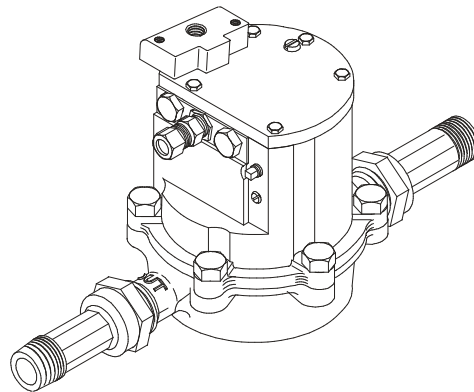


PRICE \$4.00

RATIO:FEEDER®
SERIES S
WATER MOTOR CONTROL UNITS



H.E. Anderson
COMPANY
Muskogee, OK. 74402-1006

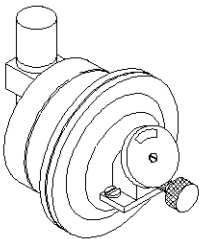
GETTING TECHNICAL ASSISTANCE

The **H.E. Anderson Company** is anxious to assist our customers with installation and use of our products. Our technical people are available each weekday from 8:30 a.m. to 4:30 p.m. central time. You may call us toll free at **1-800-331-9620** from anywhere in the U.S.A. and Canada. If no one is available, we will promptly return your call.

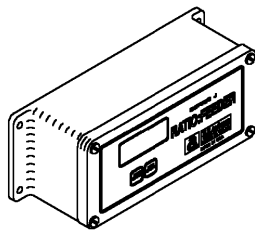
Before you call, we suggest that you review this manual. You may find the answer to your question there. But even if you do not, reviewing the manual will help us to help you.

There is some information you should have available when you call. You should know the model and serial number of your control unit. Also, you should note the number of pumpheads of each type, and their model numbers. We may not need all this information, but having it available at the start can sometimes save a lot of time and trouble for you.

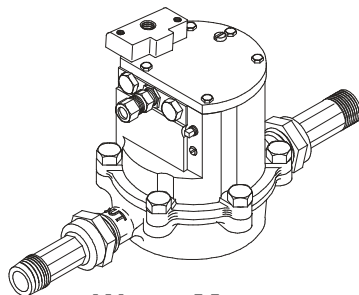
Manuals are provided for these major assemblies



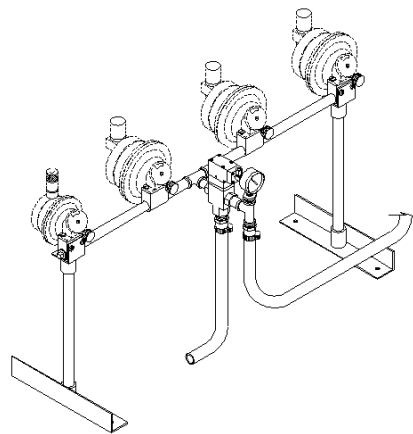
Pumpers



**Series J & SMC
Controllers**



**Water Motor
Control Units**



Manifolds or Banks

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1 INTRODUCTION

This manual covers only the water motor control unit for your Series S Ratio:Feeder® system. The pumper manual covers the pumpers and liquid end fittings for your system. If yours is a multi-pumper system you will also have a pilot valve/manifold manual. All manuals are needed for complete information on installing and maintaining your system. Keep them all in a safe place.

Section 2 covers some important installation guidelines. This section is especially important for new installations, and contains useful information applicable to all installations.

Section 3 covering installation and start up is applicable only to new installations.

Maintenance is discussed in section 4. This is important for every installation, old or new.

Sections 5. and 6. cover troubleshooting and servicing. Ordinarily, these sections need be referenced only if you encounter problems with your Ratio:Feeder® metering system. You may want to read them if you would like a more thorough understanding of the operation of your Ratio:Feeder® pump.

Parts sheets for all Series S water motors are in the rear of the manual.

If you have problems or questions about your specific installation, remember that we at H.E. Anderson Company are ready to provide help. Our toll free phone number is listed in the very front of this manual.

1.1 SINGLE PUMPER UNITS

The Ratio:Feeder® metering pump is a unique patented device for treating water. The basic design has been in production in varying configurations for over 30 years. The current Series S Ratio:Feeder® unit is a very accurate chemical metering pump that

features positive displacement, direct volume proportioning, and completely water powered. The feeder is a specially designed water meter controlling a single acting hydraulic cylinder powered by the water pressure.

This results in a very simple way to add chemical to a water system accurately. If the water flow increases, the treatment increases; If the flow stops, the treatment stops. The feeder always maintains direct proportioning.

It will maintain accurate proportioning at any water pressure from 15 to 125 psig (5 to 75 psig for some models). Water flow ranges from ½ to 160 GPM in six sizes. The temperature range is 33° to 140°F.

1.2 MULTIPLE PUMPER UNITS

The Ratio:Feeder® greatly increases its flexibility by the use of multiple pumper modules. Multiple pumpers allow feeding more than one chemical without pre-mixing; and with each individually adjustable. They also provide for increased feed by using more than one pumper per chemical.

Multi-pumper units are similar in operation to single pumper units. However, with multi-pumper units the pumpers are mounted remotely from the water motor. And, since the water motor cannot supply a volume of water large enough to operate more than one hydraulic pumper, the water supply to power the pumpers must be handled differently.

In multi-pumper systems, the water source to power the pumpers comes from the main water line, and proportional treatment is obtained by using a pilot operated valve. This valve is paced by the water pressure signal from the water motor control unit; only a very small volume of water is needed to control the valve.

2 INSTALLATION GUIDELINES

Refer to the installation drawings included with your unit for illustrations of what a good installation should look like. These drawings also provides additional information, including a bills of materials needed for a complete installation.

2.1 LOCATION AND ACCESS

You will periodically have to add chemical and inspect the unit for proper operation. You will also have to perform preventive maintenance and servicing at regular intervals. Make it easy on yourself by plumbing the feeder neatly and with room for proper access.

The feeder should be out of the way, yet accessible and installed in the water line before the point of use of the treated water. Remember also that a blending or contact tank is recommended to insure that the injected chemical is properly mixed, and the chemical reaction complete before the water goes on to its end use.

2.2 ENVIRONMENT

WARNING!

NEVER ALLOW THE UNIT TO FREEZE! THE UNIT IS NOT WARRANTED AGAINST FREEZE DAMAGE.

Freezing can cause expensive damage to your feeder, even during storage if the unit has not been disassembled and drained.

You will need a drain or container for waste water. The unit wastes approximately twice as much water as chemical pumped.

2.3 SAFETY

Most chemicals used to treat water are dangerous to someone or thing. Do not

permit access by children or pets. Label chemicals and keep a supply of antidotes, neutralizing agents, and safety precautions handy. Provide safety equipment such as goggles, gloves, aprons, or anything common sense tells you you might need. Check with the manufacturer of the chemical for safety precautions for specific chemicals.

The feeder should be protected from corrosive vapors with adequate ventilation. Corrosion can sometimes attack diaphragms from the back side, resulting in premature failure.

IMPORTANT!

IF YOUR WATER SUPPLY IS FROM A MUNICIPAL OR PUBLIC WATER LINE, REMEMBER THAT THE INSTALLATION SHOULD COMPLY WITH LOCAL CODES. THAT MEANS YOU SHOULD BE SURE THAT A BACKWARD FLOW OF TREATED WATER INTO PUBLIC MAINS CANNOT OCCUR. CONTACT YOUR LOCAL WATER AUTHORITY FOR APPROVED DEVICES AND RECOMMENDATIONS TO INSURE THAT YOUR INSTALLATION MEETS THEIR

2.4 WATER HAMMER

In installations with long pipe runs, or where quick acting valves (such as ball or solenoid actuated valves) are used, water hammer can be a serious problem. Water hammer can generate pressures of hundreds of psi, even 1,000 psi or more! This puts stress on the whole feeder (and on your entire water system), but it is especially destructive to diaphragms. If water hammer could be a problem with your installation, you should install some sort of suppresser such as a "pop" valve or an accumulator (captive air device) near your feeder.

3 UNPACKING AND INSTALLATION

3.1 UNPACKING

When you first open the boxes check for broken or damaged parts. If you find any, save all packing material and parts, and notify the delivering carrier immediately. They are responsible.

Every unit is assembled and fully calibrated and tested under actual operating conditions before being packed. Do not dispose of any material until the unit has been assembled and you are sure nothing is missing.

3.2 ASSEMBLY

Prepare to assemble the feeder. We recommend that a by-pass water line be plumbed around the feeder to permit the feeder to be removed for service or inspection, without disrupting the water service. We do not recommend this by-pass for treating flows in excess of the feeder rating by allowing some of the water to pass through the by-pass. The water flow will not divide equally at all flows, making it impossible to maintain accurate proportioning of chemical feed. Contact H.E. Anderson Co. for recommendations regarding flows greater than the rating for your unit.

You may need to get some additional pipe fittings, tees, valves, etc. before installation can proceed. You can find these at your local plumbing supply.

Gather all the pipe fittings and assemble them to the feeder control unit hand tight. This will enable you to measure how much pipe you will need to remove from the main line to make the installation.

You can use any type piping (steel, plastic, copper), but be sure the feeder has additional support if plastic is used.

You should install a check valve in the main line before the by-pass and feeder. Any on-off water valve should be installed downstream from the chemical injection point(s) (and blending/contact tank if used). This will insure that the feeder injection point will always be pressurized, making siphoning of chemical unlikely.

Install the feeder in the main line, with the by-pass around the feeder. This will minimize pressure loss across the feeder, even when reducing a large line such as 2" down to 3/4".

You can plumb the by-pass underneath, to either side, or even over the top of the feeder. Plumb a valve into the by-pass to close the by-pass when the feeder is operating. The only requirement is to have good accessibility to the feeder for adjustment, servicing, etc.

The injection point tee(s) should be downstream from the feeder, in a position so the injection fitting will be inserted from the bottom. This is especially important when feeding acids.

If necessary, you can rotate the upper motor housing to a more convenient position. Remove the large brass housing bolts, rotate the pumper to the desired position, and replace the bolts. **DO NOT OVERTIGHTEN!**

Once the plumbing is complete and all pipe connections are tight, loosen the coupling nuts on the feeder and remove the feeder. The piping should not spring apart or close up when the unit is removed. Continuous strain could interfere with proper operation. Adjust the piping if necessary.

Before reinstalling the feeder, flush the system with water to remove metal flakes and other debris from the plumbing. Then you can reinstall the feeder.

Water Motor Control Units

Connect the $\frac{3}{8}$ " O.D. waste tubing to the R-Valve fitting on the side of the control unit. You may use either the black tubing or the clear flexible tubing. You may need to secure the drain end of the hose as it may jerk when water discharges. Keep the line short, or expand it to a larger size for runs longer than fifteen feet. See Figure 1.

If you have a multi-pumper system you also need to hook up the pilot valve. We provide several different types of pilot valves, so you should see your pilot valve manual for more specific information. Use the large hose provided with the unit. Clamp one end of the hose to the exhaust fitting on the pilot valve on the manifold. Run the other end to a drain. You will probably need to secure this hose also, to keep it from moving when water discharges. You may connect it to a rigid drain pipe, but you must provide an air gap to insure there is no restriction.

3.3 PUMPER MODULES

See your pumper manual for information on setting up the pumps.

3.4 START-UP

Turn the water on *slowly* and let all lines and blending tank fill with water. You should be getting intermittent discharges of water from the waste lines.

We recommend a flooded suction which means the chemical tank is located above the suction valve. With a flooded suction, the pumps should usually prime themselves. If the pumps do not self- prime and if your injection fittings have bleed valves, open each

IMPORTANT!

THE WASTE LINE MUST EXIT TO ATMOSPHERIC PRESSURE AND MUST NOT BE ELEVATED OR RESTRICTED IN ANY WAY.

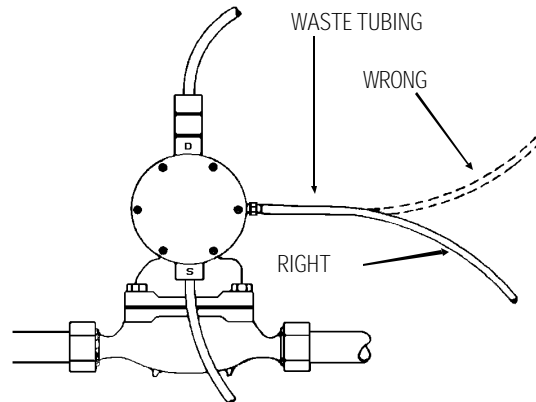


Figure 1
Proper waste tubing position

bleed valve until the pumper is primed and chemical begins squirting out the valve. If your injection fittings do not have bleed valves it may be necessary to disconnect the discharge hose until the pumps become primed.

Each pumper is calibrated under actual operating conditions at the factory. However, the dial gear can sometimes work loose during shipment or installation, causing calibration to be lost. *NOTE: pumps are usually shipped set at the full capacity setting.* If calibration has been lost, or you feel it is not correct, you should calibrate the pumps as shown in the pumper manual.

See your pumper manual for additional information on operational startup.

4 MAINTENANCE AND STORAGE

4.1 MAINTENANCE

At six month intervals, or more often if conditions warrant, shut the feeder down and clean and inspect the upper section of the water motor. You will need to partly disassemble the unit to make the following checks. You may possibly, though not usually, need to replace the cover plate gasket (P/N 00456) after performing these checks.

Remove the five hex head screws holding the top cover plate and remove the cover (with the pumper attached if a single pumper unit). This will open up the valve operating section, as shown in Figure 2, page 8.

If mud is present, flush it out thoroughly. If there is a lot of mud or dirt, you should install a filter in the water line before the feeder. Also, check the disc and measuring chamber, as they are subject to wear by sand and dirt. Refer to Section 6.4 for that procedure.

Lubricate the arm retainer and ball pivot generously with a water-proof grease, such as Lubriplate No. 130-AA. Replace the cover plate. Plan a regular schedule for this maintenance and lubrication based on the conditions you find.

Refer to your pumper manual for information on maintenance of pumps and liquid end fittings.

4.2 STORAGE

If a feeder will be out of service for an extended period, you should remove it from

service. Flush the pumper and chemical check valves with water, either by pumping water through the unit (if not feeding acid) before removing it or by rinsing these parts after removal. Tape the valve openings closed while still wet. This will protect the seals and prevent insects from plugging the openings.

After removing it from service drain it completely to prevent damage by freezing of water still inside.

WARNING!
THE UNIT IS NOT WARRANTED AGAINST FREEZE DAMAGE.

Remove the feeder from the line. Remove the three brass drain plugs; one located on the top of the water motor cover plate, one to the right of the nameplate on the side of the control unit, and the third on the bottom of the control unit. This will allow the water to drain from both the upper and lower chambers of the control unit.

After the unit is completely drained replace the plugs. This will prevent them from getting lost, and prevent spiders and insects from nesting inside.

5 TROUBLESHOOTING

If you suspect a problem with your unit please read the following section carefully.

WARNING!

DO NOT DISASSEMBLE YOUR FEEDER UNTIL YOU HAVE DETERMINED THE EXACT PROBLEM, AND THEN DO IT CAREFULLY, ACCORDING TO INSTRUCTIONS. MANY SMALL AND EASILY CORRECTED PROBLEMS ARE GREATLY AGGRAVATED BY NOT HEEDING THIS

Water should flow through the feeder motor with little loss of pressure. If there appears to

be a restriction of water flow through the unit, the measuring disc may not be operating freely. Refer to the heading MEASURING CHAMBER AND DISC ASSEMBLY in section 6.4 for the servicing procedure.

5.1 ALL UNITS

With water flowing through the system, you will observe one of the following conditions with respect to the water flow from the waste line. Table 1 serves as a brief summary of some of the possible problems and solutions. The troubleshooting questions following in this section are helpful in uncovering some problems not covered in the chart. Refer to

Condition	Probable Cause	Remedy
Distinctly intermittent flow from waste line and little or no pumping action.	Ball poppets in suction and discharge valves not seating.	Refer to pumper manual for information on servicing chemical check valves and injection fittings.
	Suction or discharge line plugged.	
	Insufficient water pressure.	Increase pressure.
Continuous flow from waste line, or any flow not distinctly intermittent, no pumping action.	Pressure relief valve not seating.	Remove and inspect, replace if necessary. Inspect upper maincase, adjust and replace parts as needed.
	Internal leak, usually from packing nut.	Replace small packing gland gasket and O-ring.
	Pressure balance valve not operating.	Remove and inspect, replace if necessary.
No flow from waste line and no pumping action.	Drive dog unscrewed.	Refer to servicing section for detailed instructions on these problems.
	Drive spindle broken.	
	Gear train inoperative.	
	Malfunction of parts in upper maincase.	
	High pressure.	Reduce pressure.

section 6. for detailed instructions on handling these and other problems.

QUESTIONS

The number in parenthesis refers you to the next step depending on the answer. The numbers following part names are part numbers. You may refer to the parts sheets for your unit to see exactly what parts are named.

1. Do you have waste water from the feeder?
Yes (2) No (8)
2. Is it regular and distinctly intermittent?
Yes (3) No (9)
3. Is the volume of waste water correct? It should be about 80 to 100 ml (3 oz.) (for a #4 size pumper) when the feed dial is set to 10, or 10-20 ml if it is a multi-pumper unit
Yes (15) No (4)
4. Is the volume of waste water more (14) or less (5)
5. Is the water line pressure on the outlet side of the feeder 15 psi or more?
Yes (7) No (6)
6. Increase pressure (back pressure) on downstream side of feeder by increasing water pressure or restricting outlet.
7. Tubing connected to R-valve (waste line of feeder) must not be restricted or elevated in anyway. Tube must open to "daylight". Or check feed dial calibration, or (16).
8. Do you have a check valve installed in the water line before the feeder?
Yes (10) No (12)
9. Does the feeder waste water erratically; sometimes wastes, and then ceases again?
Yes (10) No (13)
10. Is your line pressure above 80 psi?
Yes (11) No (12)
11. Pressure is too high for the R-valve (relief valve) setting. Set pin to the high

Table 2 – Multi-Pumper Units

Condition	Probable Cause	Remedy
No pumping action or waste water from pilot valve.	Pilot valve not operating.	Service pilot valve.
Pumpers not making full strokes, or erratic or reduced waste water from pilot valve.	Water flow beyond rated flow	Reduce water flow.
	Insufficient water pressure.	Increase water pressure or use alternate pressure source.
	Diaphragm operator leaking.	Replace pilot valve diaphragm (Type S)
No pumping action but have waste water from pilot valve.	Low pressure.	Increase pressure or use alternate pressure source.
	Ball poppets in suction and discharge valve not seating.	Dissassemble valves, clean or replace parts as necessary (See pumper manual for details)

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- pressure position, reduce pressure or consult factory. (See 16)
12. Remove maincase of feeder and check drive dog 00133 or 01678. Check for foreign particles fouling disc. Check gear box.
 3. Is the waste water continuous?
Yes (14) No (15)
 14. Check the R-valve (P/N 09317), balance valve (P/N 01975), or packing nut (P/N 01313) for leaks or proper adjustment, or (16).
 15. Clean and test suction and discharge check valves (See your pumper manual), or (16).
 16. If the feeder still does not function properly, record model and serial numbers and call the factory service hotline at 1-800-331-9620 from 8:30 a.m. to 4:30 p.m. central time.

5.2 MULTI-PUMPER UNITS

The pilot valve duplicates the pressure and waste cycles of the water motor control unit. Any suspected malfunction may be in the control unit and not the pilot valve. Pilot valves seldom need repair until they are several years old. Do not disassemble or service the pilot valve until you are sure the problem is not in the control unit.

Normal operation is indicated by regular and distinctly intermittent discharges of waste water from the exhaust port (stamped #3 or N.O. on the valve body). This occurs at the same time waste water is discharged from the control unit.

If any variance in waste water cycle is noted, it may be an indication of a malfunction in the valve. The "on" and "off" cycles should be crisp and well defined. If the valve switches sluggishly or slowly (usually indicated by a

short "extra" discharge of waste water), and the water motor control unit waste cycle is crisp and normal, the valve should be serviced.

QUESTIONS

The number in parenthesis refers you to the next step depending on the answer.

1. Is the waste water regular and distinctly intermittent?
Yes (2) No (5)
2. Is there an extra short discharge of waste water?
Yes (3) No (4)
3. Does the valve chatter when switching?
Yes (8) No (4)
4. Is the volume of waste water large and continuous while it is discharging?
Yes (10) No (9)
5. Is there any waste water at all?
Yes (6) NO (11)
6. Is the amount small and irregular?
Yes (10) No (7)
7. Is the waste water continuous?
Yes (12) No (10)
8. Check your water pressure. It must be at least 15 psi. Also the pressure on the inlet side of the control unit should be higher than that at the valve inlet port (stamped #1 or N.C. on the valve body). On new installations bleed any air from the $\frac{1}{4}$ " pilot line tubing at the pilot valve connection. Did this procedure fix the valve?
Yes (9) No (10)
9. No repair or servicing is necessary.
10. Refer to your pilot valve instructions and service according to the procedures given.

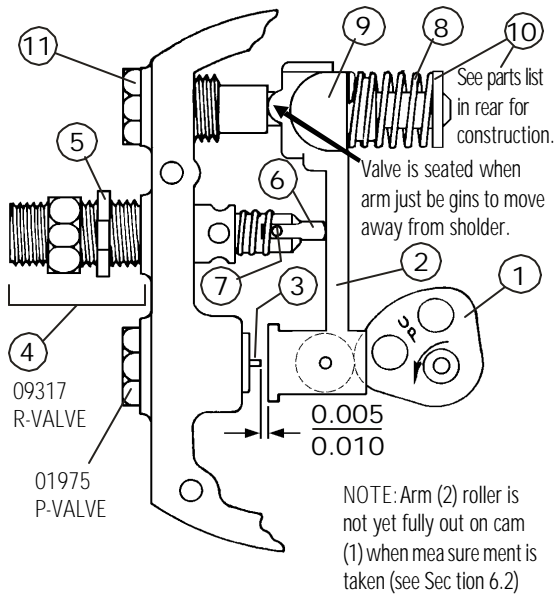


Figure 2
Valve operating section

11. Verify that the pilot line coming from the water motor control unit is transmitting a pressure pulse. Then go to (10).
12. If the waste is continuous, but varies in amount from cycle to cycle (as

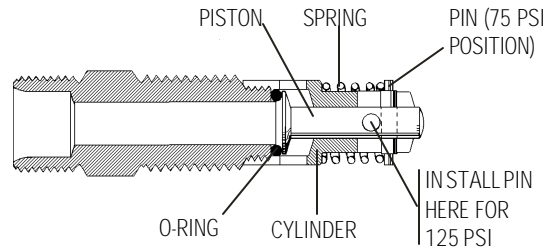


Figure 3
R-Valve, P/N 09317

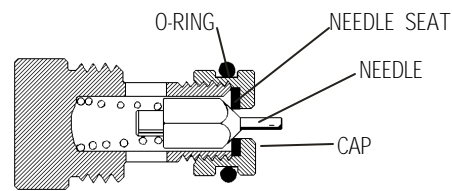


Figure 4
P-Valve, P/N 01975

determined by the control unit waste), the poppets may need replacing. Refer to your pilot valve instructions and service according to the procedures given. Also see (10) .

6 SERVICING

To service your unit, you must bypass your feeder, or turn off the water. If you will only be servicing the pumper or multiple pumper, you may refer directly to the pumper manual and proceed from there. If you will be servicing the water motor portion of your

system, you should proceed as follows. Refer to Figure 2, for the location and proper assembly of parts. You will probably also want to refer to the exploded parts drawings for your unit, included in the rear of this manual for details on parts placement and assembly.

6.1 VALVE OPERATING SECTION (TOP)

Remove the five hex head screws in the top cover (P/N 00076). Be careful that the gasket (P/N 00456) is not damaged. The exposed mechanism should appear as shown in Figure 2, and there should be no loose parts. The numbers in parentheses in this section refer to the identification numbers in Figure 2.

The arm (2) should pivot freely on the Piston (6) (pressure relief valve, P/N 09317), and compress the spring (8) on the arm retaining fitting. Move the arm with your fingers and observe the action and note whether the ball pivot (9) is sliding freely. If not, remove the retaining washer (10) by compressing the spring and sliding the washer out of the

Water Motor Control Units

groove in the arm retainer (11). Unscrew the fitting, remove the spring and ball pivot, and inspect the shaft for wear. If worn, replace the arm retainer and ball pivot. Lubricate the arm retainer and ball pivot generously with a water-proof grease, such as Lubriplate No. 130-AA.

Next, inspect the R-valve. (Figure 3) Loosen the lock nut and remove the R-valve. Note the fit of the piston to the bore in the cylinder. Excessive wear is indicated by an "egg shaped" hole in the cylinder or by the pin rubbing in the slot. If there is wear, replace the complete R-valve.

Remove the cylinder by unscrewing it from the body. Inspect the O-ring and its seat area on the brass body. If any defects are found we recommend replacing the complete R-valve; it is an inexpensive yet very important component. If there are no problems reassemble the R-valve. See the Section 6.2, following, for details on reinstalling and adjusting the R-valve.

NOTE: The R-valve piston has two holes at right angles to each other, to provide a means of adjusting the R-valve for operation at different pressures. The spring retaining pin should be installed in the hole closest to the small end for operation at lower pressures, up to 75 psig. The pin should be installed in the hole closest the flat piston end for higher pressures, up to 125 psig.

We recommend removing and inspecting the P-valve only if a problem is suspected. To inspect the P-valve (pressure valve (P/N 01975, which may be described as BAL VALVE on the parts sheets) you must remove it by unscrewing it from the maincase casting. (Figure 4.) (If the stainless steel cap does not come out with the brass valve body, push it on into the inside chamber with a pencil or similar object.)

After removing, unscrew the stainless steel cap and inspect the rubber seat and the cone shaped needle. They should be free from

defects and dirt. The O-ring around the outside of the cap should not be nicked, torn, or damaged in any way. Replace parts as required and reassemble. Test with suction on the stem side. It should seal tightly. Coat the threads with thread sealer (Permatex #1 or equivalent). Coat the O-ring with silicone lubricant.

Place the assembled valve into the casting using the following procedure: *Using your thumb, gently work the O-ring past the threads using an orbital motion. Continue applying pressure with your thumb as the threads meet the housing, and use a wrench to engage the threads. You may now remove your thumb. Screw the valve in until it seats., never reversing direction.*

Adjust the valve timing as detailed in the following section.

6.2 ADJUSTING THE VALVE TIMING

Refer to Figure 2, for this procedure. Rotate the cam (1) until the arm (2) is 0.005 to 0.01 inch from the needle (3). Hold in this position. (You may need to partially unscrew the cam from the shaft to do this, or, if the maincase has been removed from the lower section, you may turn the drive dog on the bottom side clockwise until the cam is in the proper position.) Next, screw the R-valve (4) in until the piston just seats against the O-ring seat. This is the point at which the valve arm will just begin to move away from the face of the arm retainer (11). Test by applying suction to the outlet port of the R-valve. Now, tighten the lock nut (5) to hold it in position. Back up the cam, and again rotate it until the valve just closes. This should be determined by suction testing all the while. Hold this position of the cam and check the clearance between the needle and arm. Readjust the R-valve if necessary to obtain the 0.005 to 0.01 inch clearance when the R-valve has just closed.

6.3 GEARTRAIN

Note the position of the waste line relative to the main water line connections and then remove the bolts holding the motor castings together. Also remove the top cover plate (P/N 00076) and lay it aside.

Remove the upper maincase casting from the feeder motor and lay it on its side. Rotate the drive dog on the bottom by hand and note the effort required, and whether or not the cam on the top side is turning. *NOTE: The cam may turn very slowly, depending on the gear ratio, which may be as high as 50:1.* The drive dog should rotate freely with little effort, with no binding or sticking. If the shaft appears to wobble, or you feel rough spots, proceed with disassembly.

Unscrew the cam and lay it aside. Remove the packing nut (P/N 01313) under the cam—**DO NOT loosen the thin nut under the packing nut.** On the underside of the maincase casting, remove the three screws holding the gearbox bearing plate.

NOTE: During this procedure, some water trapped in the gearbox may be spilled; you may want to perform this over a shallow pan to catch the water, and also any parts which may drop loose. Holding the gearbox bearing plate, with drive dog attached, in one hand, rotate the maincase back to its normal upright position and then wiggle the bearing plate while you push the cam shaft down, and simultaneously pull the bearing plate down. All of the gears and, if done carefully, the spindles will come out as a unit. Carefully remove the bearing plate holding the parts, and note the position of the gears so you can reassemble them in their proper position. See the exploded parts drawing and sectional drawing for information on proper parts placement.

Inspect the gears, shafts, and bushings for wear. If the gear teeth are worn thin or to a sharp point, the gear should be replaced. Gear teeth which are stripped may indicate worn

shafts and/or bushings which have allowed the gears to separate and disengage.

The grease in the gearbox should be fresh looking and not muddy or hard. If the gearbox is muddy, clean all parts thoroughly, and when reassembling, lubricate with a good waterproof grease, such as Lubriplate No. 130-AA. (A 10 oz. tube of this grease is available as our P/N 03681.)

When reassembling, insert the output gear (Gear E, P/N 00167) first. Remove the packing from the packing nut and inspect the O-ring seal. Replace it if needed. Then replace the packing nut and cam. Tighten the packing nut until you feel a slight resistance when turning the cam.

. Invert the maincase housing, and install all the remaining parts. As you put in each part, make sure all parts operate freely.

When everything but the bearing plate is installed in the inverted maincase housing, check the gear clearances for proper alignment. You may do this by placing a straight edge (ruler), on the surface where the bearing plate seats. Slide it next to the shafts and check the clearance between the straight edge and the hub of the gears. If the clearance is more than 0.015 inches, you should add a shim, to reduce the clearance to between 0.005 and 0.015 inches. Thin stainless steel washers placed on the shafts are good for this.

Replace the bearing plate. Screw on the drive dog and rotate it to check out the gear train. It should rotate easily and smoothly. Check the cam to see that it is rotating.

6.4 MEASURING CHAMBER AND DISC ASSEMBLY

Note the position of the pumper relative to the main water line connections and then remove the bolts holding the motor castings together. If your unit has 1-½ or 2" pipe connections, you should remove the bolts holding the adapter plate to the lower

Water Motor Control Units

housing. Lay the upper maincase assembly and housing gasket aside. If not already done, remove the lower housing from the water line.

If your unit has a plastic measuring chamber, it may have a plastic shim wedged between the measuring chamber and housing (See your parts drawing). If you have one, carefully remove it. Some units with plastic chambers will have, instead, a metal retainer spring (P/N 01933); if your unit is one of these, the spring will come out when the chamber is removed; be careful not to lose the spring when disassembling the lower housing. Units with bronze chambers do not have a shim or spring. If your unit has a plastic chamber, you will need to carefully remove the port gasket after removing the chamber. Follow the removal and reinstallation instructions carefully to avoid damage to the chamber.

Removing the Chamber

Gently remove the measuring chamber by lifting it straight up. **DO NOT PRY!** If it will not come out, lift the complete assembly by the disc spindle (the stainless steel shaft protruding from the center) and gently tap the brass motor housing down. If necessary, wrap the shaft with tape to get a better grip.

Servicing the Chamber

Remove the strainer from the lower housing and clean it and the lower housing. 1½ and 2" units (E***Q and F***Q models) have screws holding the chamber halves together; remove these. If your chamber is plastic, remove the port seal gasket (from the top half only unless you have a replacement gasket), which is glued onto the chamber halves. Separate the chamber halves with your thumbs by pulling them apart at the water ports. If the halves will not separate, insert a screwdriver blade into the slot provided for it opposite the water ports, and twist.

DO NOT EVER PRY AGAINST THE DISC, OR DAMAGE THE INTERIOR OF THE CHAMBER. Remove the disc by tilting

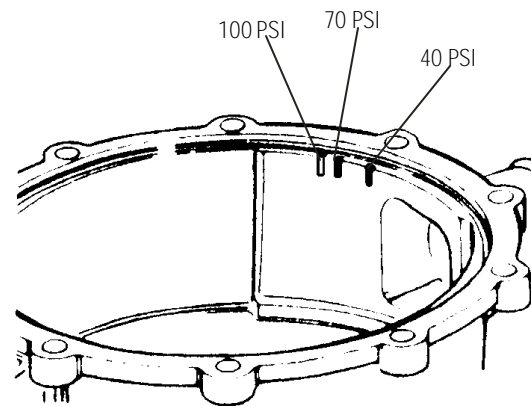


Figure 5
Chamber assembly line pressure
adjustment slots (1½ and 2" units only)

the slotted side toward the bottom, and lifting it out. Clean the disc and interior parts. Inspect the stainless steel thrust roller opposite the slot. It should fit freely but snugly in the disc, and should not be worn.

Wear is not excessive if the thrust roller is flat on the end, and the edges are square with the top; not rounded or pointed and if the disc shaft is the same diameter throughout. The thrust roller insert (T R Insert) should not be worn. The interior of the chamber halves should be smooth and not show indications of wear, such as grooves or pitting.

The disc should not show indications of wear around the edges or around the center ball. Although wear of the disc spindle will not affect operation of the feeder, the disc should generally be replaced if the spindle is worn to half its normal diameter.

Install the thrust roller in the disc, install the thrust roller insert in the lower chamber half, and insert the disc in the lower half of the chamber. The edge of the disc should fit closely to the chamber, but not bind or stick as the disc is moved around. Carefully reinstall the upper chamber half. Push the disc spindle over to one side; then move the spindle end with a circular motion, keeping it

against the side. This will cause the disc to nutate (wobble). It should move freely. Pull up on the spindle to check for looseness of the disc within the chamber. If the disc moves up and down (if there is space between the ball and upper chamber half) the disc and chamber are worn and should be replaced. This space should be about 0.020" for new discs and no more than 0.030" for worn discs.

If the parts appear to fit properly, test the chamber assembly by blowing into the outlet port with your mouth; be sure the disc spindle is pushed over to the side, **DO NOT USE COMPRESSED AIR.** The disc should nutate freely and positively, with little blowing effort. If it does not, there is probably excessive clearance, indicating wear. This will allow water to pass through the chamber without nutating the disc, and will greatly reduce performance at low flows. Replacement would be needed for the unit to meet original factory specifications.

Reinstalling the Chamber

Install the chamber in the brass housing bottom. With plastic chambers you will need to reinstall or replace the port gasket (an

adhesive may be helpful). If your unit has a retainer spring, it must be positioned on the chamber before the chamber is installed.

There is a pin in the chamber near the outlet port. This engages a slot near the outlet port of the housing bottom. Match the pin to slot and gently place the chamber in the housing. If properly aligned, it will go in easily.

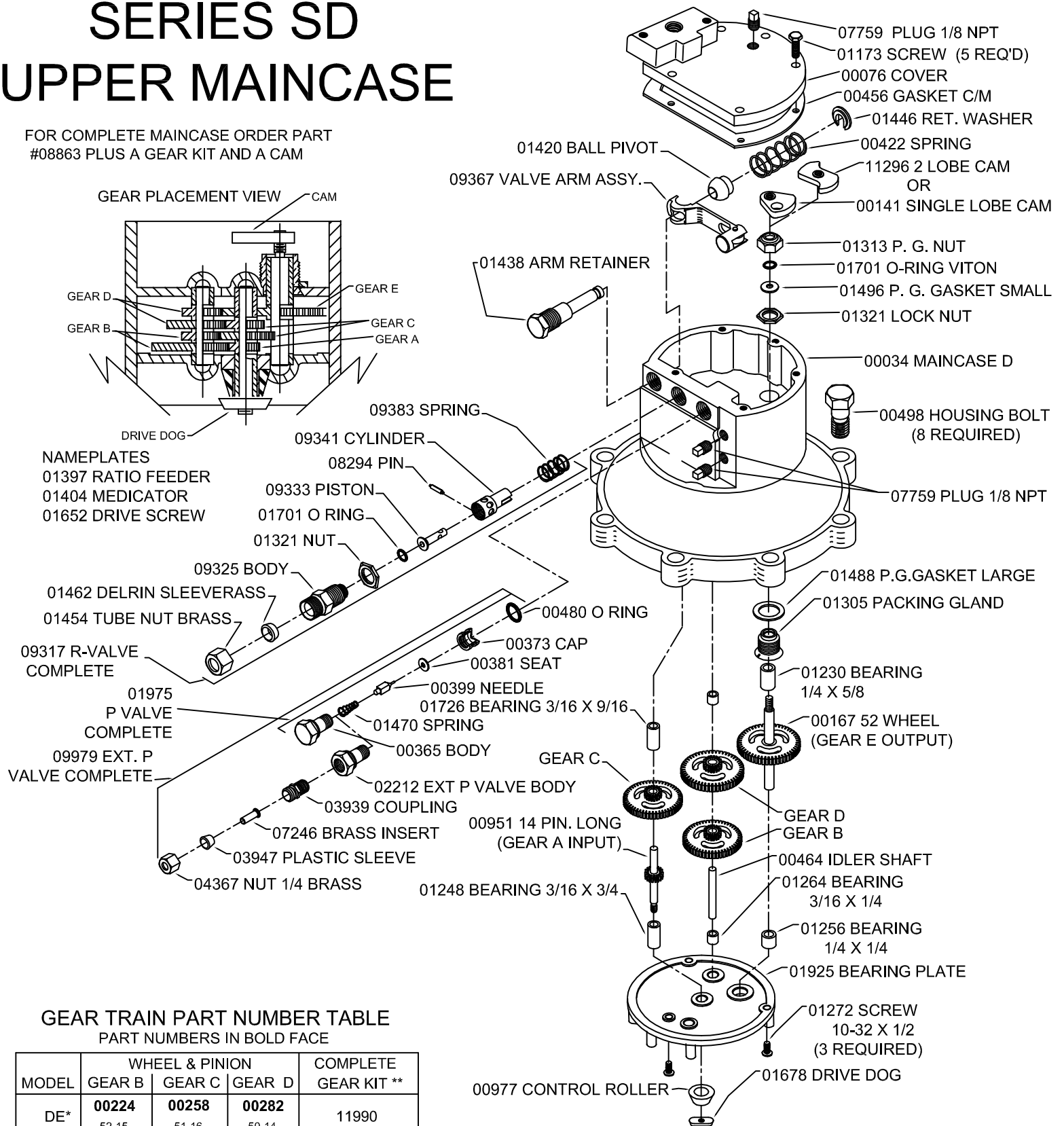
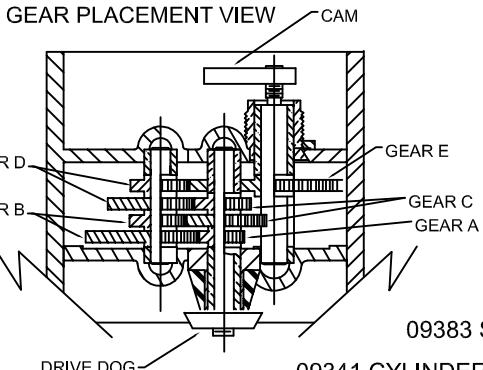
DO NOT FORCE THE CHAMBER. If your unit has a plastic retainer, replace it. See the parts drawings in rear of manual to see the proper position for the spring.

Blow gently into the outlet of the lower housing and see that the disc nutates properly. Install the housing gasket and maincase casting. Do not over tighten the brass bolts.

*NOTE: 1½ and 2" units (E**-*Q and F**-*Q models) have three possible positions for installation of the measuring chamber. (See Figure 5) The purpose of these positions is to permit the chamber to be matched to the line pressure of the system, and to prevent overloading or racing beyond the rated capacity. The chamber is shipped from the factory with the chamber in the 70 psi slot. If necessary, change the position to match your average pressure.*

SERIES SD UPPER MAINCASE

FOR COMPLETE MAINCASE ORDER PART
#08863 PLUS A GEAR KIT AND A CAM



GEAR TRAIN PART NUMBER TABLE
PART NUMBERS IN BOLD FACE

MODEL	WHEEL & PINION			COMPLETE GEAR KIT **
	GEAR B	GEAR C	GEAR D	
DE*	00224 52-15	00258 51-16	00282 50-14	11990
DJ*	00224 52-15	00240 51-21	00331 45-14	12005
DN*	00208 52-20	00290 46-20	00307 46-14	12013
DT*	00191 52-21	00315 45-24	00357 42-14	12039
DX*	01579 52-25	01587 41-25	01595 41-14	11990

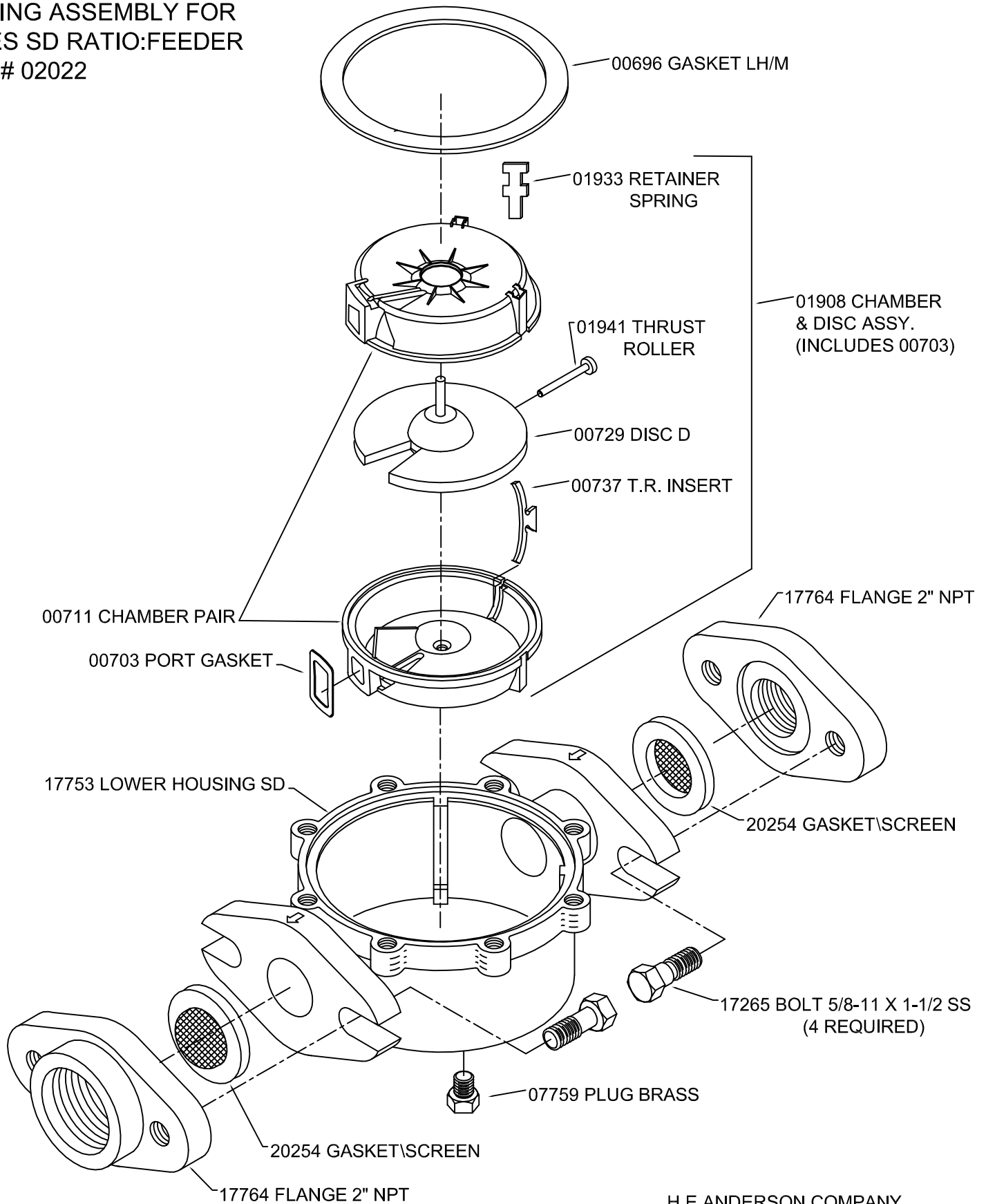
06751 MAINCASE KIT (1) 00381 (1) 00480 (1) 01496 (1) 00399 (2) 01173 (2) 01701 (1) 00422 (1) 01470 (1) 09383 (1) 00456 (1) 01488	12070 UPPER MAINCASE REBUILD KIT (1) 00422 (1) 01420 (1) 01496 (1) 09317 (1) 00456 (1) 01438 (1) 01701 (1) 09367 (1) 01313 (1) 01446 (1) 01975 (1) 01321 (1) 01488 (1) 07238
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17605 ARM RETAINER AND BALL PIVOT REBUILD KIT (1) 01420 (1) 01438 (1) 07238

** GEAR KITS INCLUDE ALL GEARS, SHAFTS, BEARINGS, CONTROL ROLLER AND DRIVE DOG

SERIES SD LOWER HOUSING

MEASURING CHAMBER/LOWER
HOUSING ASSEMBLY FOR
SERIES SD RATIO:FEEDER
PART # 02022



H E ANDERSON COMPANY
FORM SDLH 12-00

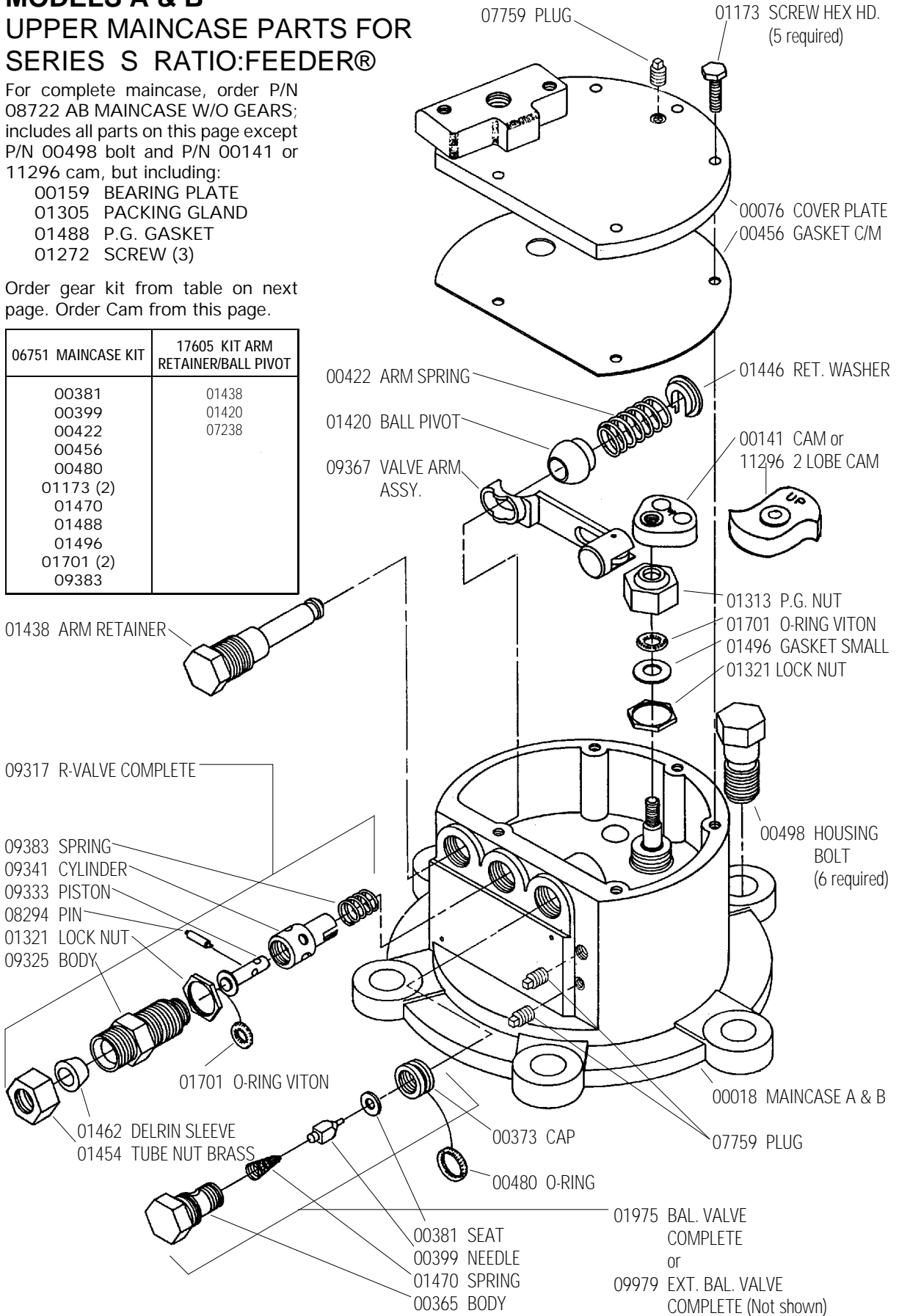
MODELS A & B UPPER MAINCASE PARTS FOR SERIES S RATIO:FEEDER®

For complete maincase, order P/N 08722 AB MAINCASE W/O GEARS; includes all parts on this page except P/N 00498 bolt and P/N 00141 or 11296 cam, but including:

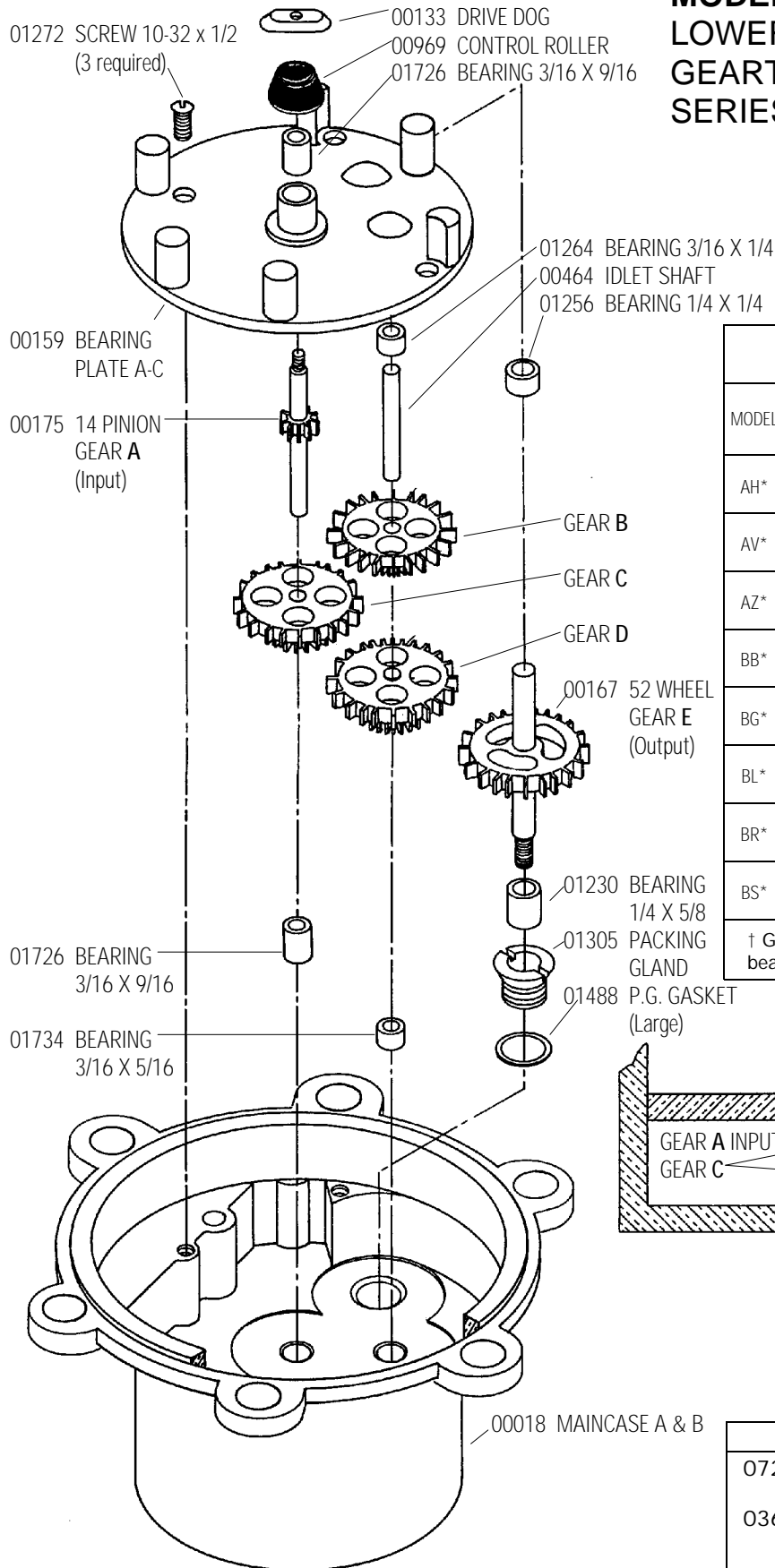
- 00159 BEARING PLATE
- 01305 PACKING GLAND
- 01488 P.G. GASKET
- 01272 SCREW (3)

Order gear kit from table on next page. Order Cam from this page.

06751 MAINCASE KIT	17605 KIT ARM RETAINER/BALL PIVOT
00381	01438
00399	01420
00422	07238
00456	
00480	
01173 (2)	
01470	
01488	
01496	
01701 (2)	
09383	

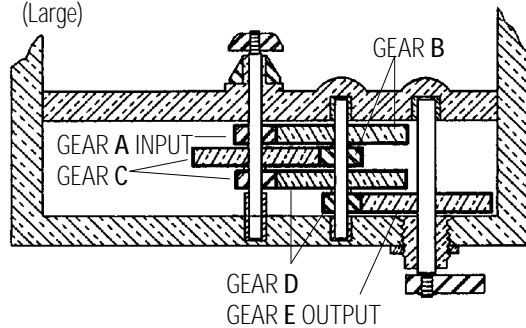


MODELS A & B LOWER MAINCASE & GEARTRAIN PARTS FOR SERIES S



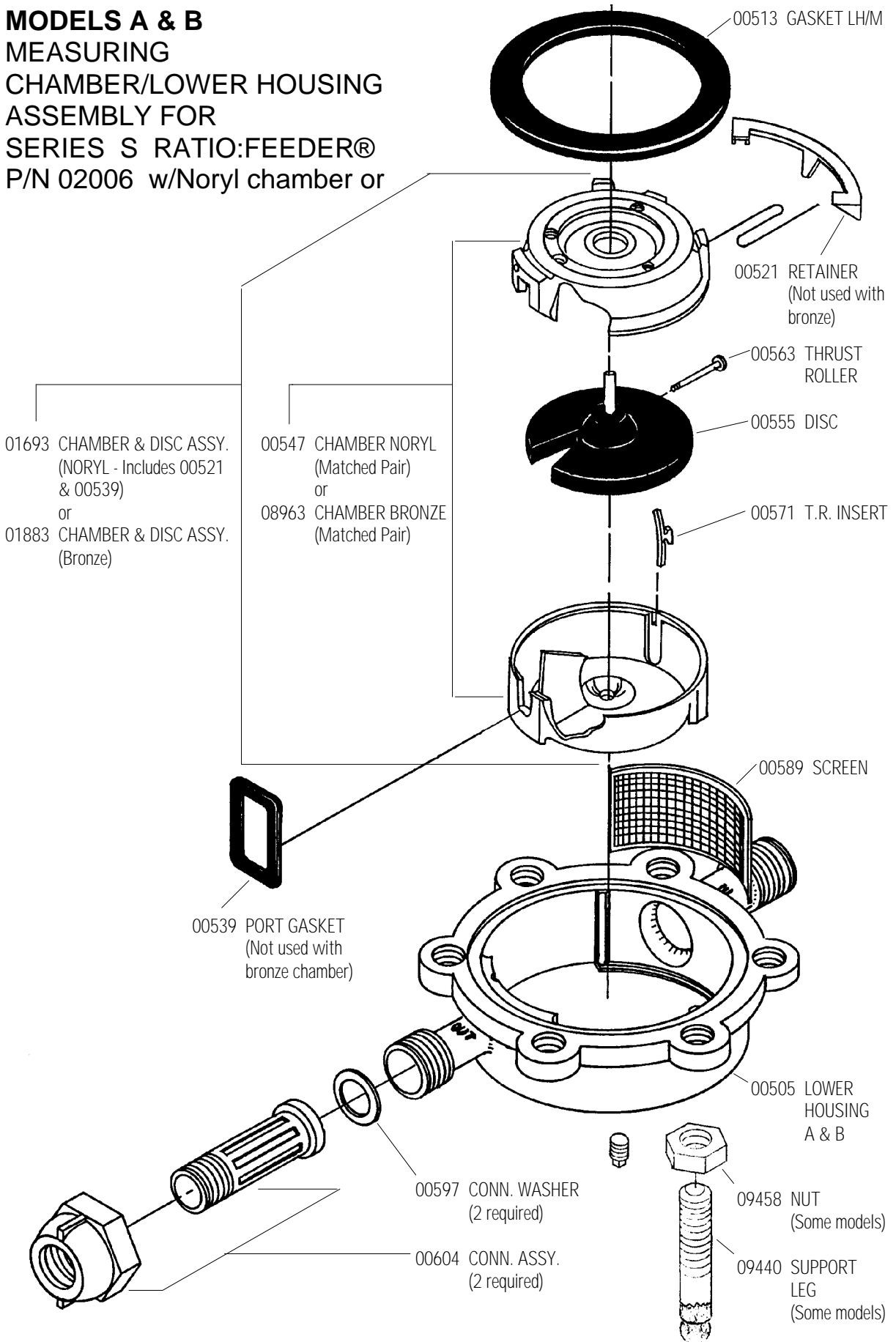
GEAR TRAIN PART NUMBER TABLE				
Part numbers in bold face				
MODEL	WHEEL & PINION			COMPLETE GEAR KIT†
	GEAR B	GEAR C	GEAR D	
AH*	10149 52-33	10222 33-33	10230 33-14	10248
AV*	00183 52-24	00349 42-24	00357 42-14	03847
AZ*	09656 52-28	09664 38-28	09672 38-14	11932
BB*	00232 52-14	00232 52-14	00232 52-14	11940
BG*	00216 52-16	00274 50-16	00282 50-14	11958
BL*	00216 52-16	00266 50-21	00331 45-14	11966
BR*	00191 52-21	00323 45-21	00331 45-14	11974
BS*	00208 52-20	08871 46-24	00357 42-14	12055

† Gear kits include all gears, shafts, bearings, control roller & drive dog.



ACCESSORIES	
07238	GREASE WATERPROOF SMALL PACKET
03681	GREASE WATERPROOF 10 OZ TUBE

MODELS A & B
MEASURING
CHAMBER/LOWER HOUSING
ASSEMBLY FOR
SERIES S RATIO:FEEDER®
P/N 02006 w/Noryl chamber or



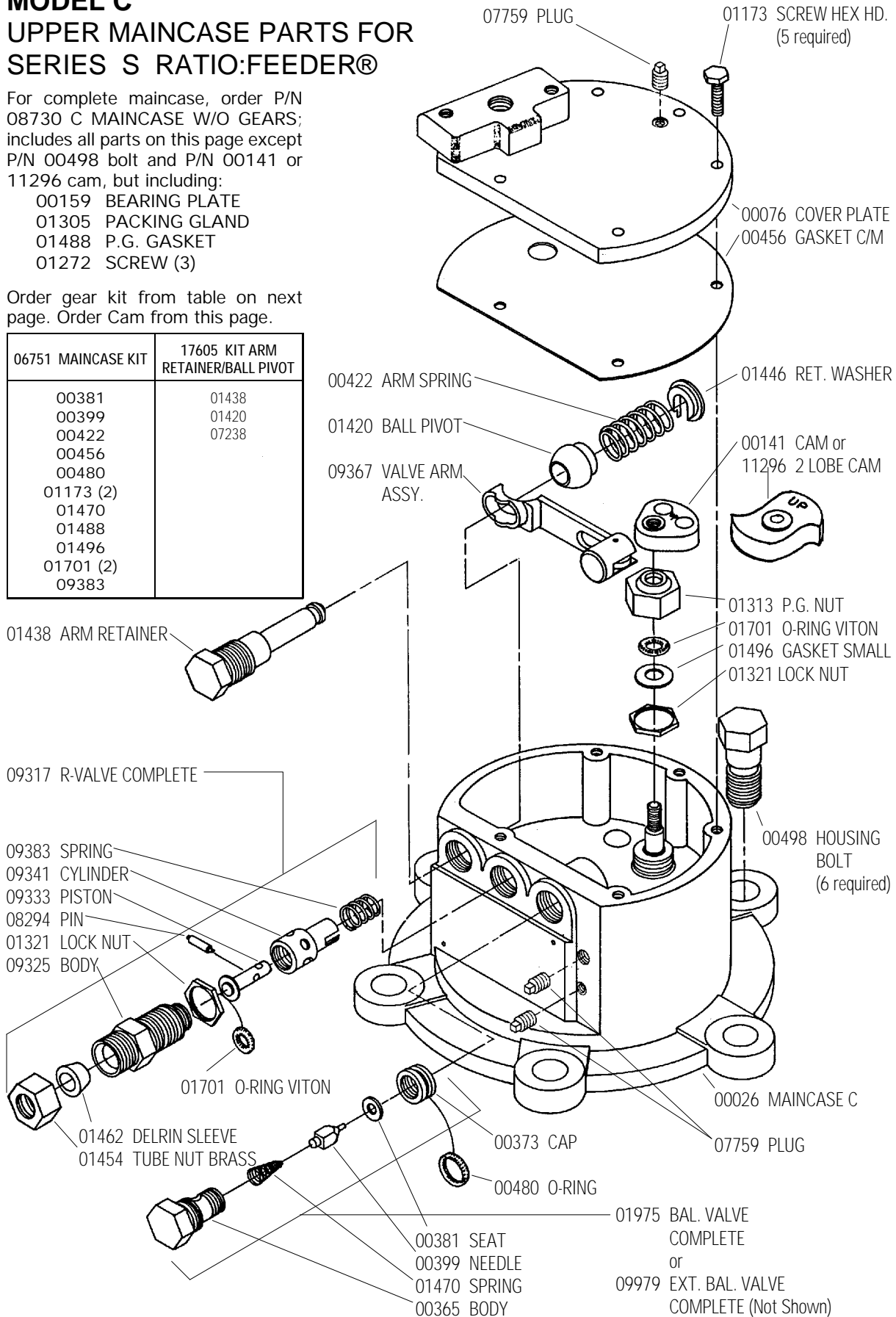
MODEL C UPPER MAINCASE PARTS FOR SERIES S RATIO:FEEDER®

For complete maincase, order P/N 08730 C MAINCASE W/O GEARS; includes all parts on this page except P/N 00498 bolt and P/N 00141 or 11296 cam, but including:

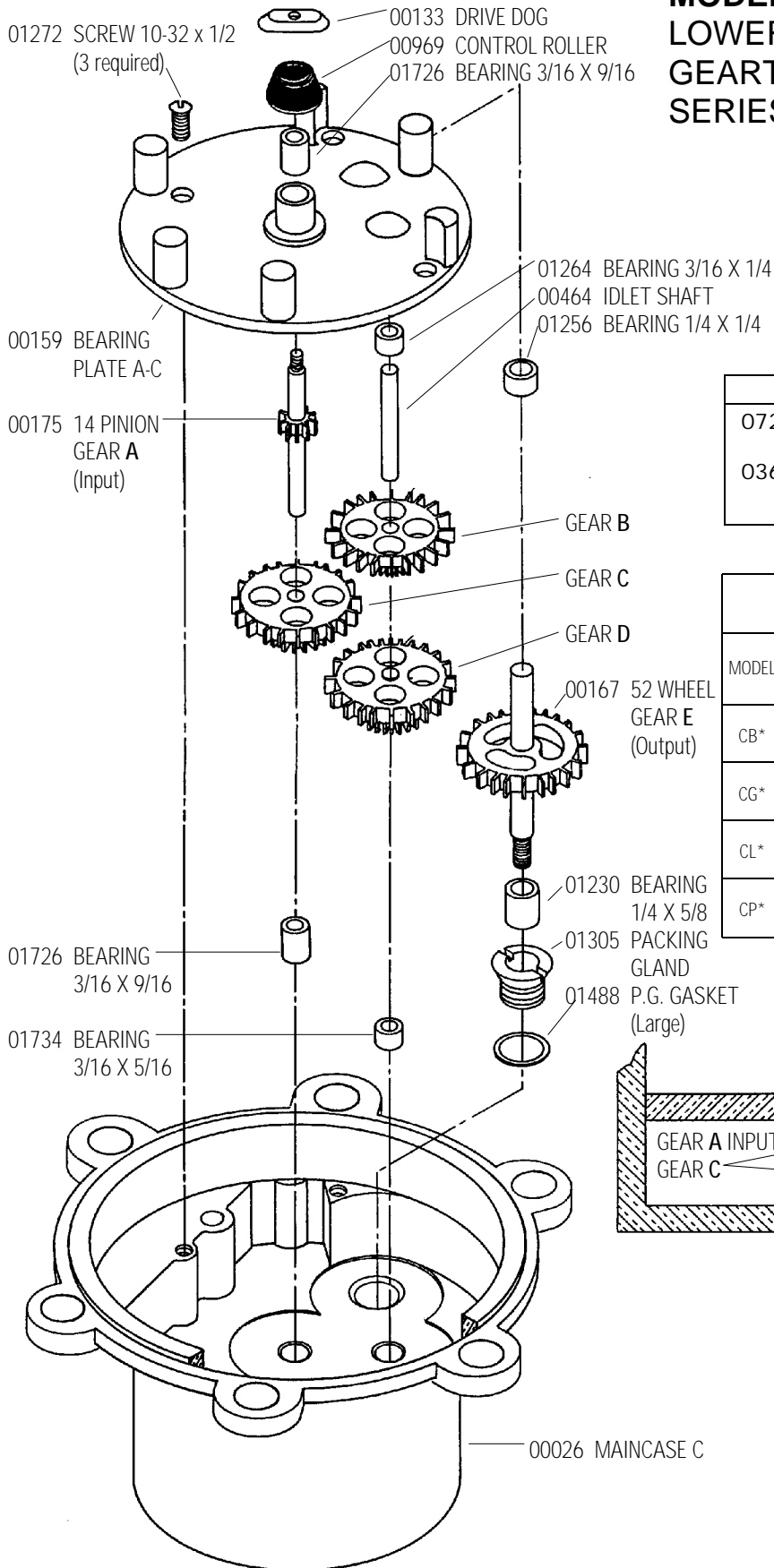
- 00159 BEARING PLATE
- 01305 PACKING GLAND
- 01488 P.G. GASKET
- 01272 SCREW (3)

Order gear kit from table on next page. Order Cam from this page.

06751 MAINCASE KIT	17605 KIT ARM RETAINER/BALL PIVOT
00381	01438
00399	01420
00422	07238
00456	
00480	
01173 (2)	
01470	
01488	
01496	
01701 (2)	
09383	

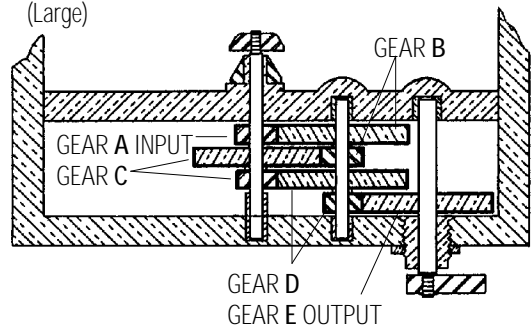


MODEL C LOWER MAINCASE & GEARTRAIN PARTS FOR SERIES S

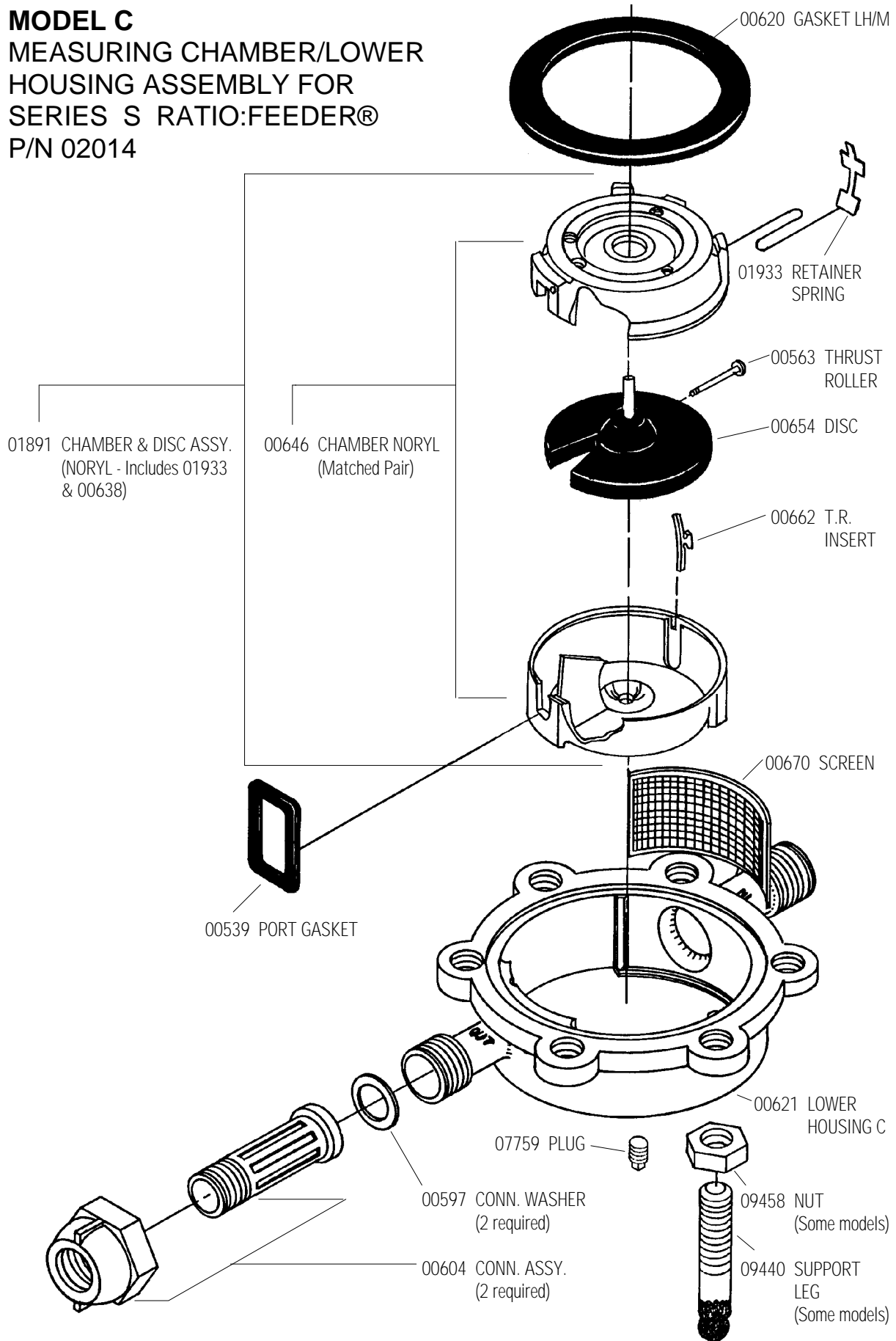


ACCESSORIES	
07238	GREASE WATERPROOF SMALL PACKET
03681	GREASE WATERPROOF 10 OZ TUBE

GEAR TRAIN PART NUMBER TABLE Part numbers in bold face				
MODEL	WHEEL & PINION			COMPLETE GEAR KIT†
	GEAR B	GEAR C	GEAR D	
CB*	00232 52-14	00232 52-14	00232 52-14	11940
CG*	00216 52-16	00274 50-16	00282 50-14	11958
CL*	00216 52-16	00266 50-21	00331 45-14	11966
CP*	00208 52-20	00472 46-21	00331 45-14	11982



MODEL C
MEASURING CHAMBER/LOWER
HOUSING ASSEMBLY FOR
SERIES S RATIO:FEEDER®
P/N 02014



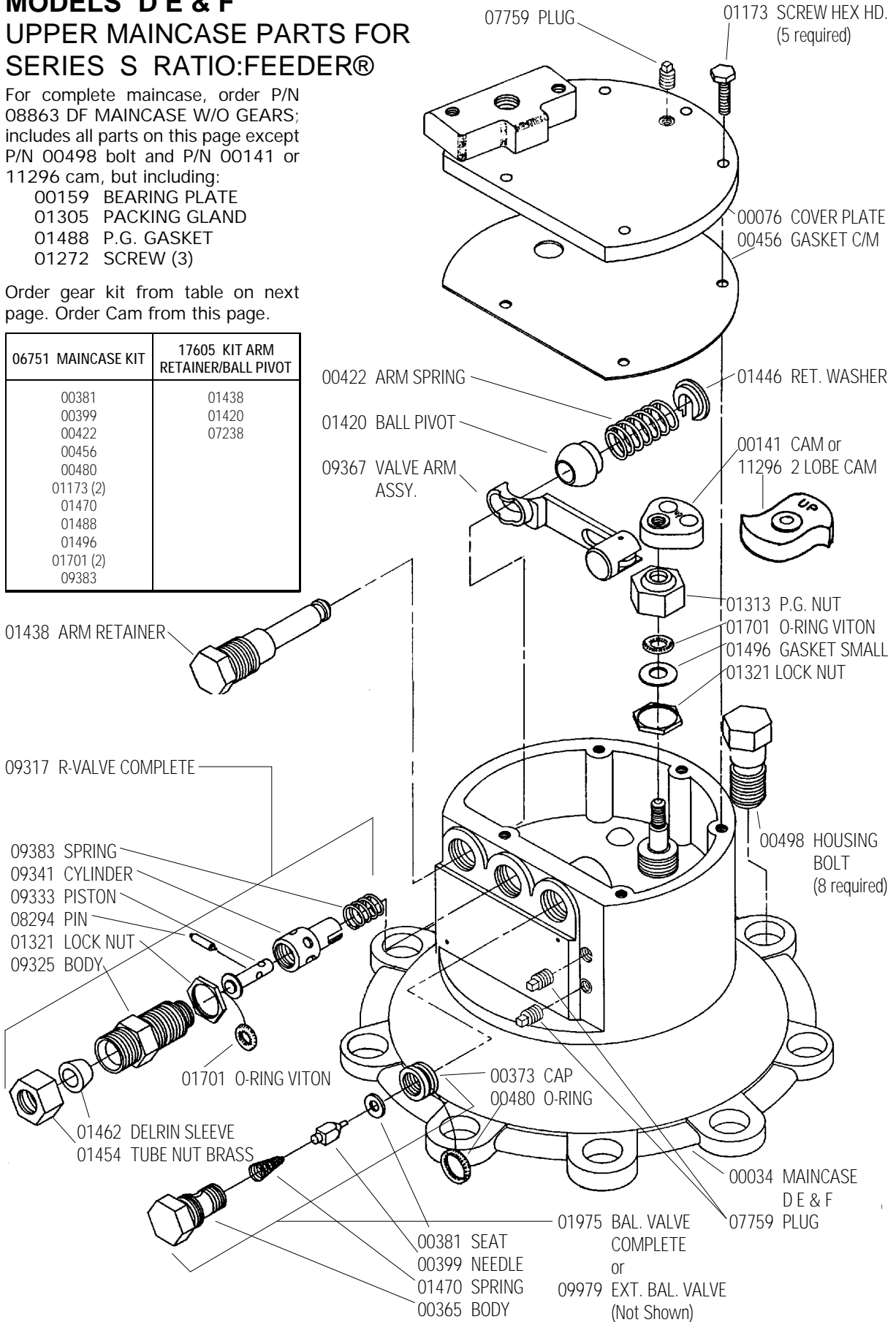
MODELS D E & F UPPER MAINCASE PARTS FOR SERIES S RATIO:FEEDER®

For complete maincase, order P/N 08863 DF MAINCASE W/O GEARS; includes all parts on this page except P/N 00498 bolt and P/N 00141 or 11296 cam, but including:

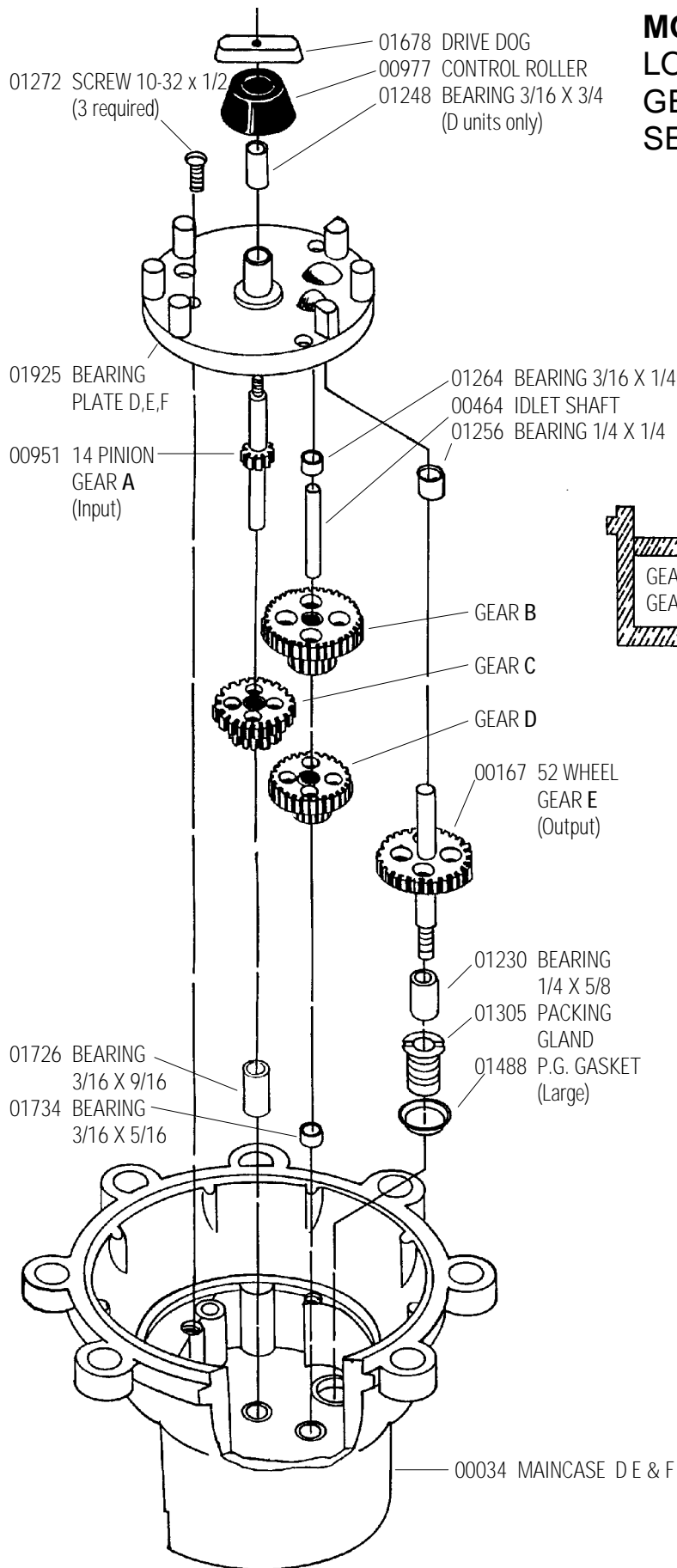
- 00159 BEARING PLATE
- 01305 PACKING GLAND
- 01488 P.G. GASKET
- 01272 SCREW (3)

Order gear kit from table on next page. Order Cam from this page.

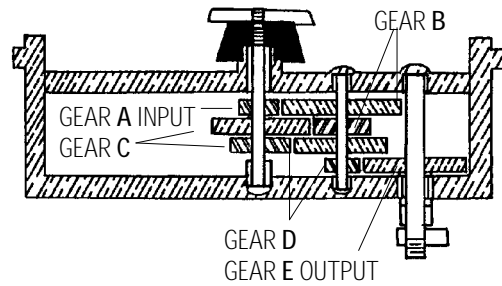
06751 MAINCASE KIT	17605 KIT ARM RETAINER/BALL PIVOT
00381	01438
00399	01420
00422	07238
00456	
00480	
01173 (2)	
01470	
01488	
01496	
01701 (2)	
09383	



MODELS D E & F LOWER MAINCASE & GEARTRAIN PARTS FOR SERIES S

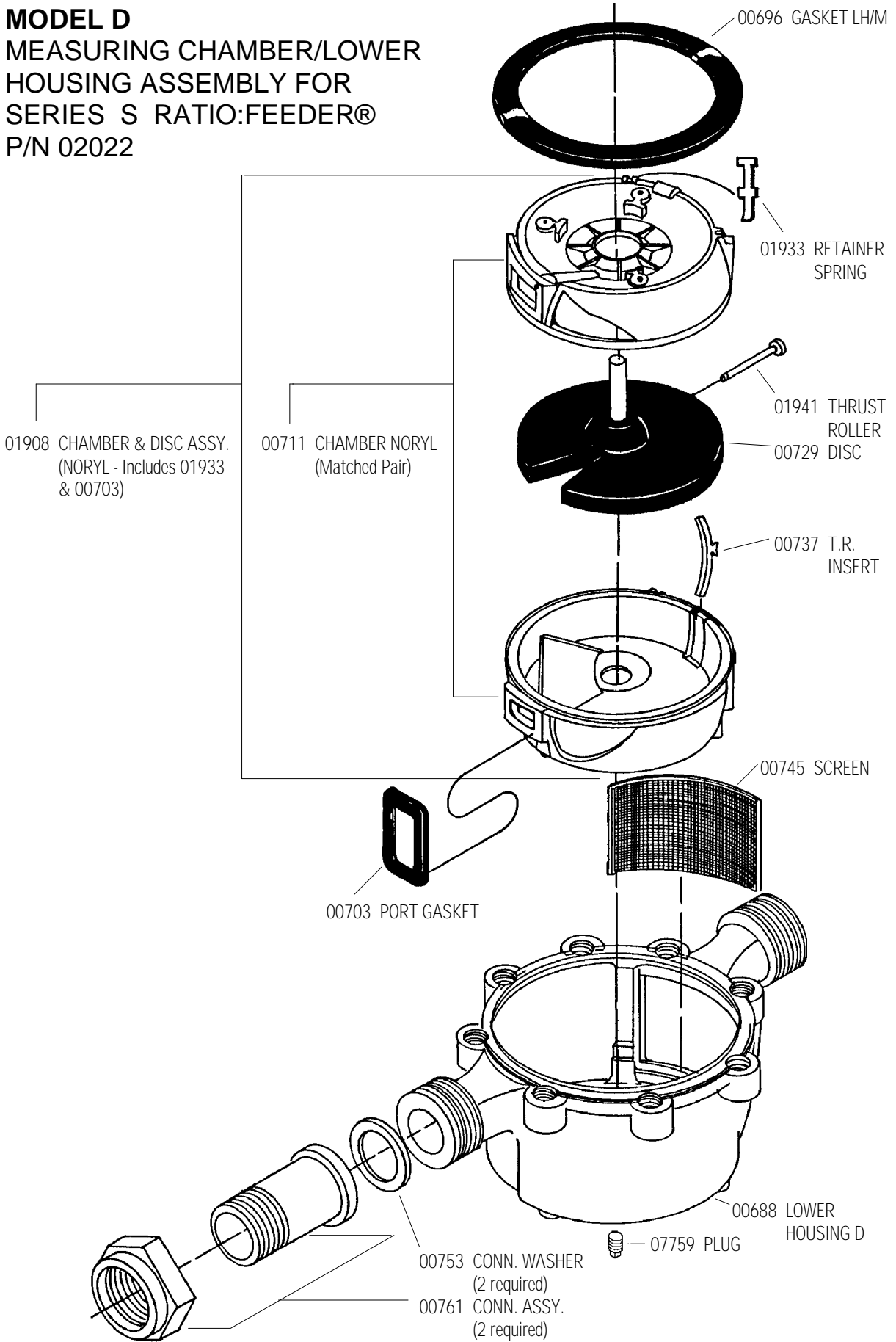


ACCESSORIES	
07238	GREASE WATERPROOF SMALL PACKET
03681	GREASE WATERPROOF 10 OZ TUBE

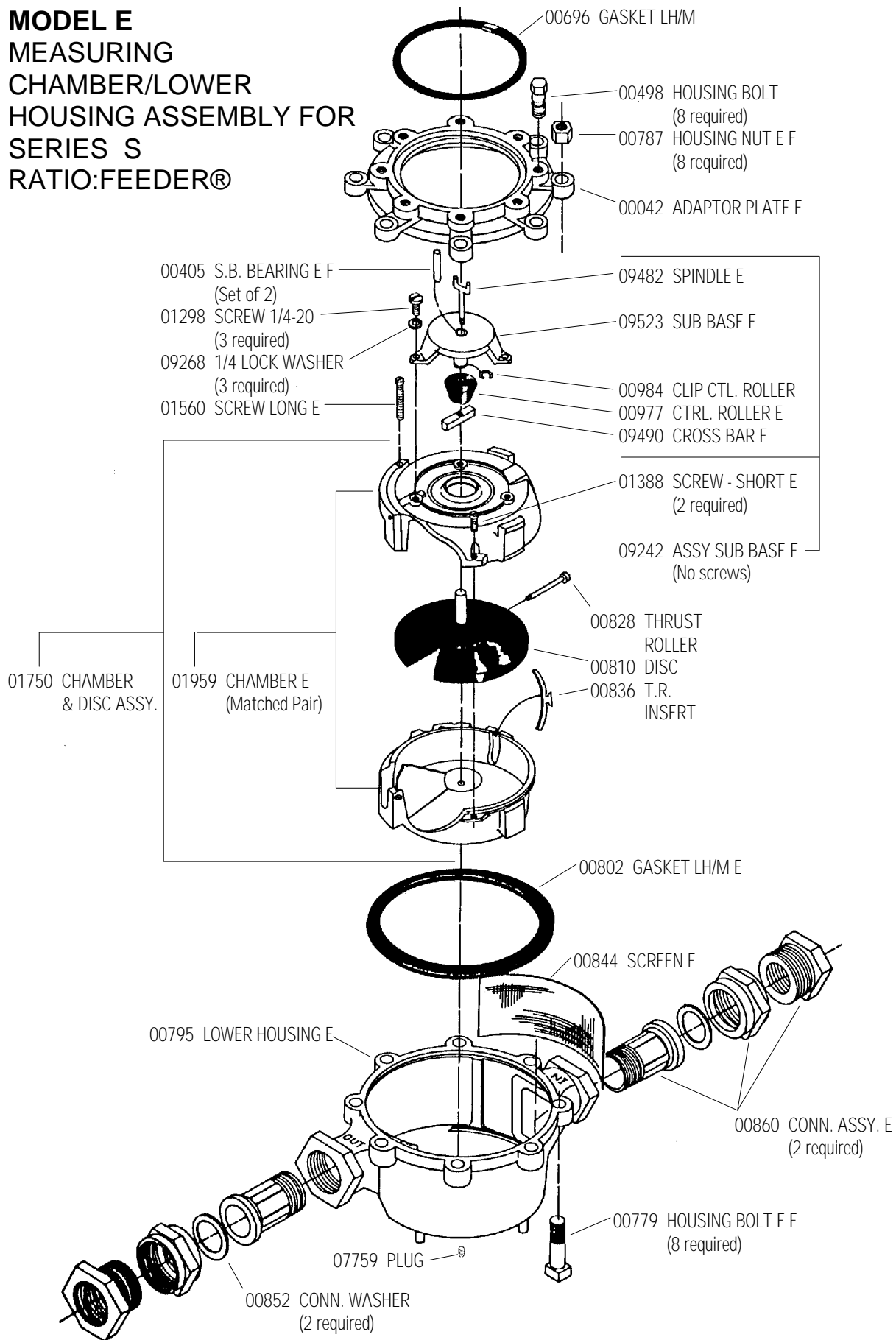


GEAR TRAIN PART NUMBER TABLE				
Part numbers in bold face				
MODEL	WHEEL & PINION			COMPLETE GEAR KIT†
	GEAR B	GEAR C	GEAR D	
DE* EE* FE*	00224 52-15	00258 51-16	00282 50-14	11990
DJ* EJ* FJ*	00224 52-15	00240 51-21	00331 45-14	12005
DN* EN* FN*	00208 52-20	00290 46-20	00307 46-14	12013
DT* ET* FT*	00191 52-21	00315 45-24	00357 42-14	12021
DX* EX* FX*	01579 52-25	01587 41-25	01595 41-14	12039
FZ*	09656 52-28	09664 38-28	09672 38-14	12047
SPECIAL SETS				
Please consult factory before using				
DA*	10165 52-27	10173 39-28	09672 38-14	10256
DD* ED*	09656 52-28	10181 38-29	10199 37-14	10264
FF*	10157 52-30	10206 36-30	10214 36-14	10272

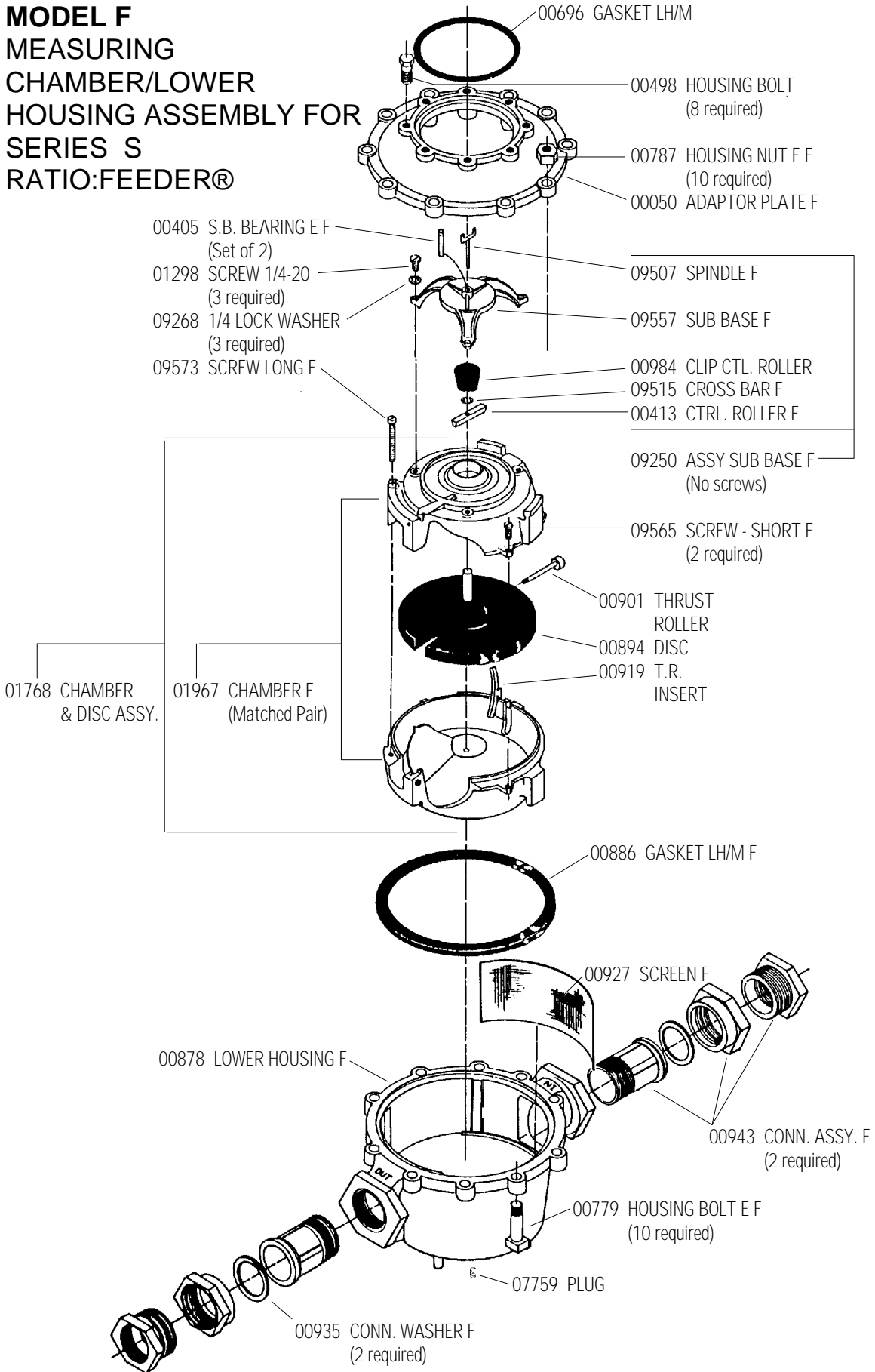
MODEL D
MEASURING CHAMBER/LOWER
HOUSING ASSEMBLY FOR
SERIES S RATIO:FEEDER®
P/N 02022



**MODEL E
MEASURING
CHAMBER/LOWER
HOUSING ASSEMBLY FOR
SERIES S
RATIO:FEEDER®**



**MODEL F
MEASURING
CHAMBER/LOWER
HOUSING ASSEMBLY FOR
SERIES S
RATIO:FEEDER®**



RATIO:FEEDER® LIMITED WARRANTY

WHAT IS COVERED

The H.E. Anderson Company of Muskogee, Oklahoma, will make any necessary repairs and/or replace any parts of any Ratio:Feeder® product made necessary because of defects in materials or workmanship for fifteen months from date of manufacture. Warranty repairs and/or replacements will be performed without charge to the owner by H.E. Anderson Company within a reasonable time after prepaid delivery of the defective product to the H.E. Anderson Company, 2100 Anderson Drive, Muskogee, Oklahoma 74403.

WHAT IS NOT COVERED

This warranty specifically excludes failure of any parts or materials caused by chemical attack or damage caused by operation above rated capacity or pressure. Further, this warranty does not cover wear or failure caused by sand or other foreign materials which may be found in water that is passed through our products, or damage caused by freezing or exposure to water temperatures above 60 °C (140 °F).

This warranty does not cover damage caused by failure to follow prescribed installation instructions and limitations issued by H.E. Anderson Company. In addition, this warranty does not cover service adjustments, repairs, or replacements caused by misuse, negligence, alteration, accident, or lack of specified maintenance.

This warranty does not cover components used by, but not manufactured by H.E. Anderson Company, in the manufacture of our products except to the extent of said component manufacturer's warranty.

This warranty specifically excludes liability for consequential damages or for charges for labor or expense in making repairs or adjustments, or losses of time or inconvenience.

This warranty gives you specific legal rights and you may also have other legal rights which may vary from state to state. H.E. Anderson Company does not authorize any person to create for it any other obligation or liability in connection with these products. ANY IMPLIED WARRANTY APPLICABLE TO THESE PRODUCTS IS LIMITED TO THE DURATION OF THIS WARRANTY. H.E. Anderson Company shall not be liable for consequential damages resulting from breach of this written warranty.

NOTE: Some states do not allow limitation on how long an implied warranty will last or the exclusion of limitations of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

WHAT TO DO IF THERE IS A QUESTION REGARDING WARRANTY

- (1) Promptly notify the consumer advisor at H.E. Anderson Company by telephone at 800-331-9620 or 918-687-4426.
- (2) Confirm the report in writing (or via FAX at 918-682-3342) to the H.E. Anderson Company, stating the circumstances surrounding the problem.

PURCHASER'S OBLIGATION

- (A) Purchaser must give H.E. Anderson Company immediate written notice on discovery of defect.
- (B) Purchaser must pay for shipment of the defective product to the H.E. Anderson Company, 2100 Anderson Drive, Muskogee, Oklahoma 74403.