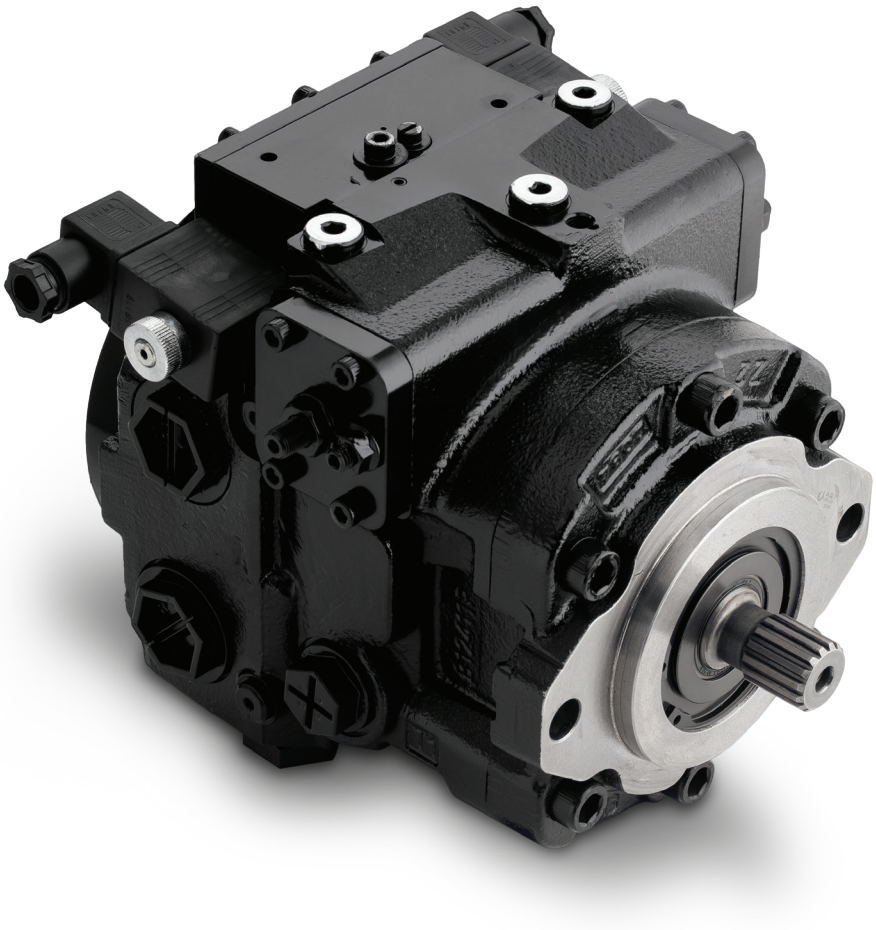


PC³ Frame Size 2 and 3

Service and Repair Catalog

Bulletin HY28-2713-02/PC3/US

Effective: October 2020

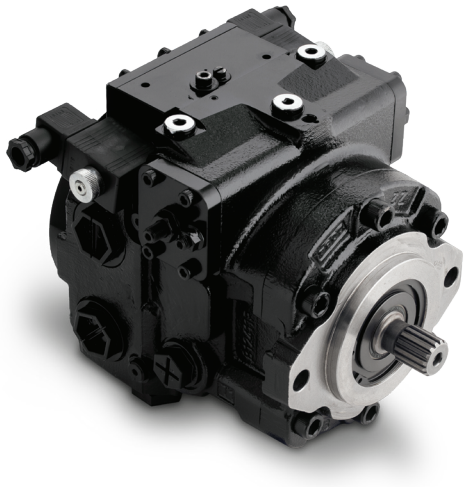
Parker

ENGINEERING YOUR SUCCESS.

Contents

Parker Hannifin Corporation
Hydraulic Pump and Power Systems Division
United States

Parker's Compact Closed Circuit (PC³) line of variable displacement piston pumps has been designed for use in a wide variety of closed circuit applications. Flow direction and volume are controlled by a rugged swashplate and bearing design and are rated to 300 bar (4350 PSI) continuous pressure.

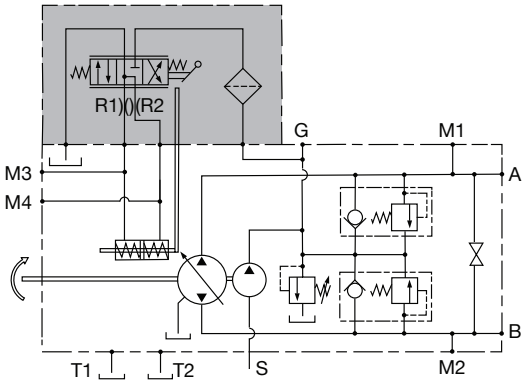


The PC³ line of pumps is available with reliable and robust controls including:

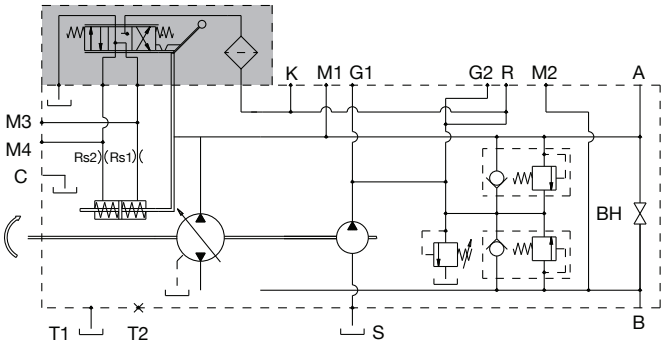
- Direct swashplate manual control
- Manual servo control
- Hydraulic proportional control
- Electric proportional control

With a full line of accessories and through drives, the PC³ line of pumps can meet your application's unique needs.

Frame Size 1



Frame Size 2 and 3



System Sizing Equations

SI units	**Output flow Q**	$= \frac{V_g.n.\eta_v}{1000}$			(l/min)
	Input torque M	$= \frac{V_g.\Delta_p}{20.\pi.\eta_m}$			(N.m)
	Input power P	$= \frac{M.n.\pi}{30\,000}$	$= \frac{Q.\Delta_p}{600.\eta_t}$		(kW)
US units	**Output flow Q**	$= \frac{V_g.n.\eta_v}{231}$			[GPM]
	Input torque M	$= \frac{V_g.\Delta_p}{2.\pi.\eta_m}$			[lbf.in]
	Input power P	$= \frac{M.n.\pi}{198\,000}$	$= \frac{Q.\Delta_p}{1714.\eta_t}$		[hp]

V_g=Displacement per revolution cm^3/tr [in^3/rev]
$\Delta p = p_o - p_i$ (system pressure) bar [PSI]
n = Speed min^{-1} [rpm]
η_v = Volumetric efficiency
η_m = Mechanical efficiency
η_t = Overall efficiency ($\eta v.\eta m$)

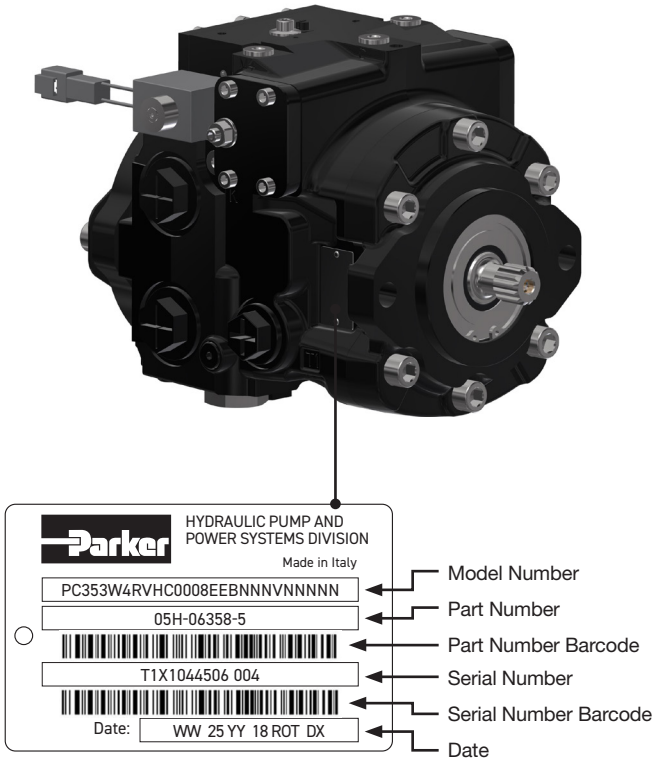
All Parker Hydraulic Pump Division products are supplied with an identification plate. Units can be properly identified only if all information is supplied.

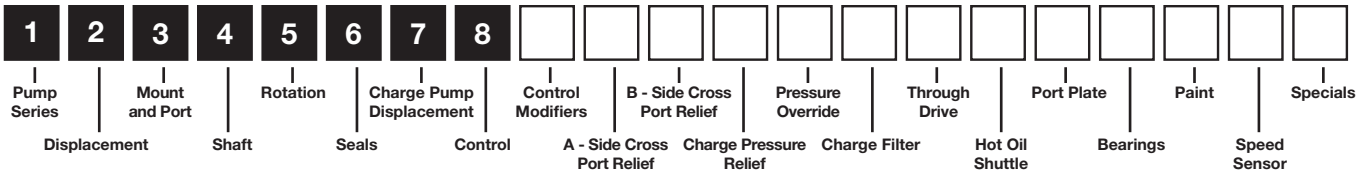
DO NOT REMOVE, ALTER OR DAMAGE THE DATA PLATE.

PC³ Series Identification Tag

The identification tag on the PC³ series pumps will have the following layout:

- The top line of the tag will contain the model code for the unit. The code number is generated by Parker Hydraulic Pump Division and will be specific to a single model code combination.
- The second line of the tag will contain the part number for the unit.
- The third line of the tag will contain the bar code information for the unit.
- The forth line of the tag will contain the serial number for the unit.
- The fifth line of the tag will contain the serial number of the unit in barcode format.
- The sixth line of the tag will contain the date information. The date information includes the week and year of production as well as the rotation information if needed.





1 - Pump Series	
PC3	PC³ Closed Circuit Pump

2 - Displacement		F1	F2	F3
07	Frame 1, 7 cc/rev	#	-	-
11	Frame 1, 11 cc/rev	#	-	-
18	Frame 1, 18 cc/rev	#	-	-
20	Frame 1, 20 cc/rev	#	-	-
25	Frame 2, 25 cc/rev	-	#	-
30	Frame 2, 30 cc/rev	-	#	-
35	Frame 2, 35 cc/rev	-	#	-
40	Frame 3, 40 cc/rev	-	-	#
45	Frame 3, 45 cc/rev	-	-	#
52	Frame 3, 52 cc/rev	-	-	#

3 - Mount and Port		F1	F2	F3
A	SAE A mount, UNF threaded work ports	#	-	-
B	SAE B mount, UNF threaded work ports	#	#	#
W	SAE B mount, ISO 6162 flange work ports	-	#	#

4 - Shaft		F1	F2	F3
1	SAE A 9T 16/32 D.P	#	-	-
2	11T 16/32 D.P	#	-	-
3	SAE B 13T 16/32 D.P	**	#	#
4	SAE BB 15T 16/32 D.P	-	#	#
5	SAE C 14T 12/24 D.P	-	-	#

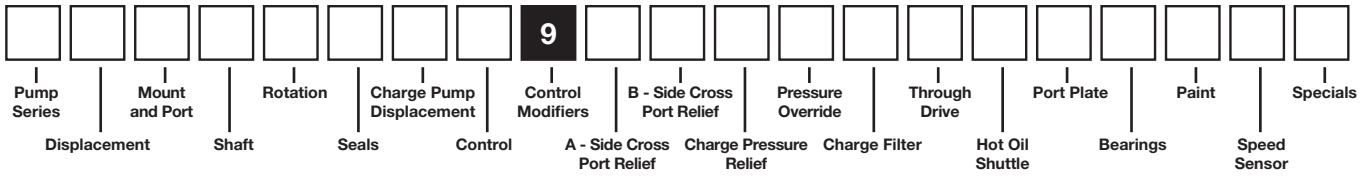
5 - Rotation *As viewed looking at the shaft*		F1	F2	F3
R	CW (clockwise)	#	#	#
L	CCW (counter clockwise)	#	#	#

6 - Seals		F1	F2	F3
V	Fluorocarbon seals	#	#	#

7 - Charge Pump Displacement		F1	F2	F3
A	5 cc/rev (0.30 CIR)	#	-	-
B	7 cc/rev (0.43 CIR)	#	-	-
C	8 cc/rev (0.55 CIR)	-	#	-
E	11 cc/rev (0.67 CIR)	-	#	#
H	16 cc/rev (0.96 CIR)	-	#	#
X	No charge pump	#	#	#

8 - Control		F1	F2	F3
M	Direct swashplate control	#	-	-
A	Manual lever, servo control	#	#	#
C	Hydraulic proportional with feedback	#	#	#
F	Electric proportional with feedback	#	#	#

Key:
= Available/standard
- = Not available
* = Optional, contact technical support
** = SAE B mount only
*** = Requires technical support/approval
F1 = Frame Size 1
F2 = Frame Size 2
F3 = Frame Size 3



Control Code Reference				9 - Control Modifier				
M	**A**	**C**	**F**					
#	-	-	-	T				Lever in top location
#	-	-	-	B				Lever in bottom location
#	-	-	-		X			Without connecting lever
#	-	-	-		L			Connecting lever pointed left (viewed from shaft)
#	-	-	-		R			Connecting lever pointed right (viewed from shaft)
#	-	-	-			N		No centering spring
#	-	-	-			S		Include centering spring
#	-	-	-				0	No centering spring (cannot be ordered with S spring option)
#	-	-	-				2	2.8 mm diameter spring
#	-	-	-				3	3 mm diameter spring
-	#	-	-	N				No neutral safety switch
-	#	-	-	S				Neutral safety switch
-	#	-	-		N			No safety valve
-	#	-	-		V			Safety valve
-	-	#	-	0	0			No additional control
-	-	-	#	1	2			12 VDC system voltage
-	-	-	#	2	4			24 VDC system voltage
-	#	#	#			0	0	No control orifice
-	#	#	#			0	6	0.6 mm control orifice
-	#	#	#			0	7	0.7 mm control orifice
-	#	#	#			0	8	0.8 mm control orifice
-	#	#	#			0	9	0.9 mm control orifice
-	#	#	#			1	0	1.0 mm control orifice
-	#	#	#			1	2	1.2 mm control orifice
EXAMPLE			F	1	2	0	8	Electronic displacement control, 12 VDC coils, 0.8 mm orifices

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F2 = Frame Size 2
F3 = Frame Size 3

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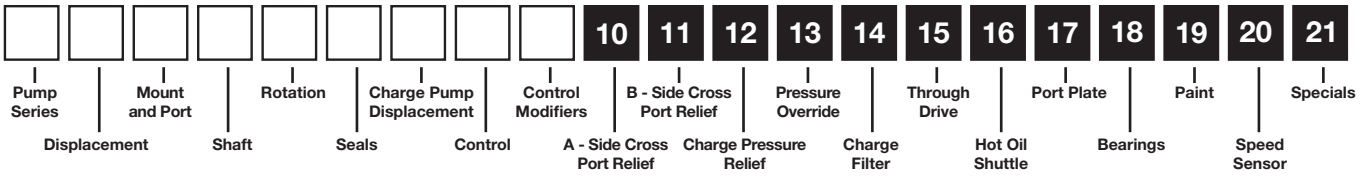
Hydraulic Pump and Power Systems Division
United States



10 - A Side Cross Port Relief		F1	F2	F3
N	Check valve only	#	#	#
A	100 bar (1450 PSI)	#	-	-
B	150 bar (2175 PSI)	#	#	#
C	200 bar (2900 PSI)	#	#	#
D	250 bar (3625 PSI)	#	#	#
E	300 bar (4351 PSI)	#	#	#
H	350 bar (5075 PSI)	***	#	#
K	370 bar (5366 PSI)	-	#	#
P	400 bar (5800 PSI)	-	#	#

11 - B Side Cross Port Relief		F1	F2	F3
N	Check valve only	#	#	#
A	100 bar (1450 PSI)	#	-	-
B	150 bar (2175 PSI)	#	#	#
C	200 bar (2900 PSI)	#	#	#
D	250 bar (3625 PSI)	#	#	#
E	300 bar (4351 PSI)	#	#	#
H	350 bar (5075 PSI)	***	#	#
K	370 bar (5366 PSI)	-	#	#
P	400 bar (5800 PSI)	-	#	#

12 - Charge Relief Setting		F1	F2	F3
A	10 bar (145 PSI)	#	-	-
B	20 bar (290 PSI)	#	#	#
C	25 bar (363 PSI)	-	#	#
D	30 bar (435 PSI)	-	#	#

13 - Pressure Override		F1	F2	F3
N	No pressure override	#	#	#
P	Pressure override	*	*	*

14 - Charge Filter		F1	F2	F3
N	No charge filter	#	#	#
F	Charge filter with no indicator	#	#	#
K	Charge filter with visual indicator	#	#	#
R	Remote charge pressure ports	#	#	#

15 - Through drive		F1	F2	F3
N	No through drive	#	#	#
A	SAE A with 9T spline coupler	#	#	#
H	SAE A with 11T spline coupler	-	#	#
B	SAE B with 13T coupler	-	#	#
Q	SAE B with 15T coupler	-	#	#
T	Tandem-no charge pump	***	***	***

16 - Hot Oil Shuttle Valve		F1	F2	F3
N	No Hot oil shuttle valve	#	#	#
V	Hot oil shuttle valve installed	#	#	#

17- Port Plate Timing		F1	F2	F3
N	Standard port plate timing	#	#	#

18 - Bearings		F1	F2	F3
N	Standard bearings	#	#	#

19 - Paint		F1	F2	F3
N	No paint	#	#	#
P	Black paint	#	#	#

20 - Speed Sensor		F1	F2	F3
N	No speed sensor	#	#	#
S	Speed sensor installed	-	#	#

21 - Specials		F1	F2	F3
N	No special options	#	#	#
M	Special modification	*	*	*

Example Model Code
PC335B4LVEF1208EECNNNVNNPNN

PC3 PC³ Pump Series
35 Frame 2, 35 cc/rev
B SAE B mount, UNF threaded work ports
4 SAE BB 15T 16/32 D.P
L CCW (counter clockwise rotation)
V Fluorocarbon seals
E 11 cc/rev charge pump displacement (0.67 CIR)
F Electric proportional control with feedback
1208 12 VDC coils and 0.8 mm diameter control orifices
E 300 bar (4351 PSI) cross port relief in A port
E 300 bar (4351 PSI) cross port relief in B port
C 25 bar (363 PSI) charge relief pressure setting
N No pressure override
N No charge filter
N No through drive
V Hot oil shuttle valve installed
N Standard port plate timing
N Standard bearings
P Black paint
N No speed sensor
N No special options

Key:
= Available/standard
- = Not available
* = Optional, contact technical support
** = SAE B mount only
*** = Requires technical support/approval
F1 = Frame Size 1
F2 = Frame Size 2
F3 = Frame Size 3

Fluids
Only fluids with a mineral oil basis and anti-corrosive, antioxidant and wear-preventing agents (HL or HM) should be used. Viscosity range at operating temperature must be between 15 and 40 cSt. For short periods and low-starting temperatures, a maximum viscosity of 800 cSt is allowed. Viscosities less than 10 cSt are not permitted. In extreme operating conditions, a viscosity range of 10-to-15 cSt is allowed for short periods.

Operating Temperature
The oil's operating temperature must be between 0-80°C (32-176° F). Running the unit outside of these temperature ranges is not recommended and could negatively impact performance.

Filtration
The PC³ pump is available with a built-in charge filter. Units also can be shipped with a block to permit a remote-mounted filter. Parker suggests a remote pressure filter with an element rating of 10 micron absolute and a minimum beta ratio of 200. A visual or electromechanical indicator is also suggested.

Correct filtration helps extend unit life. The maximum permissible contamination class is 20/18/15 per ISO 4406:1999. Suction filters are not suggested. If needed, a 100-mesh (149-micron) strainer is the finest mesh recommended.

Suction Pressure
The charge pump suction performs at a minimum absolute pressure of 0.8 bar (11.6 PSI). For short periods and low-starting temperatures, an absolute pressure of 0.5 bar (7.25 PSI) is allowed. Inlet pressure may never be lower.

Operating Pressure
Main pump: The maximum permissible continuous pressure is 300 bar (4,350 PSI).

Charge pump: Nominal pressure is 20 bar (290 PSI). Maximum admissible pressure is 40 bar (580 PSI).

Case Drain Pressure
Maximum case drain pressure is 2 bar (29 PSI). For short periods and low-starting temperatures, a pressure of 3.5 bar (51 PSI) is allowed. Higher pressures can damage the input shaft seal, reducing its life.

Seals
Parker PC³ pumps use standard FKM (Viton®) seals. In case of special fluids, contact your Parker distributor.

Displacement Limiting
An externally adjustable mechanical device limits displacement by utilizing two setting screws to limit to the control piston stroke.

Parker PC³ Technical Specifications										
	Frame Size 1				Frame Size 2			Frame Size 3		
	07	11	18	20	25	30	35	40	45	52
Displacement CC/Rev (CIR)	7 (0.43)	11 (0.67)	18 (1.10)	20 (1.22)	25 (1.52)	30 (1.83)	35 (2.13)	40 (2.44)	45 (2.74)	52 (3.17)
Input Speed (RPM)										
Minimum	700				700					
Continuous	3600				3400					
System Pressure Bar (PSI)										
Continuous	210 (3045)				300 (4350)					
Peak	350 (5075)			300 (4350)	400 (5800)					
Charge Pump Inlet Pressure										
Minimum Continuous Bar (PSI) Absolute	0.8 (11.6)									
Cold Startup	0.5 (7.25)									
Case Pressure Bar (PSI)										
Maximum Continuous	2 (29)									
Cold Startup	3 (43.5)				3.5 (51)					
Fluid Viscosity cSt										
Operating	15 to 40									
Minimum	5									
Cold Startup	1000									
Fluid Operating Temperature °C (°F)	0° to 80° (32° to 176°)									
Approximate Weight Kg (lb)	16.4 (36)				29 (64)			32 (70.5)		
Moment of Inertia Kg-m² (slug-ft²)	0.0014 (0.0010)				0.0028 (0.0018)			0.0054 (0.0038)		

**Peak is defined as no longer than 1% of every minute. For long life, design system to not run at maximum flow and pressure continuously.*

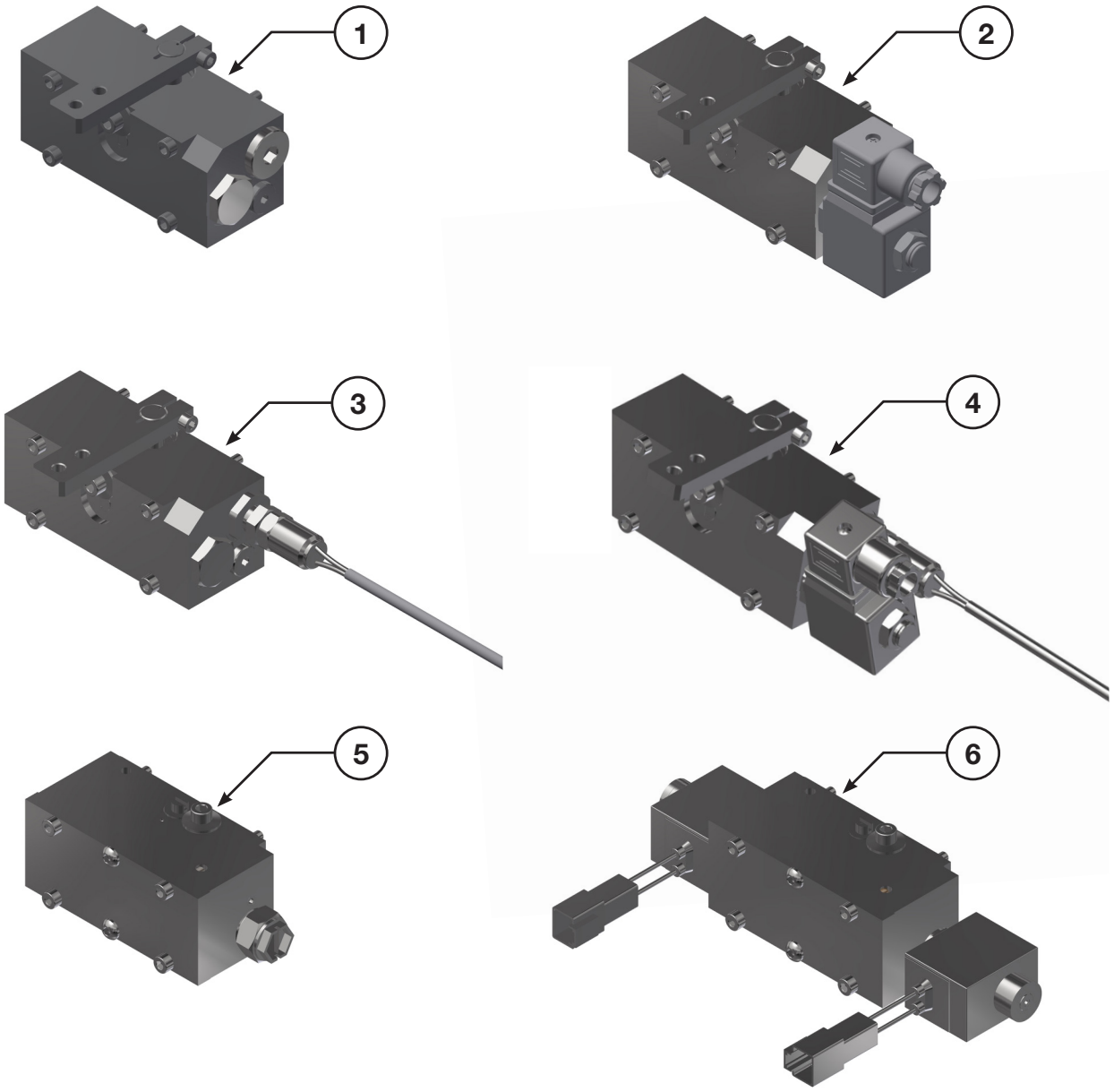
Pump Life Note

Hydraulic unit life is the life expectancy of the hydraulic components. It depends on speed and system pressure even if system pressure is the dominant operating variable. High pressure, generated by high load, reduces hydraulic unit life.

Design the hydraulic system according to the expected machine duty cycle. Take into consideration the expected percentages of time at various loads and speeds. Ask your Hydraulics representative to calculate an appropriate pressure based on your hydraulic system design. If duty-cycle data is unavailable, input power and pump displacement are used to calculate system pressure.

All pressure limits are differential pressures (referenced to charge pressure), taking a normal charge pressure into consideration.

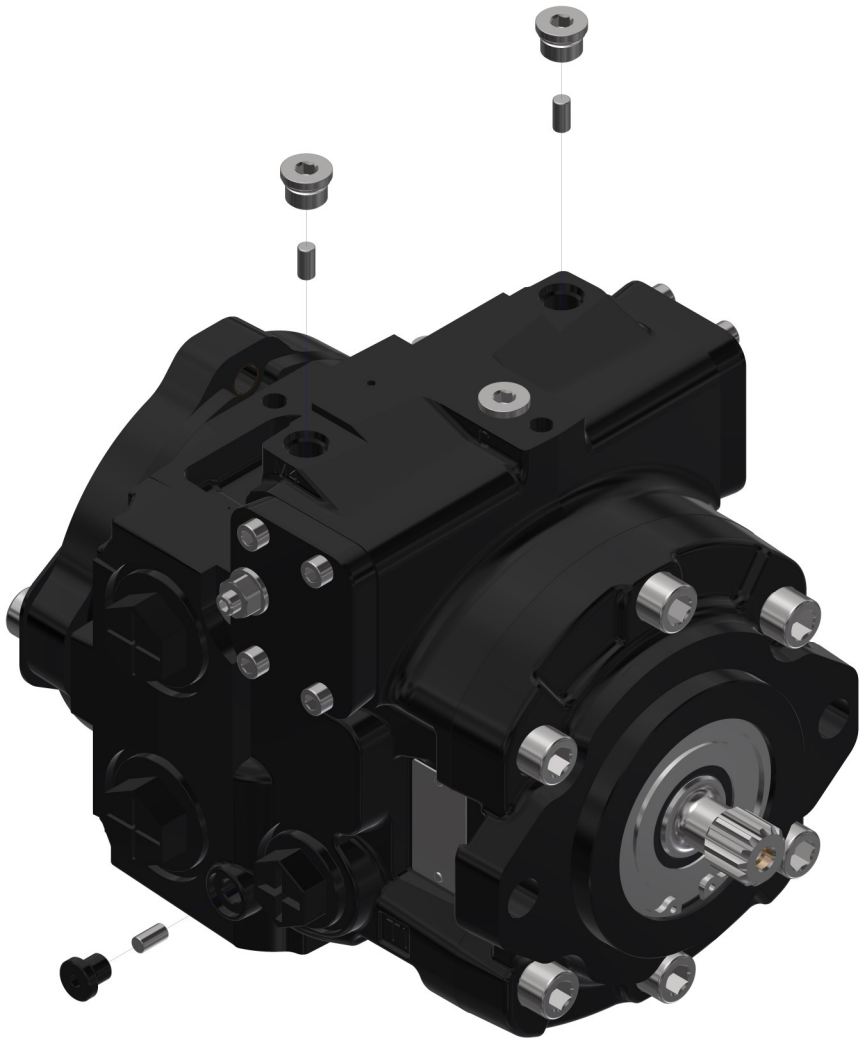
Frame Size 2 and 3



Balloon	Part Number	Description
1	S2H-20674-5	A Control PC3 F2-F3
2	S2H-20675-5	A Control with SV PC3 F2-F3
3	S2H-20676-5	A Control with SS PC3 F2-F3
4	S2H-20677-5	A Control with SV and SS F2-F3
5	S2H-20680-5	C Control PC3 F2-F3
6	S2H-20678-5	F Control 12 VDC PC3 F2-F3
6	S2H-20679-5	F Control 24 VDC PC3 F2-F3
N/A	S2H-20798-0	Coil, 12 VDC, F Control, DT Conn F2-F3
N/A	S2H-20799-0	Coil, 24 VDC, F Control, DT Conn F2-F3

Control and Hot Oil Shuttle Orifice Locations

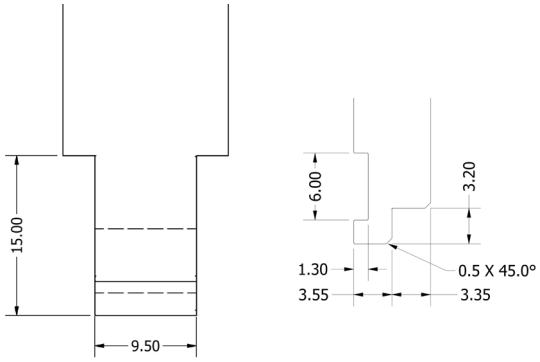
Balloon #7 are the control orifices, while balloon #8 is the hot oil shuttle orifice. In order to change the hot oil shuttle orifice, you must first remove the hot oil shuttle valve.



Part Number	Description
S2H-20681-0	Orifice kit, Frame 2 and 3 0.6mm
S2H-20682-0	Orifice kit, Frame 2 and 3 0.7mm
S2H-20683-0	Orifice kit, Frame 2 and 3 0.8mm
S2H-20684-0	Orifice kit, Frame 2 and 3 0.9mm
S2H-20685-0	Orifice kit, Frame 2 and 3 1.0mm
S2H-20686-0	Orifice kit, Frame 2 and 3 1.2mm
S2H-20687-0	Orifice kit, Frame 2 and 3 1.4mm

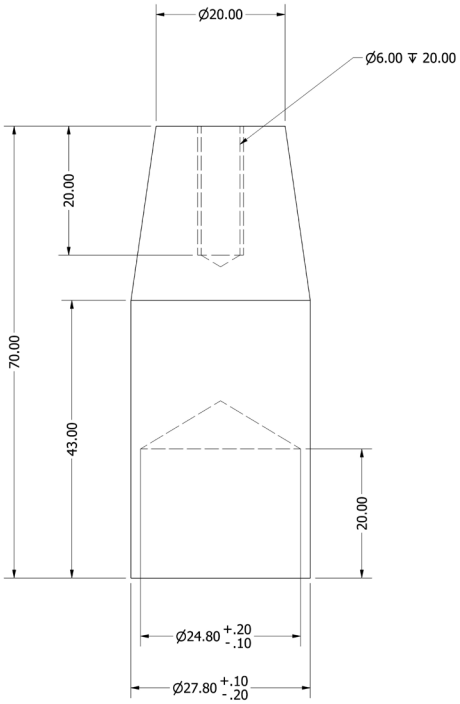
Special Tools — Detail

Kukko
2 Jaw Puller
Part Number: 14-01
EAN: 4021176459559
Series 14



Units in millimeters

Specialty Tool 2



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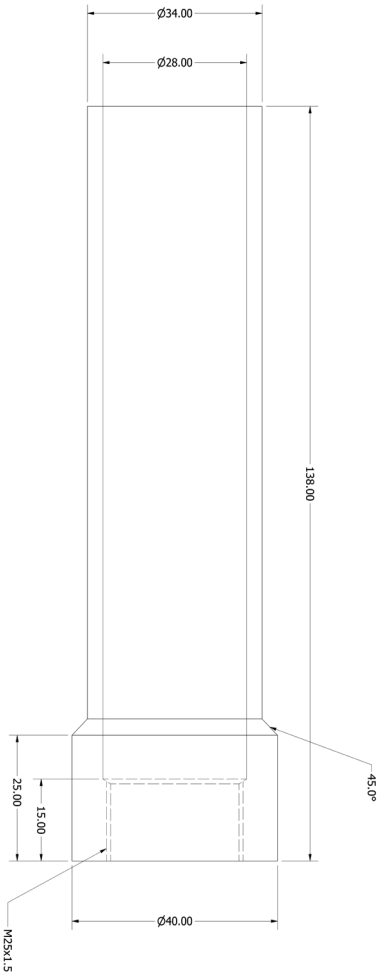
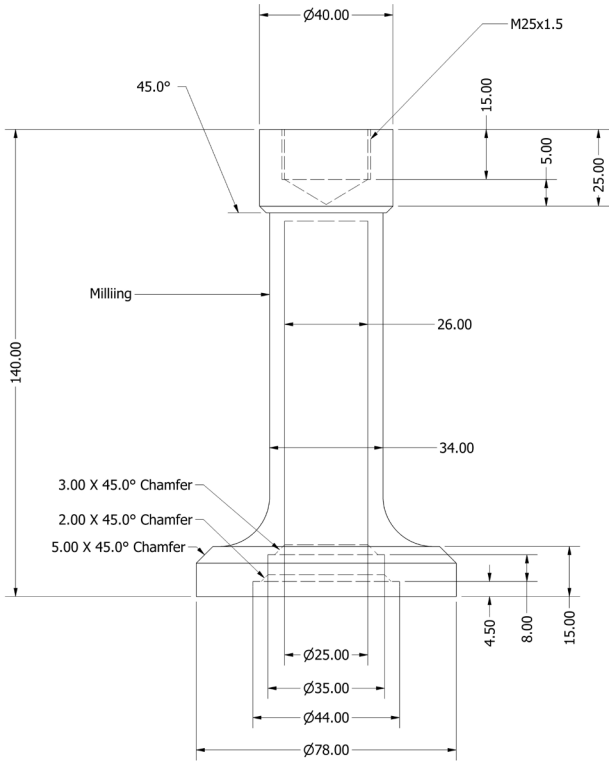
Special Tools — Detail

Specialty Tool 3

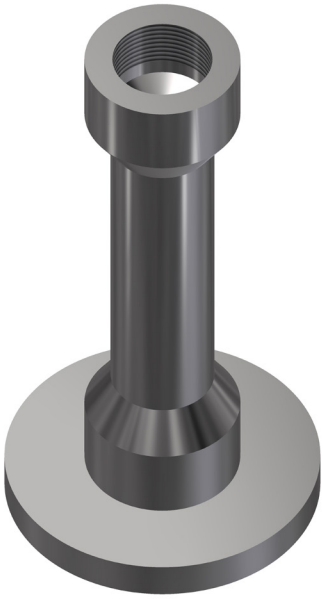


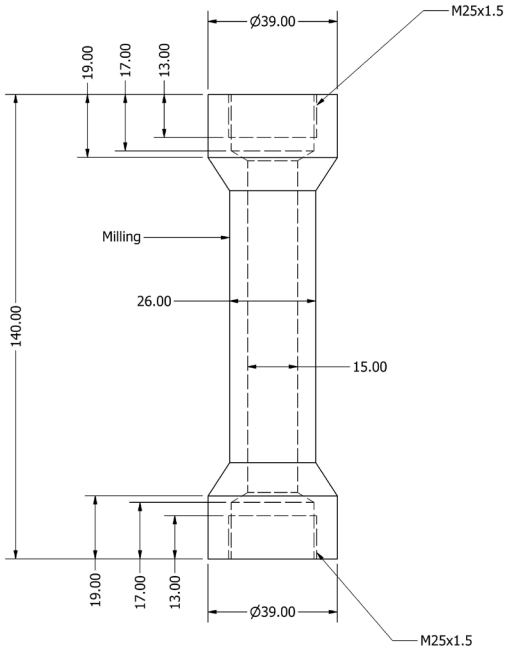
Specialty Tool 4

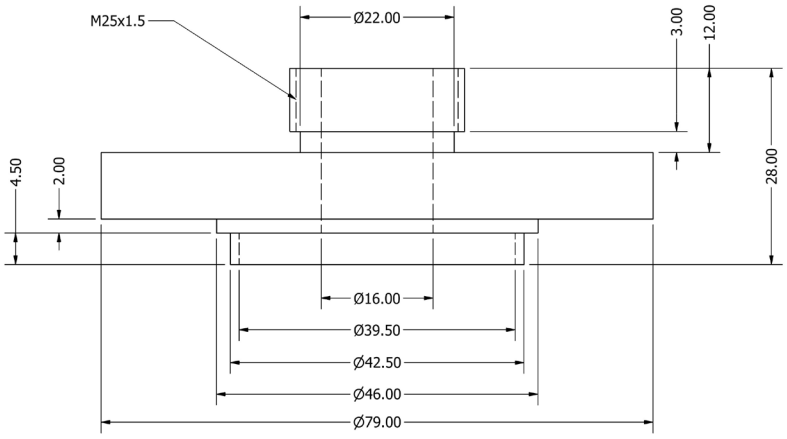


Special Tools — Detail

Specialty Tool 5







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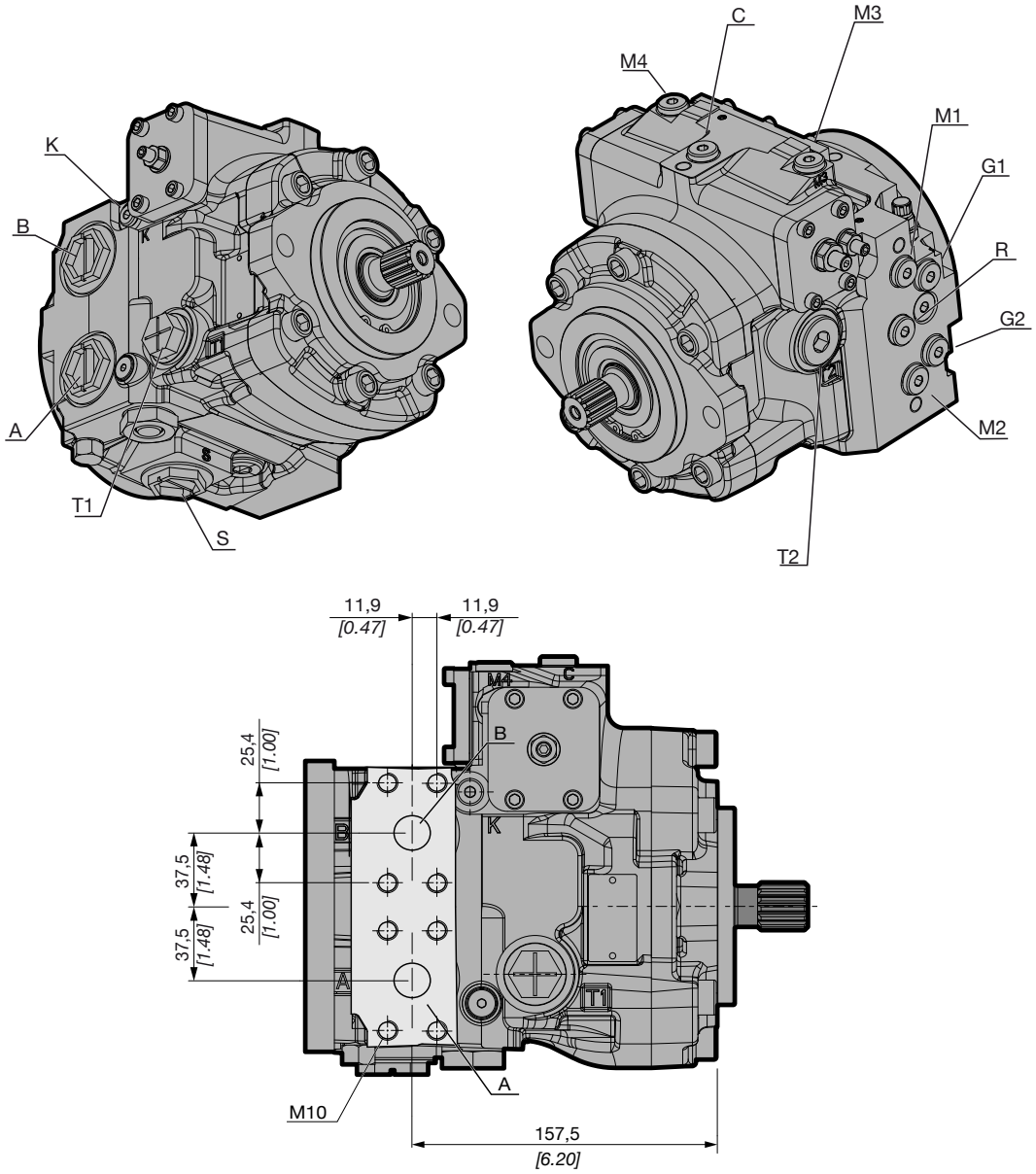
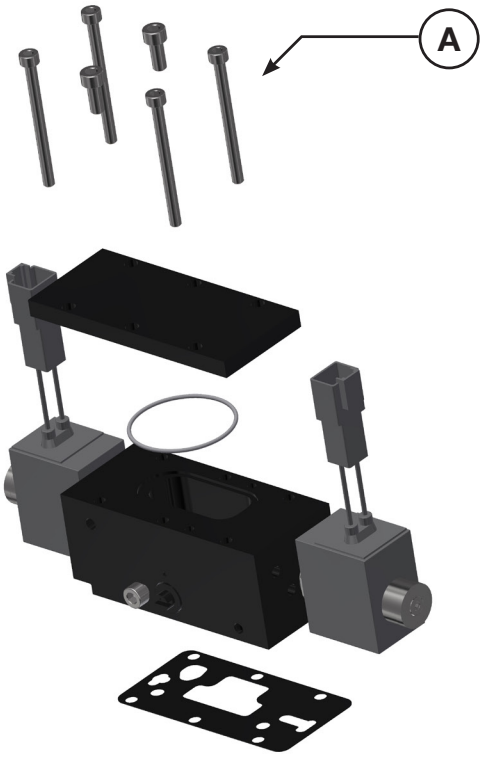


		Mount Option B		Mount Option W	
Port	**Function**	**Thread**	**Dash #**	**Thread**	**Dash #**
A/B	Main ports	1-5/16-12 UNF-2B	16	M10	N/A
C	Case pressure port	7/16-20 UNF-2B	4	7/16-20 UNF-2B	4
G1/G2	Auxiliary charge pressure ports	7/16-20 UNF-2B	4	7/16-20 UNF-2B	4
M1/M2	System gauge ports	7/16-20 UNF-2B	4	7/16-20 UNF-2B	4
M3/M4	Servo gauge ports	7/16-20 UNF-2B	4	7/16-20 UNF-2B	4
K	Charge pressure port	7/16-20 UNF-2B	4	7/16-20 UNF-2B	4
R	Charge pressure port	7/16-20 UNF-2B	4	7/16-20 UNF-2B	4
S	Charge inlet port	1-5/16-12 UNF-2B	16	1-5/16-12 UNF-2B	16
T1/T2	Case drain ports	1-1/16-12 UNF-2B	12	1-1/16-12 UNF-2B	12

1. Removing Control Support and Filter



(A) Remove control by removing mounting bolts, control body, screen and gasket.

(B) Remove charge filtration (if equipped) by removing mounting bolts. It is also suggested that you remove the charge filter element housing and examine the filter element for signs of contamination or damage. All seals should be inspected and replaced as needed.

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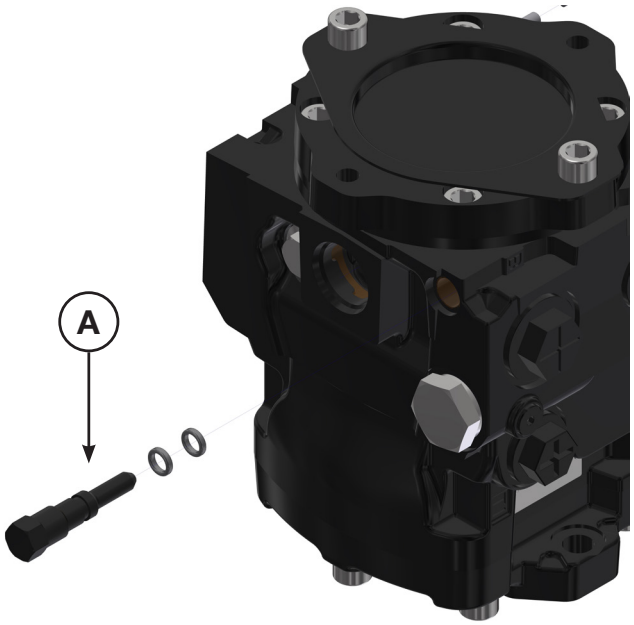
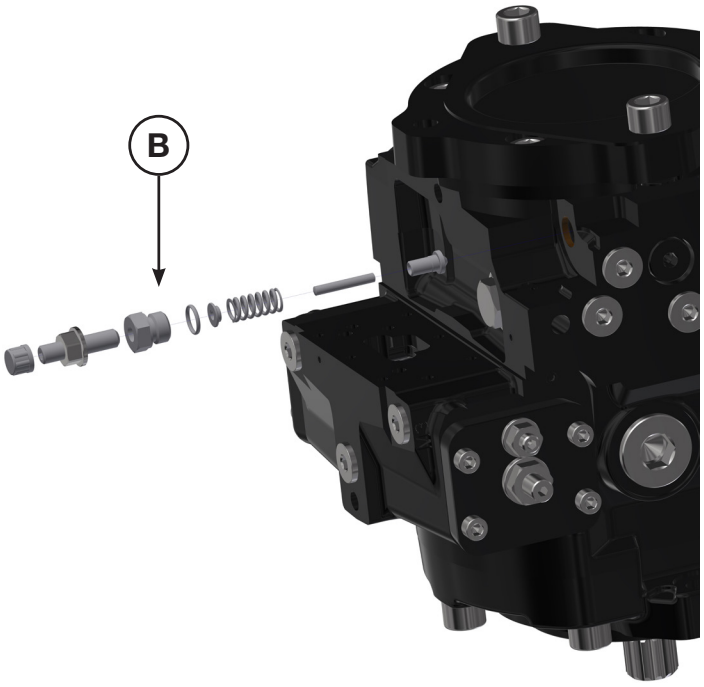
2. Removing the Bypass and Charge Valve

(A) Remove bypass valve, inspect seals and replace as needed.

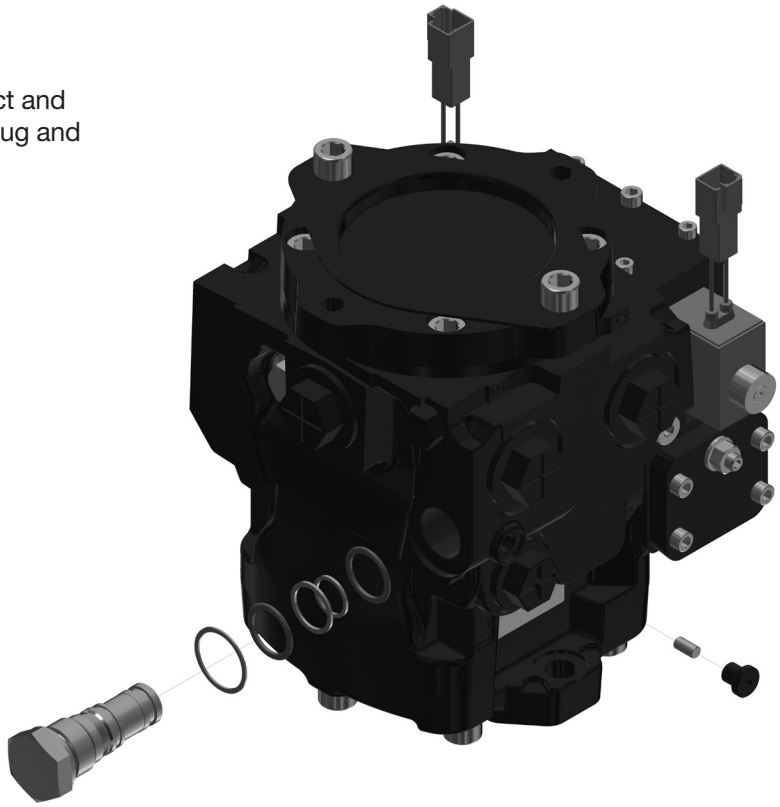
(B) Remove charge pressure relief assembly by removing the setting screw, seal nut pin and assembly nut. Using pliers, remove the spring guide ring, spring and poppet.





3. Removing the Hot Oil Shuttle

Remove Hot Oil Shuttle assembly. Inspect and replace seals as needed. Remove port plug and remove hot oil shuttle orifice.



4. Removing the Cross Port Relief Valves

Remove Cross port relief assemblies. Inspect and replace seals as needed.

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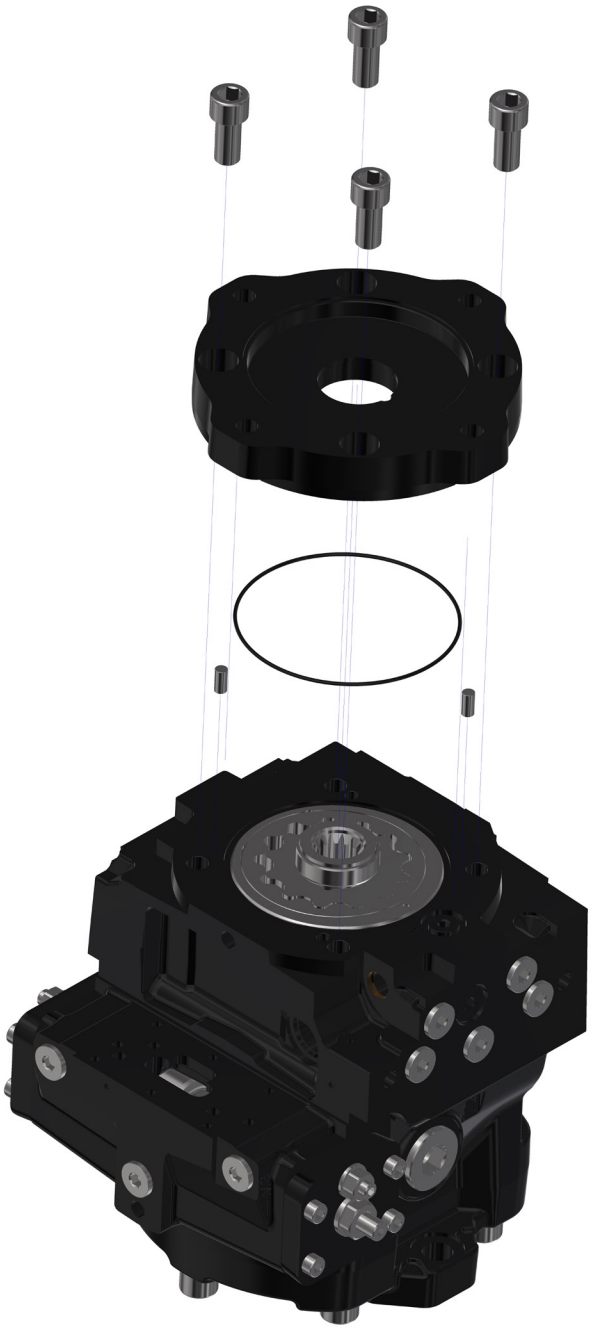
5. Removing the Charge Pump Cover

Remove charge pump cover/through drive by removing bolts and then inserting small bolts into the cover to lift cover from the housing evenly. Inspect and replace seals as needed. Remove centering pins from the housing.



6. Removing the Charge Pump Assembly

(A) First, mark the position of the assembly, this will make reassembly much easier.

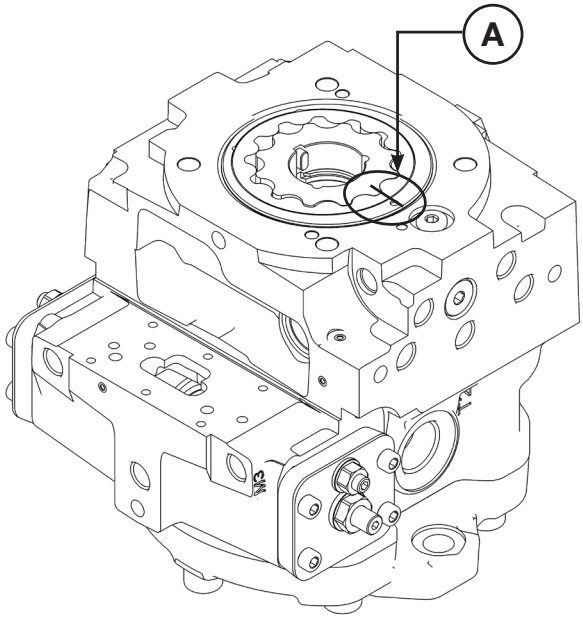
(B) Remove the cover centering pins from the housing.

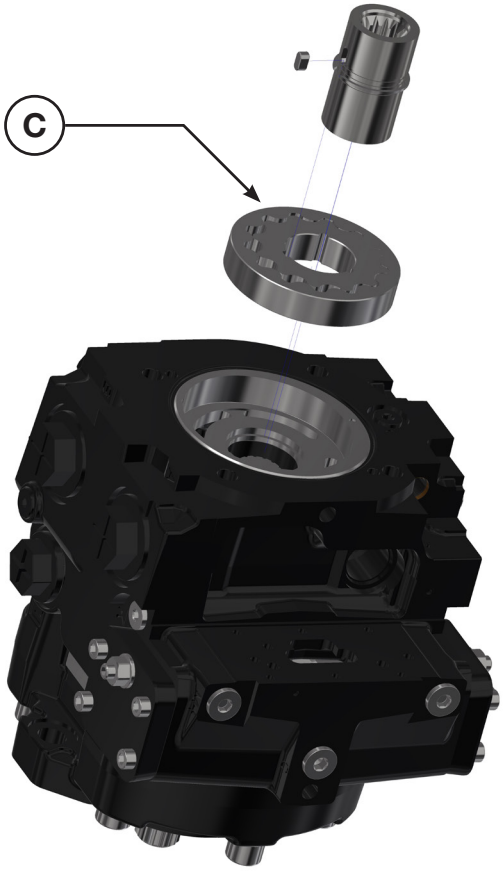
(C) Remove the inner gear and drive coupling by pulling upward on the coupling in a straight line. Be careful not to lose the key.

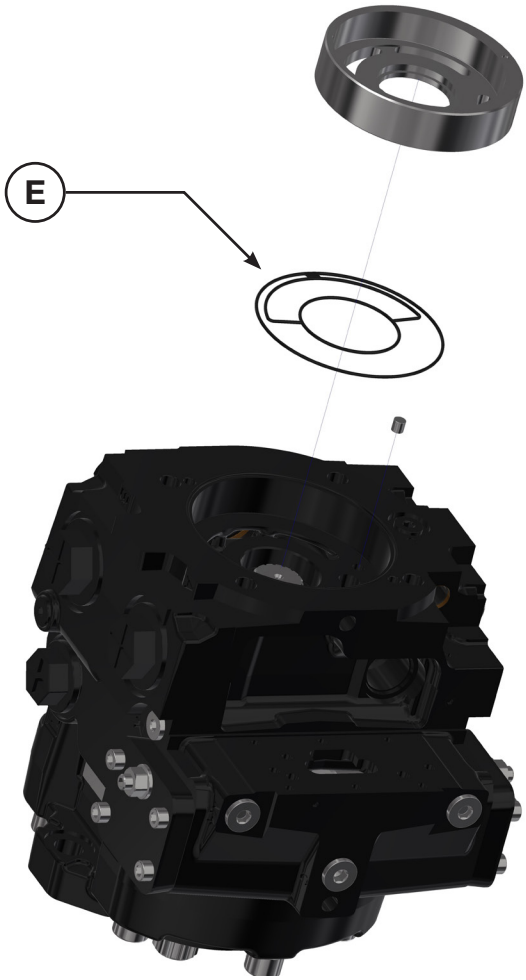
(D) The external gear can now be removed by pulling straight up in a similar manner.

(E) The gerotor eccentric can now be removed, carefully inspect and replace the gerotor seal noting its position in the eccentric.

(F) Finally, remove the eccentric locating pin.







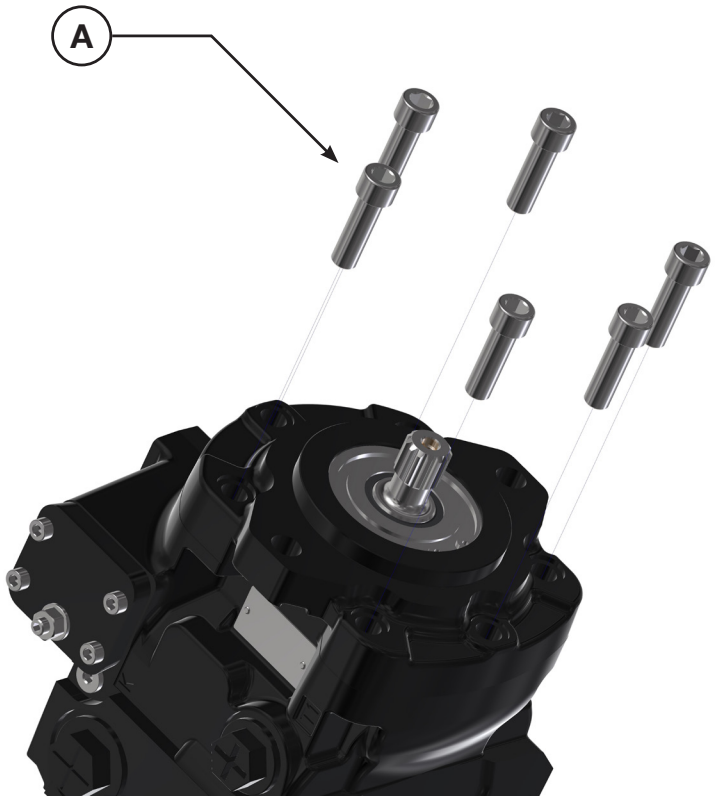
7. Remove the Rotating Group

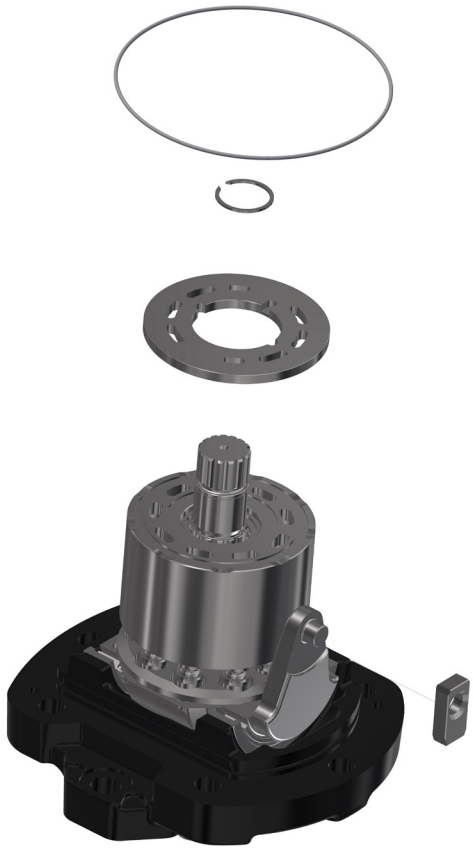
(A) Remove bolts from pump mount.

(B) Using an appropriate lifting eye, thread into the shaft and lift the rotating group straight up from the pump housing.

(C) Remove feedback link and set aside in a safe location. Using snap ring pliers, remove ring from barrel. Inspect and replace seals as needed.

(D) Remove valve plate from rotating group.





Note: Frame Size 3 has 5 bolts.

8. Barrel Disassembly

(A) Remove bearing race using the modified puller. Ensure you are engaging the race in the correct area so as to not damage the race and barrel.

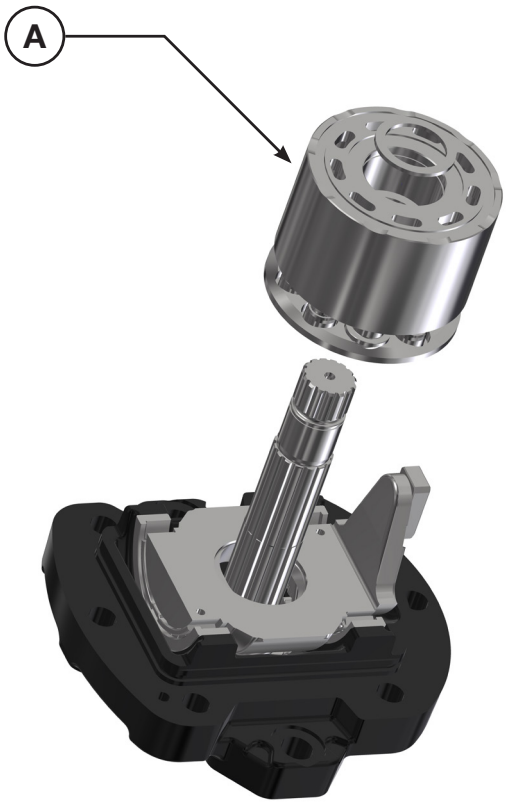
(B) Remove barrel and spacer from the shaft.

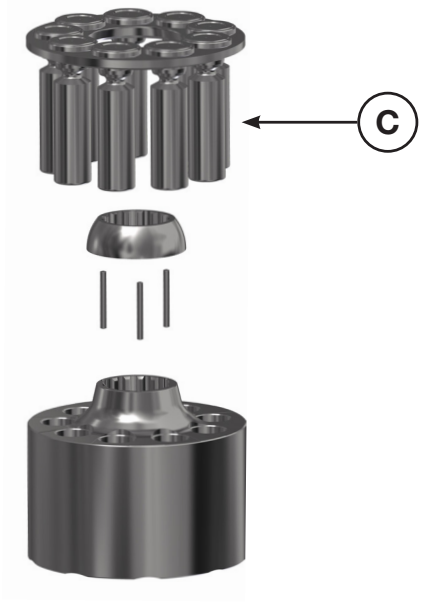
(C) Remove pistons and piston retainer from the barrel.

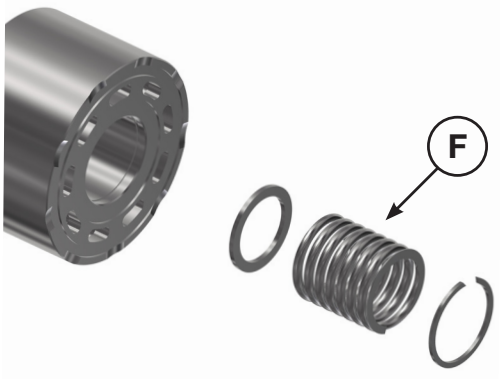
(D) Remove ball seat and pins from the barrel.

(E) Using a socket and vice, compress the hold down spring and remove the barrel retaining ring using a flat head screw driver.

(F) Use vice to slowly release tension on the barrel, hold down spring. Remove the barrel spring and washers.







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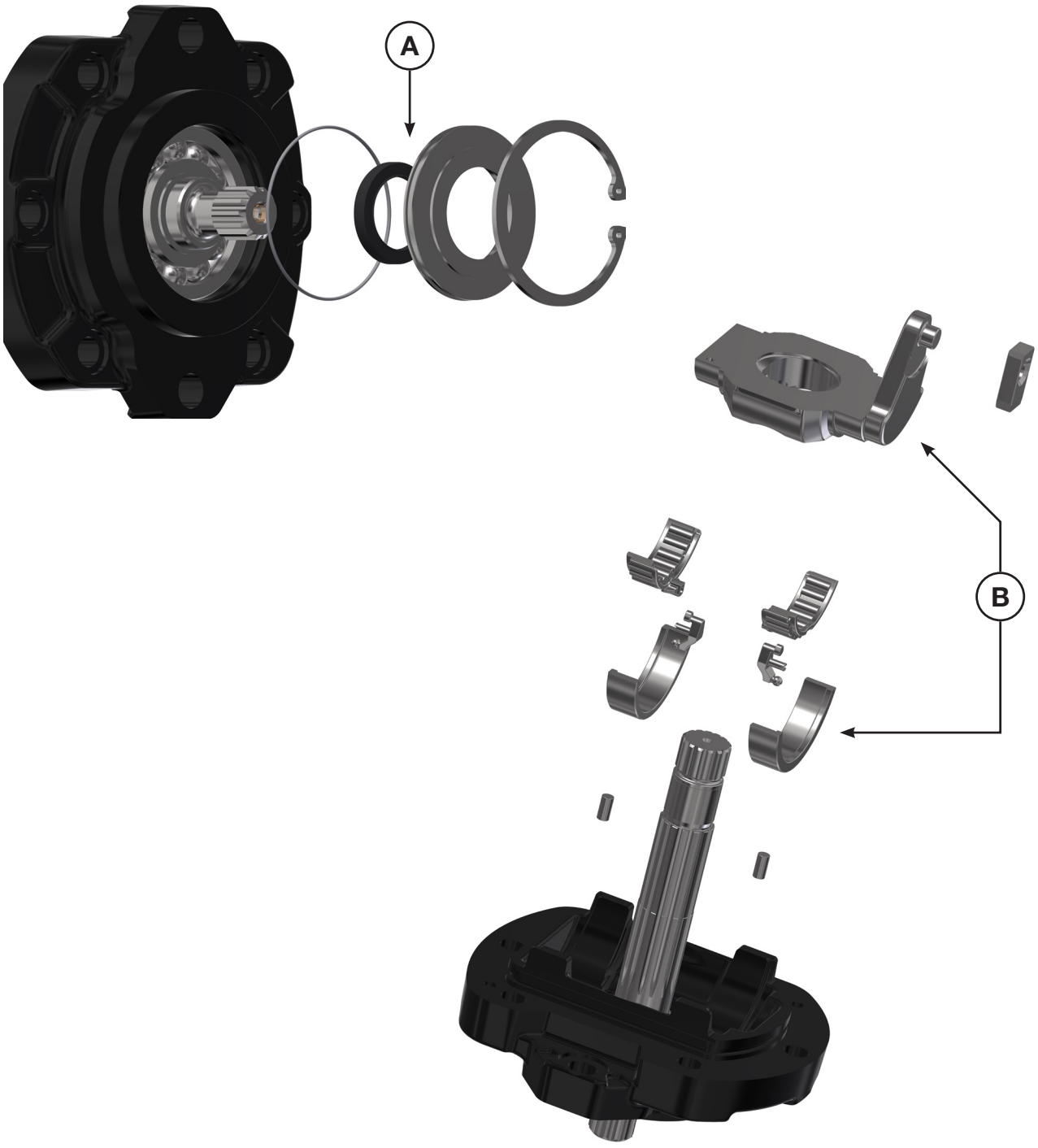
9. Bearing, Front Cover and Swashplate Disassembly

(A) Remove the snap ring.
Remove the seal support.

(B) Remove Swashplate.
Remove the bearing cage.
Remove the bearing races.
Lastly, remove the 2 pins.
(Use a magnet to remove the pins if required.)



9. Bearing, Front Cover and Swashplate Disassembly (continued)

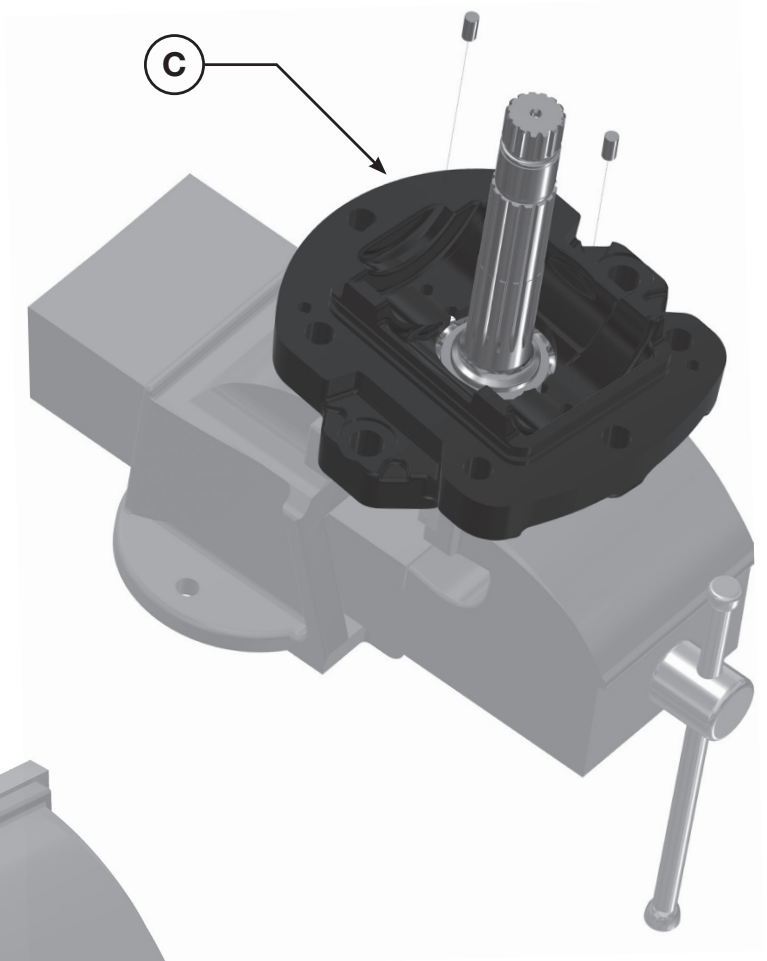
(A) Remove and discard the sealing ring using a socket and a mallet.

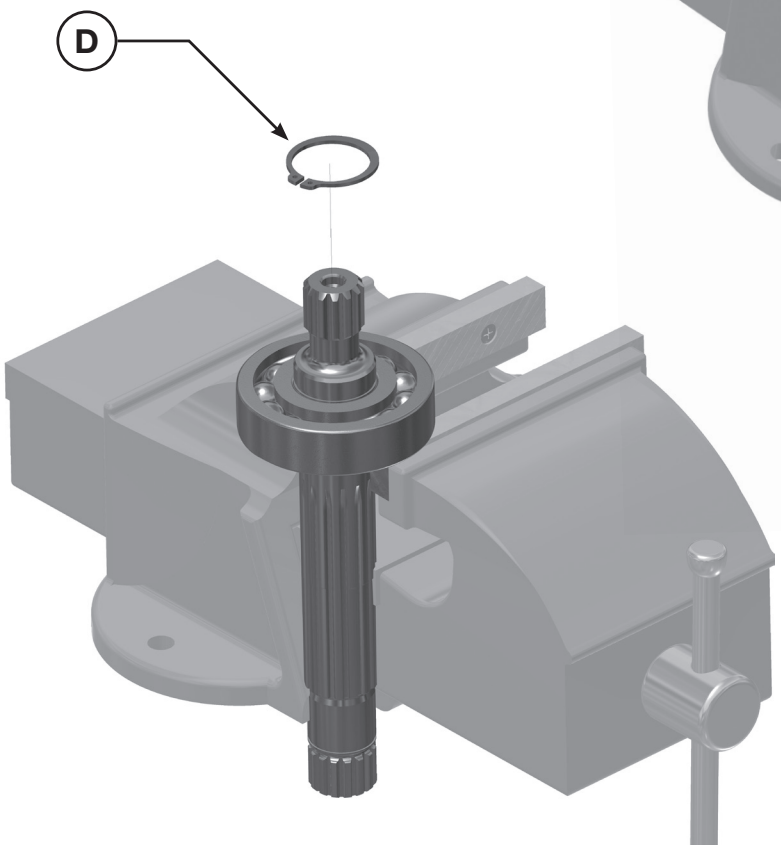
(B) Remove and discard the O-ring.

(C) Using a mallet, remove the shaft from the front cover.

(D) Remove both pins using snap ring pliers, remove the snap ring from the shaft.

(E) Remove the bearing.



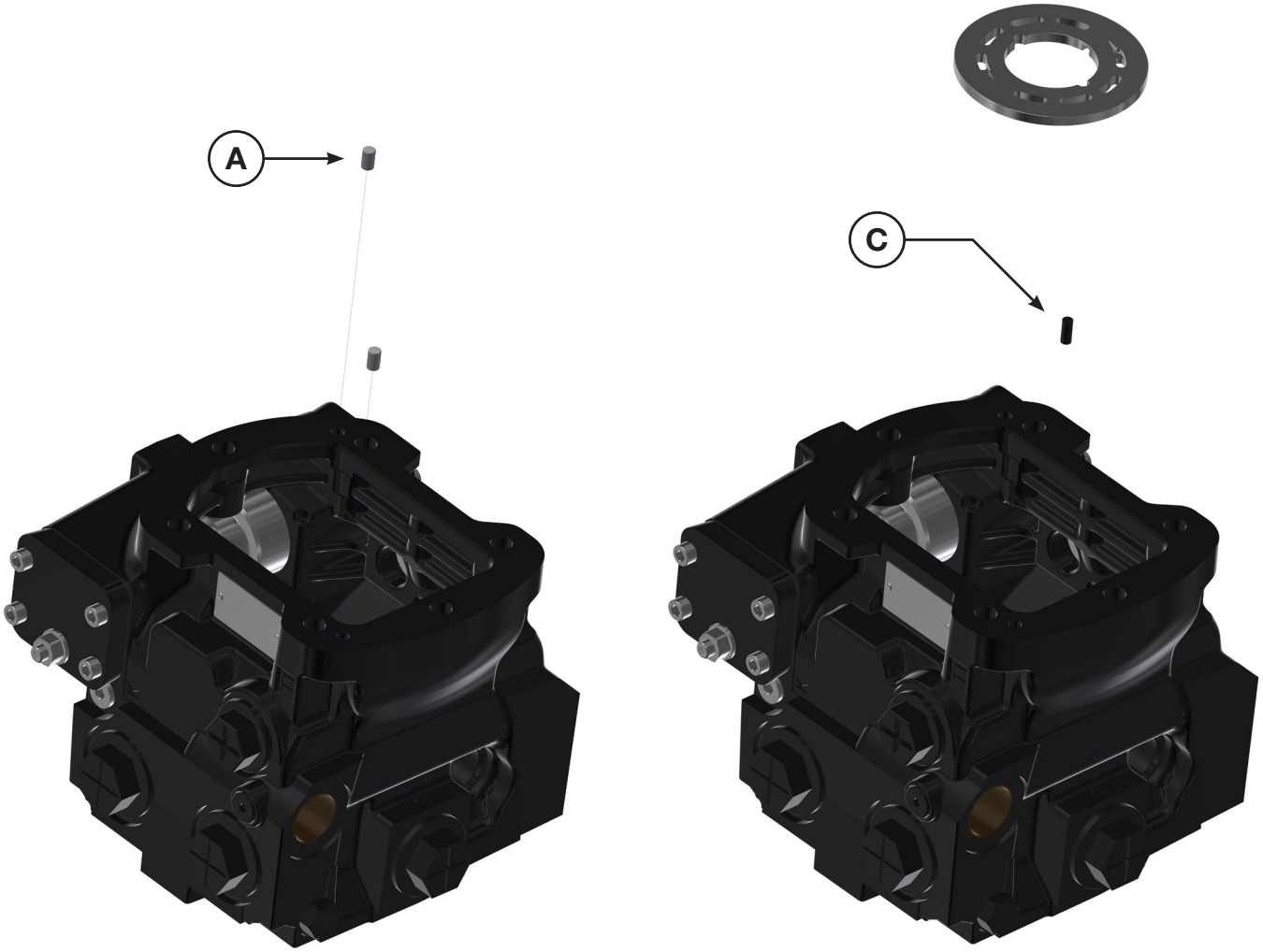


10. Valve Plate Removal

(A) Remove pins. Use of a magnet is suggested.

(B) Using a marker, mark on the valve plate to assist during reassembly. Be cautious not to damage the valve plate during marking. Place a hook or pliers in the clearance to remove the valve plate.

(C) Remove the pin.



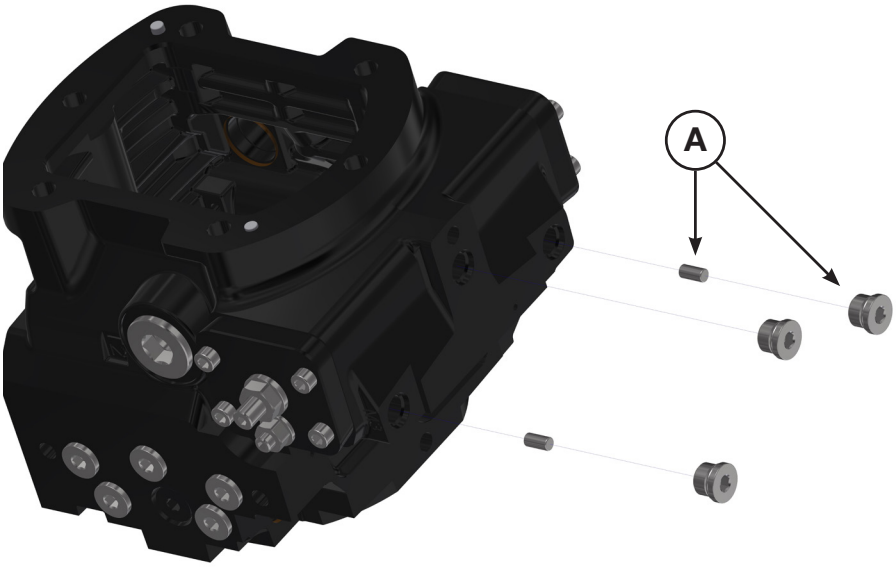
11. Servo Piston

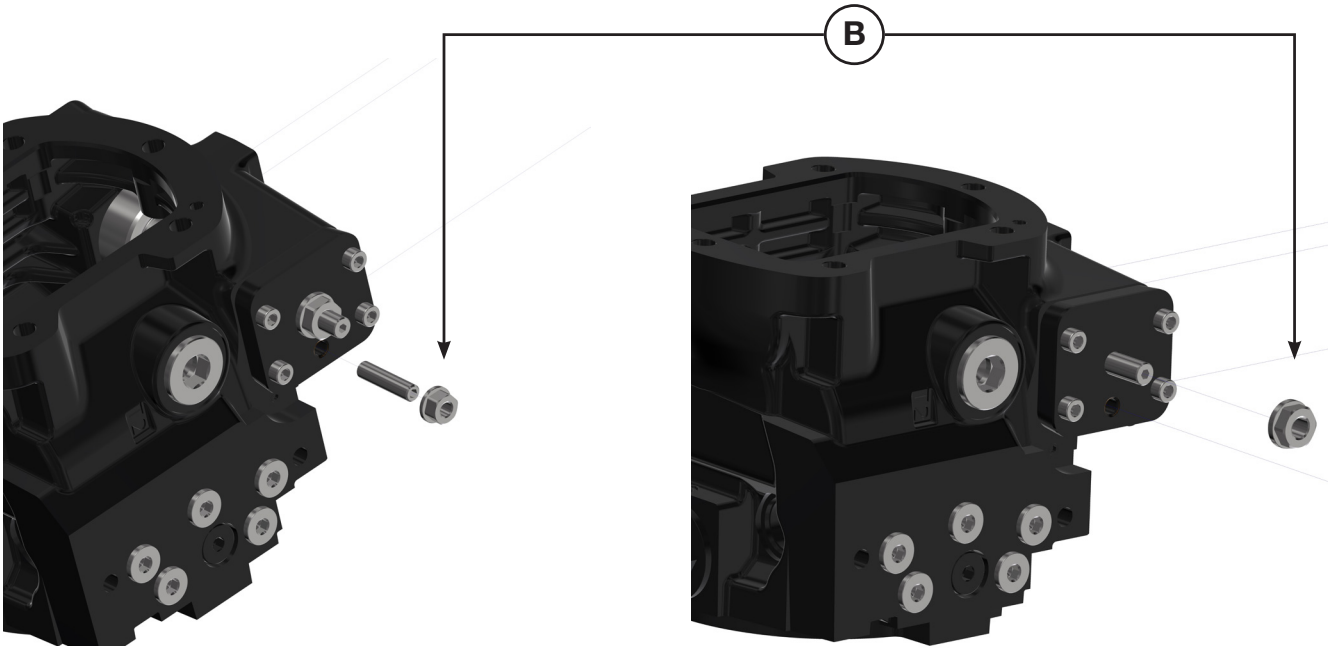
(A) Remove the plugs (qty 3). Remove restrictors (qty 2).

(B) Release the seal nuts (qty 2). Remove the displacement limitation screws (qty 2). Remove and discard the 2 seal nuts.

(C) Remove the plug, 4 mounting screws, cover and O-rings. Discard O-rings.

(D) Remove and discard the seal nut.





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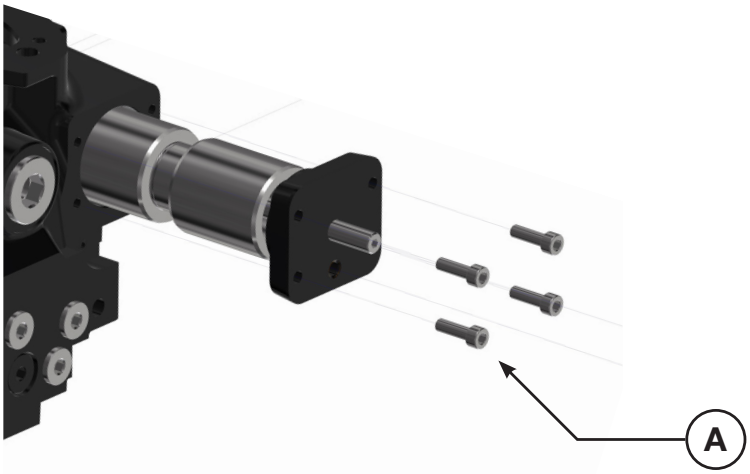
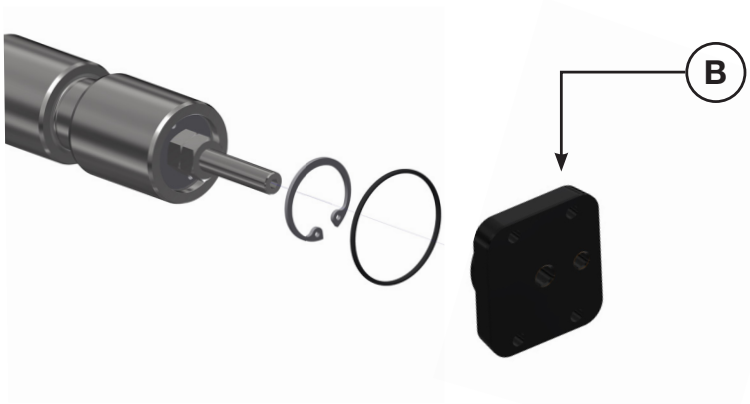
11. Servo Piston (continued)



(A) Remove the 4 mounting screws. Next, remove the servo piston.



(B) Unscrew and remove the cover from the servo piston. Remove and discard the O-ring. Next, using snap ring pliers, remove the snap ring from the servo piston.

(C) Remove the spring box from the servo piston. Remove the 2 nuts. Remove the spring guide, the spring and the spring guide.

11. Servo Piston (continued)

(A) Using a flat screwdriver, remove and discard the bushing.

(B) Remove and discard the 2 backup rings then the 2 O-rings.

Note: Be careful not to damage the housing during this process.

1. Servo Piston

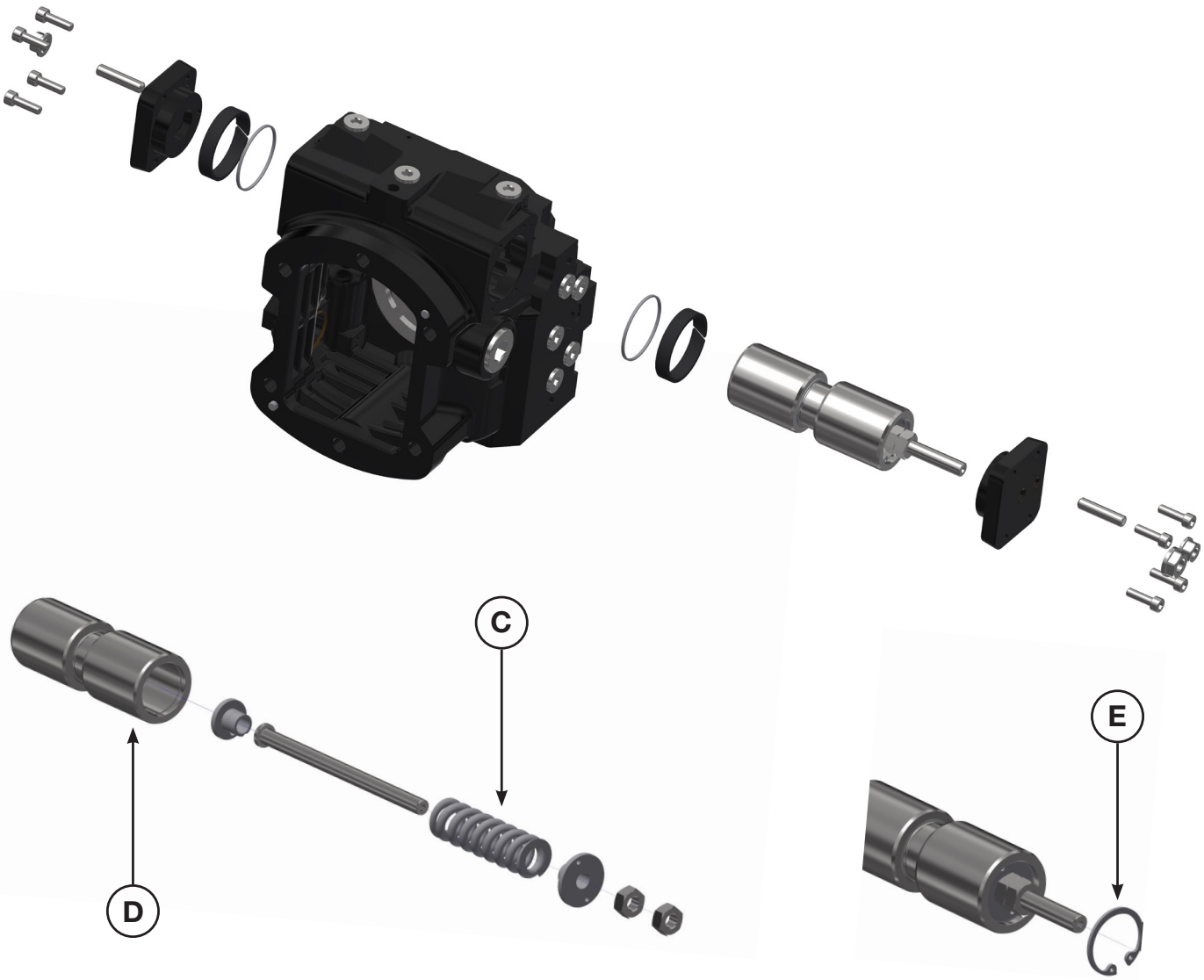
(A) Apply oil to and install the 2 new O-rings. Apply oil to and install the 2 new back up rings.

(B) Install new bushings.

(C) Install the spring guide on the screw. Install the spring on the screw. Install the spring guide onto the screw. Install the nuts and pre-tighten the spring to facilitate fitting of the snap ring.

(D) Install the spring box into the servo piston.

(E) With the snap ring pliers, install the internal snap ring into the servo piston.



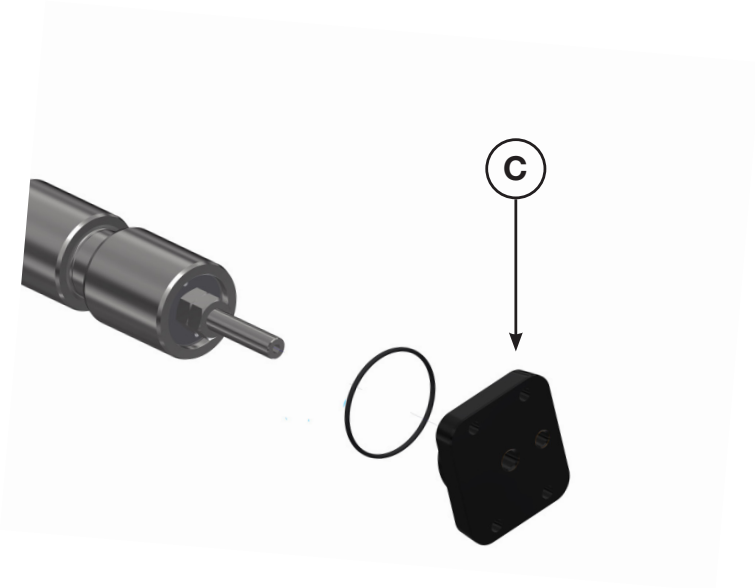
2. Mechanical Servo Control Adjustment

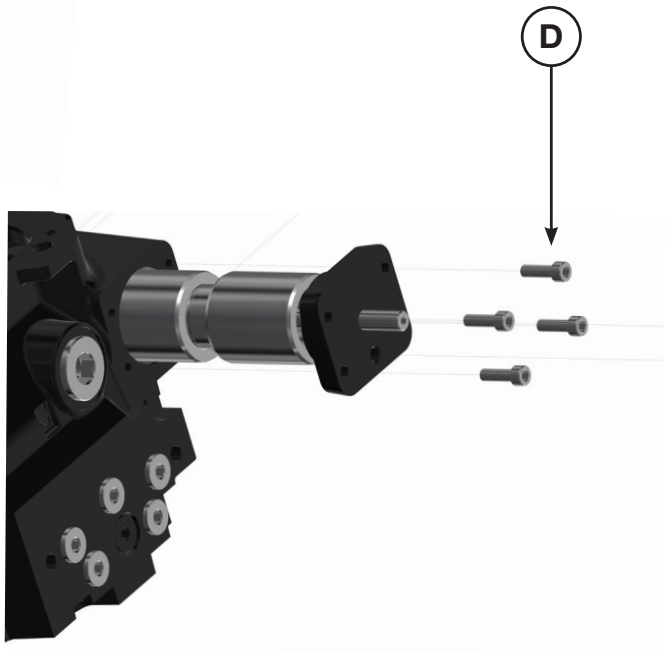
(A) Block the nut. Tighten the screw to obtain a clearance, then unscrew the screw to obtain no clearance. Block the nut using a flat wrench, thickness 2.6mm, then tighten the locknut and double check that there is no clearance. Repeat if necessary.

(B) Grease and install a new O-ring onto the cover.

(C) Screw cover onto the servo piston assembly.

(D) Apply oil to the servo piston. Next, install the complete servo piston subassembly into the housing. Install the 4 screws onto the pump housing and tighten. Tighten screws to a torque of 10+/- 1Nm.





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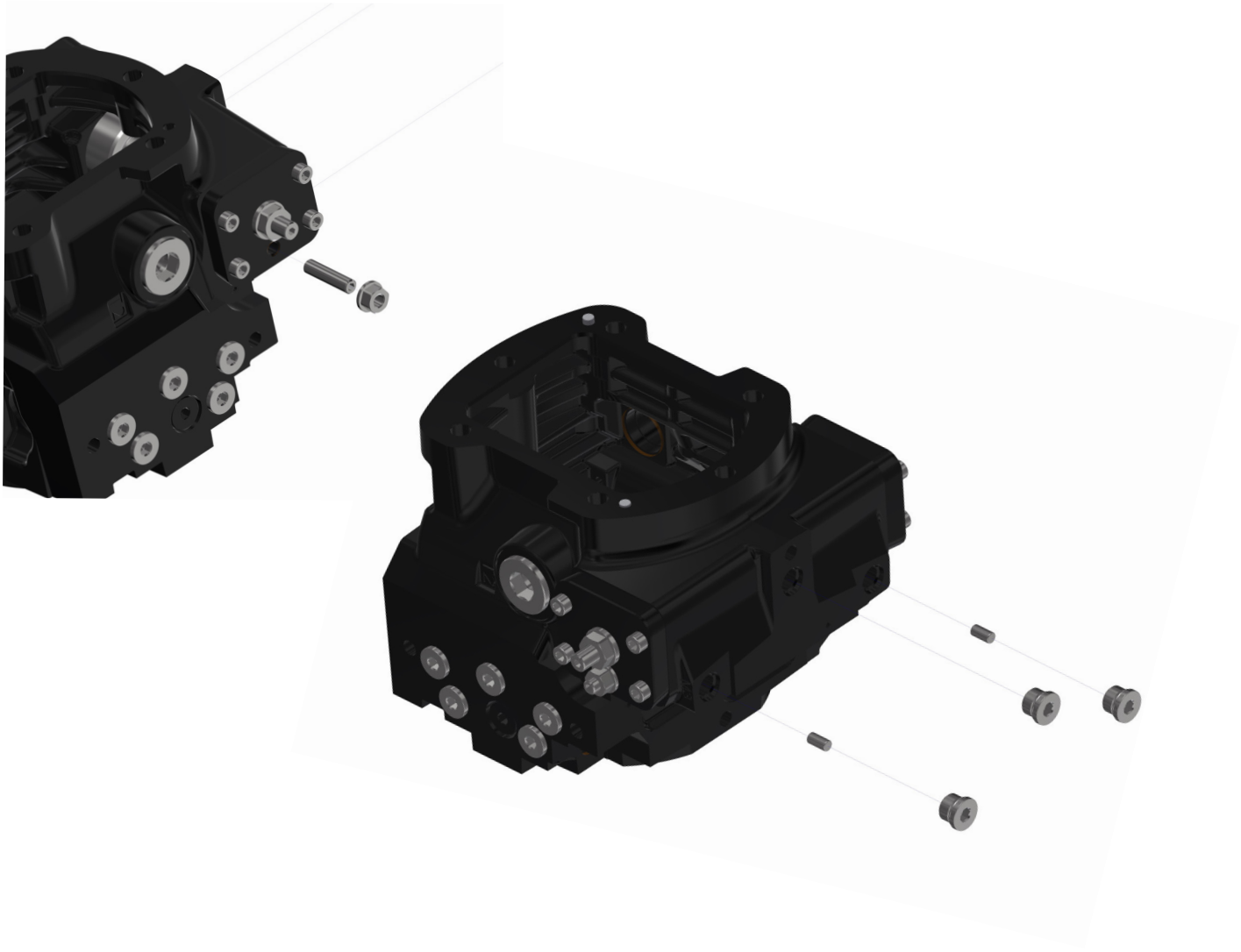
2. Mechanical Servo Control Adjustment (continued)

(A) Check that the groove of the servo piston is centered into the pump housing. If not, turn the screw clockwise or counterclockwise to adjust accordingly. Install a new seal nut onto the screw.

(B) Grease and install a new O-ring onto the cover. Tighten the plug onto the cover. Install the cover onto the pump housing using the 4 screws. Tighten the 4 screws. Tighten screws to a torque of 10+/- 1Nm.

(C) Install 2 new seal nuts onto the 2 displacement limitation screws. Install the 2 screws equipped on the 2 covers.

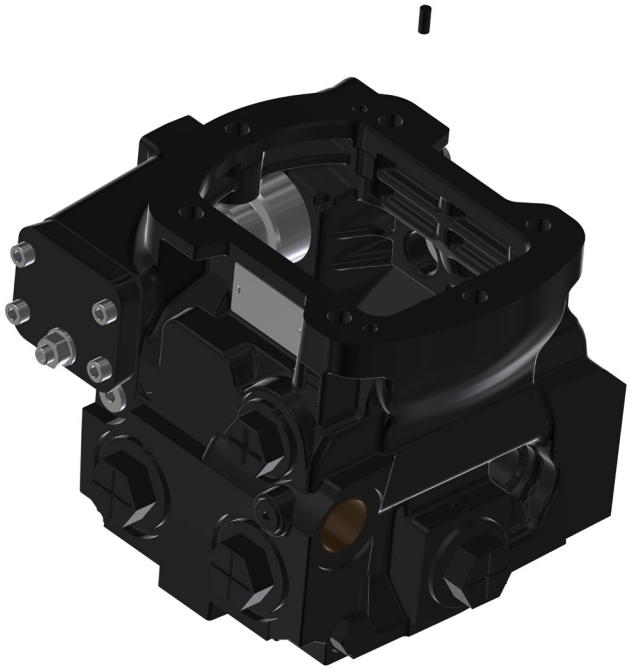
(D) Install the 2 restrictors into the pump housing. Tighten restrictors to a torque of 3.5 +/- 0.35Nm. Install the 3 plugs on the pump housing. Tighten plugs to a torque of 15 +/- 1.5Nm.



3. Valve Plate

(A) Install the pin into the pump housing. Apply grease to the pump housing. Using the mark that was made previously, install the valve plate into the pump housing.

(B) Valve Plate—Standard notch/special notch (angle is different depending on the application). Be sure to position the valve plate according to your application.

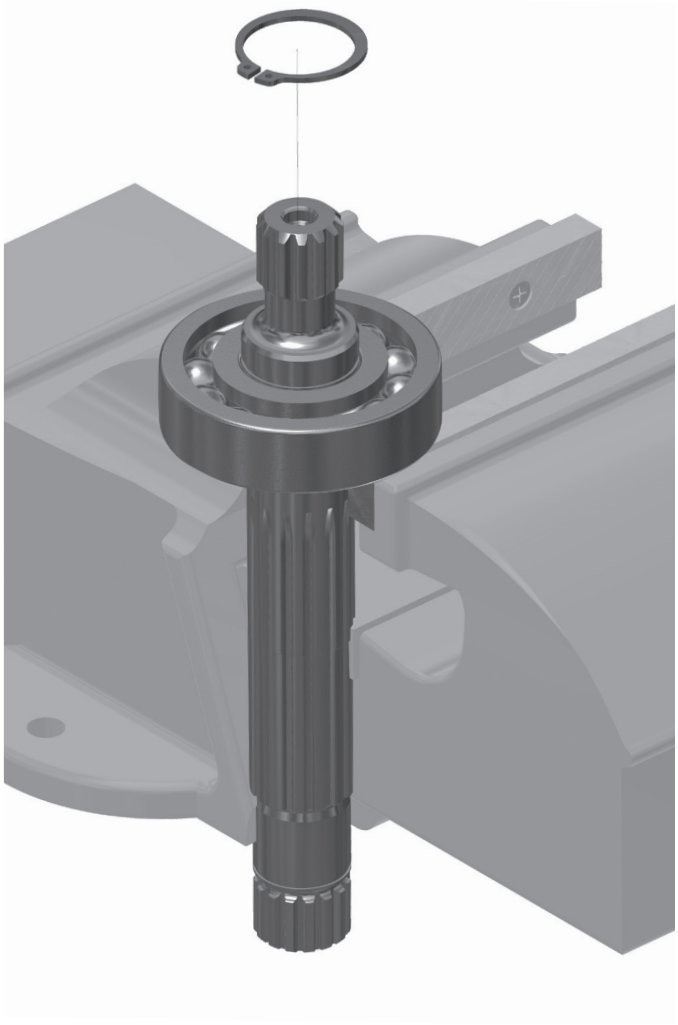


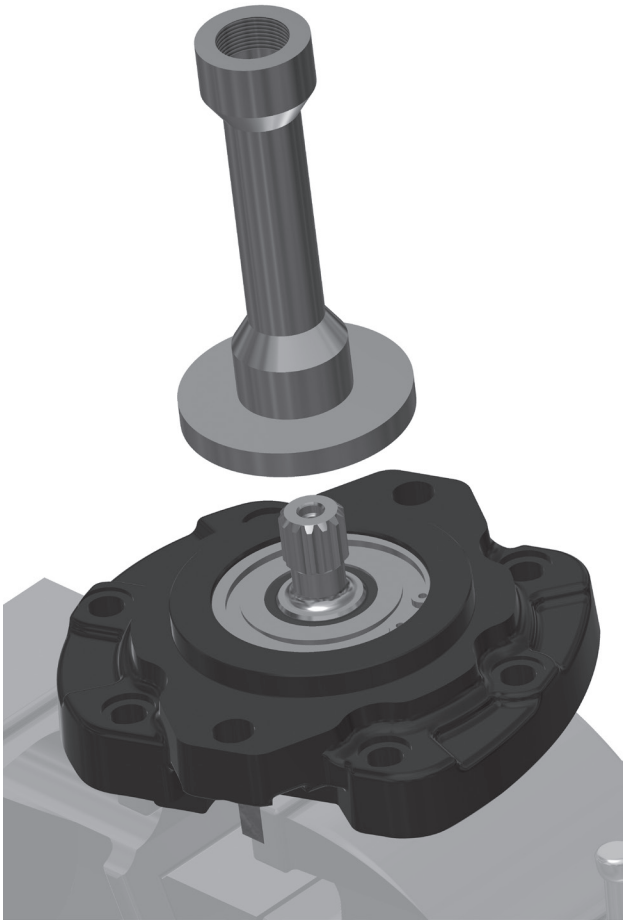
4. Revolving Unit

(A) Apply lubrication to the shaft. Install the bearing on the shaft until the stop. Use a vice with soft jaws and a mallet as needed.

(B) Install the snap ring in it's groove onto the shaft using snap ring pliers.

(C) Using Specialty Tool 5, install the drive shaft into the front cover.





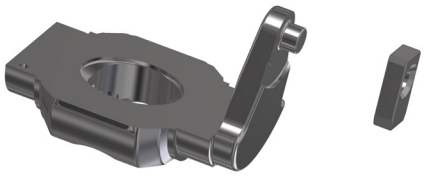
4. Revolving Unit (continued)

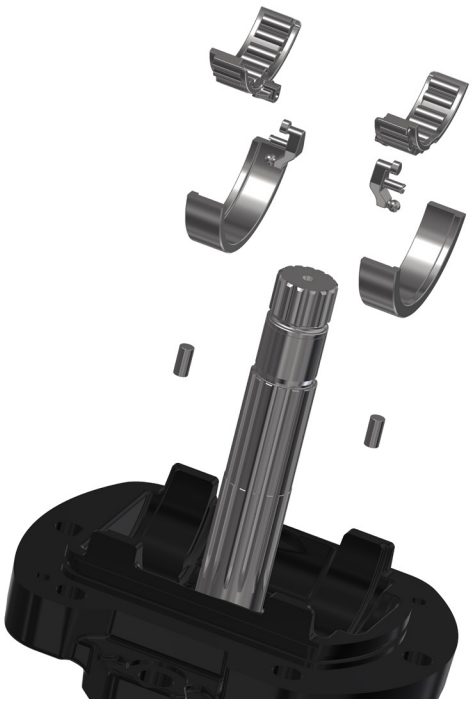
(A) Grease the new sealing ring. Using Specialty Tool 5 and mallet, install the new sealing ring into the seals support, grease and install a new O-ring onto the seals support.

(B) Install the seals support into the front cover.

(C) Using snap ring pliers, install the snap ring into the front cover.

(D) Install the 2 pins onto the front cover. Install the 2 bearing races onto the front cover. Grease and install the 2 bearing cages onto the 2 bearing races.





4. Revolving Unit (continued)

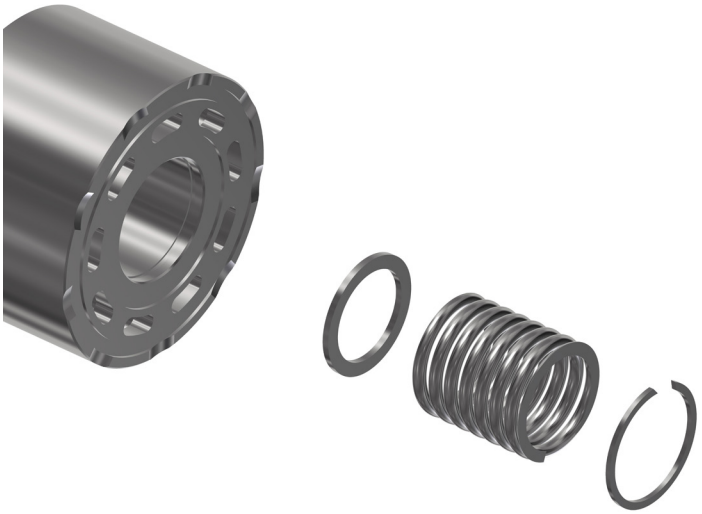
(A) Install the swashplate onto the bearing cage. Check that the swashplate slid correctly onto the bearing cage. Cseck that the bearing cage follows the swashplate for each side.

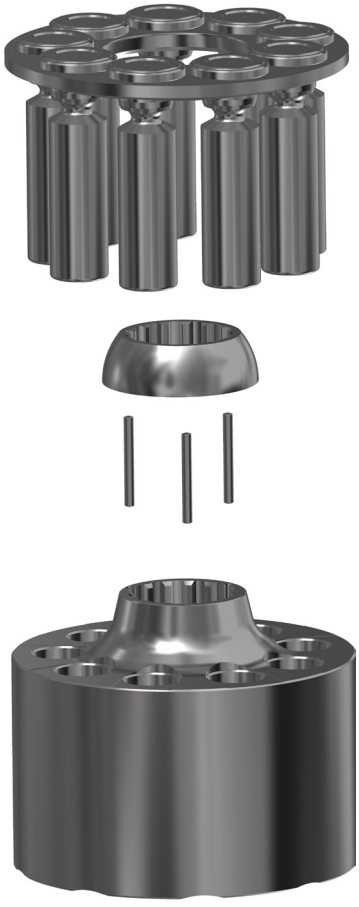
(B) Install the spring and the 2 washers into the barrel.

(C) Install the barrel in a vice with soft jaws. Using a socket, compress the spring slightly to allow the mounting of the retaining ring. Install the retaining ring into the barrel.

(D) Install the 3 pins into the barrel. Install the sphere onto the barrel.

(E) Install the pistons in the piston slipper into the retainer plate. Install the retainer plate with piston subassembly into the barrel.





4. Revolving Unit (continued)

(A) Using a vice with soft jaws, clamp the shaft. Grease the spline of the shaft. Lubricate the swashplate with oil. Install the barrel on the shaft. Install the ring on the shaft.

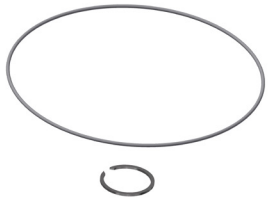
(B) Using Speciality Tools 2 and 3, install the internal bearing ring onto the shaft.

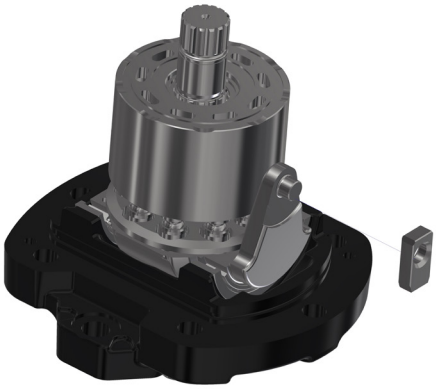
(C) Install the snap ring on the shaft. Grease and install a new O-ring onto the front cover. Grease the block slide and install it onto the swashplate.

(D) Install the pin into the pump housing.

(E) Lubricate the valve plate with oil. Using a portable crane, insert the revolving unit into the pump housing.

(F) Tighten, in a crosswire sequence, the five mounting screws. Tightening Torque: 170 +/- 17Nm.





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5. Charge Pump Reassembly

(A) If you use a filtration option, be sure to check that the plug is present in the pump housing before reassembling the boost pressure pump.

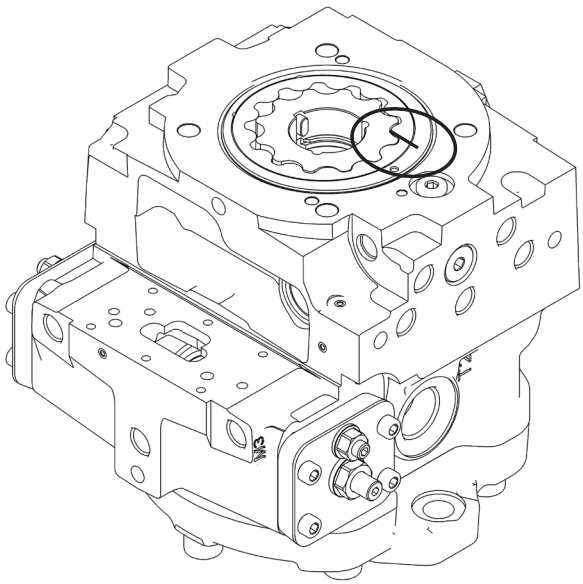
(B) The blind hold into the eccentric indicates the rotation direction of the boost pump. Clockwise rotation.

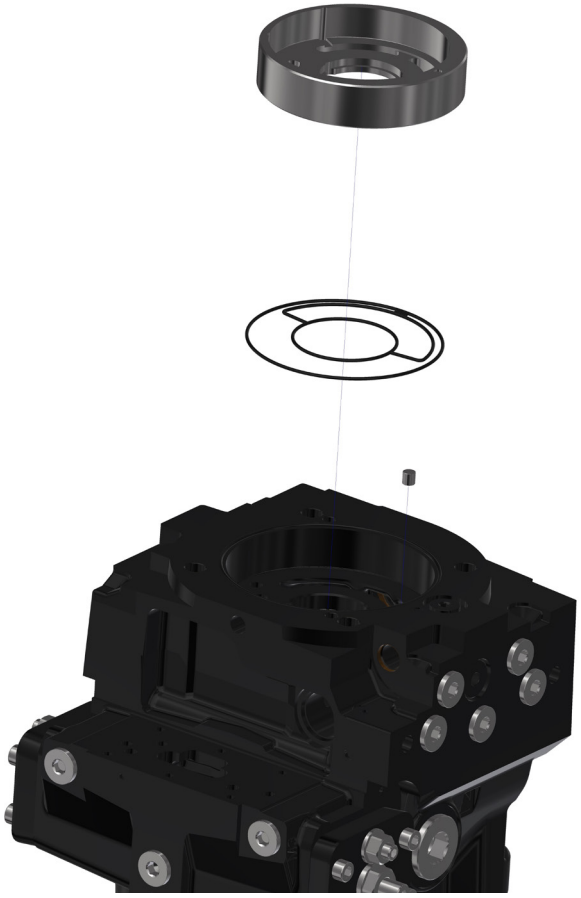
(C) Install the pin into the pump housing according to the desired rotation direction.

(D) Grease and install a new seal into the eccentric.

(E) Based on the mark on the eccentric and the pump housing, install the eccentric into the pump housing.

(F) Using a caliper, measure the thickness of the internal gerotor. If the dimension is equal to 11mm, install the snap ring into the first groove of the coupling. If the dimension is equal to 16mm, install the snap ring into the second groove of the coupling.





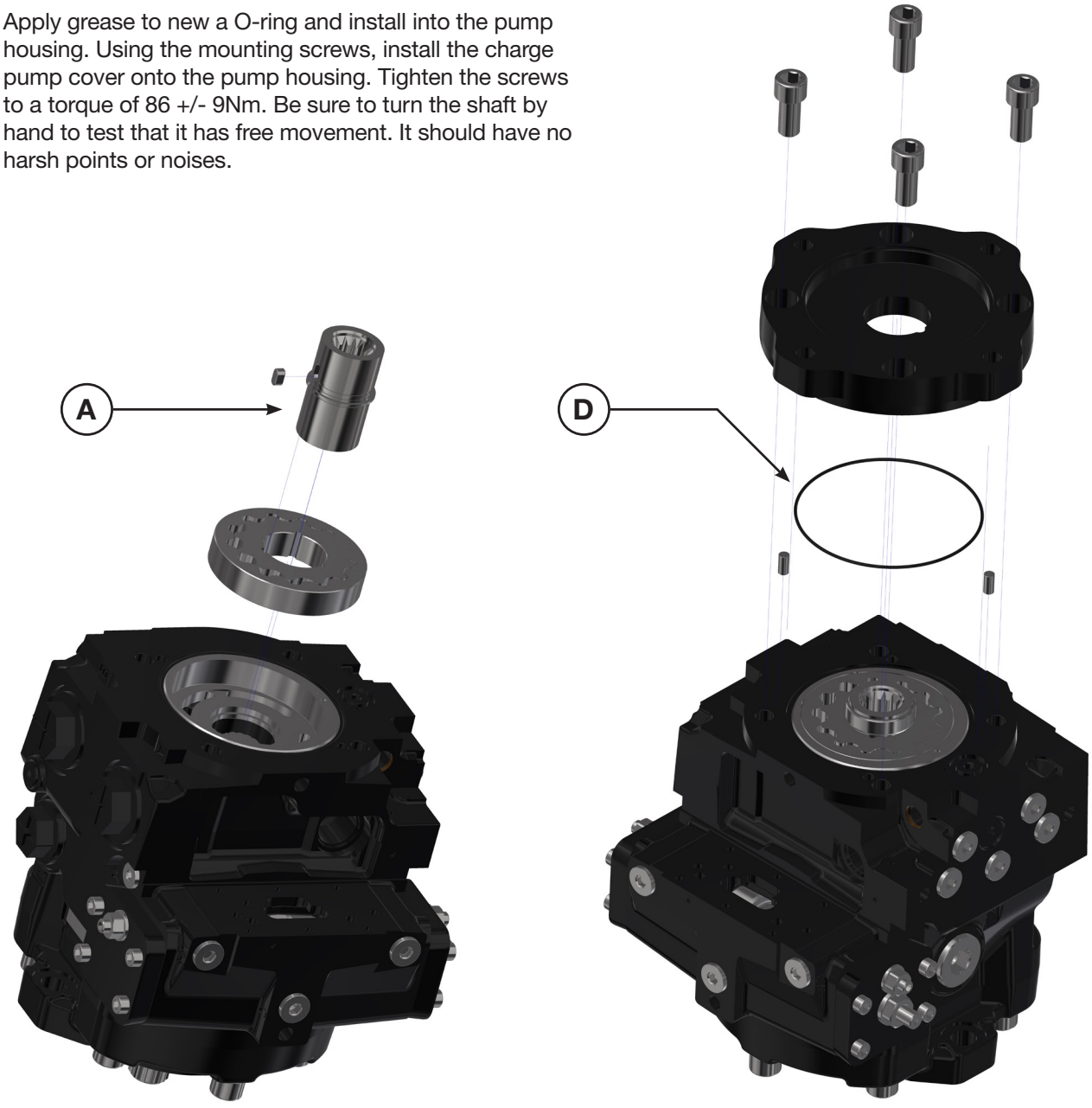
5. Charge Pump Reassembly (Continued)

(A) Install the external gerotor into the eccentric.

(B) Grease the key and install it onto the coupling. Install the internal gerotor into the coupling (according to your key position). Install the coupling onto the shaft. Lubricate the gerotor.

(C) Install the centering pins onto the pump housing.

(D) Apply grease to new a O-ring and install into the pump housing. Using the mounting screws, install the charge pump cover onto the pump housing. Tighten the screws to a torque of 86 +/- 9Nm. Be sure to turn the shaft by hand to test that it has free movement. It should have no harsh points or noises.



6. Charge Valve

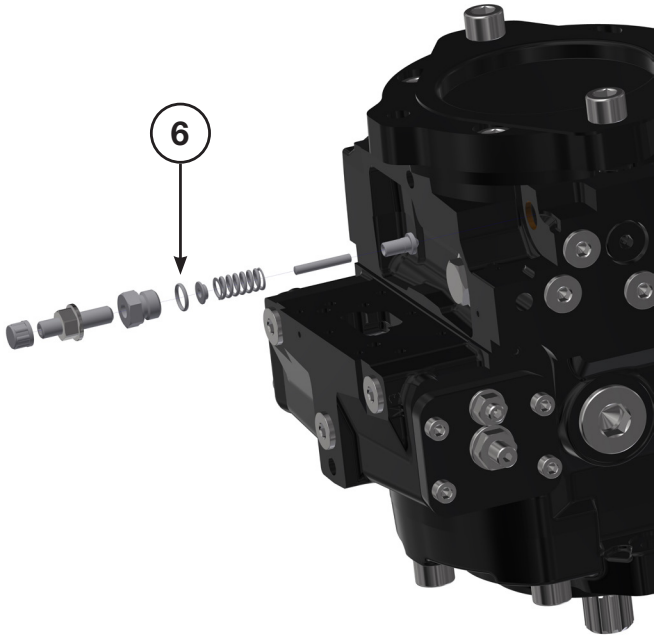
Grease and install a new O-ring onto the support screw. Install the pun into the sup-port screw. Install the spring guide ring onto the pin.

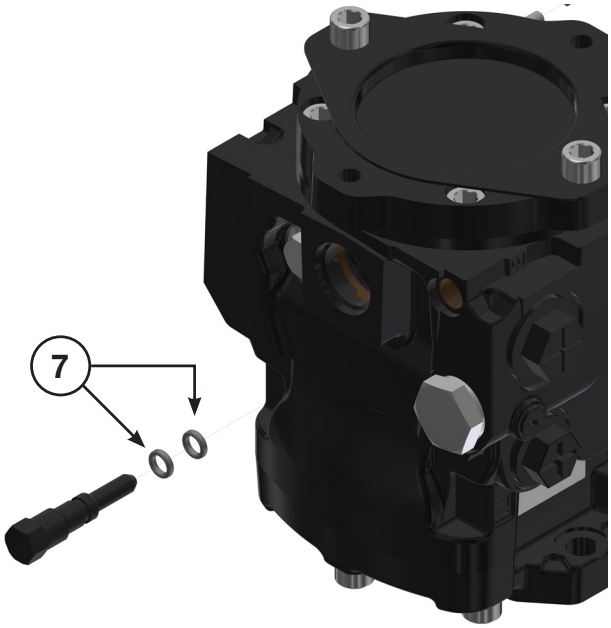
Install the spring onto the spring guide ring and the pin. Install the poppet into the spring.

Install a mew seal nut onto the setting screw. Install the setting screw onto the support screw. Install the charge relief valve assembly onto the housing. Torque to 25 +/- 2.5 Nm. Install the plastic plug.

7. Bypass Valve

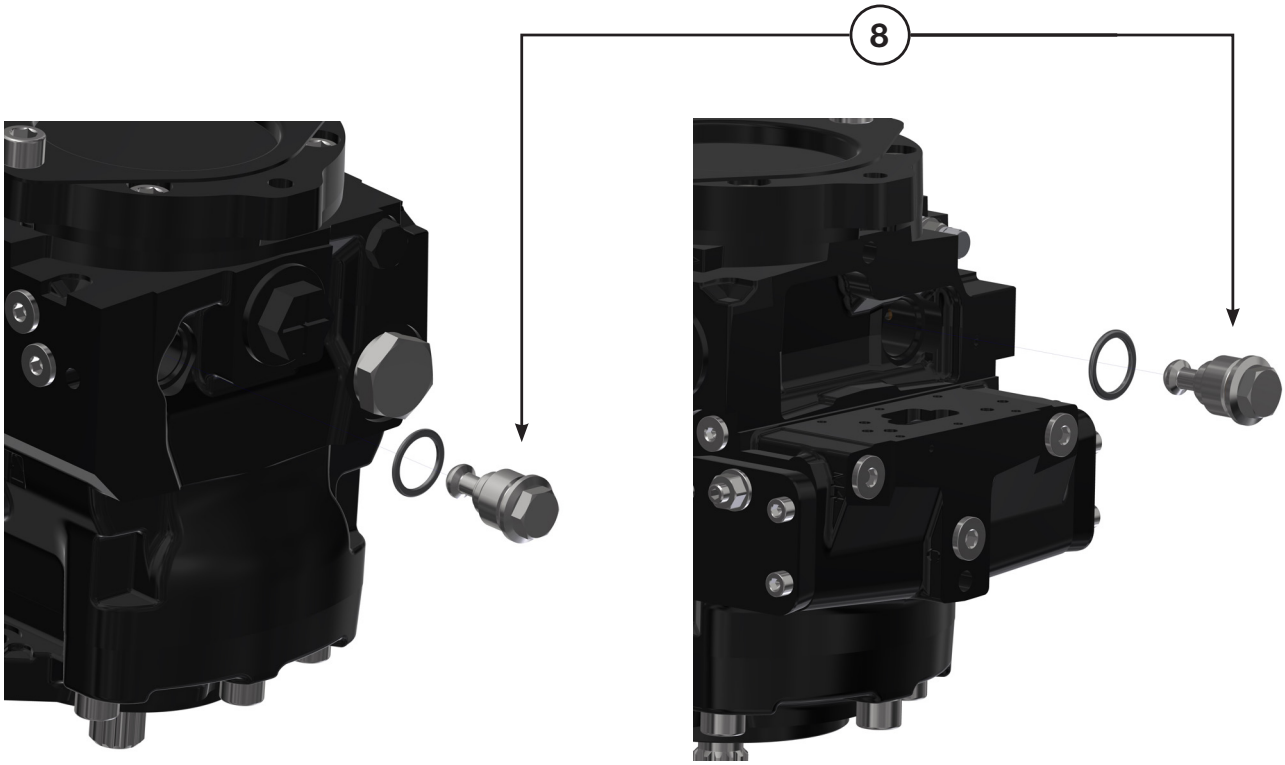
Install a new backup ring as well as a new O-ring. Grease the O-ring and the back up ring. Install the bypass valve into the pump housing. Tighten torque to 30 +/- 3 Nm.





8. Main Pressure Relief Valves

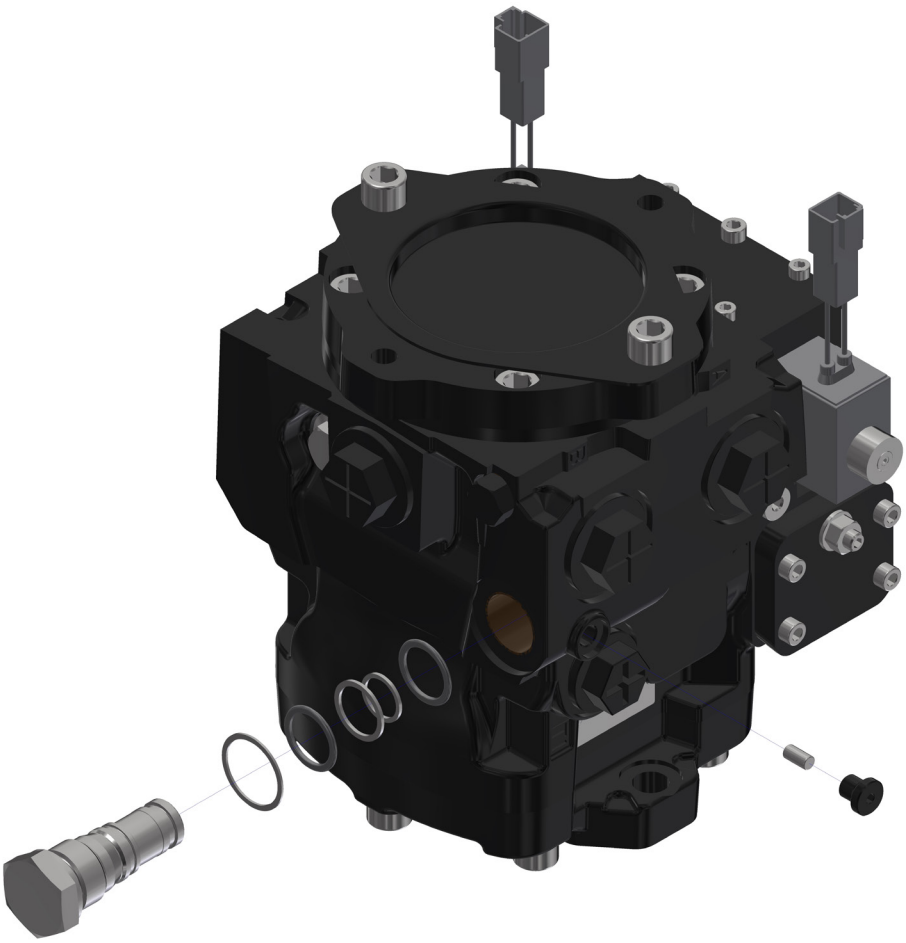
Install both pressure relief valves into the pump housing then tighten them. Torque to 52.5 +/- 2.5 Nm. If the relief valve is disassembled from the valve cap, be aware of the orientation and presence of spring.



9. Hot Oil Shuttle Valve

(A) Insert the restrictor into the housing of the pump. Tighten torque to 3.5 +/- 0.35 Nm. Be alert to not drop the restrictor into the housing. Install the plug into the pump housing. Tighten to 15 +/- 1.5 Nm.

(B) Install both O-rings onto the VME valve. Install the back up rings onto the VME valve. Install the seal onto the VME valve. Lastly, lubricate the VME valve and install it. Tighten to a torque of 65 +/- 6 Nm.



10. Filter Assembly

(A) Check to see that the plug is present in the housing if a filter was chosen as an option.

(B) Install a new filter on the filter support. Grease a new O-ring and install onto the filter cover.
Install the filter cover onto the support to a torque of 30 +/- 3Nm.
Grease and install new O-rings onto the filter support.
Install the filter support onto the pump housing using screws.

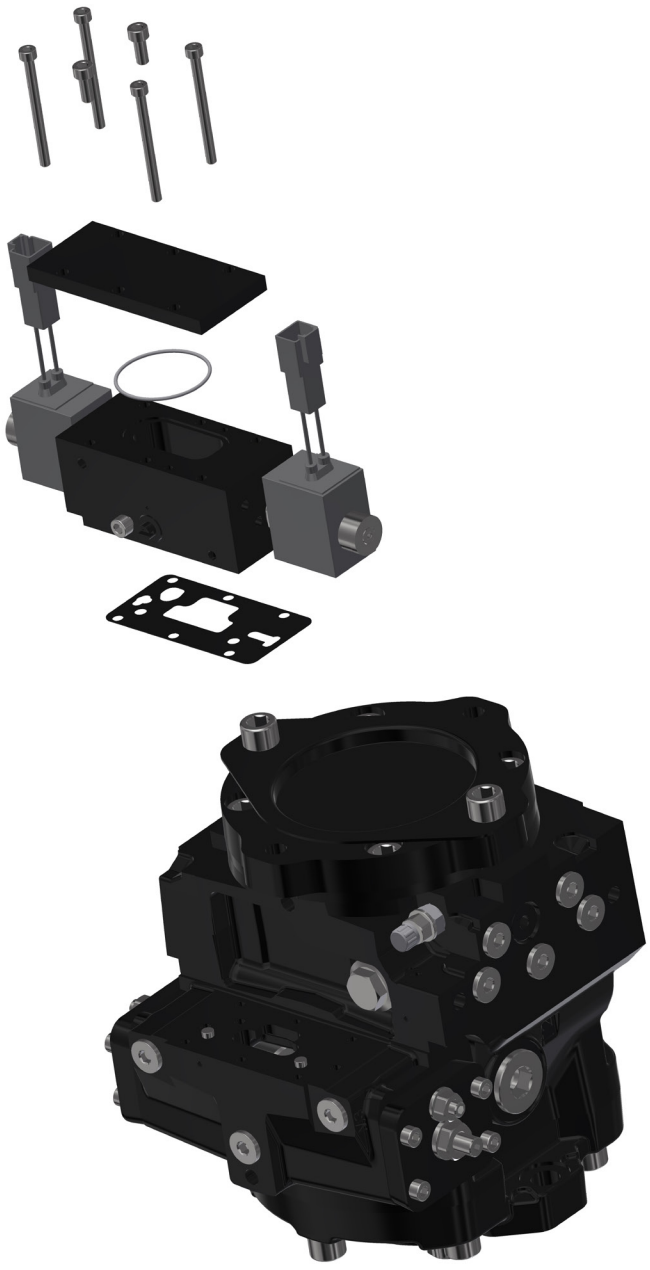
(C) Install a new clogging indicator onto the filter support if the option was chosen.
Tighten to a torque of 20 +/- 2 Nm.

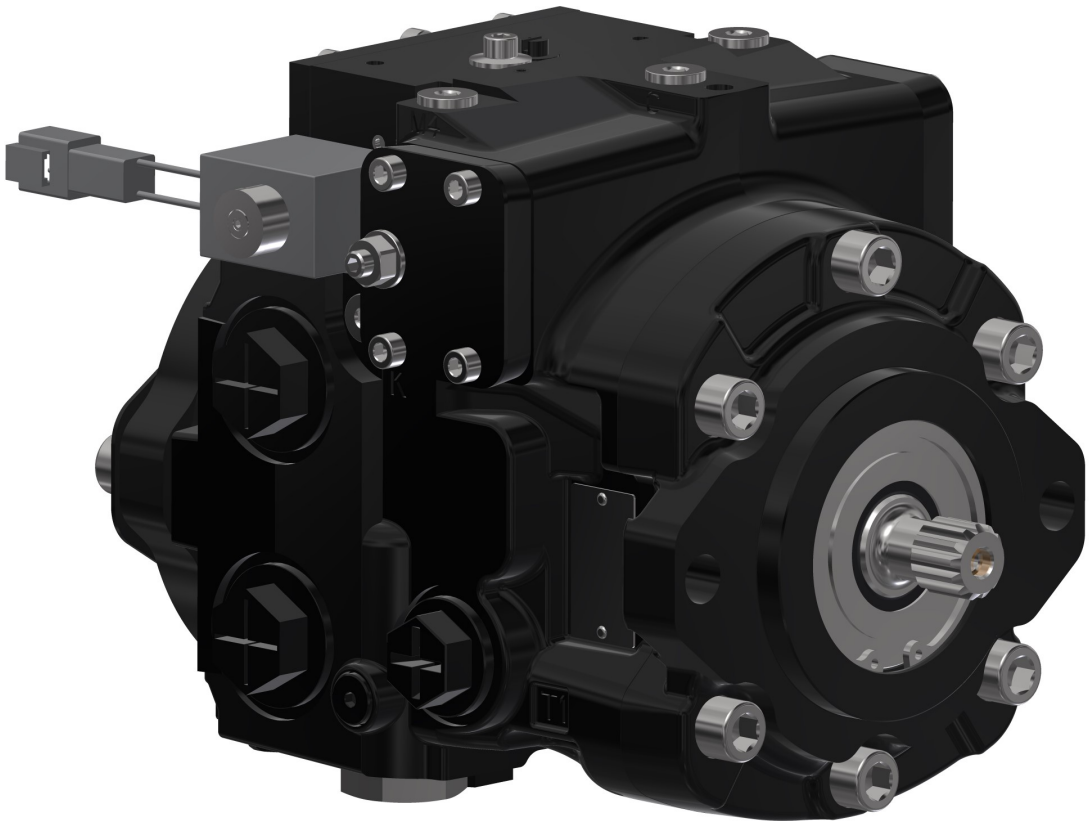
(D) Install plugs into the filter support. Tighten to a torque of 15 +/- 1.5 Nm.
Install additional plugs into the filter support at a torque of 20 +/- 2 Nm.

11. Electrical Control

(A) Examine and clean the safety screen with compressed air. If damaged, discard. Grease the safety screen and insert it back into the control support.

(B) Install the control support on the pump housing. Tighten to a torque of 5.5 +/- 0.5 Nm.





NOTICE

1. Make sure that the pump is full of oil before starting any of the following procedures.
2. Pump must have a rotation speed of 1500 RPM.
3. Oil Temperature needs to be 50C (122F).

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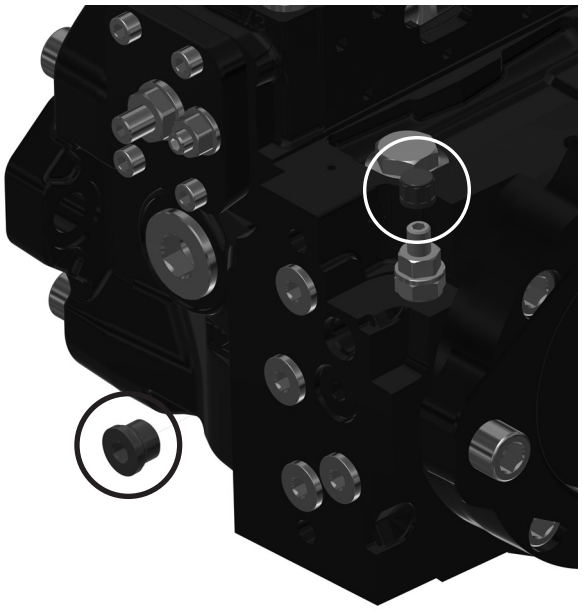
United States

1. Charge Pump Pressure Setting Adjustment

(A) Remove the plug and insert a pressure gauge. This will be used to set the pressure.

(B) Run the pump at 1500 RPM and observe the pressure. To change/set the pressure, release the seal nut and adjust the pressure using the setting screw. Once you have the desired pressure, tighten the lock nut to a torque of 25 +/- 2.5 Nm.



2. Servo Piston Zeroing Setting

(A) Remove the plug in G1 or G2 and connect a low pressure (0-60 bar) gauge. Also, remove the plugs from M1 and M2. Connect a high pressure gauge (0-600 bar) to each. Next, begin to run the pump at 1500 RPM and observe the pressure.

(B) If pressures on the high pressure gauges are different, proceed to adjust the servo piston. Untighten the nut, turn the screw clockwise or counter-clockwise until you receive the desired setting.

3. Maximum Displacement Setting

(A) Remove the plug in G1 or G2 and connect a low pressure (0-60 bar) gauge. Also, remove the plugs from M1 and M2. Connect a high pressure gauge (0-600 bar) to each. Next, begin to run the pump at 1500 RPM and observe the pressure.

(B) If pressures on the high pressure gauges are different proceed to adjust the servo piston. Untighten the nut, turn the screw clockwise or counter-clockwise until you receive the desired setting.

4. Control Neutral Setting—Control A (mechanical servo control)

(A) Remove the plug M3 and M4 and connect the low pressure 0-60 bar gauge. Untighten the locking screw. Begin turning the set screw clockwise until the pressure on the servo piston until it begins to increase.

(B) Then turn the position counter-clockwise until the pressure on the servo piston begins to increase again. Turn the setting screw back to be in the middle of the point where the pressure increased. Tighten the locking screw. After setting the pressure, the charge pressure at M3 and M4 should be identical.

5. Control Neutral Setting—Control C (hydraulic proportional with feedback)

(A) Attach pressure gauges to the M4 and M3 ports as well as the M6 and M5 ports on the hydraulic proportional control.

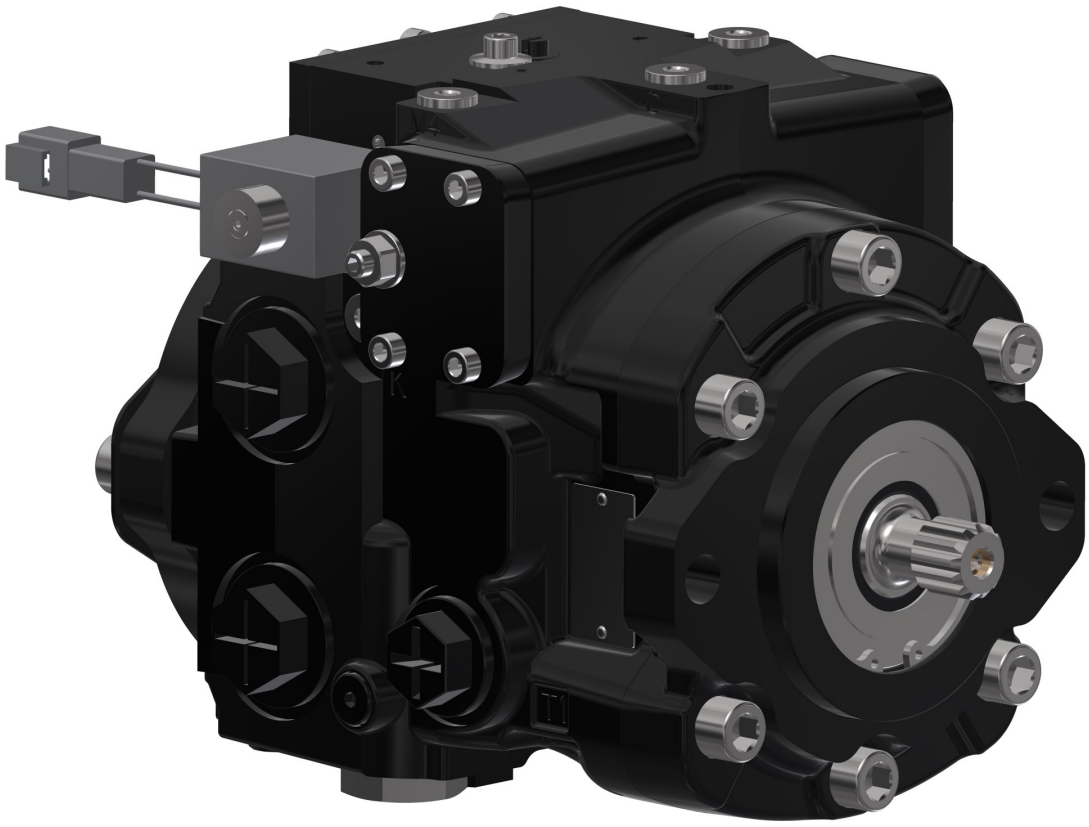
(B) Untighten the locking screw. Activate the pressure at M5 until the pressure on the servo piston begins to increase. Repeat this step on M6. Then, turn the setting screw to have the same pressure. After setting, the pressure at M3 and M4 must be the same. If that is the case, tighten the locking screw.

6. Control Neutral Setting—Control A (electric proportional with feedback))

(A) Plug EV1 and EV2 solenoids into potentiometers. Remove the plugs at M3 and M4 and connect the appropriate pressure gauges. Untighten the locking screw.

(B) Once the pump is running at 1500 RPM, activate the pressure on M5 until the pressure on the servo increases. Repeat this step at M6. Next, turn the setting screw to have the same pressure as M5 and M6.

After setting this, the charge pressure at M3 and M4 should be the same. Once this is achieved, tighten the locking screw.



NOTICE

1. Make sure that the pump is full of oil before starting any of the following procedures.
2. Pump must have a rotation speed of 1500 RPM.
3. Oil Temperature needs to be 50C (122F).

1. Charge Pump Pressure Setting Adjustment

(A) Remove the plug in port G1 and insert a pressure gauge. This will be used to set the pressure.

(B) Run the pump at 1500 RPM and observe the pressure. To change/set the pressure, release the seal nut and adjust the pressure using the setting screw. Once you have the desired pressure, tighten the lock nut to a torque of 25 +/- 2.5 Nm.

2. Servo Piston Zeroing Setting

(A) Remove the plug in G1 or G2 and connect a low pressure (0-60 bar) gauge. Remove the plugs from M1 and M2. Connect a high pressure gauge (0-600 bar) to each. Next, begin to run the pump at 1500 RPM and observe the pressure.

(B) If pressures on the high pressure gauges are different, proceed to adjust the servo piston. Untighten the nut, turn the screw clockwise or counter-clockwise until you receive the desired setting.

3. Maximum Displacement Setting

(A) Remove the plug in M1 and M2 and connect a low pressure (0-60 bar) gauge. Remove the plugs from M1 and M2. Connect a high pressure gauge (0-600 bar) to each. Next, begin to run the pump at 1500 RPM and observe the pressure.

(B) Untighten the nut. Based on your model code, adjust the displacement setting. Check the flow using a flowmeter. Use the screw to adjust the displacement. Tighten the nut once the desired level is reached. Lastly, activate the control to 200 bar on the B side and repeat the same operation above.

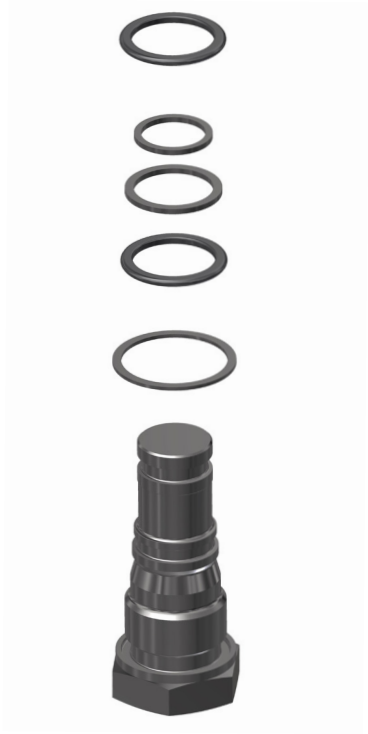
4. Control Neutral Setting—Control A (mechanical servo control)

(A) Remove the plug M3 and M4 and connect the low pressure 0-60 bar gauge. Untighten the locking screw. Begin turning the set screw clockwise until the pressure on the servo piston until it begins to increase. Then turn the position counter-clockwise until the pressure on the servo piston begins to increase again. Turn the setting screw back to be in the middle of the point where the pressure increased. Tighten the locking screw. After setting the pressure, the charge pressure at M3 and M4 should be identical.

Part Number	Description
S2H-20688-5	Cross Port Relief 150 bar
S2H-20689-5	Cross Port Relief 200 bar
S2H-20690-5	Cross Port Relief 250 bar
S2H-20691-5	Cross Port Relief 300 bar
S2H-20692-5	Cross Port Relief 350 bar
S2H-20693-5	Cross Port Relief 370 bar
S2H-20694-5	Cross Port Relief 400 bar

Part Number	Description
S2H-20695-5	Charge relief Frame 2 and 3

Part Number	Description
S2H-20696-5	Hot oil shuttle Frame 2 and 3



Part Number	Description
S2H-20697-5	Bypass valve Frame 2 and 3

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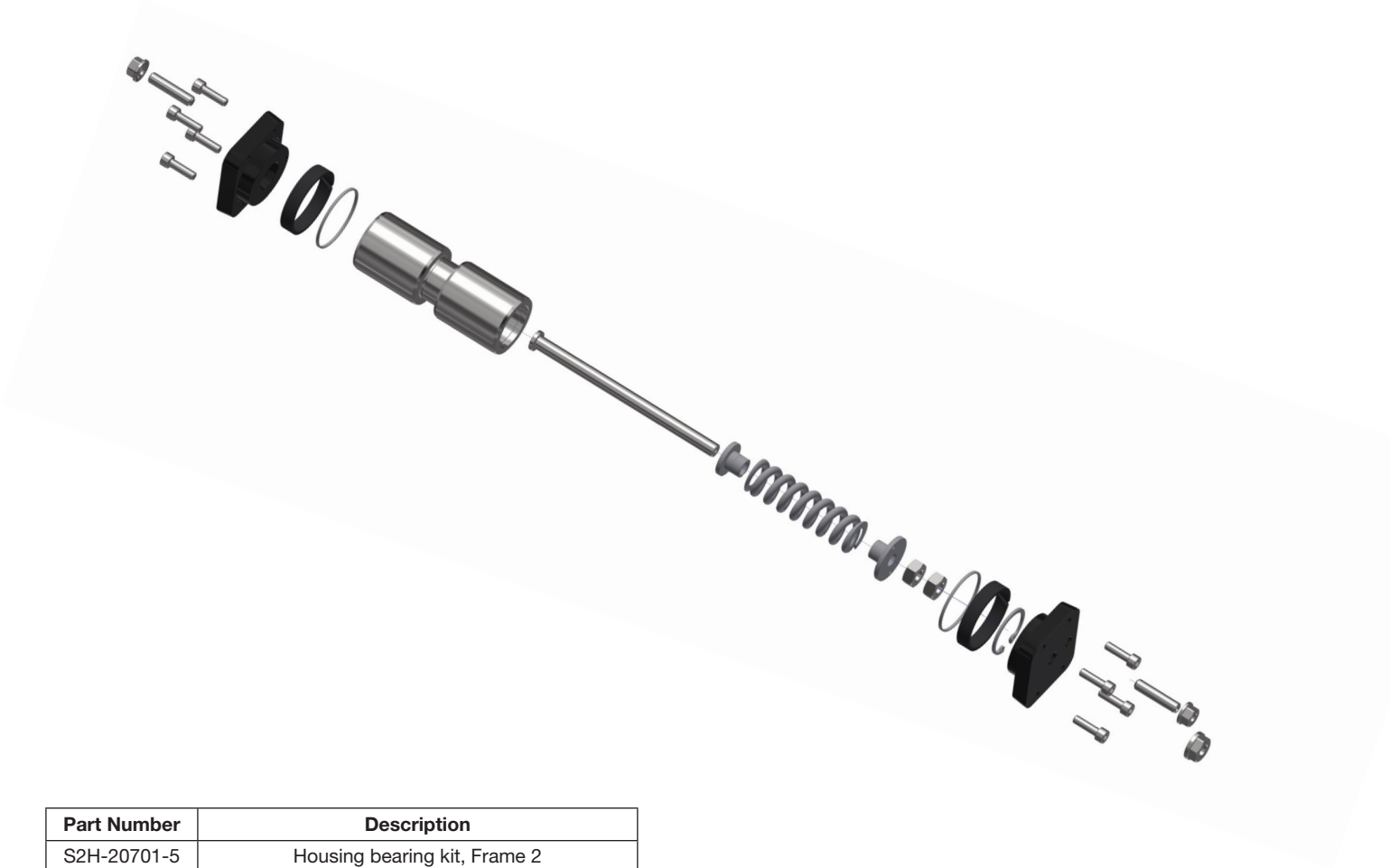
Part Number	Description
S2H-20698-5	Seal kit, FKM, Frame 2
S2H-20770-5	Seal kit, FKM, Frame 3

Part Number	Description
S2H-20703-5	Shaft retainer kit Frame 2
S2H-20775-5	Shaft retainer kit, Frame 3

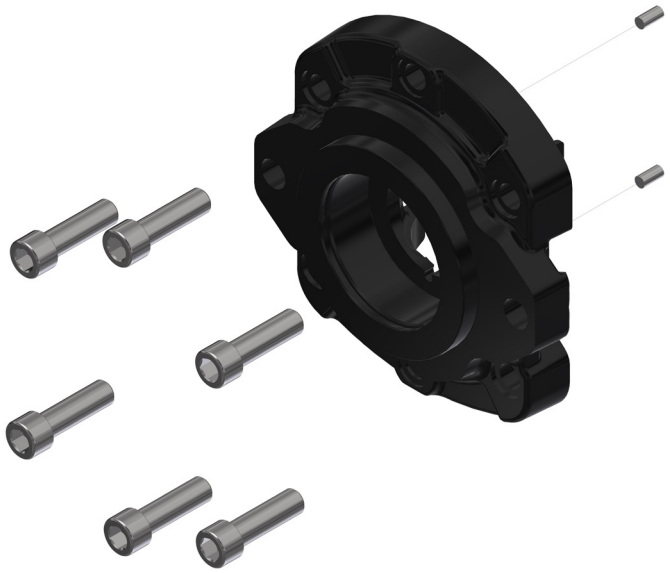
Part Number	Description
S2H-20711-0	Shaft kit, Frame 2, SAE B 13T
S2H-20712-0	Shaft kit, Frame 2, SAE BB 15T
S2H-20778-0	Shaft kit, Frame 3, SAE B 13T
S2H-20779-0	Shaft kit, Frame 3, SAE B-B 15T
S2H-20780-0	Shaft kit, Frame 3, SAE C 14T

Part Number	Description
S2H-20702-5	Servo piston kit, Frame 2
S2H-20774-5	Servo piston kit, Frame 3

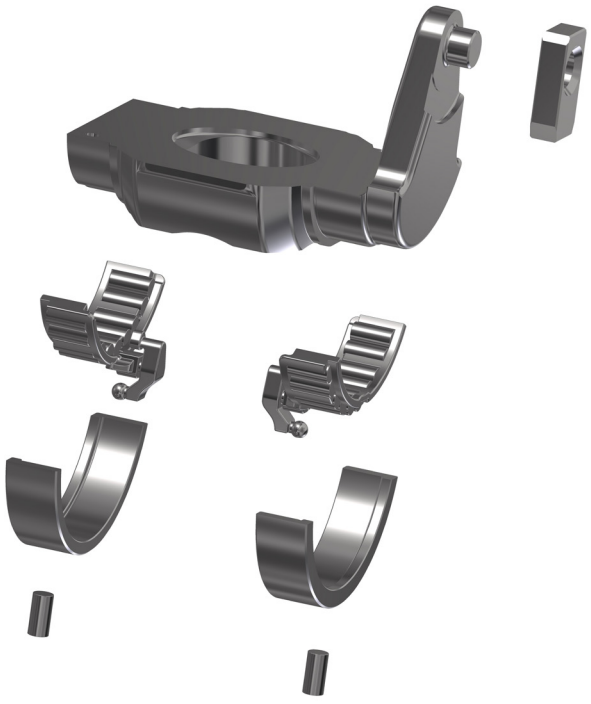


Part Number	Description
S2H-20701-5	Housing bearing kit, Frame 2
S2H-20773-0	Housing bearing kit, Frame 3

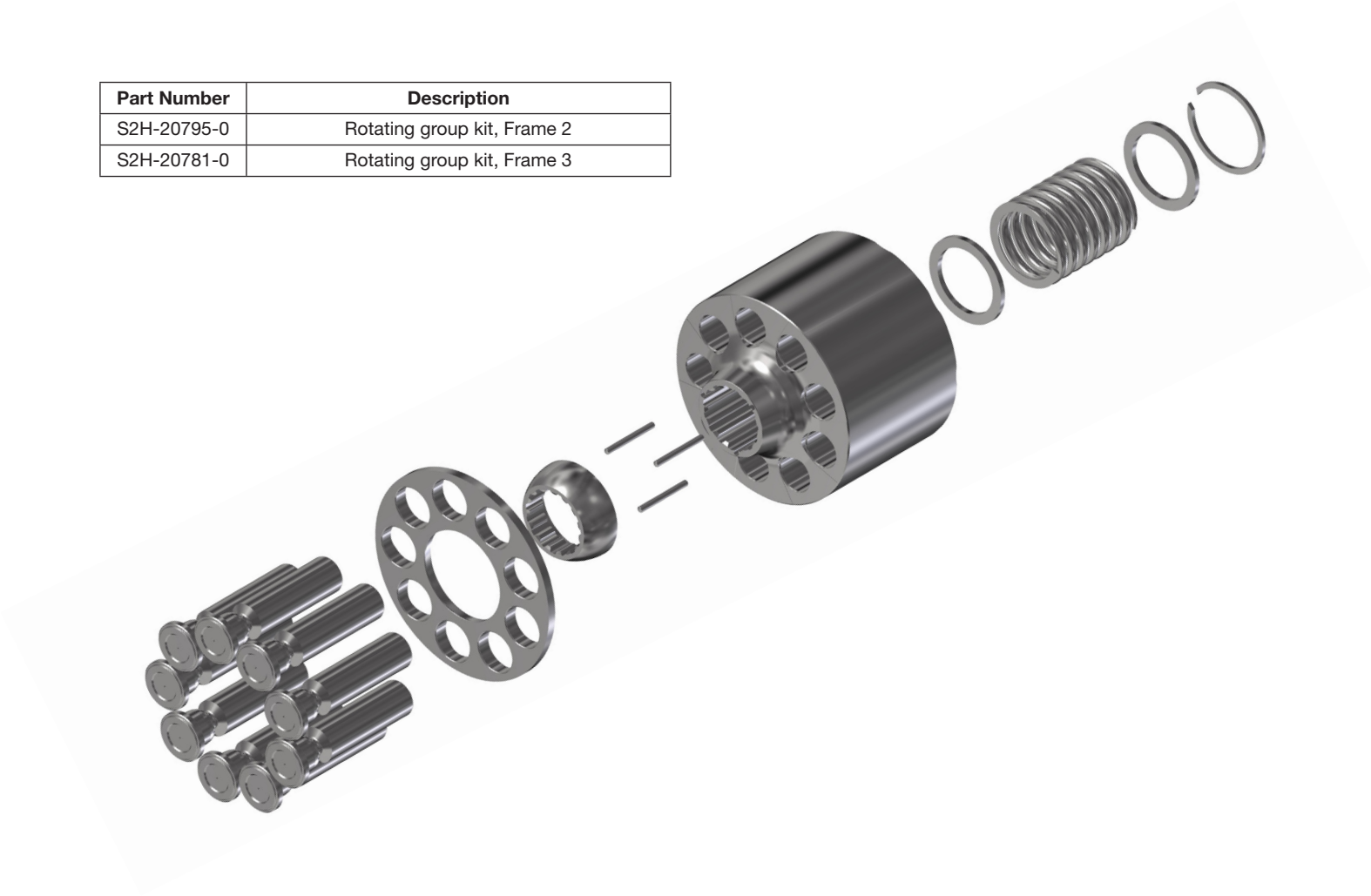
Part Number	Description
S2H-20704-0	Mount housing kit, Frame 2
S2H-20776-0	Mount housing kit, Frame 3



Part Number	Description
S2F-20705-0	Swashplate kit, Frame 2
S2H-20777-0	Swashplate kit, Frame 3

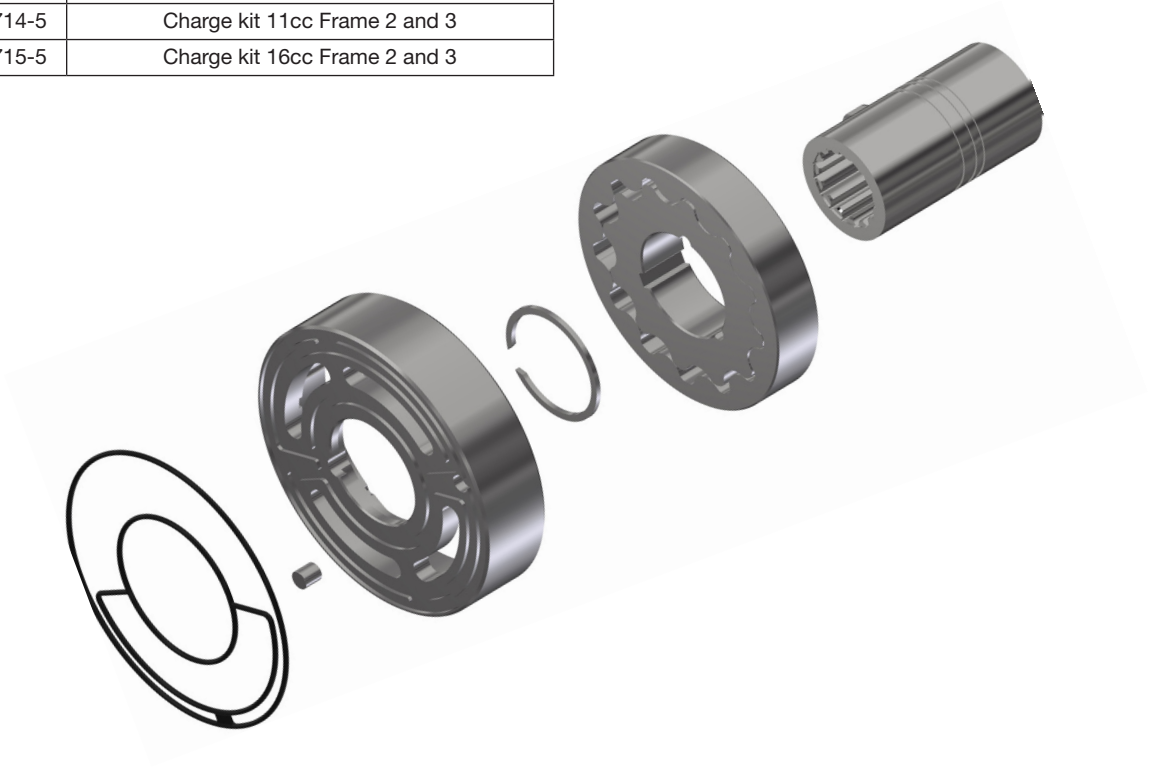


Part Number	Description
S2H-20795-0	Rotating group kit, Frame 2
S2H-20781-0	Rotating group kit, Frame 3



Part Number	Description
S2H-20707-0	Valve plate, CW, Frame 2, Standard timing
S2H-20709-0	Valve plate, CCW, Frame 2, Standard timing
S2H-20782-0	Valve plate, CW, Frame 3 Standard timing
S2H-20783-0	Valve plate, CCW, Frame 3 Standard timing

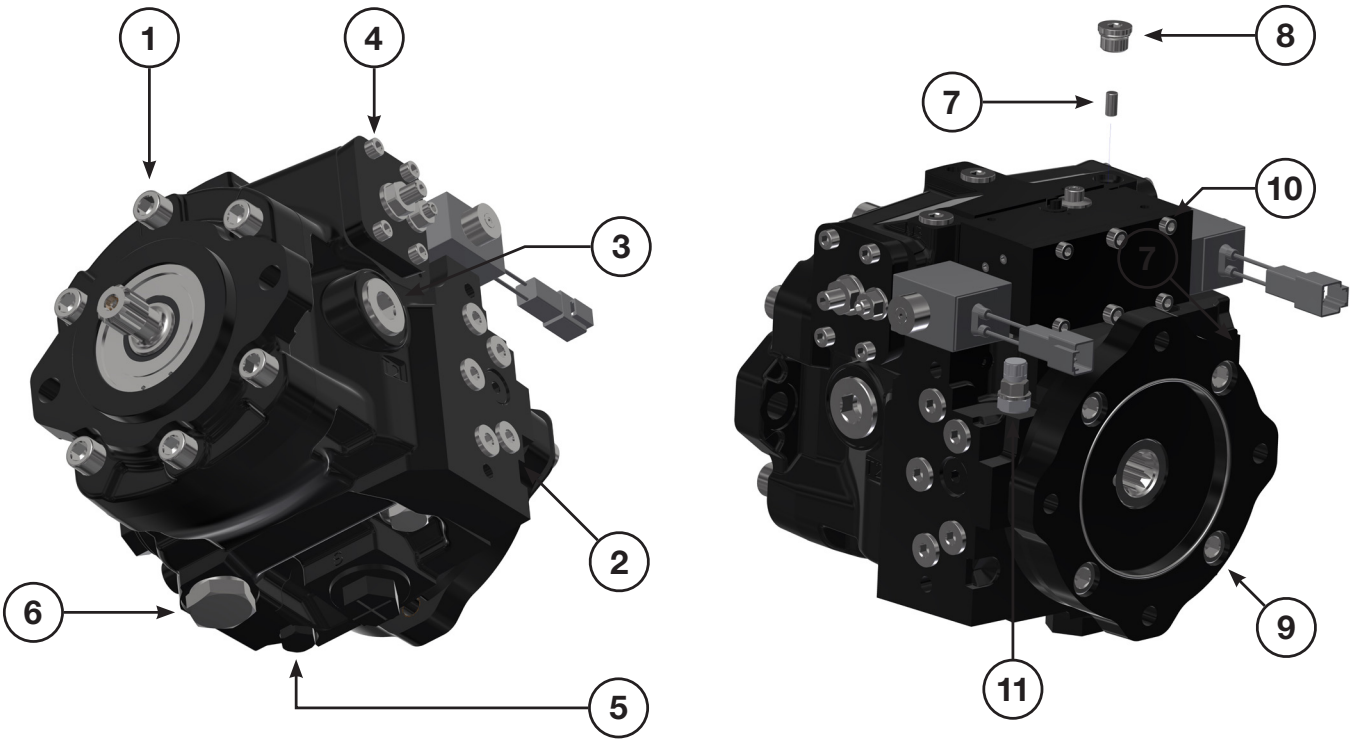
Part Number	Description
S2H-20713-5	Charge kit 8cc Frame 2 and 3
S2H-20714-5	Charge kit 11cc Frame 2 and 3
S2H-20715-5	Charge kit 16cc Frame 2 and 3



Part Number	Description
S2H-20716-5	Frame 2 and 3 end cover kit
S2H-20717-5	Frame 2 and 3 SAE A 9T through drive kit
S2H-20718-5	Frame 2 and 3 SAE A 11T through drive kit
S2H-20719-5	Frame 2 and 3 SAE B 13T through drive kit
S2H-20720-5	Frame 2 and 3 SAE BB 15T through drive kit

Part Number	Description
S2H-20769-5	SAE A blanking plate
S2H-20786-5	SAE B blanking plate

Part Number	Description
S2H-20721-5	Charge filter assembly, no indicator, Frame 2
S2H-20793-5	Charge filter assembly, no indicator, Frame 3
S2H-20794-5	Charge filter assembly, indicator, Frame 3
S2H-20723-5	Charge filter element Frame 2 and 3



			Tightening Torque	
Item	**Qty**	**Designation**	**Nm**	**Lbf.ft**
1	6	Mounting Flange Bolts	170 +/- 17	125.4 +/- 13
2	5	M1, M2, G1, G2, R	20 +/- 2	14.8 +/- 1.5
3	1	T2	46 +/- 4.6	33.9 +/- 3.4
4	8	Servo Piston Cover	10 +/- 1	7.38 +/- 0.7
5	1	Bypass Valve	30 +/- 3	22.1 +/- 2.2
6	1	Hot Oil Shuttle	65 +/- 6	47.9 +/- 4.4
7	2	Control orifice	3.5 +/- 0.35	2.6 +/- 0.26
8	3	Plugs - M4, M3, C	15 +/- 1.5	11.1 +/- 1.1
9	4	Through Drive Bolts	86 +/- 9	63.4 +/- 6.6
10	4 or 6	Control Bolts	6 +/- 0.6	4.43 +/- 0.5
11	1	Charge Relief Valve	25 +/- 2.5	18.44 +/- 1.8

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14. **Force Majeure**. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.
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16. **Termination.** Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.
17. **Governing Law.** This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.
18. **Indemnity for Infringement of Intellectual Property Rights.** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.
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October 2020	Initial Release

HY28-2713-02/PC3/US 10/2020

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