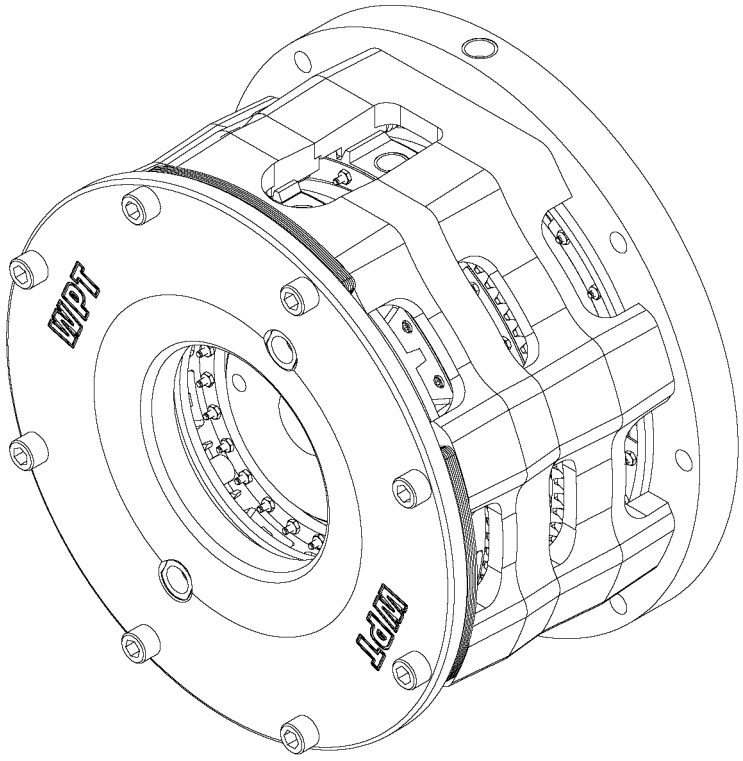
COPPER WATER COOLED (CWC) CLUTCHES/BRAKES

INSTALLATION & MAINTENANCE INSTRUCTIONS



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1.0 INTRODUCTION

1.1 The WPT Power Clutch/Brake is the most rugged available on the market today. Follow the procedures detailed in this Installation Maintenance Manual for years of service.

1.2 When ordering parts, use the part numbers from the Bill of Materials supplied with this unit. Also, include the part number and the serial number from the unit itself. These will be found on a metal tag riveted to the Clutch/Brake. Your WPT Distributor can provide a copy of the Bill of Materials if the one provided should become lost. **NOTE: The drawing and bill of material supplied with the clutch/brake overrides the information in this manual.**

1.3 The diagrams and instructions in this manual are not intended to cover all models of clutches/brakes but are to provide general information for the field repairman servicing the WPT clutch/brake. This manual also has metric measurements given. The metric measurements are shown in parenthesis (*).

! DANGER

Forward this manual to the person or persons responsible for the installation and/or operation and/or maintenance of the product described herein. Without access to this information, faulty installation, operation and/or maintenance will occur, which could result in equipment damage, personal injury and even death.

! DANGER

Use of improper tools and/or methods used in installing or servicing this clutch/brake can result in accidents causing injury and/or death. Adequate lifting points are provided to safely handle only the individual clutch/brake components. Lifting and handling of the assembled clutch/brake will require the use of alternate methods.

! DANGER

Read these instructions thoroughly and review until you fully understand all warning and hazards before proceeding with the work described in this manual. Failure to follow these instructions in this manual can result in unreasonable exposure to hazardous conditions and/or personal injury and/or death.

Throughout there are HAZARD WARNINGS that must be read and adhered to, in order to prevent possible loss of equipment and/or personal injury and /or loss of life. The three warning words are “DANGER”, “WARNING” and “CAUTION”. They are used to indicate the severity of the hazard and are preceded by a safety alert symbol. ⚠

“DANGER” – Denotes the most serious injury hazard and is used when serious injury or death **WILL** result from misuse or failure to follow the specific instructions sit forth in this manual.
“WARNING” – Denotes when serious injury or death **MAY** result from misuse or failure to follow the specific instructions set forth in this manual.
“CAUTION” – Denotes when injury or product or equipment damage may result from the misuse or failure to follow the specific instructions set forth in this manual.

It is the responsibility of the personnel involved in the installation, operation, and maintenance of this equipment, on which this clutch/brake is mounted, that they must fully understand the warnings and dangers that are listed in this manual and are aware of what the correct procedures must be to safely install, operate and maintain this equipment.

2.0 PRODUCT DESCRIPTION

The WPT Copper Water Cooled Brake (CWC) is designed for high energy braking applications. It is very well suited for high inertia stopping and rapid heat dissipation. This is accomplished by the passing of cooling water through a Water Jacket behind Copper Alloy Wear Plates.

The design of the WPT CWC brake permits mid-shaft and end-shaft mounting.

WPT CWC's are available in various sizes and quantities of friction discs. Consider for example, a 314 CWC indicates that there are three 14" diameter Drive Plates.

The WPT CWC can be used on either closed-loop or open-loop water systems.

The Brake must have the Hub attached to the shaft of the equipment that is being managed.

The Brake works when the Actuator is pressurized and applies an axial force to the assembly. The Floating Plate Water Jacket moves towards the Backplate Water Jacket, which engages the friction disc material with the Copper Wear Plates. Release Springs disengage the Brake when pressure is released from the Actuator.

The Brake's output torque can be controlled by varying the actuation pressure.

Torque flows through the Brake from the equipment's shaft, through the Hub, through the friction material mounted to the Drive Plates, through the wear surfaces, through the Clamp Tubes and the Studs, to the mounting Backplate which is attached to a rigid surface.

3.0 INSPECTION

3.1 The machine surface (or attached mounting bracket) should have a machined pilot to allow for the mounting and alignment control of the Brake. The design should provide full support for the face of the mounting flange to prevent any deflection during operation. Refer to the appropriate drawing for the detailed mounting pilot diameters, mounting bolt circles and positions, and Stud support bracket recommendations for each Brake.

3.2 For proper operation and service life, the Brake should be mounted to a solid part of the machine which has a mounting pilot for the Backplate Water Jacket. Use a dial indicator to verify that the total indicated reading of alignment is within the specification provided in **Table 7**. Correct as necessary.

Table 1 – Alignment Requirements – in. (mm)

SIZE	CONCENTRICITY	PERPENDICULARARITY
14"	0.005 (0.13)	0.007 (0.18)
18"		0.009 (0.23)

3.3 Concentricity **of the Shaft**: With the dial indicator mounted to a solid part of the machine, place place the indicator tip on the shaft and rotate the shaft. The Total Indicated Reading should be within value shown in **Table 1**. See **Figure 1** below.

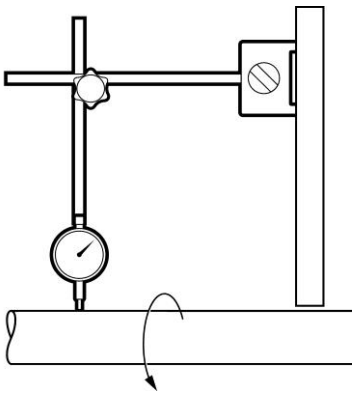


Figure 1

3.4 **Concentricity of Mounting Bracket**: With the dial indicator mounted to the shaft, place the indicator tip on the pilot diameter and rotate the shaft. The Total Indicated Reading should be within value shown in **Table 1**. See **Figure 2** below.

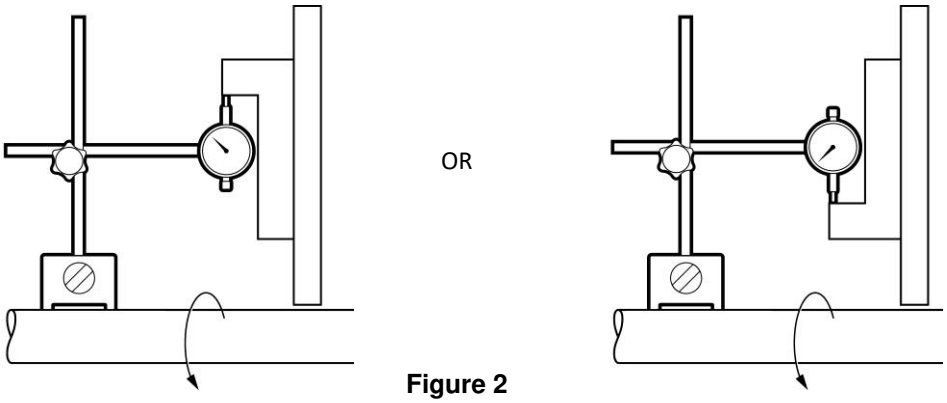


Figure 2

3.5 **Perpendicularity of Mounting Bracket**: With the dial indicator mounted to the shaft, place the indicator tip on the face of the mounting bracket/surface and rotate the shaft. The T.I.R. (Total Indicated Reading) should be within value shown in **Table 1**. See **Figure 3** below.

NOTE: Adjustment of the mounting surfaces may be necessary.

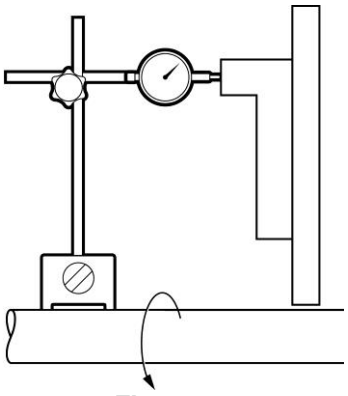


Figure 3

4.0 INSTALLATION

⚠ CAUTION

Proper alignment is necessary to ensure that the friction disc track properly. Improper alignment will result in excessive wear to the friction material and the mating surfaces and generate heat and excessive drag. Improper alignment will also overstress the gear and the splined bore of the center plate. See Figure 2.

⚠ WARNING

Maximum allowable air pressure is 130 lbf/in² (9.0 bar). Operating he clutch/brake beyond the maximum air pressure may result in damage to the clutch/brake.
Compressed air must be dry and filtered to avoid contamination of the airtube and possible damage to valves during operation. Lubrication in the air line is not required for the clutch/brake but may be required for any valves.

4.1 The brake is usually mounted to a mounting bracket. The pilot on the mounting bracket must be concentric and perpendicular with the shaft. This can be checked with a dial indicator as shown in 3**.0 INSPECTION**.

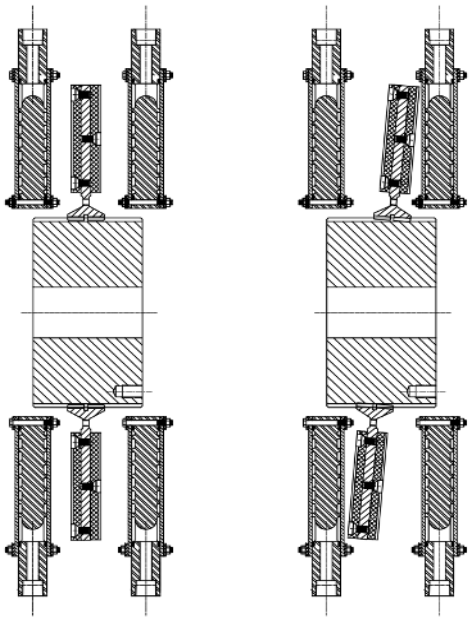


Figure 4

Correct ✓ **Incorrect** ✗

4.2 The Hub should be positioned to ensure that the disc splines will not overhang the end of the Hub when the Brake is mounted. Refer to your Brake drawing for the dimension between the Brake mounting surface and the end of the Hub. The Brake Hub should be checked for overhang with new and worn conditions after installation is complete.

4.3 Check that the shaft of the equipment is free of nicks and burrs. Ensure that the key will fit properly in the shaft and the Hub.

4.4 Apply a light coat of anti-seize compound to the shaft and the key. Tap the key into the shaft keyway.

4.5 Heat the Hub uniformly to 250° F (121° C) to expand the bore and ease the assembly. Press the Hub onto the shaft, making sure that the dimension between the Hub and the Brake mounting surface is maintained. Allow the Hub to cool.

4.6 Lock the hub in this position to prevent axial movement during operation.

4.7 If the unit is to be mounted while completely assembled, for multiple plate units be sure that the spline(s) on the drive plate(s) are aligned with the splines on the hub. This is accomplished by installing the Hub in the Drive Plates to align the splines. Center the Hub and Drive Plates in the Brake and apply and maintain 25% of the rated actuation pressure to engage the Brake. Keep pressure applied to the Actuator until the Brake is installed.

4.8 Slide the complete unit over the pilot on the mounting bracket. Insert the mounting bolts and tighten (see page 13 for torque values). For a brake, the water inlets must be at the lowest level of the water chamber, and the water outlets at the highest level. This is necessary to insure a full chamber of water.

4.9 Even though the units are properly set before shipment from the factory, they should be checked for proper clearance before being put into operation.

4.10 Operating clearance is obtained by measuring the distance the pressure plate moves while applying and removing operating pressure to the airtube. Add or remove shims to achieve the proper clearance listed in **TABLE 2** below.

Table 2 – Operating Clearances

Clutch/Brake Size: Inches	Minimum – Maximum Operating Clearances					
	1 Disc Units		2 Disc Units		3 Disc Units	
	Inch	mm	Inch	mm	Inch	mm
14	1/16 – 1/8	1.59 – 3.18	3/32 – 5/32	2.38 – 3.97	1/8 – 3/16	3.18 – 4.76
18	1/16 – 1/8	1.59 – 3.18	3/32 – 5/32	2.38 – 3.97	1/8 – 3/16	3.18 – 4.76

4.11 Install all flexible water connections to the unit. Be sure that all floating water jackets are free to move.

4.12 If the unit is disassembled before mounting, follow steps 7.8 thru 7.23 (reassembly). Note: when assembling 2 or 3 plate units horizontally, all threads can be used to support the ring, shims and airtube holding plate.

4.13 When movement on the pressure plate reaches the tabulated distance below, shims should be removed to achieve the proper clearance. When all shims have been removed and the pressure plate moves the tabulated distance below, the friction material needs to be replaced. **14" and 18" sizes = 7/16" (11.11)**

4.14 Burnishing before initial operation is recommended to reach rated torque. At initial startup, run the equipment at 50% of the rated horsepower until the rated torque is achieved. Failure to do so will reduce the torque capability of the brake until worn in.

5.0 OPERATION

5.1 Allowable actuation pressure:

Table 3 – Actuation Pressures

Pressure for Pneumatic Airtube Style CWC's		
Size	14"	18"
Rated Maximum	100 lbf/in² (7 bar) 130 lbf/in² (9 bar)	

! CAUTION

Do not operate Brake beyond maximum allowable actuation pressure. Exceeding the allowable pressure will cause damage to the Clutch/Brake.

5.2 Braking torque is directly proportional to the actuation pressure applied.

5.3 Excessive slip speeds will result in rapid friction material wear and reduced torque. To extend the life of the frictions and wear plates, the values listed on Table 15 should not be exceeded.

Table 4 – Maximum Disc Speeds

Size	Max. Speed RPM
14" CWC	1600
18" CWC	1300

! DANGER

Do not operate above the maximum slip speeds. Exceeding the maximum slip speeds may result in reduced torque and damage to the Clutch/Brake.

5.4 Maximum inlet water pressure should never exceed 60 lbf/in² [4.1 bar].

5.5 Never should there be more than a 50 deg. F (10 deg. C) rise between the inlet and the outlet. Refer to Table 5 for the maximum coolant outlet temperature for various Water/Ethylene Glycol mixtures.

Table 5 – Maximum Coolant Outlet Temperatures

% Ethylene Glycol By Volume in Water	Maximum Outlet ° F (°C)
0	150 (65)
30	165 (74)
50	170 (77)

Table 6 – Minimum water flow requirements

Model Number	Dissipation Capacity HP (KW)	Parallel Water Flow - % Ethylene Glycol – GPM (LPM)		
		0 %	30 %	50 %
114	75 (56)	7.5 (28)	9.8 (37)	12 (45)
214	150 (112)	15 (56)	20 (74)	24 (90)
314	225 (168)	22.5 (84)	29 (111)	36 (135)
118	120 (90)	12 (45)	16 (60)	19 (72)
218	240 (180)	24 (90)	32 (120)	38 (144)
318	360 (270)	36 (135)	48 (180)	57 (216)

INSTRUCTIONS FOR REPLACING O-RINGS AND COPPER WEAR PLATES SIZES 6" THRU 24"

6.0 DISASSEMBLY PROCEDURE

6.1 Remove all flexible hose connections (air & water) from unit.

6.2 Remove the cap screws which hold the airtube holding plate onto the unit and remove the airtube holding plate, the airtube, and the pressure plate from the unit.

! CAUTION

When disassembling, caution should be taken when removing the actuating assembly to prevent the front ring from separating from the back ring.
NOTE: when disassembling 2 or 3 plate units horizontally, use all threads to support the ring, shims and airtube holding plate.

6.3 Remove the floating water jacket.

6.4 Remove the drive plate assembly from the splined hub.

6.5 Remove the front ring. Leave the back ring in place.

6.6 Remove the separator springs. Remove the center water jacket. Remove the second drive plate assembly and the second set of separator springs. For 3 plate units, continue until all water jackets, drive plate assemblies and springs have been removed.

6.7 Remove the mounting bolts which hold the unit onto the mounting bracket and remove the backplate water jacket and the back ring.

6.8 Remove all socket head capscrews in the backplate water jacket in order to separate the back water jacket from the ring.

6.9 For replacement of the copper wear plates and o-rings, remove all copper O.D. and I.D. retaining capscrews and O.D. retaining snap rings as applicable, from the water jackets.

6.10 Remove copper plate from water jackets.

6.11 Remove the "O" rings from the water jackets.

6.12 Check jackets for cracks or deformities.

6.13 Check "O" ring grooves for any porosity and roughness that may cause leaks.

7.0 ASSEMBLY PROCEDURE

7.1 Clean all "O" ring grooves by brushing all corrosion from the grooves, being careful not to damage or nick the surfaces.

7.2 With the water jacket in a horizontal position and with the water cavity facing up, apply a uniform bead of "O" ring lubricant in the I.D. and O.D. "O" ring grooves.

7.3 Position both "O" rings into their respective grooves.

7.4 Place the copper wear plate into the water jacket, being careful that the "O" rings are not disturbed.

7.5 Replace all capscrews, snap rings, support rings, and spring retainer as applicable on the water jacket and torque the flexloc nuts to:

#6 flexloc nuts	1.5 lbf•ft	18 lbf•in	2 Nm
#8 flexloc nuts	3 lbf•ft	36 lbf•in	4 Nm
#10 flexloc nuts	4 lbf•ft	48 lbf•in	5 Nm
1/4" flexloc nuts	6 lbf•ft	72 lbf•in	8 Nm

Torque stainless steel nuts and stainless-steel thread lock bolts to:

#10 stainless steel nuts	2.5 lbs/ft	30 lbs/in	3.4 Nm
1/4" stainless steel nuts	4 lbs/ft	48 lbs/in	5.4 Nm

7.6 For the center water jacket, place both the O.D. and the I.D. "O" rings in their respective grooves and position the copper wear plate on one side of the center water jacket. Bolt the copper wear plate down with six equally spaced bolts on the I.D. of the wear plate to the center water jacket. Invert the water jacket and support the copper on blocks. Remove the nuts from the bolts. Be careful that the o-rings in the down position do not come out of their grooves. Place the o-rings in their respective grooves on the side facing up, and position the copper wear plate in place. Replace the nuts on the six bolts, in order to hold the wear plates in place. Insert the rest of the bolts and tighten, do not over tighten, torque nuts as specified in 7.5 above. Install O.D. snap rings as applicable.

7.7 Connect the water supply to the assembled water jackets and test for leaks before reinstalling into unit. **CAUTION: Inlet water pressure should not exceed 45 lbf/in² [3.1 Bar]. If leakage occurs, disassemble, and reassemble as described previously**.

7.8 Bolt the backplate water jacket to the bottom ring with the socket head capscrews and torque bolts per the chart on page 13. Slide the ring and backplate assembly over the pilot on the mounting bracket. Insert the mounting bolts and tighten (see page 13 for torque values).

7.9 Place the drive plate assembly onto the splined hub and push the drive plate assembly until it touches the copper wear plate on the backplate water jacket.

7.10 Position the separator springs into the counter-bored holes or over the dowels in the backplate water jacket (for single plate units go to 7.19 below).

7.11 Slide the center water jacket into the splined ring, being sure that the water inlet and outlet in the water jacket line up with the slots in the front ring. If necessary, with a small diameter rod, the springs can now be aligned with the counter-bored holes in both the water jackets.

7.12 Place the second drive plate assembly onto the splined hub and push the drive plate assembly until it touches the copper wear plate on the center water jacket.

7.13 Set front ring onto back ring. Take care that the water outlet slots in both rings align with the water inlet-outlet in the backplate water jacket. Note: when assembling 2 or 3 plate units horizontally, all threads can be used to support the ring, shims and airtube holding plate.

7.14 Install second set of springs in counter-bored holes or over dowels (for double plate units go to 7.19 below).

7.15 Slide the second center water jacket into the splined ring, being sure that the water inlet and outlet in the water jacket line up with the slots in the front ring. If necessary, with a small diameter rod, the springs can now be aligned with the counter-bored holes in both the water jackets.

7.16 Place the third drive plate assembly onto the splined hub and push the drive plate assembly until it touches the copper wear plate on the center water jacket.

7.17 Set second ring onto back ring. Take care that the water outlet slots in both rings align with the water inlet-outlet in the backplate water jacket. Note: when assembling 2 or 3 plate units horizontally, all threads can be used to support the ring, shims and airtube holding plate.

7.18 Install third set of springs in counter-bored holes or over dowels.

7.19 Slide the floating water jacket into the splined front ring, being sure that the water inlet and outlet in the water jacket line up with the slots in the front ring. If necessary, with a small diameter rod, the springs can now be aligned with the counter-bored holes in water jackets.

7.20 IMPORTANT: Do not remove the all threads until some of the socket head cap screws have been installed through the airtube holding plate and into the back ring.

7.21 Reverse the disassembly procedure in 6.1 and 6.2 (Disassembly Procedure) to replace the pressure plate, airtube, and airtube holding plate.
CAUTION: Pressure plate buttons on the rib side of the pressure plate should be positioned into the counter-bored holes in the floating water jacket. Caution should be taken to ensure that the proper number of shims are reinstalled to obtain adequate clearance as indicated in 4.10 on page 8 of this document.

7.22 Be sure that the cap screws for mounting the airtube holding plate to the unit are torqued before connecting the flexible air lines. See chart on page 13 for bolt torque values.

7.23 Replace all flexible water and air connections to the unit. Be sure that all floating water jackets are free to move. Check all air and water lines for leaks before putting the unit back in operation.

8.0 REPLACEMENT OF DRIVE PLATES

8.1 See 6.0 (Disassembly Procedure), follow steps 6.1 thru 6.6 for removal of drive plates.

8.2 See 7.0 (Assembly Procedure), follow steps 7.9 thru 7.23 for reassembly.

NOTE: For replacement of friction pucks on the 18" drive plate, depending on whether the design is an old or new style, only half of the supplied bolts, nuts, and washers may be required. Also, note that (2) lock washers go under the head of each bolt.

9.0 REPLACEMENT OF AIRTUBE

9.1 Units do not have to be dismounted to replace the airtube.

9.2 Remove air lines and elbows.

9.3 Remove the cap screws which hold the airtube holding plate onto the unit and remove the airtube holding plate and the airtube from the unit.

! CAUTION

When disassembling, caution should be taken when removing the actuating assembly to prevent the front ring from separating from the back ring.
NOTE: when disassembling 2 or 3 plate units horizontally, use all threads to support the ring, shims and airtube holding plate.

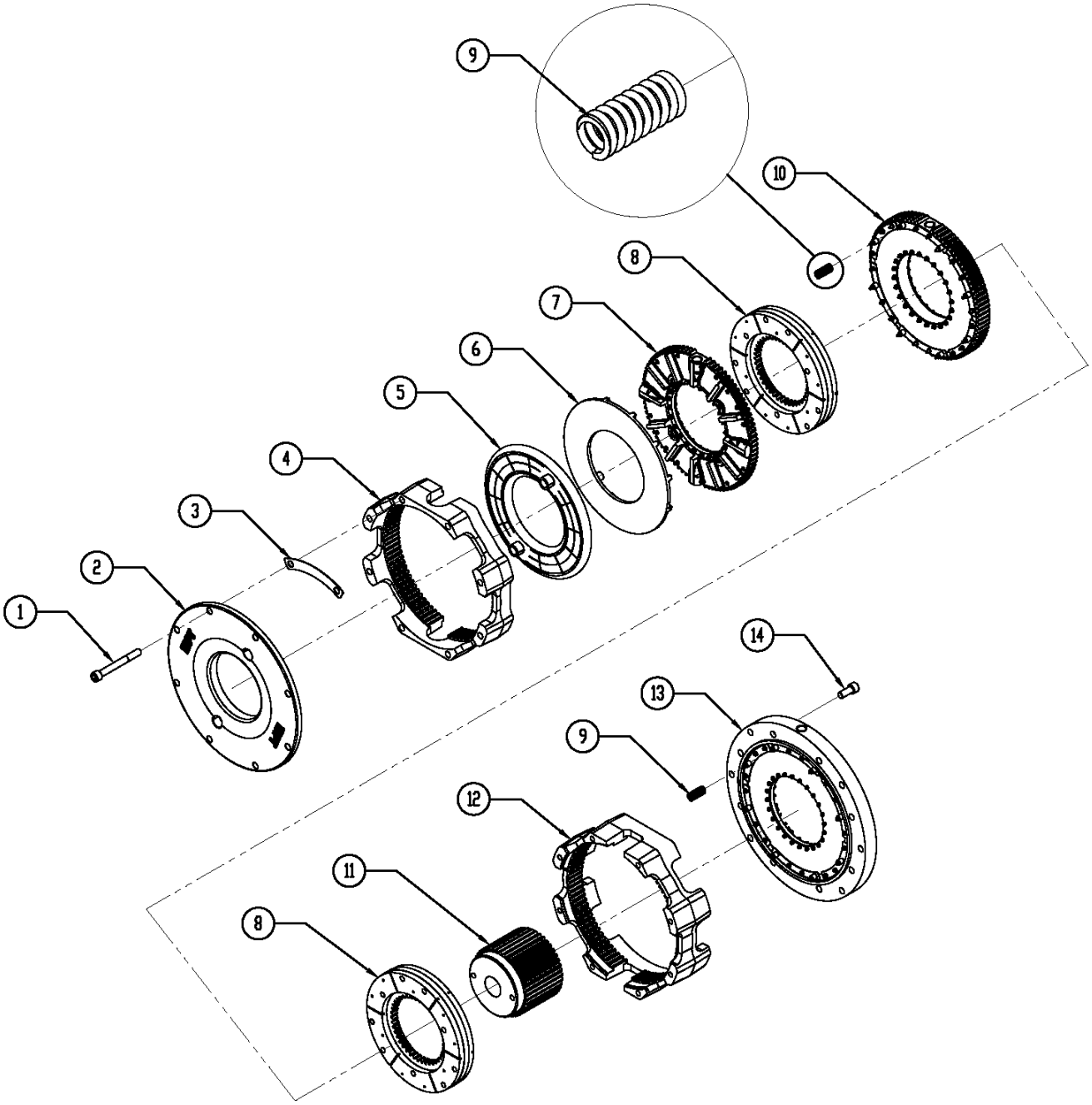
9.4 Reverse steps 9.1 through 9.3 to reassembly airtube and airtube holding plate.

10.0 TORQUE VALUES FOR CAPSCREWS

TORQUE VALUES FOR SOCKET HEAD AND HEX HEAD CAPSCREWS						
SOCKET HEAD CAP SCREWS						
BOLT SIZE IN INCHES	**As Received**			**Lubricated****		
	LB - FT	**LB - IN**	**Nm**	**LB - FT**	**LB - IN**	**Nm**
1/4	13	150	17	10	120	13
5/16	23	305	34	18	244	27
3/8	45	545	62	36	436	49
7/16	70	840	95	56	672	76
1/2	108	1300	147	86	1040	117
9/16	155	1860	210	124	1488	168
5/8	211	2530	286	168	2024	228
3/4	367	4400	497	293	3520	397
7/8	583	7000	791	466	5600	632
1	867	10400	1175	693	8320	940
1 1/8	1242	14900	1684	993	11920	1347
1 1/4	1750	21000	2374	1400	16800	1899
1 3/8	2317	27800	3142	1853	22240	2513
1 1/2	3042	36500	4125	2433	29200	3300
1 3/4	4950	59400	6714	3960	47520	5371
2	7492	89900	10161	5993	71920	8128
HEX HEAD CAP SCREWS - Grade 8						
BOLT SIZE IN INCHES	**As Received**			**Lubricated****		
	LB - FT	**LB - IN**	**Nm**	**LB - FT**	**LB - IN**	**Nm**
1/4	8	100	11	6	80	9
5/16	17	200	23	13	160	18
3/8	30	360	41	24	288	32
7/16	48	570	64	38	456	51
1/2	83	990	112	66	792	89
9/16	107	1285	145	85	1028	116
5/8	143	1714	194	114	1371	155
3/4	256	3070	347	204	2456	277
7/8	417	5000	565	333	4000	452
1	625	7500	848	500	6000	678
HEX HEAD CAP SCREWS - Grade 5						
BOLT SIZE IN INCHES	**As Received**			**Lubricated****		
	LB - FT	**LB - IN**	**Nm**	**LB - FT**	**LB - IN**	**Nm**
1/4	6	71	8	5	56	6
5/16	12	142	16	9	113	12
3/8	22	260	29	17	208	23
7/16	34	410	46	27	328	36
1/2	53	636	72	42	508	57
9/16	74	890	101	59	712	80
5/8	104	1250	141	83	1000	112
3/4	183	2200	249	146	1760	199
7/8	298	3570	403	238	2856	322
1	440	5280	597	352	4224	477
1 1/8	553	6640	750	442	5312	600
1 1/4	775	9300	1051	620	7440	840
1 3/8	1012	12140	1372	809	9712	1097
1 1/2	1350	16200	1831	1080	12960	1464

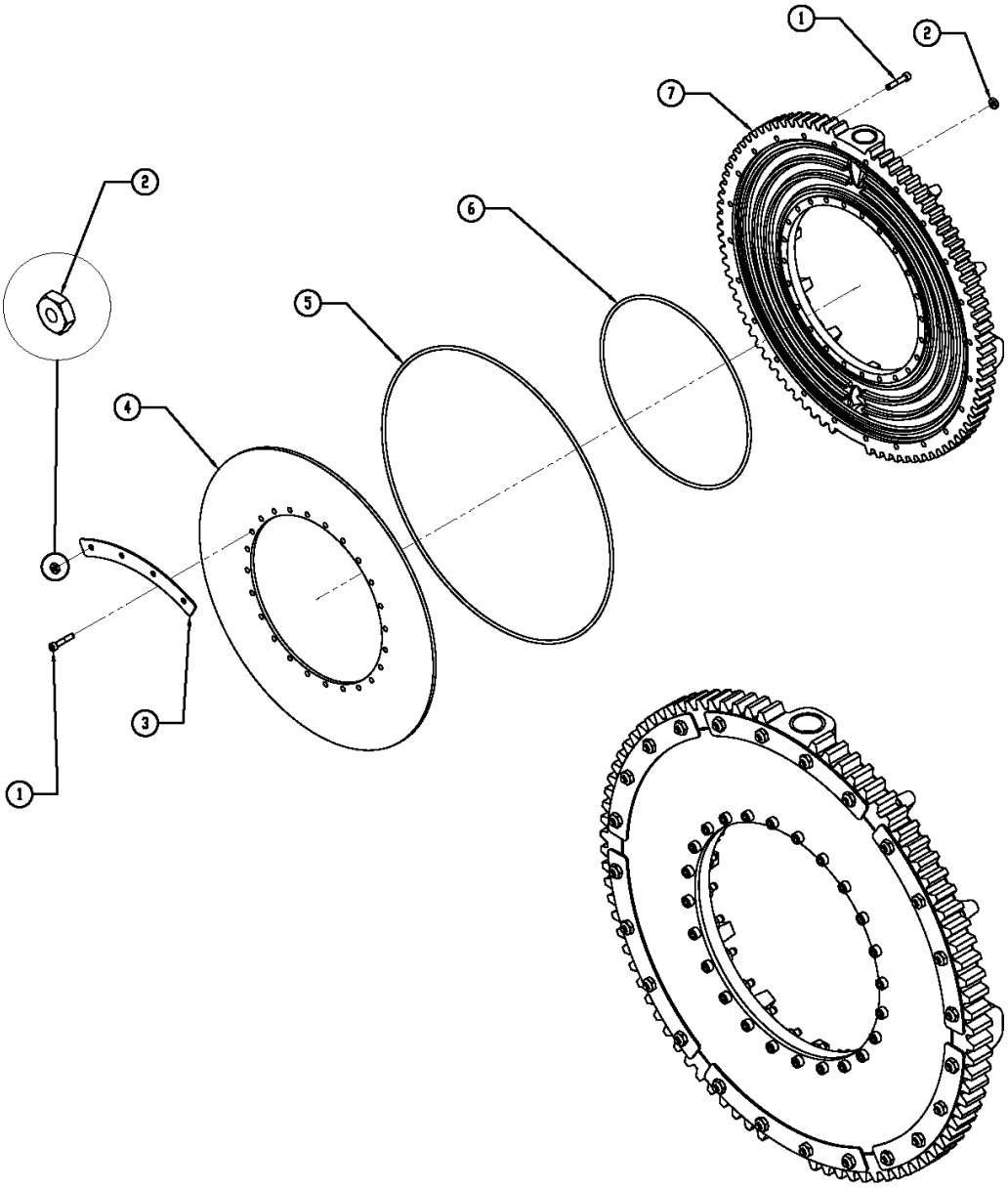
**** NOTE: For loctite use lubricated values**

11.0 COPPER WATER COOLED (CWC) BRAKE EXPLODED VIEW



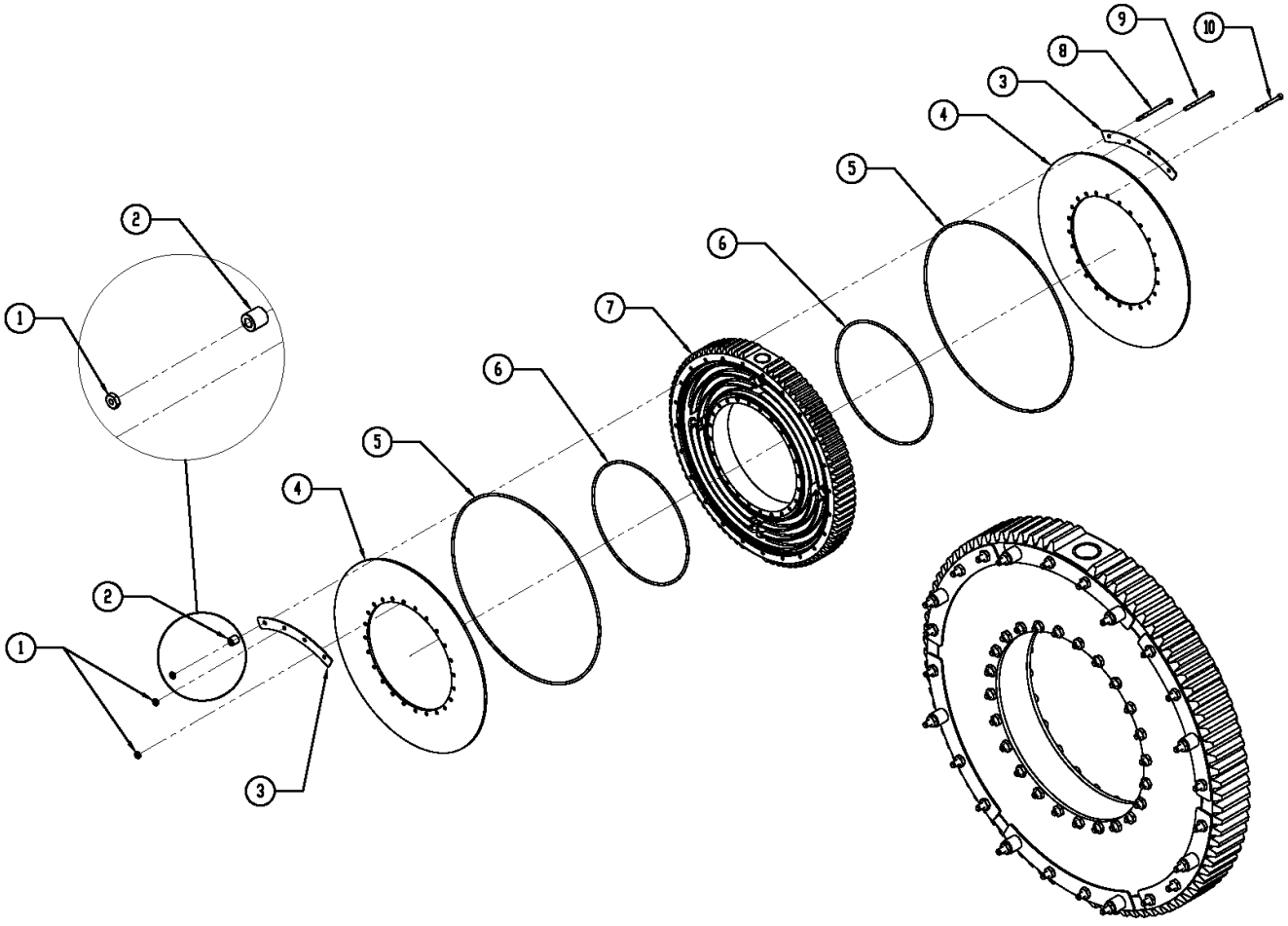
Item	Description	Qty	Item	Description	Qty
1	SHCS	8	8	Drive Plate Assembly	2
2	Airtube Holding Plate	1	9	Spring	16
3	Shim	28	10	Center Water Jacket Assembly	1
4	Front Ring	1	11	Hub	1
5	Airtube	1	12	Back Ring	1
6	Pressure Plate	1	13	Backplate Water Jacket Assembly	1
7	Floating Water Jacket Assembly	1	14	SHCS	8

12.0 FLOATING WATER JACKET ASSSEMBLY



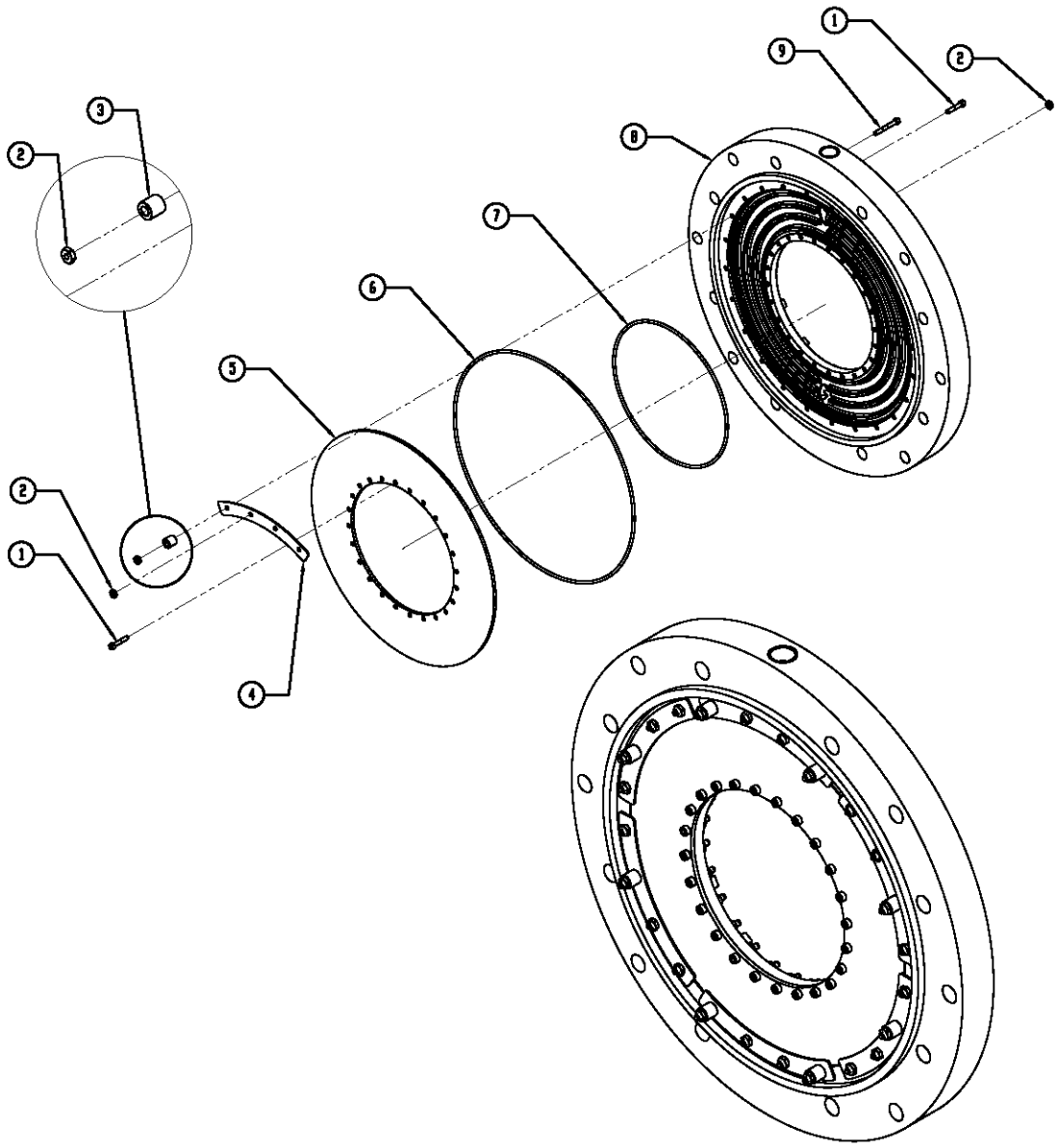
Item	Description	Qty	Item	Description	Qty
1	SHCS	48	5	Drive Plate Assembly	1
2	Nut	48	6	Spring	1
3	Copper Retainer	6	7	Floating Water Jacket	1
4	Copper Wear Plate	1			

13.0 CENTER WATER JACKET ASSEMBLY



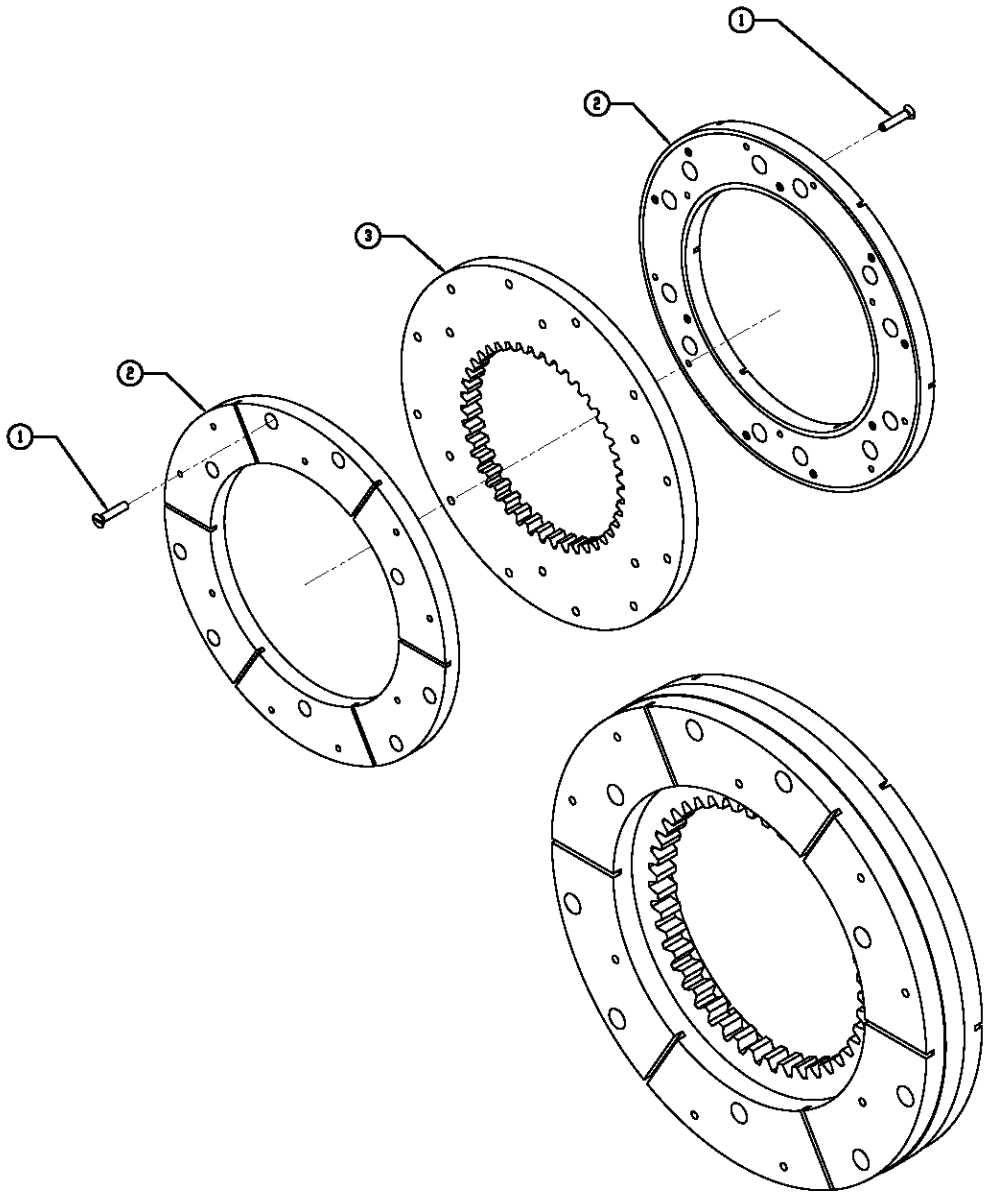
Item	Description	Qty	Item	Description	Qty
1	Nut	48	6	I.D. O-Ring	2
2	Spring Retainer	48	7	Center Water Jacket	1
3	Copper Retainer	6	8	SHCS	8
4	Copper Wear Plate	1	9	SHCS	16
5	O.D. O-Ring	2	10	SHCS	24

14.0 BACKPLATE WATER JACKET ASSEMBLY



Item	Description	Qty	Item	Description	Qty
1	SHCS	40	8	O.D. O-Ring	1
2	Nut	48	9	I.D. O-Ring	1
3	Spring Retainer	8	10	Backplate Water Jacket	1
4	Copper Retainer	6	11	SHCS	8
5	Copper Wear Plate	1			

15.0 DRIVE PLATE ASSEMBLY



Item	Description	Qty	Item	Description	Qty
1	FHMS	18	3	Drive Plate	1
2	Friction Disc	2			

16.0 TROUBLESHOOTING GUIDE

Problem	Possible Cause	Remedy
Leaking Water	Damaged or unseated Seal	Inspect copper surface Seals and replace If needed
	Insufficient coolant flow (overheating)	Increase Coolant Flow
Reduced Braking Torque	Excessive clearance	See Section 4.10 Checking Brake Clearance. Wear spacer removal may be required.
	Friction Material Contamination	Thoroughly clean friction material. Replace material if necessary.
	Failure to burnish new Brake assembly	See Section 4.14 Installation
	Insufficient actuation pressure/flow	See Section 5.0 Operation - Conditions
Brake Doesn't Engage Properly	Friction Material reached maximum wear	See Section 4.10 & 4.13 Checking Brake Clearance
	Insufficient actuation pressure/flow	See Section 5.0 Operating - Conditions
	Excessive Clearance	See Section 4.10 Checking Brake Clearance
Brake Doesn't Disengage Properly	Damaged/ Jammed Release Springs	Check for damaged Springs or debris within the Jacket spacing
	Insufficient actuation pressure/flow	See Section 5.0 Operating - Conditions
Dragging Drive Plate	Improper Alignment	See Section 3.0 Inspection and Alignment
	Vibration	Observe machinery and supports for excessive vibration
	Excessive coolant pressure	Reduce coolant pressure. See Section 7.7
	Insufficient Clearance	See Section 4.10 Checking Brake Clearance
Slow Brake Response	Volume Booster Valve	See valve supplier for proper requirements.
Slow Brake Release	Volume Booster Valve	Valve not achieving full flow