#	
all	10	51E037	COUP 3/4"F W/1"M NPTONOD 304S	
all	11	51A032	HEXPIPBUSH 3/4X1/2 GAL 150#	
all	12	02 15847C	ADAPTER,CARBSTL2-1/2HOSX2NPT	
all	13	27A075	T-BOLT HOSECLAMP 2.75"-3.06"	
all	14	60E301A10A	HOSE= *2.5"ID PE X10"	
G	15	02 03657	SPECIAL-TEE=2HOLES=STEAM CWM	
H	15	02 03657A	SPECIAL-TEE=3HOLES=STEAM CWM	
All	16	5N2A02MG42	NIP 2X2.625 STDTOEX1/2"TOE GAL	
all	17	02 03447	FILL TUBE NIPPLE (2X3TOE)GAL	
all	18	12P11ESB	SNAPBUSH 1.25MHX.94 T=1/8HEYCO	
all	19	12K077	STRAP 1/2" HVY CONDUIT 2-HOLE	
all	20	02 14170	SUPPORT=PIPE SUPPLEMNT STEAM	

1/2” & 3/4” Hayes Electric Steam Valves

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.



GENERAL MAINTENANCE:

1. COUPLING NUTS MUST NOT BE TIGHTENED EXCESSIVELY. USE A STEADY PULL WITH A 14" OR SMALLER WRENCH. DO NOT HAMMER ON NUT OR WRENCH. LIMIT MAXIMUM TORQUE ON COUPLING NUT TO 600LB/INCH. EXCESSIVE TIGHTENING OF COUPLING NUT WILL DISTORT VALVE BODY CAUSING THE PISTON BODY TO JAM AND THE VALVE TO SHUT OFF.

2. IF THE VALVE LEAKS BETWEEN THE BODY AND BONNET, LOOSEN THE COUPLING NUT AND TURN THE BONNET SLIGHTLY, THEN TIGHTEN THE COUPLING NUT. IF THE VALVE STILL LEAKS, REPEAT THE OPERATION. IN NO CASE MUST THE COUPLING NUT BE TIGHTENED EXCESSIVELY.

Parts List—Electric Steam Valve

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	96P039	1/2"STEAMVAL 24V50/60C 150PSI	1/2" VALVE- 24 VOLT
	B	96P039A37	1/2"STEAMVAL120V50/60C 150PSI	1/2" VALVE- 120 VOLT
	C	96P039A71	1/2"STEAMVAL240V50/60C 150PSI	1/2" VALVE- 240 VOLT
	D	96P040E	3/4"STEAMVAL 24V50/60C 150PSI	3/4" VALVE- 24 VOLT
	E	96P040A37	3/4"STEAMVAL120V50/60C 150PSI	3/4" VALVE- 120 VOLT
			----------COMPONENTS----------	
A,B,C	1	96V224S	PISTON ASSY STEAMVAL HAYS #763	
D,E	1	96V224SA	PISTON ASSY STEAMVAL HAYS #777	
A,B,C	2	96V225S	PISTON SEAT WASHER HAYS #85553	
D,E	2	96V225SA	PISTON SEAT WASHER HAYS #85567	
A,B,C	3	96V248	SEATWASHER NUT HAYS#82222 96P0	
D,E	3	96V226	SEAT WASHER FOR 96P053 HAYS	
A,B,C	4	96V246	COUPLING NUT FOR 96P014&96P016	
D,E	4	96V254	COUPLING NUT HAYS #76028 = 9	
A,B,C	5	96V244	PISTON SPRING FOR HAYS 3/08	
D,E	5	96V222A	PISTON SPRING HAYS 82488	
A,B,C	6	96V242	BONNET FOR HAYS 3108 HAYS83021	
D,E	6	96V260	BONNET HAYS #83192 FOR 96P151	
all	7	96V223	PLUNGER HAYS #7319503	
A,D	8	96P040V24	COIL 1/2"&3/4" STEAMVALVE 24V5	
B,E	8	96P040V37	COIL 1/2"&3/4"STEAMVALVE 120V5	
C	8	96P040V71	COIL 1/2"&3/4" STEAMVALVE 240V	
A,B,C	9	96V222TS	TEFLONSPLIT RING HAYS #86334	
D,E	9	96V222TSA	TEFLON SPLITRING STEMVAL HAYS#	
all	12	96V250	PALNUT HAYS #3069-PC	
all	13	96V251	SPRING WASHER HAYS #83600	
all	14	96V264	BOTTOM PLATE (COIL) HAYS#8223	
all	15	96V262	FERRULE (COIL SLEEVE) HAYS #82	

Drain Sump Installation

3010 G5E,G5X,CGE; 3015G5E,G5X,CGE

30015, 30022Vxx, Txx, C4A, C4T, C4E; 30015, 30020, 30022Qxx

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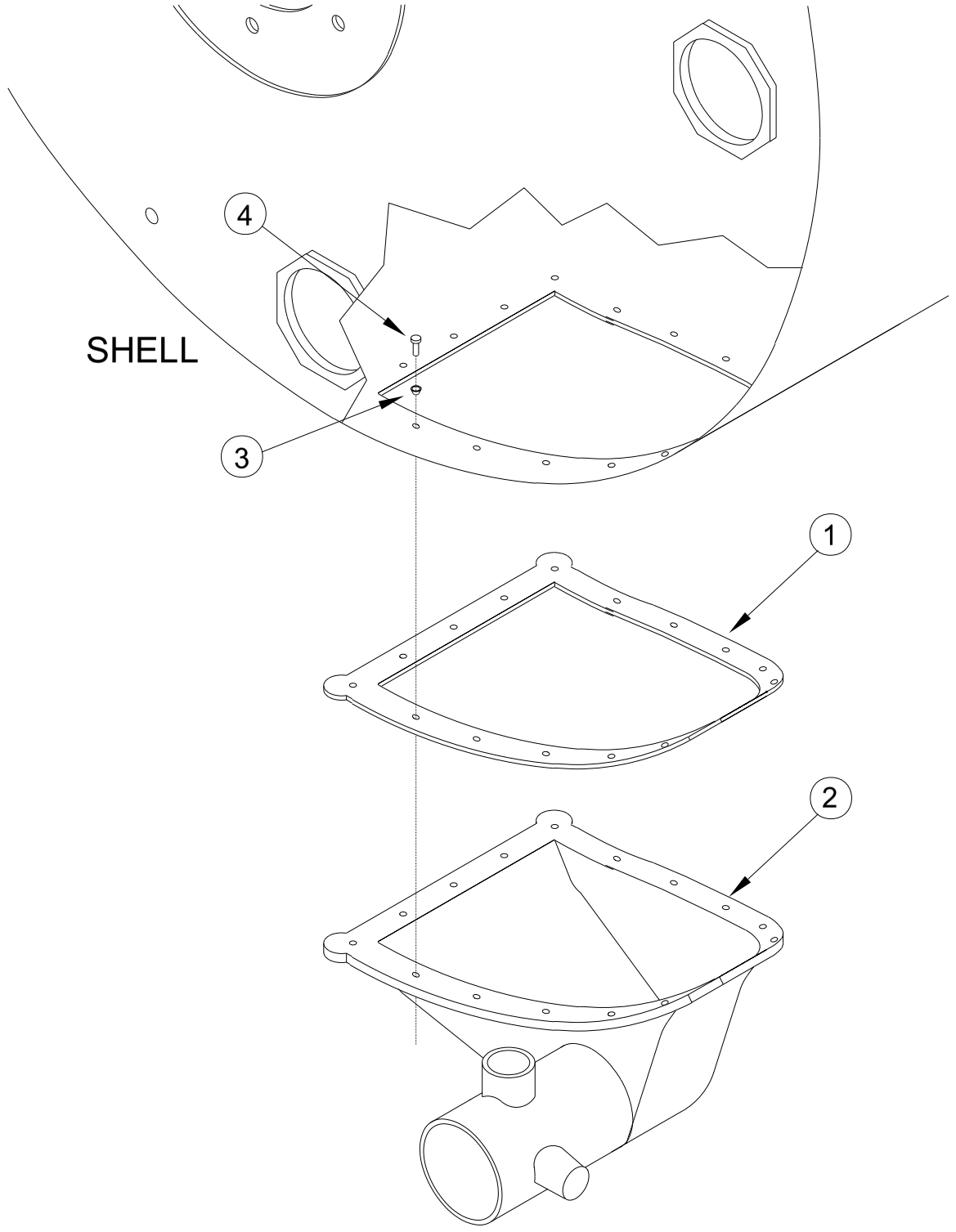
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.



Parts List—Drain Sump Installation

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------COMPONENTS----------	
all	1	02 03366A	DRAIN SUMP GASKET 1/8"EPDM	
all	2	02 03332A	BODY=SUMP-1608 GLASTIC	
all	3	24G018N	ROLLED WASH.194ID NYLTITE 10W	
all	4	15P050	PHDCUT-F PANHD 10-32X3/4 SS410	

DrainValve Installation

30015, 30020 & 30022 Rigid Mount Washer Extractors

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

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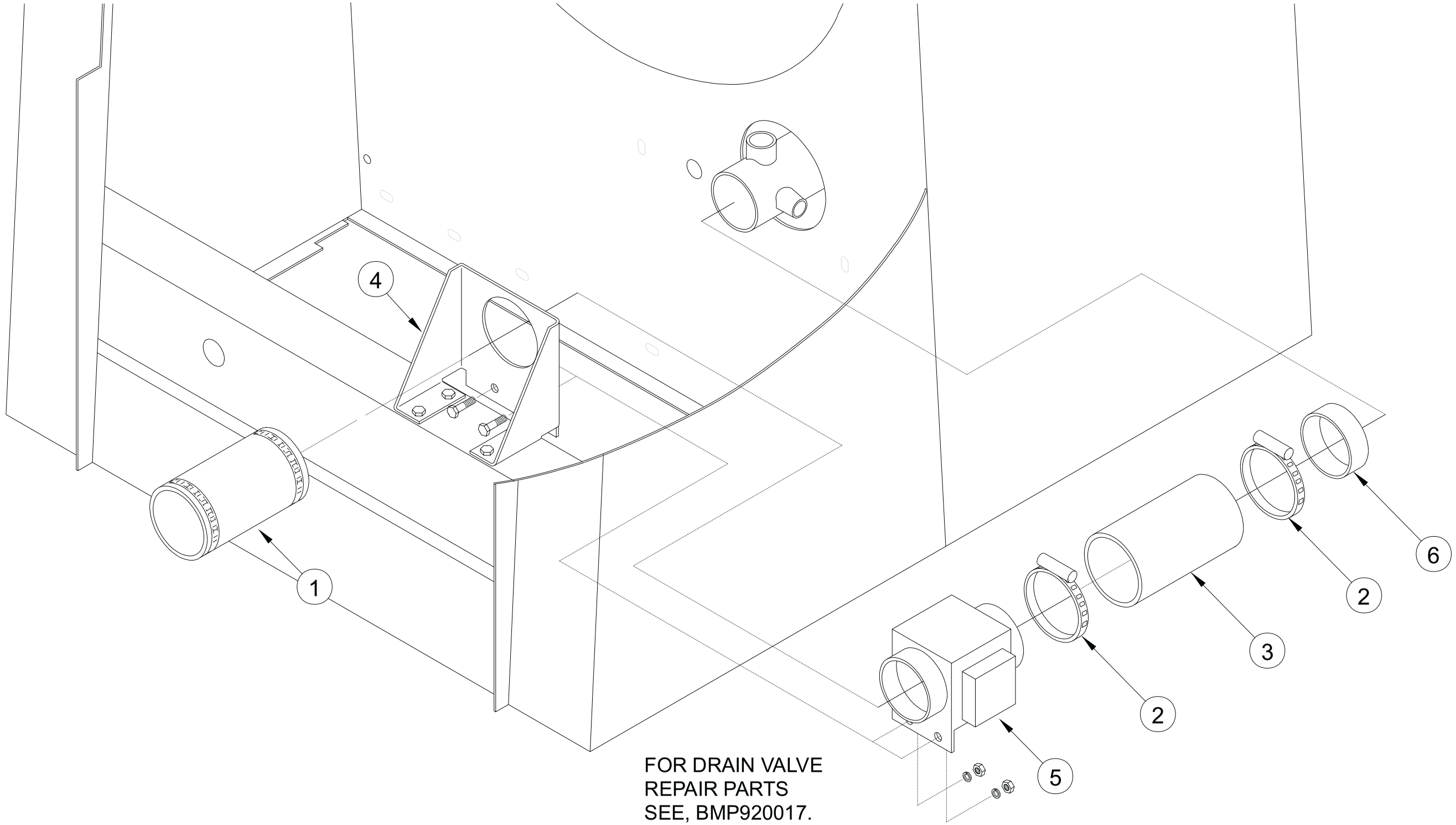


FOR DRAIN VALVE
REPAIR PARTS
SEE, BMP920017.

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
Litho in U.S.A.

Parts List—Drain Valve Installation

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

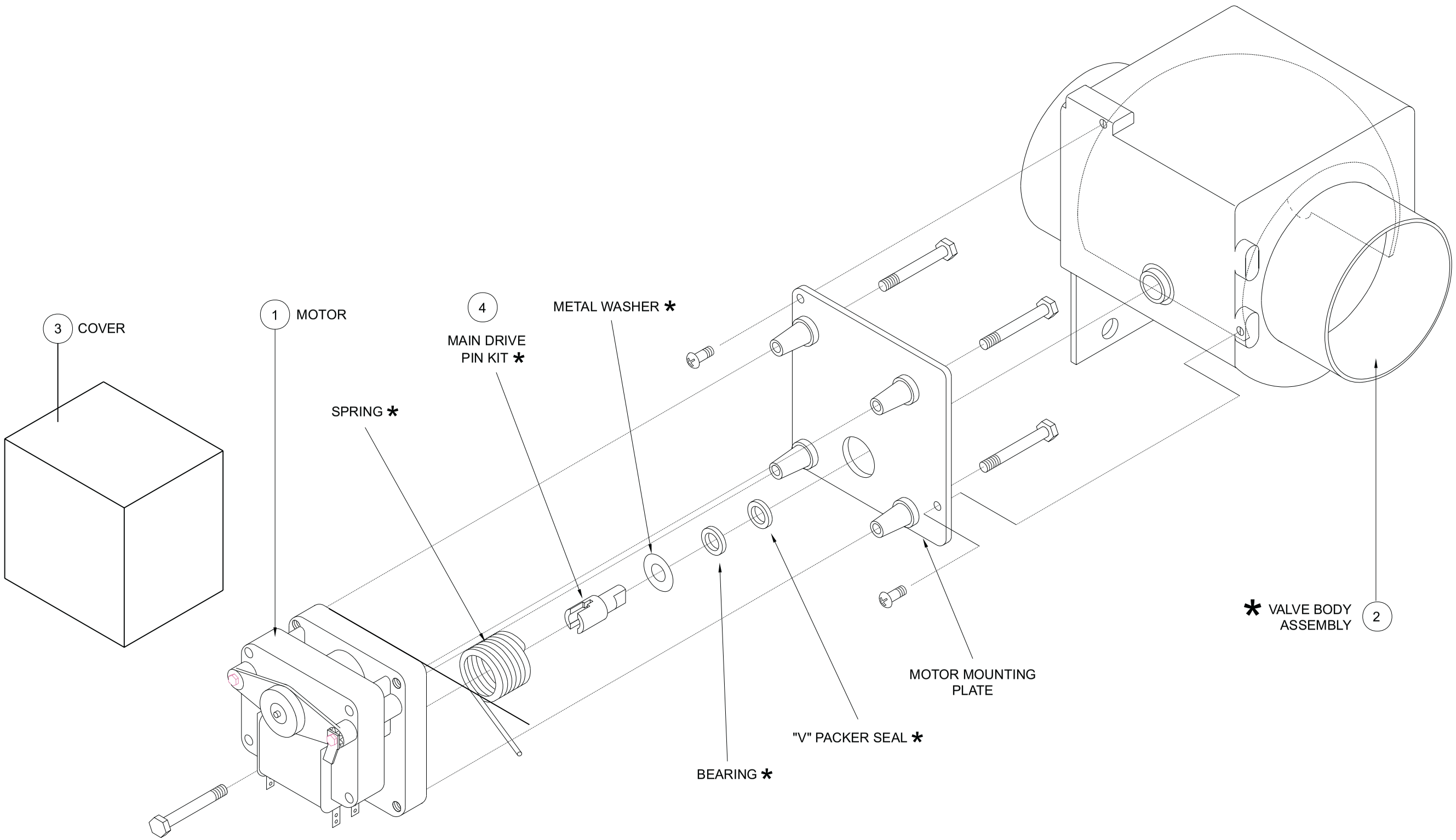
Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	AD-33-011S	FLL TUBE & DRAIN ASSY 240V 30V	
			----------COMPONENTS----------	
all	1	60B075	DFW56-33PMSP RUBB CONN.	
all	2	27A082	HOSECLAMP 2.5625-3.5CADSC#HS48	
all	3	60E303A07A	HOSE=3"ID X 7" LG.	
all	4	02 03412	BRKT=DEPEND-O DUMPVAL MTG	
all	5	96D350A71	DRINVAL 3"MTRDR 240V 50/60C	
all	6	02 03412S	SLEEVE=DUMPVALVE HOSE	

3” Electric Drain Valve

BMP920017/2002044V
(Sheet 1 of 2)

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400

Litho in U.S.A.



Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
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Parts List—3” Electric Drain Valve

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
	A	96D350A37	DRINVAL 3"N/O MTRDR120V 50/60C	
	B	96D350A71	DRINVAL 3"N/O MTRDR240V 50/60C	
			----------COMPONENTS----------	
A	1	96D35MTR37	120V 50/60CMTR FOR 3"DRAINVAL	
B	1	96D35MTR71	240V 50/60CMTR FOR 3"DRAINVAL	
all	2	96D35B0D	B0DY & BALL FOR 3" DRAIN VALVE	
all	3	96D35C0V	MTRCOVER 2-PCFOR 3"DRAINVAL	
all	4	96D35PIN	DRIVE PIN KIT FOR 3" DRAIN VAL	

Section 8

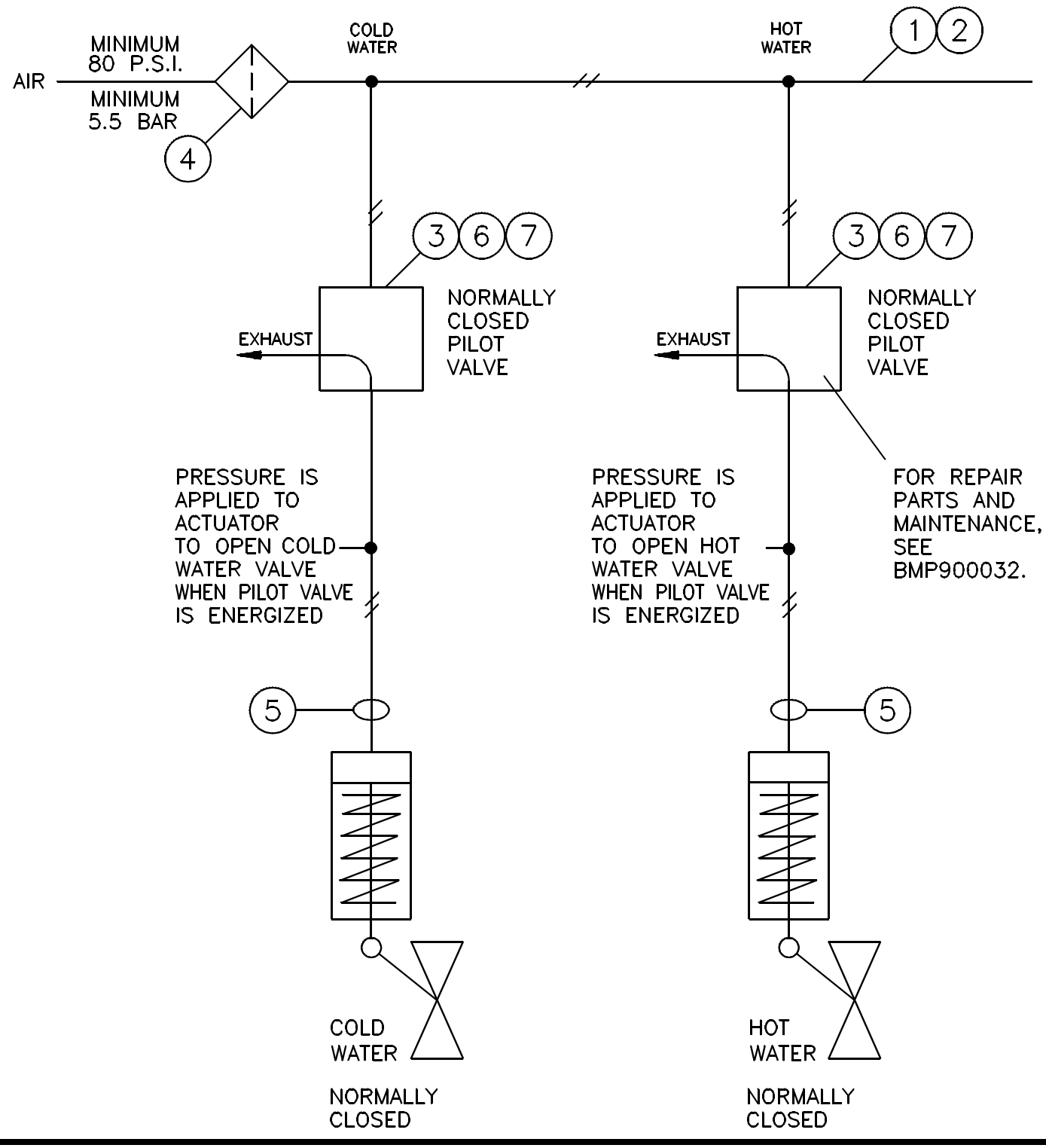
Pneumatic Piping and Assemblies

PELLERIN MILNOR CORPORATION
700 JACKSON STREET/POST OFFICE BOX 400
KENNER, LOUISIANA 70063-0400 USA

DRAWING AND PARTS LIST
(See other page for more, if applicable.)

PNEUMATIC SCHEMATIC
30015, 30020 & 30022 RIGID MOUNT WASHER-EXTRACTORS

BMP920018/93251V (Page 1)



ITEM	PART NUMBER	DESCRIPTION	HOW PART IS USED IN ASSEMBLY (Only if pertinent)
001	X3 01507H	87231C MANIFOLD BLOCK MACH 10 PORT	
002	03 LF1X5K	88303C LOCK BAR=VALVE SET 10 STAT	
003	96R301A71	02Z 1/8" PILOT 3W-N/C 220/50 240/60	
004	51T020	STRAINER-T 1/4"ANCHOR #101ST-4	
005	60E004TE	04Z 1/4"OD X.170"ID NYLON TUBING *	
006	03 01508	77362A FITTING-SCREW 7/16 HEX	
007	60C105	ORING 1/4 ID 1/16CS BN 70 DURO #010	
		******** END OF PARTS LIST ********	

How to Read Parts List

Reference Item Numbers—Items 00A, 00B, 00C, etc., or 00X, 00Y, 00Z, etc., appearing at the top of **some** parts lists, are for reference and provide:

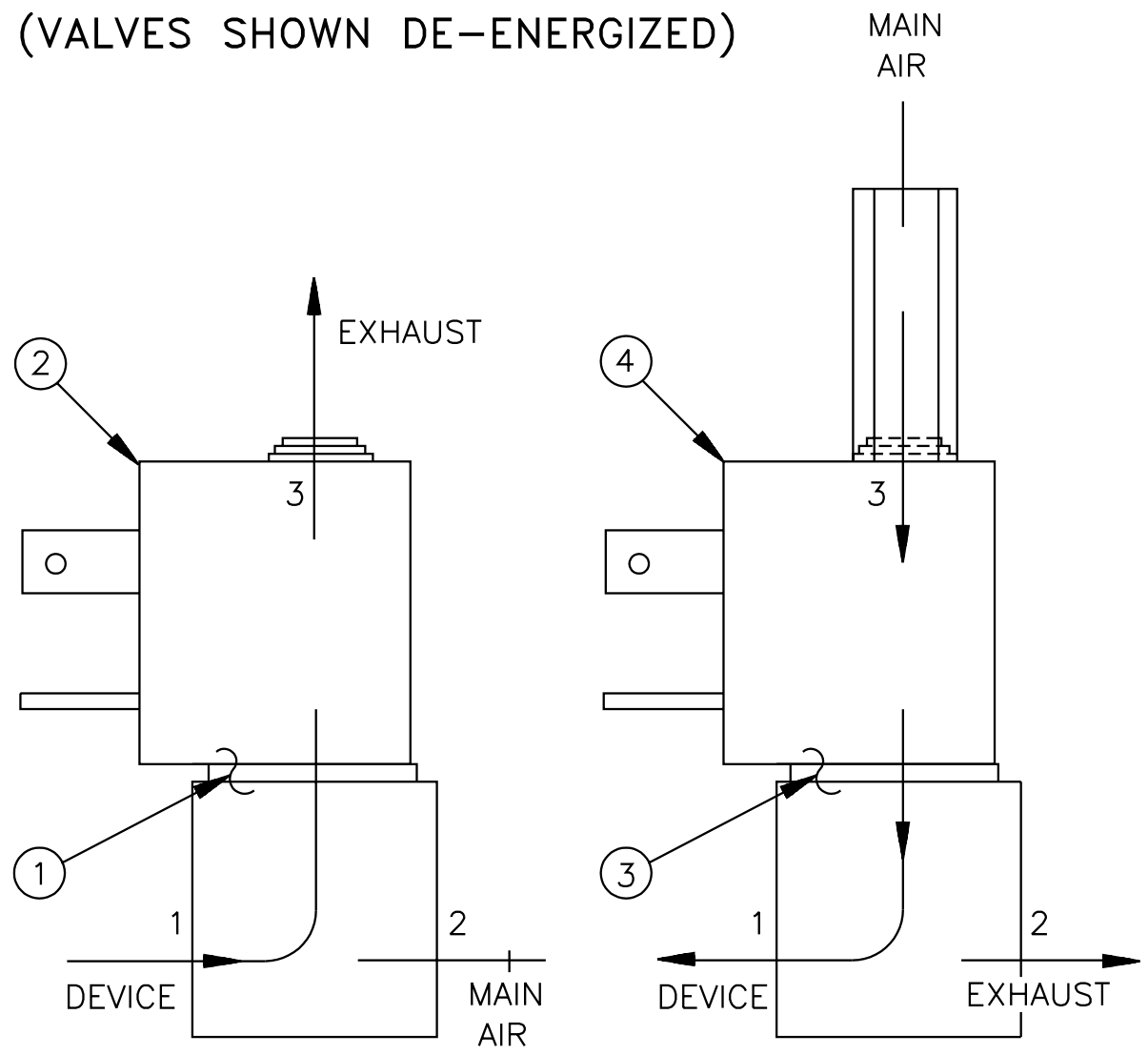
1. The part number for the entire assembly depicted in the drawing or a major sub-assembly thereof, and/or
2. The range of machine models this drawing applies to.

If more than one reference item appears, this usually means this drawing applies to more than one assembly (and thus to more than one range of machines).

Component Item Numbers—For any item on the drawing (e.g., item ①), there may be several corresponding items on the parts list (e.g., 001A, 001B, 001C, etc.) which are similar components on different assemblies. "How Part Is Used In Assembly" identifies which components apply to your machine, by listing either the machine model, or the reference item number from the top of the parts list (e.g., 00A, 00B, 00C, etc.), or a particular characteristic (e.g., bronze or stainless steel), or special ordering information, such as a repair kit number.

3-Way Pilot Valves

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063-0400
BMP900032/91182V (1 of 1)
Litho in U.S.A.



FOR REPAIR OR REPLACEMENT PARTS FOR PILOT VALVES USED ON WASHER EXTRACTORS GENERALLY PRIOR TO JUNE 1, 1985, SEE BMP701359.

Parts List—3-Way Pilot Valves

Find the correct assembly first, then find the needed components. The item letters (A, B, C, etc.) assigned to assemblies are referred to in the "Used In" column to identify which components belong to an assembly. The item numbers (1, 2, 3, etc.) assigned to components relate the parts list to the illustration.

Used In	Item	Part Number	Description	Comments
			----------ASSEMBLIES----------	
			none	
			----------COMPONENTS----------	
all	1	96R301A37	05Z 1/8" AIRPILOT 3W NC 120V50/60	
all	1	96R301A24	06Z 1/8" AIRPILOT 3W NC 24V50/60	
all	3	96R302A37	06Z 1/8" AIRPILOT 3W NO 120V50/60	
all	3	96R302A24	07Z 1/8" AIRPILOT 3W NO 24V50/60	