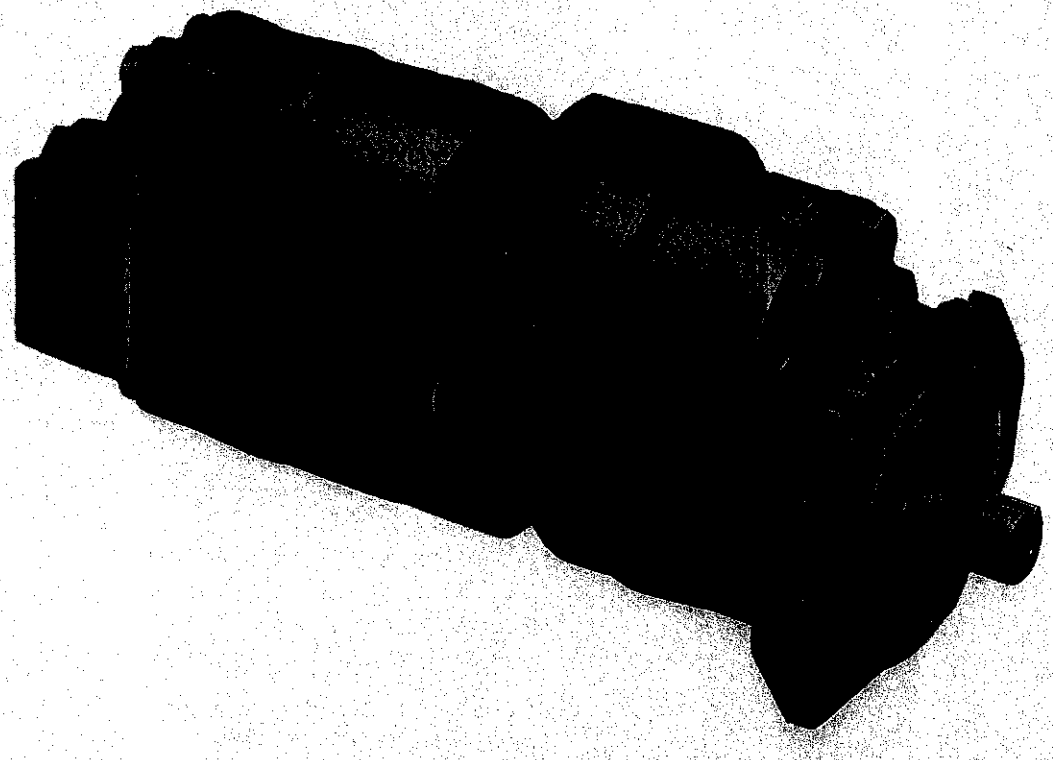
VICKERS®
A TRINOVA COMPANY

Overhaul Manual

Single Gear Pumps	G20W	SERIES – 61 DESIGN
	G20D	SERIES – 61 DESIGN
	G30C	SERIES – 32 DESIGN
	GT20W	SERIES – 51 DESIGN
	GT30C	SERIES – 32 DESIGN
Double Gear Pumps	G3030C	SERIES – 32 DESIGN
	G3020W	SERIES – 50 DESIGN
	G2020W	SERIES – 51 DESIGN



Vickers, Incorporated

P.O. Box 302
Troy, Michigan 48007-0302

Released 11-1-89 **M-2389-S**

TABLE OF CONTENTS

Section I –INTRODUCTION

A. PURPOSE OF MANUAL

This manual is to assist users of high performance single and double gear pumps in properly installing, maintaining and repairing their units. The single and double gear pumps are described in detail in Section II.

B. GENERAL INFORMATION

1. Related Publications – Service parts information and installation dimensions are not contained in this manual. The parts drawings listed in Table 1 are available from authorized distributors or sales engineers.

2. Model Codes – Variations within each basic model series are covered in the model code. Table 2 is a complete breakdown of the codes covering these units. Service inquiries should always include the complete unit model code number stamped on the rear cover.

MODEL SERIES	PARTS DRAWING
G20D-61	M-2381-S
G20W-61	M-2382-S
GT20W-51	M-2383-S
GT30C-32	M-2384-S
G30C-32	M-2385-S
G2020W-51	M-2386-S
G3020W-50	M-2387-S
G3030C-32	M-2388-S

Table 1. Available Parts and Installation Drawings

MODEL CODE BREAKDOWN
SINGLE GEAR PUMPS & THRU–DRIVE

(F3) – G (*) * – * – * – * – ** – * – * – ** – * – ** – **– (*)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15]

STANDARD MODELS

[1] SPECIAL SEALS

F3 – Mineral oil & fire resistant fluids.
Omit – Standard

[2] GEAR PUMP

[3] OMITTED FOR SINGLE UNITS

[4] SERIES

[5] FLANGE TYPE

D – Dry mount flange W – Wet mount flange C – G30, GT30 G3030

[6] MOUNTING

1 – SAE "A" 2 Bolt flange G20 only
2 – SAE "B" 2 Bolt flange G20 only
4 – SAE "C" 4 Bolt flange G30 only
6 – SAE "B" 2 & 4 Bolt combination flange G20 only
7 – SAE "C" 2 Bolt flange G30 only
8 – SAE "C" 2 & 4 Bolt combination flange G30 only

[7] INLET PORT CONNECTIONS

B – 4 Bolt flange – 1.00 DIA
C – 4 Bolt flange – 1.25 DIA
D – 4 Bolt flange – 1.50 DIA
E – 4 Bolt flange – 2.00 DIA
V – 1.3125 – 12 Str. Thd.
W – 1.6250 – 12 Str. Thd.
X – 1.8750 – 12 Str. Thd.

[8] SAE USGPM RATED CAPACITY (1200 RPM @ 100 PSI)

7 – 7 GPM
9 – 9 GPM
11 – 11 GPM
13 – 13 GPM
15 – 15 GPM
17 – 17 GPM
19 – 19 GPM
21 – 21 GPM
24 – 24 GPM
27 – 27 GPM

[9] OUTLET PORT CONNECTIONS

A – 4 Bolt flange – .75 DIA
B – 4 Bolt flange – 1.00 DIA
C – 4 Bolt flange – 1.25 DIA
D – 4 Bolt flange – 1.50 DIA
S – .875 – 14 Str. Thd.
T – 1.0625 – 12 Str. Thd.
V – 1.3125 – 12 Str. Thd.
W – 1.6250 – 12 Str. Thd.
X – 1.8750 – 12 Str. Thd.

[10] SHAFT SEAL

A – Single B – Double

[11] SHAFT TYPES

1 – Straight keyed (SAE "B" size)
5 – Tapered Threaded
7 – Tapered Threaded (Woodruff) & Threaded
11 – Spline (SAE "B" EXT., Major Dia. Fit)
12 – Spline (SAE "B" EXT., Side Fit)
18 – Spline (SAE "A" EXT., Major Dia. Fit)
99 – Spline (SAE "B" – "B" EXT.)

[12] PORT POSITIONS

A – Side inlet & Side outlet
B – Side inlet & Rear outlet
C – Rear inlet & Side outlet
D – Rear inlet & Rear outlet

[13] DESIGN

[14] SHAFT ROTATION (Viewed from shaft end)

L – Counterclockwise
Omit – Clockwise

THRU DRIVE MODELS

[1] SPECIAL SEALS

F3 – Mineral oil & fire resistant fluids.
Omit – Standard

[2] GEAR PUMP

[3] THRU DRIVE

[4] SERIES

[5] FLANGE TYPE

D – Dry mount flange W – Wet mount flange C – GT30, GT30 GT3030

[6] MOUNTING

2 – SAE "B" 2 Bolt flange GT20 only
4 – SAE "C" 4 Bolt flange GT30 only
6 – SAE "B" 2 & 4 Bolt combination flange GT20 only
7 – SAE "C" 2 Bolt flange GT30 only
8 – SAE "C" 2 & 4 Bolt combination flange GT30 only

[7] INLET PORT CONNECTIONS

B – 4 Bolt flange – 1.00 DIA
C – 4 Bolt flange – 1.25 DIA
D – 4 Bolt flange – 1.50 DIA
E – 4 Bolt flange – 2.00 DIA
V – 1.3125 – 12 Str. Thd.
W – 1.6250 – 12 Str. Thd.
X – 1.8750 – 12 Str. Thd.
Y – 2.500 – 12 Str. Thd.

[8] SAE USGPM RATED CAPACITY (1200 RPM @ 100 PSI)

7 – 7 GPM
9 – 9 GPM
11 – 11 GPM
13 – 13 GPM
15 – 15 GPM
17 – 17 GPM
19 – 19 GPM
21 – 21 GPM
24 – 24 GPM
27 – 27 GPM

[9] OUTLET PORT CONNECTIONS

A – 4 Bolt flange – .75 DIA
B – 4 Bolt flange – 1.00 DIA
C – 4 Bolt flange – 1.25 DIA
D – 4 Bolt flange – 1.50 DIA
S – .875 – 14 Str. Thd.
T – 1.0625 – 12 Str. Thd.
V – 1.3125 – 12 Str. Thd.
W – 1.6250 – 12 Str. Thd.
X – 1.8750 – 12 Str. Thd.

[10] MOUNTING (PORT SECTION)

1 – SAE "A" 2 Bolt flange
6 – SAE "B" 2 Bolt & 4 Bolt combination flange
8 – SAE "C" 2 Bolt & 4 Bolt combination flange

[11] SHAFT SEAL

A – Single B – Double

[12] SHAFT TYPES

1 – Straight keyed (SAE "B" size)
12 – Spline (SAE "B" EXT., Side Fit)
99 – Spline (SAE "B" – "B" EXT.)

[13] COUPLING TYPE

A – SAE "A" Size
B – SAE "B" Size
BB – SAE "BB" Size
C – SAE "C" Size

[14] DESIGN

[15] SHAFT ROTATION (Viewed from shaft end)

L – Counterclockwise
Omit – Clockwise

Table 2. Model Code Breakdown

MODEL CODE BREAKDOWN
DOUBLE GEAR PUMPS

(F3) - G 2020 - * - * - * - ** - * - ** - * - ** - * - ** - (L)

[1] [2][3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14]

[1] SPECIAL SEALS

F3 - Mineral oil & fire resistant fluids.
Omit - Standard

[2] GEAR PUMP

[3] SERIES DESIGNATION

G2020
G3020
G3030

[4] FLANGE TYPE

W - Wet mount flange - G3020, G2020
C - G3030 ONLY

[5] MOUNTING

2 - SAE "B" 2 Bolt flange (G2020 only)
4 - SAE "C" 4 Bolt flange (G3020 & G3030 only)
6 - SAE "B" 2 & 4 Bolt combination flange (G2020 only)
7 - SAE "C" 2 Bolt flange (G3020 & 3030 only)
8 - SAE "C" 2 & 4 Bolt combination flange (G3020 & 3030 only)

[6] INLET PORT CONNECTIONS

E - 4 Bolt flange, 2.00 DIA. (G2020 & G3020 only)
F - 4 Bolt flange, 2.50 DIA.
G - 4 Bolt flange, 3.00 DIA. (G3020 & G3030 only)
Y - 2.50 - 12 Str. Thd (G3020 only)

[7] SAE USGPM RATED CAPACITY (SHAFT END PUMP)

G2020 Series (1200 RPM @ 100 PSI)

7 - 7 GPM	17 - 17 GPM
9 - 9 GPM	19 - 19 GPM
11 - 11 GPM	21 - 21 GPM
13 - 13 GPM	24 - 24 GPM
15 - 15 GPM	27 - 27 GPM

G3020 & G3030 Series

18 - 18 GPM	35 - 35 GPM
21 - 21 GPM	40 - 40 GPM
25 - 25 GPM	45 - 45 GPM
30 - 30 GPM	50 - 50 GPM

[8] OUTLET PORT CONNECTIONS (SHAFT END PUMP)

A - 4 Bolt flange - .75 DIA. (G2020 only)
B - 4 Bolt flange - 1.00 DIA
C - 4 Bolt flange - 1.25 DIA (G3020 & G3030 only)
D - 4 Bolt flange - 1.50 DIA (G3020 & G3030 only)
S - .875 - 14 Str. Thd. (G2020 only)
T - 1.0625 - 12 Str. Thd. (G2020 only)
V - 1.3125 - 12 Str. Thd. (G2020 only)

[9] SAE USGPM RATED CAPACITY (COVER END PUMP)

G3020, G2020 Series (1200 RPM @ 100 PSI)

7 - 7 GPM	17 - 17 GPM
9 - 9 GPM	19 - 19 GPM
11 - 11 GPM	21 - 21 GPM
13 - 13 GPM	24 - 24 GPM
15 - 15 GPM	27 - 27 GPM

G3030 Series

18 - 18 GPM	35 - 35 GPM
21 - 21 GPM	40 - 40 GPM
25 - 25 GPM	45 - 45 GPM
30 - 30 GPM	50 - 50 GPM

[10] OUTLET PORT CONNECTIONS (COVER END PUMP)

A - 4 Bolt flange - .75 DIA. (G2020 & G3020 only)
B - 4 Bolt flange - 1.00 DIA
C - 4 Bolt flange - 1.25 DIA (G3030 only)
S - .875 - 14 Str. Thd. (G2020 & G3020 only)
T - 1.0625 - 12 Str. Thd. (G2020 & G3020 only)
V - 1.3125 - 12 Str. Thd. (G2020 & G3020 only)

[11] SHAFT TYPES

1 - Straight keyed
12 - Spline (SAE "B" EXT)
99 - Spline (SAE "B" - "B" EXT. Flat root side fit, G2020 only)

[12] SHAFT SEAL

A - Single
B - Double

[13] DESIGN

[14] SHAFT ROTATION (Viewed from shaft end)

L - Counterclockwise
Omit - Clockwise

Table 2. Model Code Breakdown

Section II - DESCRIPTION

A. GENERAL

The single and double gear pumps in this series are used to provide fluid flow for the operation of hydraulic driven machinery. The double pump (Figure 2) consists of two single pumps, each having its own outlet port, sharing a common inlet port and input shaft. It is a compact power source capable of either serving two separate hydraulic circuits, or supplying greater volume to a single circuit through the combined delivery of both pumps. Since the entire unit requires only one inlet connection and one mounting and drive point, the cost of the total hydraulic installation is generally lower than using two single pumps. The pumps are cast iron construction for reliability, strength and improved sound reduction. All gear pumps are assembled for either clockwise or counterclockwise rotations.

These latest design single gear pumps (Figure 1) have been developed for increased pressure ratings, improved low speed capability, better overall efficiency, enhanced flexibility and improved reliability. The all cast iron construction adds to pump durability and noise reduction. The high pressure capacity and high speed, allows for efficient power transmission in a small sized package.

B. ASSEMBLY AND CONSTRUCTION

Basic Pumps - The pumps illustrated in Figures 1, 1a, and 2 are representative of all double and single pumps in this series. The gear pump consists of a port section, front and rear cover, adaptor section (double pump), center section, drive gears, driven gears, wear plates, seal packs, shaft seals, and shaft couplings (double pump). Thru-drive models have different port housing subassemblies and drive gear shafts along with SAE drive couplings.

The one piece shaft/gear construction provides maximum strength and allows the use of large bushings for greater load carrying capacity. The gears are carburized, hardened and ground to a super finish. A ten-tooth gear design reduces pressure ripple and provides quiet operation. The bushing provides a lead and PTFE impregnated overlay on a bronze backed steel bushing to assure superior lubrication under all conditions and gives optimum shaft alignment. The bushings adjust to shafts that are deflected by high hydraulic loads. This greatly increases the life of the pump. The deflectable bronze-faced wear plates are axially pressure loaded and balanced to minimize running clearances and leakage across gear faces, thus increasing operating efficiency.

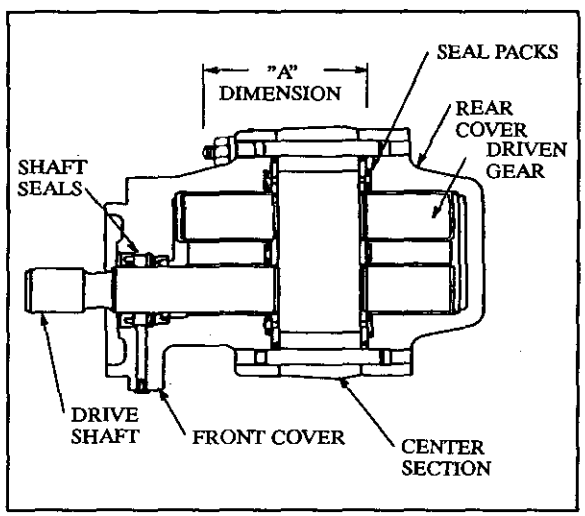


Figure 1. Single Gear Pump Section View

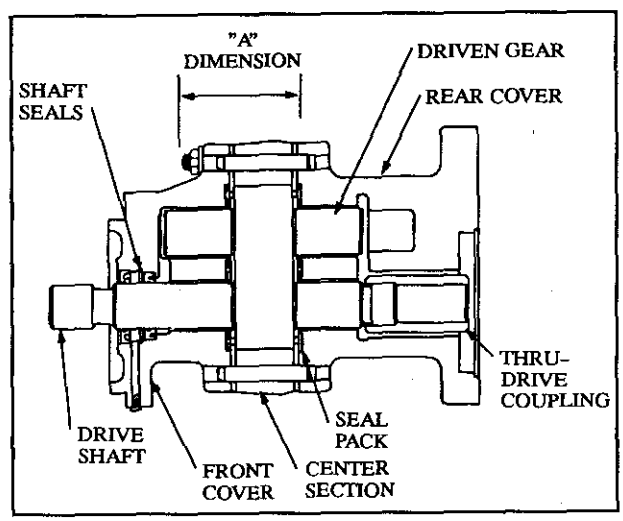


Figure 1a. Thru-Drive Single Gear Pump Section View

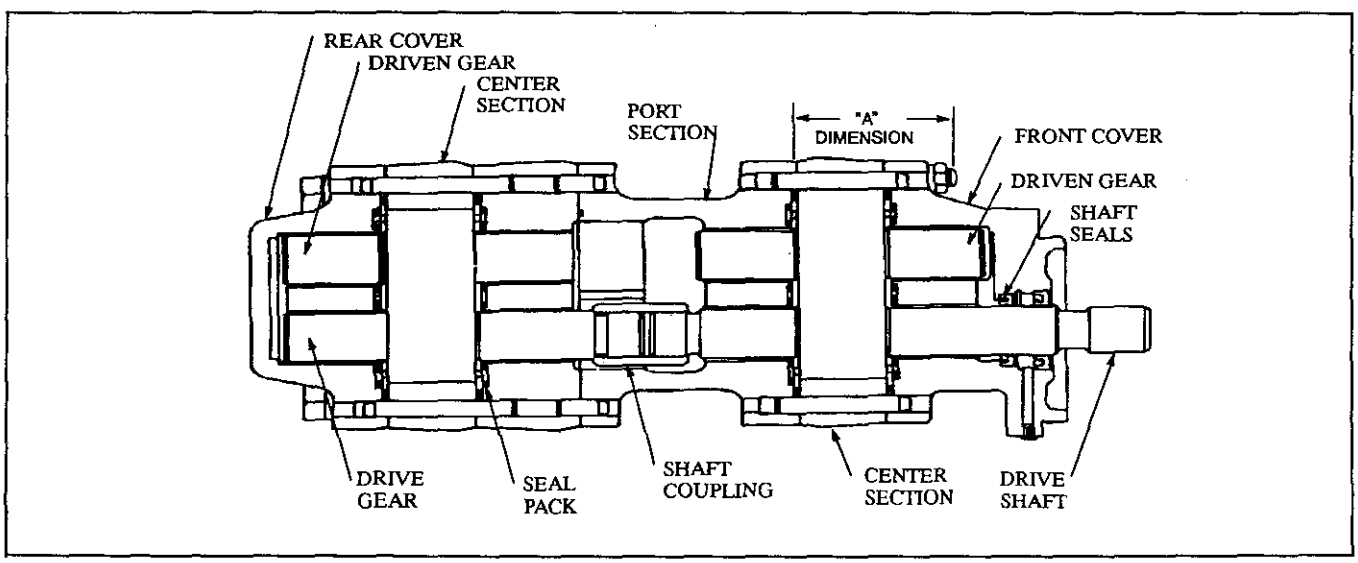


Figure 2. Basic Double Pump Construction

Section III – PRINCIPLES OF OPERATION

Operation of the single and double gear pumps is essentially the same. Rotation of the drive and driven gears causes the inlet pressure to decrease. Fluid, pushed into the inlet by atmospheric pressure, is carried to the outlet in chambers formed between the gear teeth and the center section. As the gear teeth mesh, the fluid is forced out through the outlet. The interaction of these two gears, which are the only moving parts within the pump, provide a continuous transfer of fluid from inlet to outlet. Changes in pump volume are accomplished by increasing or decreasing pump speed.

The double gear pump is essentially two single gear pumps united with a port section and shaft coupling. The inlet port is located in the port section and is common to both pumps.

Refer to Figure 3.

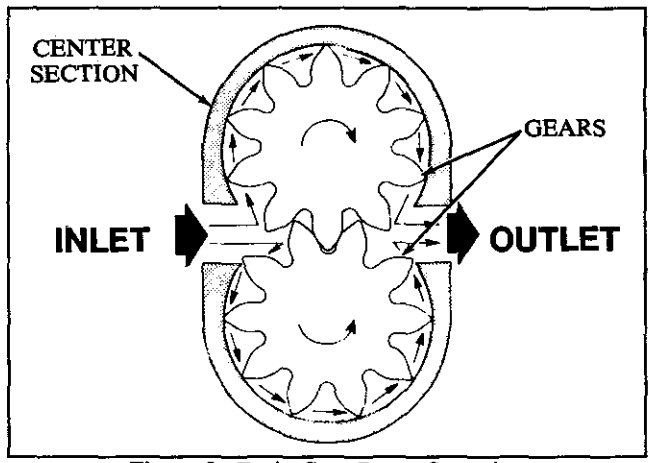


Figure 3. Basic Gear Pump Operation

Section IV – INSTALLATION AND OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The parts drawings listed in Table 1 are available from any sales engineer or authorized distributor.

B. MOUNTING AND DRIVE CONNECTIONS

High performance single and double gear pumps are designed for S.A.E. standard wet flange mountings and are available with single or double shaft seals. Mounting pads meet S.A.E. standards and are available in several sizes and types.

1. Direct Drive – A pilot on the mounting flange (Figure 4) assures correct mounting and shaft alignment, provided the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening all flange mounting screws to prevent misalignment. Shaft keys and couplings must be properly seated to avoid slipping and possible shearing. Proper coupling alignment is essential to prolong pump life.

CAUTION

Shafts are designed to be installed in couplings with a slip fit or very light press. Pounding the coupling on the shaft can ruin the bushings and wear plates. Shaft tolerances are shown on the pump installation drawings. (See Table 1.)

2. Indirect Drive – An indirect drive mounting is subject to engineering approval.

C. SHAFT ROTATION

NOTE

The gear pumps are normally assembled for right hand (clockwise) rotation as viewed from the shaft end. Pumps made for left hand (counterclockwise) rotation are identified by an "L" in the model code. (See Table 2.)

CAUTION

Never drive a pump in the wrong rotation. Damage may result to the shaft seal and seal packs.

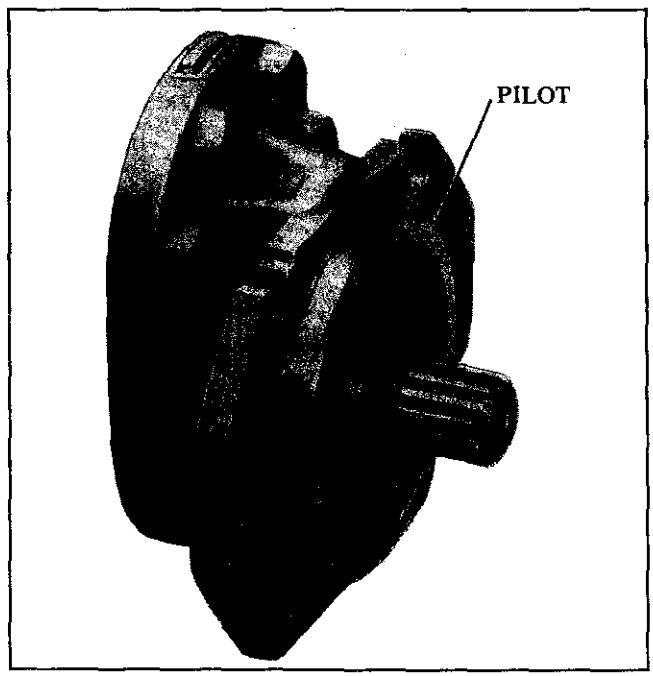


Figure 4. Front Cover Mounting Pilot

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wirebrushing and pickling.

NOTE

For instructions on pickling, refer to sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage, use only as many fittings and connections as necessary for proper installation.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulance and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

E. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components.

For Mobile applications, order data sheet M-2950-S. For Industrial applications, order data sheet I-286-S.

The oil recommendations noted in the data sheets are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, contact your nearest sales or engineering representative.

F. CLEANLINESS

To insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of fluid to prevent introduction of contaminants into the system.

3. Provide continuous fluid filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.

5. Proper servicing of filters, breathers, reservoirs, etc., cannot be overemphasized.

6. Good system and reservoir design will insure aeration of fluids is kept to a minimum.

G. SOUND LEVEL

Noise is indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at startup temperatures can cause the loudest noises due to cavitation.

2. Running with a moderately high viscosity fluid will slow the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir and will be recycled through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings, or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similr to cavitation.

4. Contaminated fluids can cause excessive wear of internal pump parts, which may result in increased sound levels.

H. OVERLOAD PROTECTION

Relief valves must be installed in the system as close to the pump outlets as possible. The relief valves limit pressure in each system to a prescribed maximum and protects components from excessive pressure. Each relief valve pressure setting depends on the work requirements of the circuit being fed and should not exceed the pressure ratings of the pump.

I. STARTUP

Whenever it is possible to do so, fill the pump ports with system fluid. This will make it easier for the pump when it is first started.

Self Priming – With a minimum drive speed of 600 RPM, a pump should prime immediately. Failure to prime within a short length of time may result in damage due to lack of lubrication. Inlet lines must be tight and free from air leaks. However, it may be necessary to loosen a fitting on the outlet side of the pump to allow entrapped air to escape.

No Load Starting – These pumps are designed to start up with no load on the pressure ports. They should never be started against a load or a closed center valve.

Section V – SERVICE, INSPECTION & MAINTENANCE

A. SERVICE TOOLS

No special tools are required for the disassembly or assembly of the gear pumps with the exception of a shaft seal driver for the G20** and G30**. See Figures 5 through 8. The following standard tools are required:

1. Screwdriver (6 inch)
2. Socket set with ratchet (½ inch drive)
3. Plastic hammer (Computhane, Model X-1 HD, or equivalent)
4. Torque wrench box end adapter (Sturtevant Co. P/N BX-11/16)
5. Torque wrench box end adapter (Sturtevant Co. P/N BX-7/8)
6. Torque wrench (0-200 lb. ft.)
7. Torque wrench (0-200 lb. in.)
8. Internal retaining ring pliers (Truarc #23)

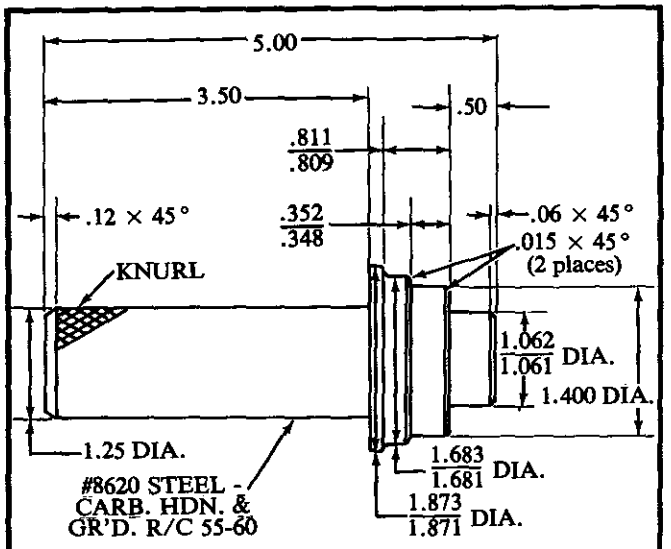


Figure 5. Inner Seal Driver

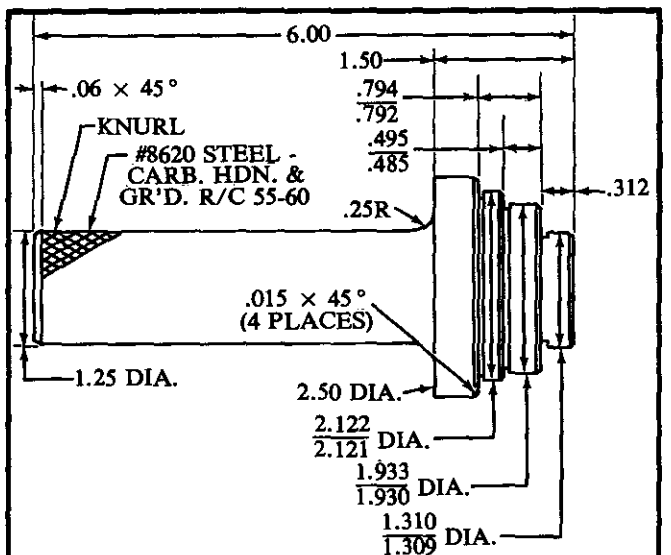


Figure 6. Inner Seal Driver

MODEL	'A' DIA. (inch)	'B' DIA. (inch)	'C' DIA. (inch)	'D' DIA. (inch)	'E' DIA. (inch)
G20**-2	4.002 / 4.004	4.500	2.298 / 2.300	7.00	5.50
-6					
G20**-7	5.002 / 5.004	5.500	2.298 / 2.300	8.00	6.50
G30**-4					
-7					
-8					

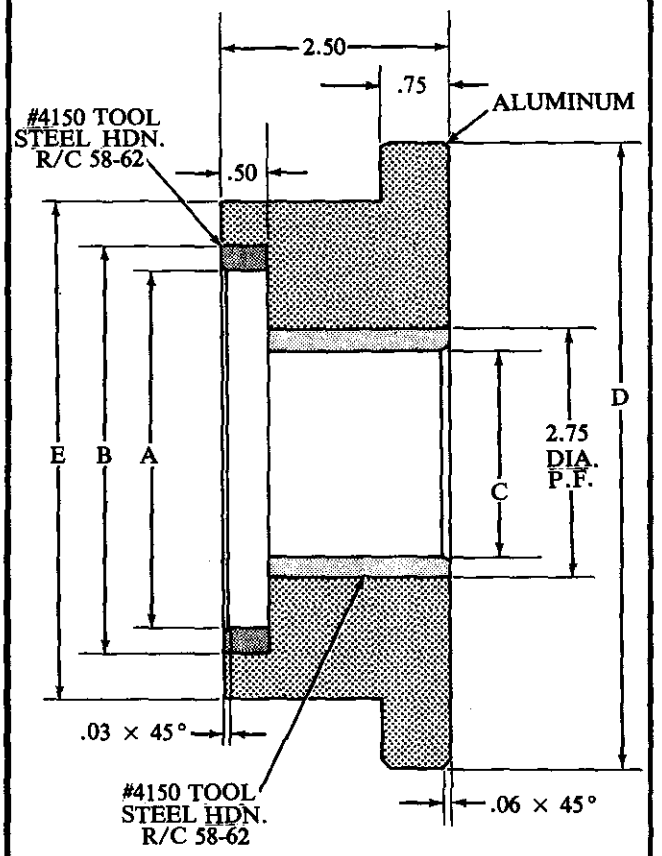


Figure 7. Guide

Model	'A' Dia. (inch)	'B' Dia. (inch)	'C' Dia. (inch)	'D' Dia. (inch)	'E' (inch)	'F' Drill (inch)	'G' (inch)	'H' (inch)
G20**	1.078 / 1.068	1.312 ± .001	1.870 / 1.865	2.2965 / 2.2960	.091 / .089	1.250 × 3.000	3.50	2.50
G30**	1.325 / 1.315	1.562 ± .001	2.125 / 2.115	2.2965 / 2.2960	.084 / .082	1.500 × 3.000	3.50	2.50

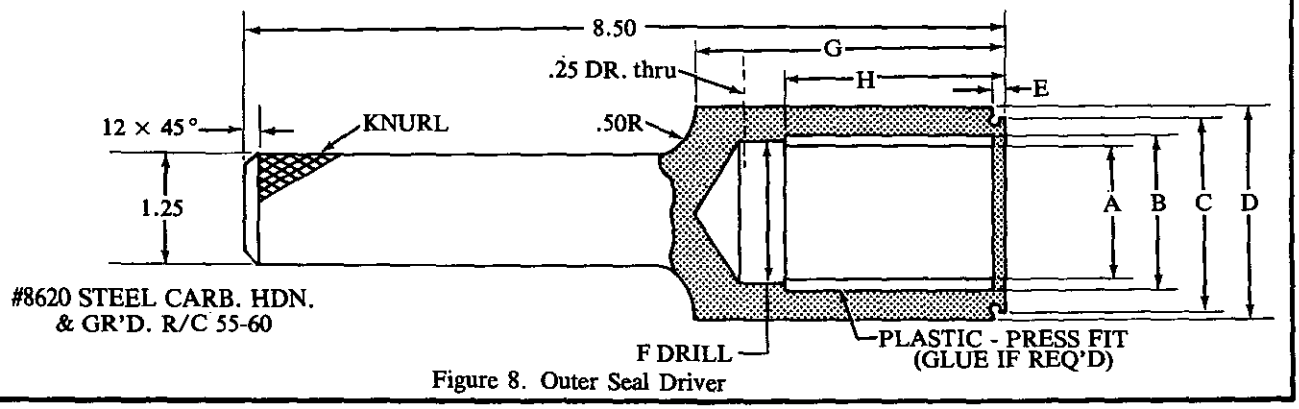


Figure 8. Outer Seal Driver

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump may result. In suction or return lines, loose connections permit air to be drawn into the system, resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be thoroughly drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak.

5. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic components. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from getting into the system.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the input drive shaft coupling should be specified by its manufacturer.

F. REPLACEMENT PARTS

Reliable operation throughout the specified range is assured only if genuine manufacturer's parts are used. Sophisticated design proceses and materials are used in the manufacture of our parts. Substitutions may result in early failure. Parts service drawings are shown in Table 1.

G. TROUBLESHOOTING

Table 3 lists the common difficulties experienced with gear pumps and hydraulic systems. It also indicates the probable causes and remedies for each of the troubles listed.

TROUBLE	CAUSE	REMEDY
I. Excessive noise	1. Low oil level in reservoir 2. Air in system 3. Oil too thick 4. Damaged or missing seals inside pump	Fill reservoir to proper level. Bleed hydraulic lines at highest point downstream of pump. Warm up pump in cold weather. Locate and replace seals.
II. Pump overheating	1. Heat exchanger not functioning properly 2. Bushings partially seized inside unit 3. Pump assembly incomplete	Locate and repair. Locate and replace necessary parts. Check pump assembly
III. System not developing pressure	1. Relief valve stuck open 2. Gear pump assembled for opposite rotation 3. Pump inlet/outlet connections reversed 4. Disconnected or broken drive mechanism	Repair or replace. Reassemble pump for proper rotation. Reverse inlet/outlet connections. Repair or replace.
IV. Pump delivery (flow) too low	1. Burrs on mating surfaces 2. Damaged or missing seals inside unit 3. Center section/gear clearance not to specification	Disassemble unit and remove burrs. Replace damaged or missing seals. Return to shop for evaluation and repair.
V. Loss of fluid	1. Ruptured hydraulic line 2. Leaking or missing seals 3. Bolts or nuts not torqued to specifications 4. Seized bushings	Replace ruptured line. Replace seals. Torque to specifications. Replace necessary parts.

Table 3. Troubleshooting Chart

Section VI – OVERHAUL OF SINGLE GEAR PUMP

A. GENERAL

During disassembly, pay particular attention to identification of the parts for correct assembly. Figure 10 is an exploded view which shows the proper relationship of parts for disassembly and subsequent assembly.

> WARNING
> Before breaking a circuit connection make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure. Plug all removed units and cap all lines to prevent the entry of dirt into the system.

B. DISASSEMBLY

A clean work area is most essential for disassembly of the pump. A work bench, bench vise (6 inch), cleaning tank and shop air are also useful. Kraft paper to layout disassembled parts should be used. Due to the similarity of parts, they should be placed in an orderly maner on the Kraft paper to avoid mixing the parts during assembly. All shaft seals, 'O' rings and seal packs removed must be discarded and replaced with new.

Disassemble the single gear pump as follows: (Refer to Figure 10)

1. Secure cover S/A (3) in a vise.

a. Remove the eight screws (1) and eight washers (2). Remove bolts, washers and studs if applicable.

b. Gently lift cover S/A (4) from center section (9).

c. Remove wear plate (10) from cover S/A (4).

d. Remove drive gear (12) and driven gear (6) from center section (9).

e. Removal of center section (9) from cover S/A (3) may require the use of a plastic hammer.

f. Remove wear plate (8) from cover S/A (3).

g. Remove seal retainers (7) and seal glands (6) from cover S/A (4) and cover S/A (3).

h. Remove and discard seal glands (6).

i. Remove and discard 'O' rings (5 and 15) from cover S/A (4) and cover S/A (3).

ITEM	NOMENCLATURE	QTY
1	Screw	8
2	Washer	8
3	Cover S/A	1
4	Cover S/A	1
5	'O' Ring	2
6	Seal Gland	2
7	Seal Retainer	2
8	Wear Plate	2
9	Center Section & Pin S/A	1
10	Driven Gear	1
11	Drive Gear	1
12	Shaft Seal (Inner)	1
13	Retaining Ring – if applicable	1
14	Shaft Seal (Outer) – if applicable	1

Figure 9. Single Pump Part Nomenclature

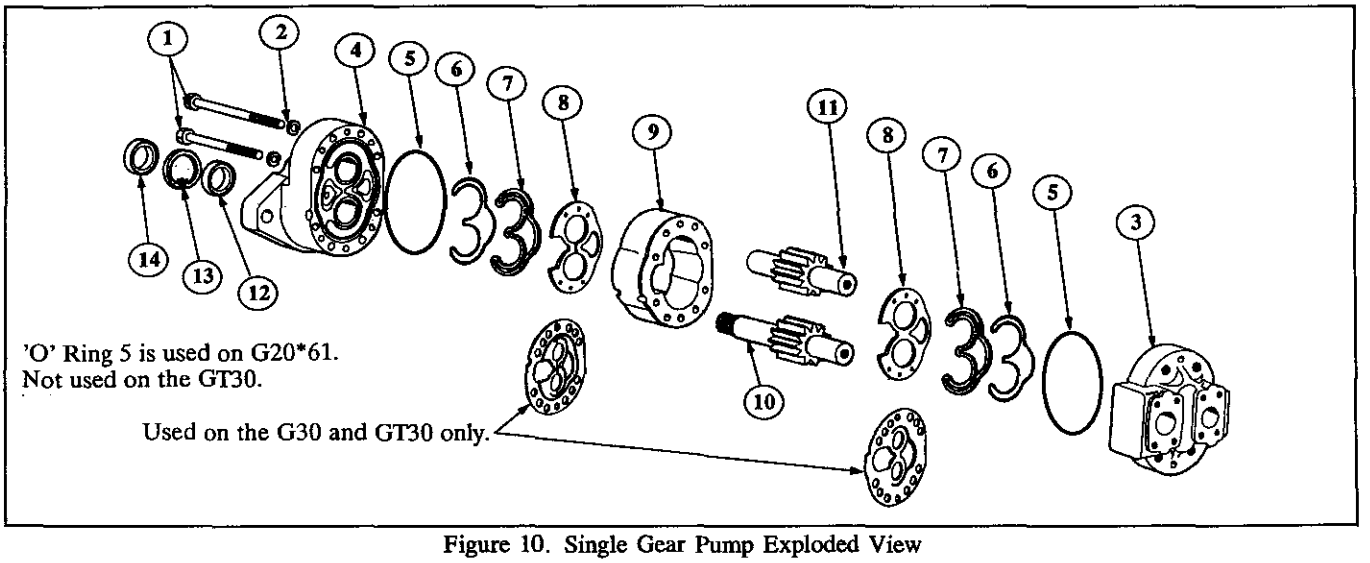


Figure 10. Single Gear Pump Exploded View

j. Remove shaft seal (14) from cover S/A (4) if applicable.
k. Remove retaining ring (13) if applicable.
l. Remove shaft seal (12) from cover S/A (4).

This completes the disassembly of a single gear pump.

C. INSPECTION AND REPAIR – Single Gear Pumps

Cleaning – All parts must be thoroughly cleaned and kept clean during inspection and assembly. Close tolerance of parts makes this requirement very important. Paint found on the edges of all parts must be removed. Clean all removed parts, using a commercial solvent that is compatable with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination.

1. Cover S/A – To remove the shaft seal, perform the following steps:

a. Place cover S/A (4) in a vise (mounting flange up). Using a screwdriver, pop out the outer shaft seal (if applicable) being careful not to raise a burr on the shaft seal bore.

b. Remove the retaining ring (if applicable) with internal retaining ring pliers.

c. Remove cover S/A (4) from vise and place on work bench with mounting flange down. Using a bronze drift and hammer, drive the inner shaft seal out through the mounting flange, being careful not to damage the bearing surface.

d. Inspect the drive (10) and driven gear (11) bushings of cover S/A (4) and cover S/A (3) for pickup, scoring, discoloration or excessive wear. Any of the preceding conditions shall warrant replacement of the cover S/A's. Inspect mounting flange for nicks and burrs. Remove with india stone.

2. Wear plates (8) – Inspect for erosion, pitting, scratches and/or scoring. Replace if necessary.

3. Center section (9) – Inspect for porosity, cracks, and scratches (.010 or deeper). Replace if necessary. DO NOT deburr the figure eight edges of the center section.

4. Drive gear (12) – Inspect splines for nicks or excessive wear. Inspect gear journals for scratches and discoloration. Any discoloration warrants replacement. Inspect gear teeth for spalling, scratches and/or excessive wear. Replace if necessary. Stoning teeth to remove burrs is permissable. The face of the gear teeth should also be inspected for scratches and cracks.

5. Driven gear (6) – Same procedure as step 4.

D. ASSEMBLY

NOTE
Coat all parts with clean hydraulic fluid to aid in assembly and provide initial lubrication. Use small amounts of petroleum jelly to hold seal retainer and seal in place during assembly.

1. Assemble seals (6) into seal retainers (7). Note seal retainer must be assembled with the flat side facing the wear plate.

NOTE
Steps 1.a. and 1.b. pertain to installation of cover S/A (4) shaft seals. Lubricate the shaft seals with Marfak #1 grease to provide initial lubrication.

a. Install inner shaft seal (12) into cover S/A (4). Make sure the spring loaded member of shaft seal faces the inside of pump. Use one of the shaft seal drivers shown on page 6. Place the shaft seal on driver and press in place.

b. Double shaft seal arrangement – Perform step 1.a. and install retaining ring (13) then install outer shaft seal (14) into cover S/A (4). Install outer shaft seal (14) as follows: Place a guide over the pilot diameter of cover S/A (4). Next, install a new outer shaft seal (14). Make sure the spring loaded member of shaft seal faces the inside of the pump. Finally, insert the driver and shaft seal through the guide and press in place.

c. Install "O" ring (5), seal retainers and seals against cover S/A (3) and cover S/A (4).

d. Lubricate bronze face of wear plates (8). Install center section (9) on wear plates (8). Bronze surfaces of wear plates must face gears. Make sure wear plates and center section set flush against cover S/A (3).

e. Tape the spline area of drive gear (11) to prevent cutting shaft seals during assembly.

f. Lubricate drive gear (11) and driven gear (10). Install drive gear (10) and driven gear (11) into cover S/A (3).

NOTE
On pumps that use studs install taper-lock stud in port section. Torque studs in cover section to 33.9-47.5 N.m (25-35 lb. ft.) The length from face of port section to the end of stud must be a required length. Figures 1 and 2 show the location of the "A" dimension. Refer to the appropriate Service Literature for the dimension size.

g. Carefully position cover S/A (4) over studs (1), gears and center section guide pins. Gently slide over the gears until it is flush against wear plate (10). Align notches on covers to center section.

h. Lubricate screw threads (1) with hydraulic fluid. Install washers (2). Torque all screws or nuts to 70 ft. lbs. (± 5 ft. lbs.) on G20's and 150 ft. lbs. (±5 ft. lbs.) on G30 models.

i. Turn the drive gear (12) one revolution with a suitable socket wrench. No binding can be evident during this operation. The breakaway torque necessary to turn the drive gear must not exceed 35 lb.in. after assembly.

Section VII – OVERHAUL OF DOUBLE GEAR PUMPS

A. DISASSEMBLY

Refer to single gear pump disassembly (Section VI) GENERAL procedures before proceeding. (Refer to Figure 12.)

1. Cover end pump disassembly – The G2020, G3020 and G3030 cover end pumps are disassembled in the same manner. Clamp the port section (16) in a vise with protective jaws to avoid damage to the port section's machined surfaces. Disassemble the cover end pump as follows:

a. Remove the four short screws (1) and four washers (2).

b. Remove the four long screws (3) and four washers (2).

c. Remove the rear cover (4). Remove wear plate (7). Remove "O" ring (5), if applicable, and seal gland (6) and seal retainer from rear cover and discard.

d. Remove wear plate (7) from center section (10).

e. Remove drive gear (8) and driven gear (9) from center section (10).

f. Removal of the center section (10) from wear plate (7) may necessitate the use of a plastic hammer.

g. Lift wear plate (7) from adapter section.

h. Remove seal gland (12) from adapter section and discard.

i. Remove adapter section and "O" ring (5) and discard from port section (15).

j. Remove "O" ring (14) from port section (15) and discard.

k. Remove gear coupling (13) from port section (15).

This completes the disassembly of the cover end gear pumps.

2. Shaft end pump disassembly – G2020, G3020 and G3030 shaft end pumps disassembled in the same manner. With the port section clamped in a vise as previously described, disassemble the shaft end pump as follows:

a. Remove eight nuts (16) and eight washers (17).

b. Remove front shaft end cover (18). Remove wear plate (7).

c. Remove seal gland (6) and "O" ring (5) from shaft end cover (18) and discard.

d. Remove drive gear (20) and driven gear (19) from center section (21).

e. Removal of the center section (21) may necessitate the use of a plastic hammer.

f. Remove wear plate (7) from port section (15).

g. Remove seal gland (6), seal retainer (12), and "O" ring (5) from port section (15) and discard.

This completes disassembly of the shaft end pump.

CAUTION

If the shaft end pump or the cover end pump is suspected of failure, both pumps must be disassembled and inspected.

ITEM	NOMENCLATURE	QTY	ITEM	NOMENCLATURE	QTY
1	Screw (short)	4	14	"O" Ring	1
2	Lock Washer	8	15	Port Section & Pins	1
3	Screw (long)	4	16	Nut	8
4	Rear Cover S/A	1	17	Lock Washer	8
5	"O" Ring	4	18	Shaft End Cover S/A	1
6	Seal Retainer	4	19	Driven Gear	1
7	Wear Plate	4	20	Drive Gear	1
8	Drive Gear	1	21	Center Section	1
9	Driven Gear	1	22	Shaft Seal (outer)	1
10	Center Section	1	23	Retaining Ring	1
11	Adapter Section	1	24	Shaft Seal (inner)	1
12	Seal Gland	4	25	Stud	8
13	Coupling	1	26	Plug	1

Figure 11. Part Nomenclature

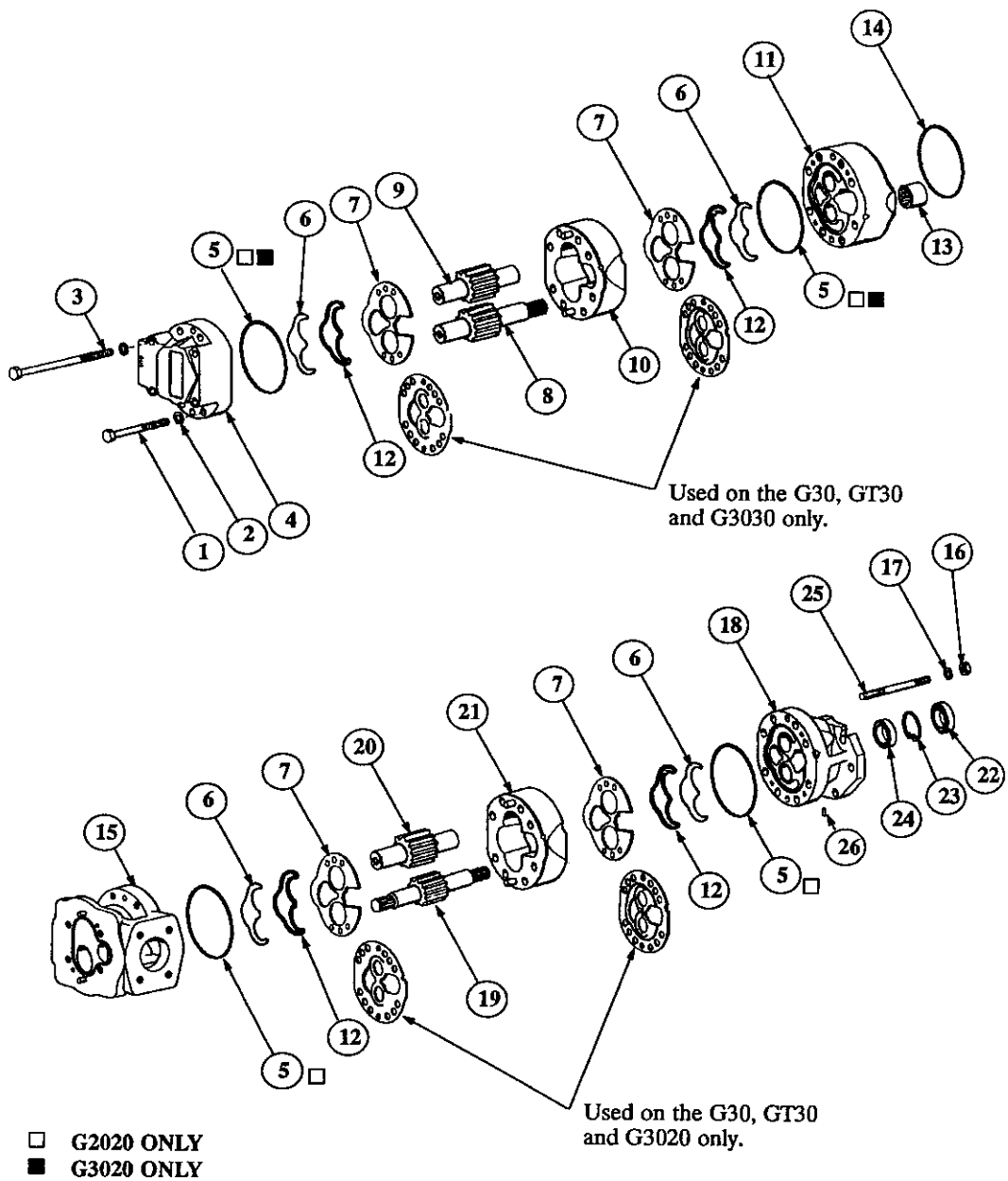


Figure 12. Double Gear Pump, Exploded View

B. INSPECTION AND REPAIR

Cleaning – All parts must be thoroughly cleaned and kept clean during inspection and assembly. Close tolerance of parts makes this requirement very important. Paint found on the edges of all parts must be removed. Clean all removed parts, using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination.

A new seal kit is required for assembly. Refer to parts drawing noted in Table 1 for seal kit numbers. Wash the metal parts, blow them dry with air and place on a clean surface (Kraft paper) for inspection.

1. Front cover S/A – To remove the double shaft seal, perform the following steps:

a. Place front cover S/A in a vise (mounting flange up). Using a screwdriver, pop out the outer shaft seal (22) being careful not to raise a burr on the shaft seal bore.

b. Remove the retaining ring (23) with internal retaining ring pliers.

c. Remove front cover S/A (18) from vise and place on work bench with mounting flange down. Using a bronze drift and hammer, drive inner shaft seal (24) out through mounting flange being careful not to damage bearing.

d. Inspect the drive and driven gear bushings of shaft end cover (18) for pickup, scoring, discoloration or excessive wear. Any of the preceding conditions shall warrant replacement of the front cover S/A. Inspect mounting flange for nicks and burrs. Remove with India stone.

2. Wear plates (7), – Inspect for erosion, pitting, scratches and/or scoring. Replace if necessary.

3. Center sections (10) and (21) – Inspect for porosity, cracks, and scratches (.010 or deeper). Replace if necessary. DO NOT deburr the figure eight edge of the center section.

4. Drive gears (8) and (19) – Inspect splines for nicks or excessive wear. Inspect gear journals for scratches and discoloration. *Any discoloration warrants replacement.* Inspect gear teeth for spalling, scratches and/or excessive wear. Replace if necessary. Stoning teeth to remove burrs is permissable. The face of the gear teeth should also be inspected for scratches and cracks.

5. Driven gears (9) and (20) – Same procedure as step 4.

6. Port section (15) – Inspect the drive and driven gear bushings for pickup, scoring, discoloration and/or wear. *Any of the preceding conditions shall warrant replacement of the port section.* Inspect inlet flange for nicks and burrs. Stone to remove. Inspect studs (25) for cross threads, cracks and burrs. If studs are defective, remove as follows: Install a nut (16) on the stud as far as possible. Then install another nut over the first one and tighten to lock in place. Apply torque to the first nut and remove the stud. Refer to parts drawing noted in Table 1 for stud part numbers and installation instructions.

7. Adapter Section (11) – Inspect the drive and driven gear bushings for pickup, scoring, discoloration and/or wear. *Any of the preceding conditions shall warrant replacement of the adapter.*

8. Rear cover (4) – Inspect the drive and driven gear bushings for pickup, scoring, discoloration and/or wear. *Any of the preceding conditions shall warrant replacement of the rear cover.*

C. ASSEMBLY

To assemble double gear pumps: first, assemble the cover end pump, second, assemble the shaft end pump, third, assemble the cover end pump to the shaft end pump.

NOTE

Coat all parts with clean hydraulic fluid to facilitate assembly and provide initial lubrication. Use small amounts of petroleum jelly to hold seal packs (seal gland and retainer) in place during assembly.

1. Assemble seal packs by inserting the seal glands into the seal retainers. Install seal packs on the following parts prior to assembly with the seal retainers wear plates.

a. Install "O" ring (5) and seal retainer (6) and seal gland (12) into cavity located on face of rear cover (5).

b. Install "O" ring (5) and seal retainer (6) and seal gland (12) into cavity located on face of adapter (10).

c. Install seal retainer (6) and seal gland (12) into cavity located on face of port section (15).

2. Shaft end pump assembly – Place port section (16) in vise with studs facing up. Assemble the shaft end of pump as follows:

NOTE

The following steps (3.a. and 3.b.) pertain to installation of front cover shaft seals. Lubricate the shaft seal(s) with Marfak grease to provide initial lubrication.

a. Install inner shaft seal (24) into front cover (18). Make sure the spring loaded member of shaft seal faces the inside of pump. Use one of the shaft seal drivers shown in Table 4. Place the shaft seal on driver and press in place. Install retaining ring (23) into front cover on top of shaft seal.

MODEL	USE DRIVER SHOWN IN
G20**-61st Design	Figure 5
G30**-32nd Design	Figure 6

Table 4. Inner Shaft Seal Drivers

b. Double shaft seal arrangement – Perform step 3.a. and then install the outer shaft seal (22) into front cover. Install outer shaft seal as follows: Place a guide over the pilot diameter of front cover. Next, install a new outer shaft seal (22) on the driver. Make sure the spring loaded member of shaft seal faces the inside of pump. Finally, insert the driver and shaft seal through the guide and press in place. Refer to Table 5 for proper guide and driver.

MODEL CODE (Mounting)	PILOT DIA. (Inches)	GUIDE	DRIVER
G20**-2	4.00	See Figure 7	See Figure 8
G20**-6	4.00		
G20**-7	5.00		
G30**-4	5.00		
G30**-7	5.00		
G30**-8	5.00		

Table 5. Outer Shaft Seal Guide and Driver

c. Place wear plate (7) on port section (15) with bronze face up and notch facing inlet port.

d. Lubricate bronze face of wear plate (7). Install center section (21) on top of wear plate (7) and into locating holes of port section (15) with major diameter facing port section and notch facing inlet port. Make sure wear plate and center section set flush against port section.

e. Tape the spline area (long spline) of drive gear (19) to prevent cutting shaft seal(s) during assembly.

f. Lubricate drive gear (19) and driven gear (20). Install drive gear (19) into port section (15) with short spline towards port section. Install driven gear (20).

g. Lubricate bronze face of wear plate (7). Install wear plate (7) over locating pins of center section (G30 series) (21) with bronze face towards center section and notch facing inlet port.

h. Install seal retainer (16) and seal gland (12) into cavity located on face of shaft end cover (18). Install "O" ring (5). Apply petroleum jelly around seal pack area on face of front cover.

i. Carefully position shaft end cover (18) over studs, gears and center section guide pins. Gently slide shaft end cover over the gears until it is flush against wear plate (7).

j. Lubricate stud (25) threads with hydraulic fluid. Install washers (17) and nuts (16) on ends of studs. Cross torque nuts to 150±5 lb.ft. on G30** series and 70 ±5 lb.ft. on G20** series.

3. Clamp port section (15) into vise with studs facing down. Make sure port section is clamped securely. Assemble rear cover portion of pump as follows:

a. Install "O" ring (14) into groove located on face of port section (15). Install "O" ring (5).

b. Install lubricated coupling (13) on spline of drive gear (19). Install cover end pump.

c. Lubricate locating pins and face of port section (15). Install adapter section (11) over locating pins of port section with notch facing inlet port.

d. Place wear plate (7) on adapter section (11) with bronze face up and notch facing inlet port.

e. Lubricate bronze face of wear plate (7) with clean hydraulic fluid. Install center section (10) on top of wear plate (7) with major diameter facing the wear plate and the notch facing inlet port. Locating pins of center section should mate with adapter section (11) holes.

f. Make sure the assembly thus far is flush and solid. Lubricate the drive gear (8) and driven gear (9). Install both gears in place. The splined end of drive gear (8) must engage into coupling (13).

g. Lubricate bronze face of wear plate (7) and place over locating pins of center section (10) with bronze face down and notch facing inlet port.

h. Lubricate seal retainer (6) area and face of real cover (4) with petroleum jelly. Carefully place rear cover (4) over locating pins of center section (10) with outlet port opposite inlet port.

i. Lubricate threads of four long screws (3). Place lock washers (2) on screws. Install screws through rear cover (4) and into port section (15). Cross torque screws to values shown in Table 6.

j. Lubricate threads of four short screws (1). Place lock washers (4) on screws. Install screwws through rear cover (4) and into adapter section (11). Cross torque screws to values shown in Table 6.

MODEL	TORQUE (lb. ft.)
	REAR COVER SECTION
G2020	65-75
G3020	65-75
G3030	145-155

Table 6. Rear Cover Screw Torque

4. Turn the drive gear (19) one revolution with a suitable socket wrench. No binding shall be evident during this operation. The breakaway torque necessary to turn the drive gear must not exceed the values noted in Table 7.

MODEL	TORQUE (lb. in.)
G2020	140
G3020	150
G3030	160

Table 7. Breakaway Torque

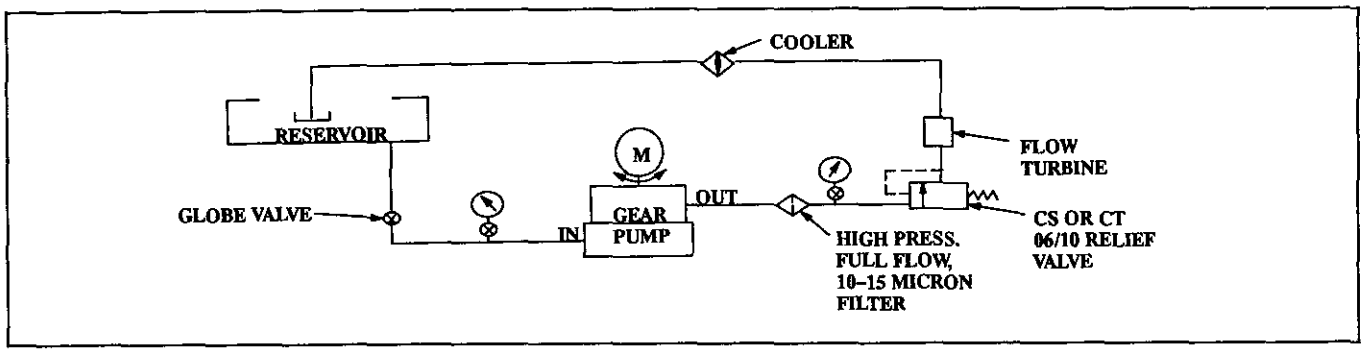


Figure 13. Single Pump Test Circuit

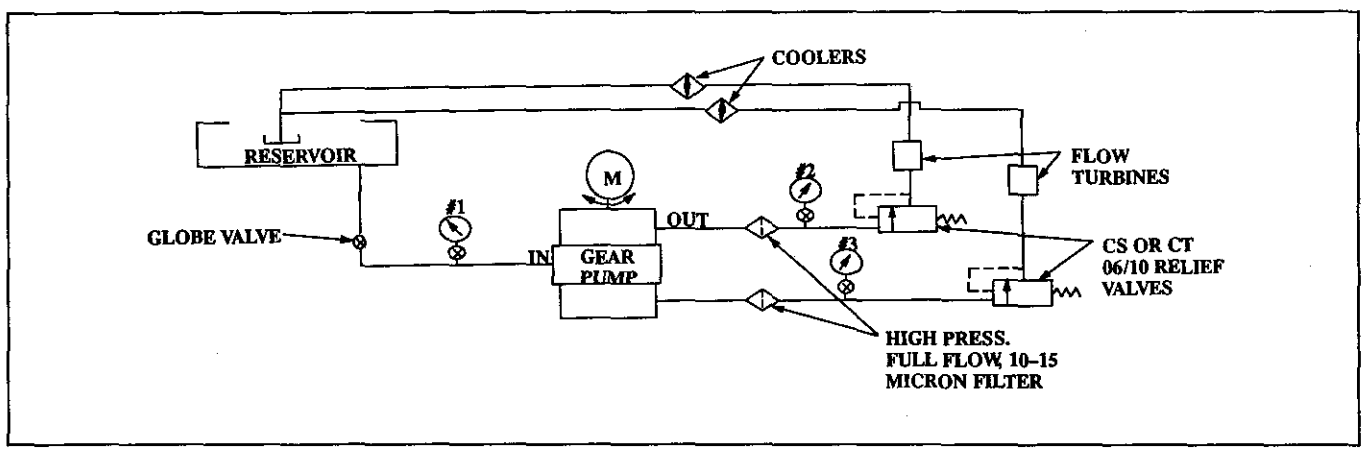


Figure 14. Double Pump Test Circuit

A. BREAK-IN TEST CONDITION

Test Fluid – Hydraulic fluid in accordance with data sheet M-2950-S or I-286-S and having a viscosity between 50 and 80 SUS at 180°F.

Fluid Temperature – Fluid at pump inlet to be maintained at 180°F +10/−40.

Filtration – A high pressure, full flow, 10-15 micron filter system must be fitted immediately after pump outlet to catch particles generated during break in period. The filter system shall not develop back pressure in excess of 50 PSIG at maximum flow.

Inlet Condition – A flooded inlet that maintains 0-15 PSIG at pump inlet port.

B. BREAK-IN TEST PROCEDURE

1. Install gear pump into circuit as shown in Figures 13 and 14. Make sure full flow, 10-15 micron high pressure filters are installed at pump outlets. Be sure all connections are tight and the motor is set for proper pump rotation.

2. Fully open globe valve to allow fluid to enter gear pump. Back off relief valve to minimum setting.

3. Turn on system using normal start up procedure.

4. Slowly increase motor speed to the test RPM as shown in Tables 8 and 9. (NOTE: Inlet pressure gauges should read 0-15 PSIG. Outlet pressure gauges should read 100-150 PSIG.)

NOTE
During the following steps DO NOT hold maximum pressure during each cycle more than two seconds.

5. Slowly increase relief valve setting to 500 PSIG. Immediately back off relief valve to minimum setting (approx. 100 PSIG). Repeat this step five times.

6. Set relief valve to 500 PSIG. Warm up system fluid to 180°F +10/−40.

7. When system fluid temperature is obtained, cycle gear pump five times from 100 PSIG to 1000 PSIG at test RPM (see Tables).

8. At test RPM, cycle gear pump five times at intervals of 500 PSIG until maximum pressure setting is achieved. See Tables 8 and 9 for maximum pressure settings.

9. Repeat step 8, and cycle pump 10 times per pressure setting.

10. Maintain rated pressure setting and check minimum flow of pump as shown in Tables 8 and 9.

NOTE
During the preceding test there should be no evidence of external leakage.

MODEL	NOM. DEL. @ 1200 RPM @ 100 PSIG	TEST RPM	TEST PRES. PSI	MIN. FLOW @ TEST CONDITIONS USGPM
G2*-**7**	7	2500	3600	9.6
-9	9	2500	3600	13.7
-11	11	2500	3600	17.7
-13	13	2500	3600	22.2
-15	15	2200	3600	23.0
-17	17	2200	3300	25.5
-19	19	2200	3000	30.3
-21	21	2200	2750	33.6
-24	24	2200	2250	39.0
-27	27	2200	2000	44.4
G30-18	18	2500	3600	25.6
-21	21	2500	3600	31.0
-25	25	2500	3600	38.0
-28	28	2500	3300	50.3
-30	30	2200	3300	47.5
-32	32	2200	3000	51.8
-35	35	2200	3000	57.0
-40	40	2200	2500	66.8
-45	45	2200	2250	76.3
-50	50	2200	2000	85.7

Table 8: Single Gear Pump Test Ratings

MODEL	NOM. DEL. @1200 RPM @ 100 PSIG	TEST RPM	TEST PRES. PSI	MIN. FLOW @ TEST CONDITIONS USGPM
G20**7**-**	7	1800	3600	5.0
G20**9	9	1800	3600	8.0
G20**11	11	1800	3600	11.0
G20**13	13	1800	3600	14.0
G20**15	15	1800	3600	16.7
G20**17	17	1800	3300	20.0
G20**19	19	1800	3000	23.6
G20**21	21	1800	2750	26.3
G20**24	24	1800	2250	31.0
G20**27	27	1800	2000	35.0
G20**30	30	1800	1000	41.4
G30**18-****	18	1800	3600	19.3
G30**21	21	1800	3600	23.7
G30**25	25	1800	3600	29.4
G30**28	28	1800	3600	34.4
G30**30	30	1800	3300	37.0
G30**32	32	1800	3000	40.1
G30**35	35	1800	3000	44.8
G30**40	40	1800	2500	53.0
G30**45	45	1800	2250	60.7
G30**50	50	1800	2000	68.5

Table 9. Double Gear Pump Test Ratings

Litho in U. S. A.