WSB 11210-WCSB3 Brake Installation Operation and Maintenance

Airflex by Danfoss

Service Manual



ENGINEERING TOMORROW

AX456071887589en-000101

General Information

⚠ Warning

Forward this manual to the person responsible for Installation, Operation and Maintenance of the product described herein. Without access to this information, faulty Installation, Operation or Maintenance may result in personal injury or equipment damage.

⚠ Caution

Use Only Genuine Airflex® by Danfoss Replacement Parts

Danfoss recommends the use of genuine Airflex replacement parts. The use of non-genuine Airflex replacement parts could result in substandard product performance, and may void your Danfoss warranty. For optimum performance, contact Danfoss at danfoss.com

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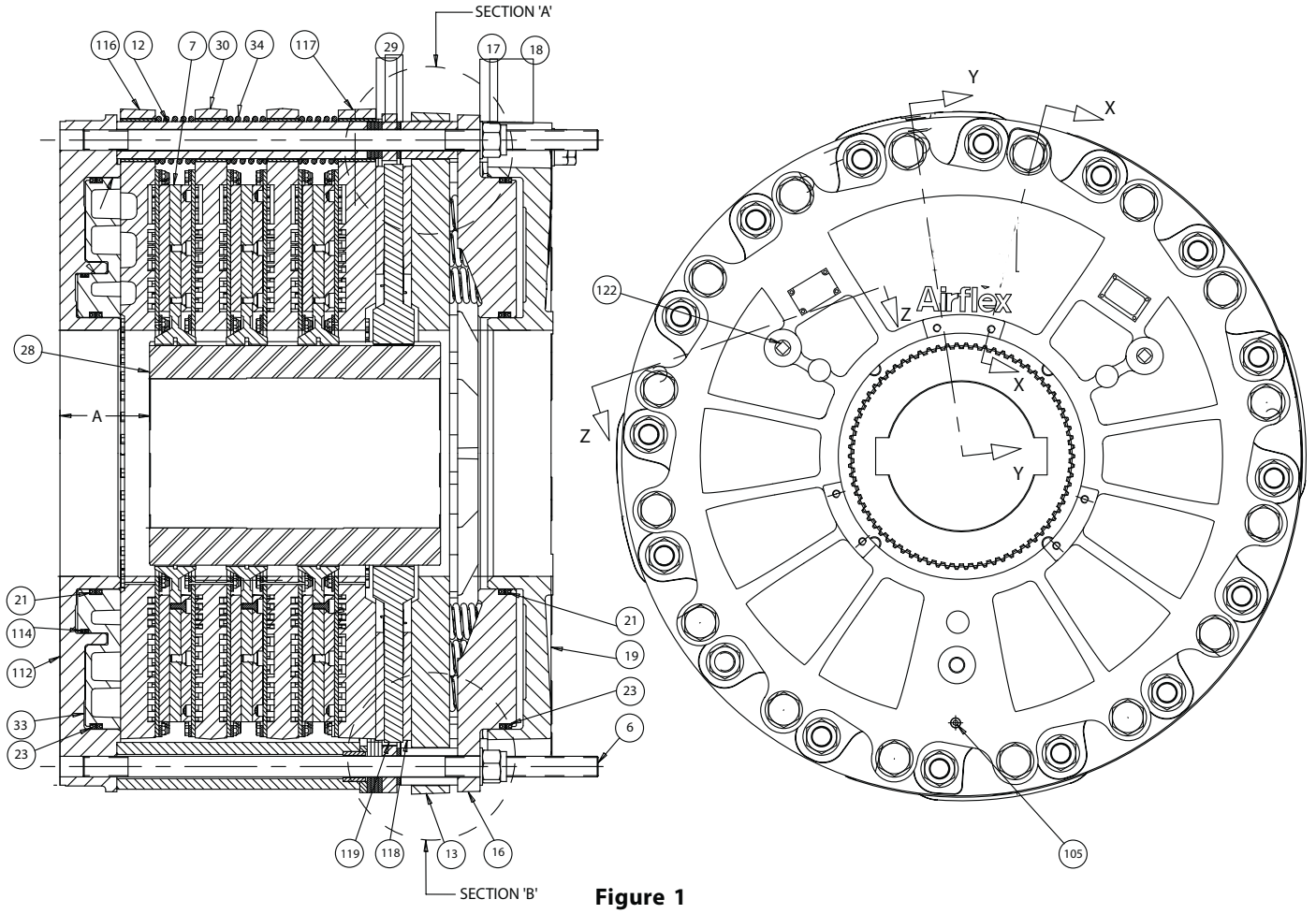


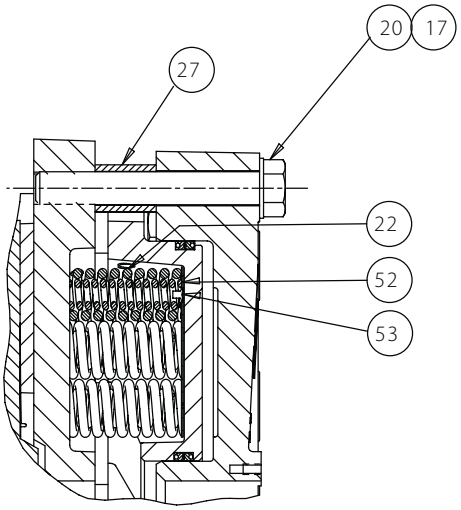
Figure 1

Table 1
Item Description for Figure 1

Item	Description
6	Stud
7	Friction Disc Assembly
12	Clamp Tube
13	AC Pressure Plate
16	Spring Housing
17	Flat Washer
18	Self Locking Nut
19	C/R Cylinder
20	Hex Head Screw
21	PolyPak Seal (inner)
22	36WCSB Outer Apply Spring
23	PolyPak Seal (outer)
27	Spacer Tube
28	Gear
29	Wear Spacer (Clamp Tube)
30	Reaction Plate
33	Dual Piston
34	Release Spring
52	Inner Apply Spring
53	Spring Retainer

Item	Description
105	Brass Pipe Plug
112	Mounting Flange/cylinder
114	PolyPak seal
116	Pressure Plate S/A
117	End Plate S/A
118	Friction Disc
119	Disc
121	Flat Head Screw
122	Pipe Plug, Sq Hd., Black Iron
124	AC Clamp Tube
125	Stop Plate
127	Pipe Plug, Sq Hd., Black Iron
138	Support Beam
139	Wear Spacer (Support Beam)
141	Wear Spacer Retainer
142	Plain Washer
143	Hex Head Screw
144	Support Beam Bushing
145	Self Locking Nut

Section 'X - X'



Section 'Y -Y'

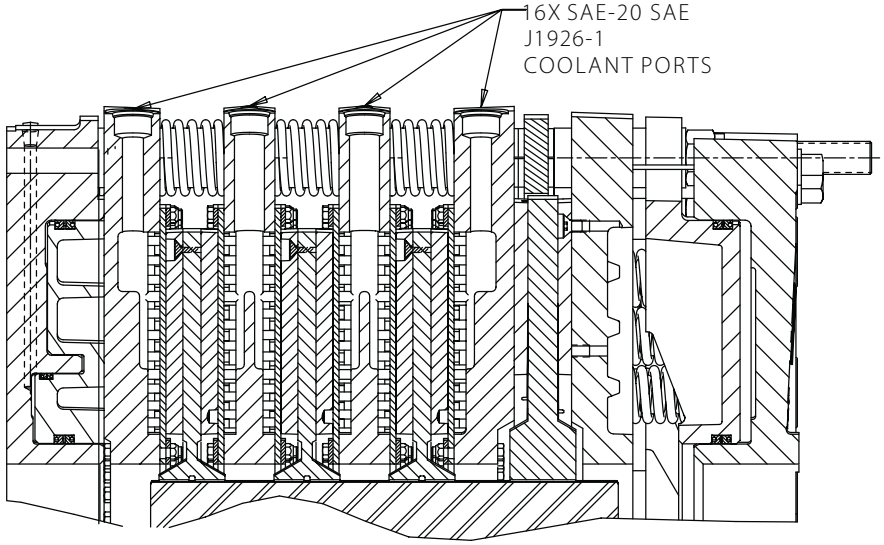
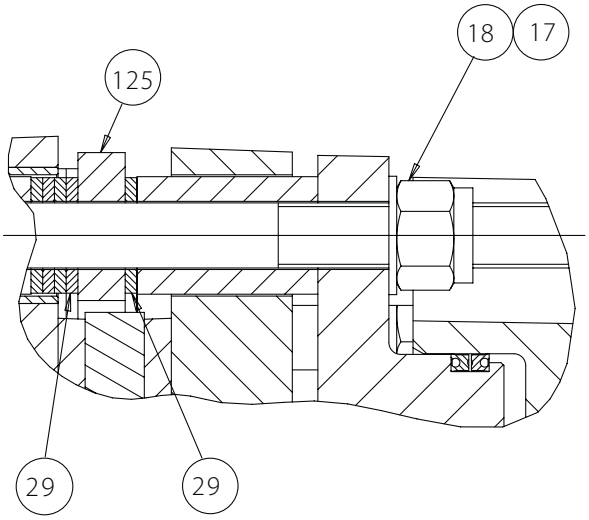


Figure 1B

Section 'A'



Section 'B'

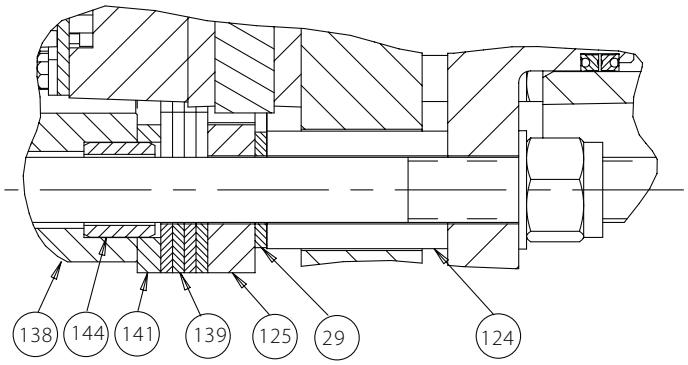


Figure 1A

Section 'Z - Z'

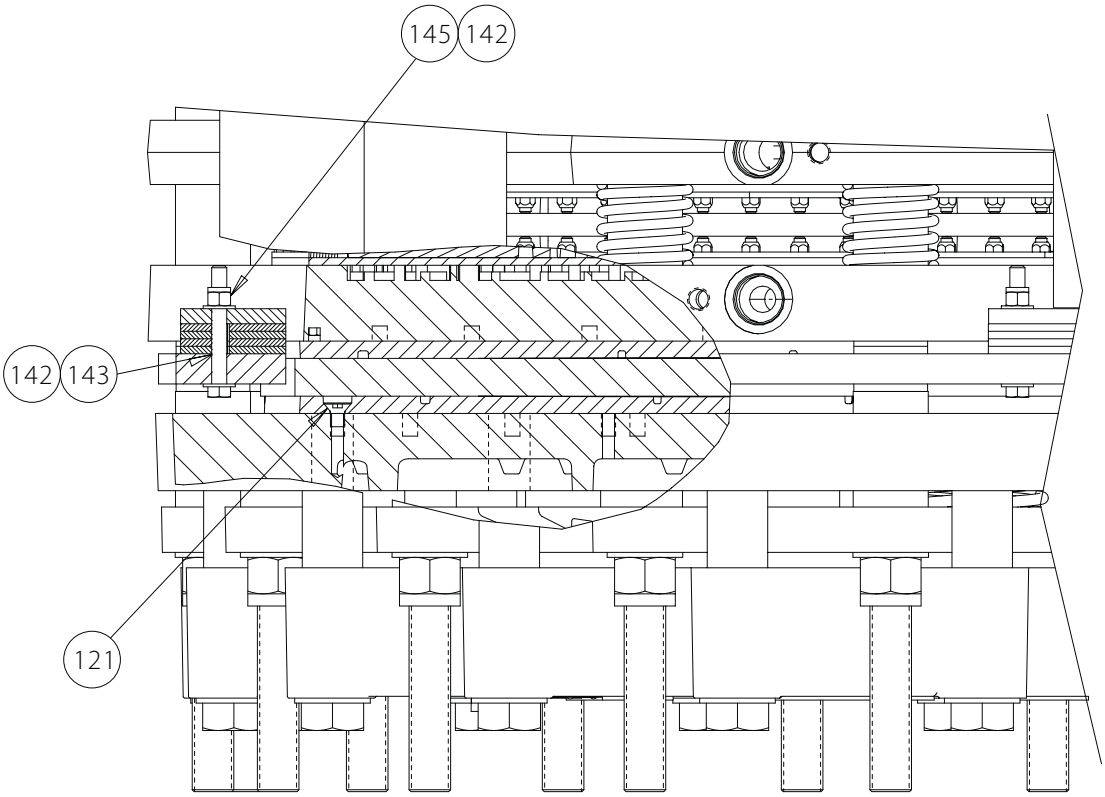


Figure 1C

1.0 INTRODUCTION

Throughout this manual there are a number of HAZARD Warnings that must be read and adhered to in order to prevent possible personal injury and/or damage to equipment. Three signal words Danger", "Warning" and "Caution" are used to indicate the severity of a hazard, and are preceded by the safety alert symbol

⚠ **Danger**
Denotes the most serious hazard, and is used when serious injury or death WILL result from misuse or failure to follow specific instructions.

⚠ **Warning**
Used when serious injury or death MAY result from misuse or failure to follow specific instructions.

⚠ **Caution**
Used when injury or product/equipmentdamage may result from misuse or failure to follow specific instructions.

1.1 Description

It is the responsibility and duty of all personnel involved in the installation, operation and maintenance of the equipment on which this device is used to fully understand the Danger, the Warning and the Caution procedures by which hazards can be avoided.

1.1.1 The Airflex WCSB3 water-cooledtensioner is designed for constant tension applications and is designed with a dual piston and cylinder on the water cooled tensioner. It is exceptionally well suited for high inertia stopping, rapid heat dissipation and offers high corrosion protection. The WCSB3 incorporates both an air applied water-cooled tensioner and an air-cooled spring set brake into one relatively compact unit. The water-cooled section is used for high energy, constant slip tensioning, while the spring set brake serves as an emergency stopping or parking brake. The addition of the support beam design adds strength and rigidity to the assembly and eliminates the need for a support bracket on the free end of the plate. The WCSB3 wear spacer design and location allow for easy wear adjustment. The design of the WCSB3 tensioner permits mid-shaft or end-shaft mounting and can handle high horsepower. The rugged construction ensures long, trouble free service.

1.1.2 WCSB3 tensioner is available in multiple designs. The model number identifies the multiple of discs and the nominal disc diameter. For example, 436WCSB3 indicates there are four total discs in the assembly and the nominal diameter of the water-cooled discs is 36" diameter. Note that the air-cooled disc is typically larger in diameter by 2" when compared to the water-cooled disc; therefore, the model number will refer to the total number of Water cooled plus Air Cooled discs. Additional notations may be made in describing the model number to indicate the number of water-cooled (WC) disc assemblies and number of air cooled (AC) discs. For example, a 436WCSB3 (3WC/1AC) would indicate three water-cooled discs and one air-cooled disc.

1.1.3 When size, such as 36WCSB3, is referred to in this manual, it means that the information given applies to all models using the 36" diameter water-cooled disc assembly; i.e., 236WCSB3, 336WCSB3.

1.1.4 Tensioners can be used with either closed loop or open loop fresh water systems. Tensioners can be used with closed loop 50/50 ethylene glycol systems.

1.1.5 This manual includes metric equivalents usually shown in (#) following the U.S. measurement system value. Be sure to use the correct value.

1.1.6 All Airflex WCSB3 tensioners are supplied with long wearing, non-asbestos friction material .

1.2 How It Works

1.2.1 Referring to Figure 1 and Table 1, the gear (28) is mounted on the shaft which is to be stopped and the tensioner assembly is attached to the machine frame.

The WCSB3 has a dual chambered piston/ cylinder on the air-applied, water-cooled tensioner. Air pressure is first applied through the ports in the mounting flange/ cylinder (112) causing the piston (33) to apply force to the pressure plate assembly (116). As air pressure is applied through the ports in the cylinder (19) on the spring set section of the unit, the cylinder and pressure plate (13), which are attached to each other with screws (20), flat washers (17) and spacer tubes (27), move away from the mounting flange (112), which is connected to the machine frame. The pressure plate compresses the springs (22) and (53) against the stationary spring housing (16). As the pressure plate moves, the end plate subassembly (117) also moves away from the mounting flange/cylinder until it rests against the stop plates (125) which are axially fixed. The pressure plate (13) then continues to move away from the end plate subassembly and the clamp force is removed from the disc (119) that rides on the gear. As the end plate subassembly (117) moves towards the stop plates, the piston (33) and friction disc subassembly move by means of the air pressure initially applied. Relieving the air pressure within the mounting flange/cylinder reduces the clamp force applied to the friction discs, allowing the shaft to be free to rotate. Modulation of the air pressure controls the applied torque of tensioner.

As air pressure is exhausted from both the mounting flange/cylinder (112) and the cylinder (19), the springs force the pressure plate (13) toward the mounting flange, clamping the disc (119) between the pressure plate and the end plate subassembly (117). As the piston (33) retracts, the endplate subassembly continues to move towards the mounting flange/ cylinder, pressing against the friction disc assemblies (7), reaction plate (30) and pressure plate subassembly (116). As the pressure plate (116) comes to rest against the mounting flange, the spring force clamps all discs between adjacent surfaces, applying stopping torque to the shaft.

High heat dissipation within the tensioner section in the WCSB3 is accomplished by passing water through a cavity behind copper alloy wear plates.

⚠ **Caution**
The tensioner is never to be operated without the coolant supply attached and coolant running through the pressure plate (116), reaction plates (30) and end plate (117).

1.3 Dual Piston Design Advantages

The air applied pistons in the tensioner are available in either single or dual piston designs. The WCSB3 dual piston/cylinder (112) power head offers precise tensioning control by dividing the piston/cylinder into inner and outer sections (See Figure 1). This provides the ability to improve fine modulation of clamping pressure on the tensioner discs and improved control over our standard single chamber design. For very light tensioning loads, the outer piston can be used solely, with no pressure applied to the inner piston. For the largest tensioning loads, both pistons can be used together. If it is desirable to operate the tensioner at maximum tensioning load and not utilize the precise tensioning feature, the tensioner can be ordered without the intermediate piston seal (114).

⚠ **Danger**
Prior to installation of the WCSB3 tensioner, make sure that the machinery will remain in a secured position. Failure to do so could result in serious personal injury or possibly death.

⚠ **Warning**
Only qualified maintenance personnel should install, adjust or repair these units. Faulty workmanship will result in unreasonable exposure to hazardous conditions or personal injury.

⚠ **Caution**
Read these instructions thoroughly and review until you fully understand the installation sequence before proceeding with the work described in this section. Failure to follow these instructions will result in unreasonable exposure to hazardous conditions or personal injury.

2.0 INSTALLATION

2.1 Alignment

⚠ **Caution**
Proper alignment is necessary to ensure that the friction discs track properly. Improper alignment will result in excessive wear to the friction material and mating surfaces, plus the gear and splined bore of the friction disc assemblies. See Figure 2.

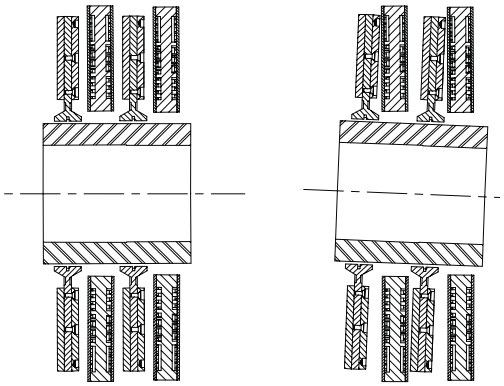


Figure 2

2.1.1 To aid in obtaining an accurate reading, a rigid bracket should be fabricated for mounting a dial indicator when checking alignment.

2.1.2 Bearing or machinery manufacturers may require different alignment tolerances. Use the tightest of those recommended.

2.1.3 Refer to the appropriate catalog information (available upon request) for appropriate envelope dimensions, mounting register diameters, mounting bolt circles and positions for each specific tensioner.

2.1.4 The tensioner reaction member (such as the machine frame) should have a machined register to allow for mounting and alignment control of the tensioner. The mounting surface should be designed to provide full support of the face of the mounting flange/cylinder (112), preventing deflection during operation.

2.1.5 For proper operation and service life, the tensioner reaction member must be aligned to the shaft within the limits shown in Table 2.

Table 2
Alignment Requirements

Size	Concentricity (Parallel, TIR) of Shaft and Element (Inches (mm))	Perpendicularly (Angular,TIR) of Mounting Flange to shaft* (Inches (mm))
36WCSB3	0.010 (0,25)	0.019 (0,48)

*Perpendicularity measured near the O.D. of the mounting flange.

2.1.6 Refer to Table 3 for the setup dimension between the tensioner mounting surface and the end of the gear (dimension "A" on Figure 1). Gears should be positioned to ensure that - when the tensioner is mounted - the disc splines will not overhang the end of the gear when components are in both new and worn conditions. The gear (28) is typically bored and keyed for a resulting Class FN2S interference fit for inch shafting and ISO System S7h6 for metric shafting. Contact Airflex Application Engineering for specific recommendations.

Table 3
"A" Dimension on Figure 1, inches (mm)

Size	236	336	436
36WCSB3	n/a	n/a	6.00 (152.40)

2.2 Mounting

2.2.1 The WCSB3 must be mounted to a clean, rigid surface with hardened flat washers and screws of the grade, quantity, and size as listed in Table 4. Mounting to a properly aligned, rigid surface that fully supports the face of the mounting flange/cylinder (112) minimizes any deflection during operation and helps to ensure that the friction discs will track properly within the mounting flange/cylinder (112), reaction plate (30) and pressure plate (13) assemblies.

Table 4
436WCSB3 Fastener Description and Assembly Torque, ft.-lb. (Nm)

Item No.	Description	Specification	36WCBD3
4 & 5	Wear Plate Screws	Size Quantity Torque (Dry)	3/8"-16 NC2 see Note 2 40 (54)
18	Locknut	Size Torque (Lubed)	1-3/8"- 6NC-2 Gr. 8 16 1300 (1763)
20	Hex Head Screw	Size Quantity Torque (Loctite 262)	1-3/8-8NC-2 Gr. 8 16 750 (1016)
1	WC Friction Disc Screw	Size Quantity Torque (Loctite 262)	1/2"-13NC-3 FI Std 270 Brass 144 15 (20)
121	Air Cool Friction Disc Screw	Size Quantity Torque (Loctite 262)	1/2"-13NC3 72 20 (27)
143	ShimRetainer Bolt	Size Quantity Torque (Dry)	1/2"-13NC-2 Gr. 2 12 38 (52)
145	Locknut	Size Quantity Torque (Dry)	1/2"-13NC3 12 38 (52)
Customer Supplied	Mounting Screws For Mounting Flange 112	Size Quantity Torque (Dry)	1"-8NC-2 Gr. 8 12 660 (895)
6	Stud	Size Quantity Hand thread with Loctite 271	1-3/8"-6NC-2A 16 See Item6 Below
ORB Fittings	SAE-12	Apply Manufacturer's recommended Lube and finger tighten Torque (Lubed)	68-78 lb-ft (92=106)
	SAE-20	Apply Manufacturer's recommended Lube and finger tighten	146-171 lb-ft (198-232)

Note 1: Item20 - Clean threads that engage in Item13 with Loctite Loc-quic primer grade "T". Assemble with Loctite No. 262.

Note 2: Item4 & 5 - Refer to Section 7.0 sub-assemblies parts list and sub assembly Figure 13 for locations and quantity.

Note 3: Item1 - Refer to Figure 17 (Friction Disc Sub-Assembly) for itemlocation. Refer to Kits in Section 6.1.1.2 for part number

Note 4: Item6 - Clean shorter length threads that engage in Item112 with Loctite Loc-Quic Primer Grade "T" and assemble with Loctite 271. Assemble shorter length thread into Item112 until stud threads bottomin Item112 threads.

Note 5: WARNING: Mounting Screws for mounting flange (112) must be Grade 8. Mounting Screws are Customer supplied.

Note: The 12 customer supplied mounting screws need to be Grade 8 and torqued to 70% yield load.

Note: To facilitate the mounting process, the friction disc assemblies should be aligned to the gear and centered in the tensioner. With the tensioner positioned with the mounting flange/cylinder (112) facing down, lower the gear (28) slowly and carefully into the splined bore of the friction disc assemblies (7). Adjust the discs so that they are centered in the tensioner. Apply and maintain an air pressure of 25 psig (1.7 Bar) to the cylinder to release the brake and install the gear. Center the Gear then release the air pressure and remove the gear.

⚠ **Danger**
Use only the proper number and grade fasteners shown in Table 4. Use of commercial grade (Grade 2) fasteners where Grade 8 fasteners are specified may result in failure of the fasteners and a sudden and drastic reduction in brake torque.

2.2.2 Ensure that the shaft is free of nicks or burrs and the key fits properly in the shaft and gear.

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

2.2.4 Heat the gear uniformly to 250°F (121°C) to expand the bore and ease assembly. Press the gear onto the shaft, making sure that the dimension between the gear and the tensioner mounting surface ("A") is maintained. See Figure 1 and Table 3. Allow the gear to cool.

⚠ **Caution**
Do not allow the gear temperature to exceed 350 degree F (176 degree C). Overheating the gear will adversely affect the hardness and wear life.

2.2.5 Apply a thin coat of MOLUB-ALLOY® 936SF Heavy grease to the gear teeth and slide the tensioner assembly onto the gear. (Reference Part Number 000153x1182).

⚠ **Caution**
Excessive lubricant may contaminate friction material, resulting in erratic response or loss of torque.

⚠ **Caution**
The use of anti-seize or bearing greases on the gear splines may result in premature gear and disc spline wear.

2.2.6 Pre-fill the grease channel in the friction disc splines with MOLUB-ALLOY 936SF Heavy grease or equivalent as shown in Figure 3. Try to maintain the grease level at 1/8" (3mm) below the top of the friction disc splines as shown in Figure 3. For reference, the recommended grease is part Number 000153X1182.

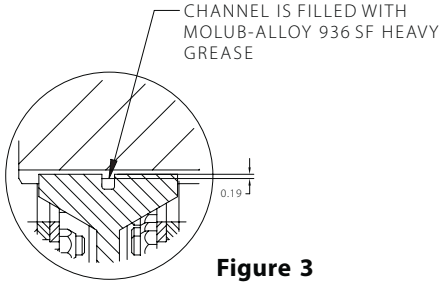


Figure 3

⚠ **Caution**
Excessive lubricant in the grease channel and on the gear teeth may contaminate friction disc material, resulting in erratic response or loss of torque.

2.2.7 Rig the WCSB3 into position and slide it over the gear.

⚠ **Caution**
Avoid placing lifting straps or cables directly on the release springs (34).
Note: Orient the tensioner to position the drain plug (105) at a nominal 6 o'clock position. This will help ensure the coolant outlets are at a nominal 12 o'clock and a nominal 6 o'clock position (provided that the tensioner is been assembled correctly).

2.2.8 While supporting the WCSB3, connect an air supply to the cylinder (19) and apply adequate pressure to release the brake. Attach the mounting flange/cylinder (112) to the mounting surface using the appropriate fasteners. Tighten the fasteners to the specified torque value (See Table 4). Exhaust the air from the cylinder after tightening the fasteners.

⚠ **Caution**
Maximum allowable air pressure in the cylinder (19) is 120 psi (8,2 bar). See sections 2.3 and 3.2 for further limitations.

2.2.9 WCSB3 tensioners should be covered to protect the unit from dirt, rain, overspray, and other sources of external contamination. In extreme environments them use of a sealed enclosure with internal strip heater is recommended to prevent moisture from collecting on the unit.

⚠ **Warning**
Contamination from rain, overspray, coolant, dirt, oils and grease must be avoided. Failing to provide adequate protection against contamination may result in loss of performance and/or damage to the tensioner.

2.3 Air System

⚠ **Warning**
Maximum allowable air pressure is 120 psig (8,2 Bar). Application of pressure exceeding maximum allowable pressure may result in damage to the tensioner. See section 3.2 for further limitations.

⚠ **Caution**
Minimum releasing pressure for the spring set brake should be observed. Operation at pressures below minimum will result in brake drag, excessive heat and wear, and damage to break components.

⚠ **Caution**
When applying operating pressure to only one of two ports on units with dual pressure pistons (33) and three seals (21), (23), (114), the second piston pressure port not being used must be open and vented to atmosphere. Porting should be filtered to avoid contamination of the piston/cylinder during single piston actuation.

2.3.1 Maximum allowable pressure is 120 psig (8,2 Bar) in the spring set brake cylinder (19) and 120 psig (8,2 Bar) in the air applied mounting flange/cylinder (112). See Section 3.2 for other limitations.

2.3.2 Use only clean, filtered air (a 40 micron filter or better is recommended) which is free of excess moisture. Long air line runs or dips in the line that allow moisture to collect should have drip legs with blow-down capability. Excess moisture due to temperature changes can be removed by using an inline ambient dryer.

2.3.3 Air inlet sizes are shown in Table 5. Air inlets for the spring set brake are on the face of the cylinder (19). There are three inlets located 120 degrees apart. Additionally, each size 36WCSB3 has one drain hole hat is to be used to purge moisture from the cylinder. See Figure 1 and reference the drain plug (105). The outermost port next to the drain plug shall be located at the 6 o'clock position to purge moisture that may accumulate in the air system or cylinder.

Air inlets for the air applied, water cooled tensioner are radially located in the mounting flange (Refer to Section 4.9.4).

Note: Purging of moisture from the air lines and cylinder should be performed at regular intervals as determined by the customer and the quality of air being supplied. Purging of moisture from the air lines and cylinder should be performed after extended periods of shutdown or down time.

Table 5
Air Inlet Sizes

Cylinder (19)

Port Type	Quantity	Thread Size
Air Inlet	3	3/4"-14 NPT
Drain Plug	1	3/8"-18 NPT

Mounting Flange (112)

Port Type	Quantity	Thread Size
Inner Piston	4	3/8"-18 NPT
Outer Piston	4	3/4"-14 NPT

2.3.4 Use full size piping consistent with the control valve size. All pipes should be free of metal chips, cutting compound and any other foreign matter. Pipe ends should be reamed after cutting to eliminate possible restrictions or airline contamination. For optimum air system response, a minimum number of bends and elbows should be used. Good engineering practices should be followed, such as, blow-down of all air piping after installation and before connecting and operating valves and the tensioner.

2.3.5 Spool type solenoid valves are not recommended for the spring set side of the brake. Use poppet type valves and locate them as close as possible to the cylinder (19).

2.3.6 The WCSB3 tensioner does not require lubricated air; however associated control valves may. Consult the valve manufacturer for appropriate recommendations.

⚠ **Caution**
The use of lubricated air in the air supply system (if required) will require the addition of a 'point of use' lubricator. Lubricated air is not required for the Tensioner but once lubrication is used, lubrication will always be required in the air system. If the lubricator is allowed to run dry then pneumatic valves and cylinders will dry out and stick thus creating erratic operation and down-time. Good engineering design practices shall be followed when using lubrication thus avoiding the overuse of lubrication, long airline runs and elevation changes.

2.3.7 A pressure switch should be located in the air supply line to the tensioner and interlocked with the equipment electrical controls to guard against operation of the tensioner when the brake is set.

2.4 Coolant System

Note: Positioning the drain plug (105) at a nominal 6 o'clock position will help insure the coolant outlets are at a nominal 12 o'clock and 6 o'clock position.

2.4.1 The 36WCSB3 is designed with four (4) coolant ports on each pressure plate (116), end plate (117) and reaction plate (30). Each plate has two opposing inlet ports and two opposing outlet ports. In order to mount the 36WCSB3 with the coolant inlet and outlet ports in the proper orientation, first locate the air purge port (drain plug (105)) on the cylinder (19) on the spring-set brake. With the drain plug (105) located at a nominal 6 o'clock position, the drain and supply ports will be in the proper orientation. The coolant supply ports shall be located at a nominal 3 o'clock and a nominal 9 o'clock position and the coolant drain (return) ports shall be located at a nominal 12 o'clock and a nominal 6 o'clock position.

2.4.2 The WCBD3 water cooled brake is designed with SAE O-ring Boss (ORB) ports for the coolant inlets and outlets. These ports utilize a straight thread and an O-ring for sealing. ORB ports provide superior sealing properties and reduce the risk of damage to the brake during fitting installation. An ORB port can be identified by the machined spot face and a chamfer (for sealing of the O-ring). See Figure 4. Follow the fitting manufacturer's recommendation for the proper method of installation and tightening. Torque to values per Table 4. The 36WCBD3 uses the SAE-20 for the ORB port size.

⚠ **Caution**
Installation of NPT or other incompatible threaded piping or fittings into SAE ports will damage the ports, resulting in leakage or other failure.

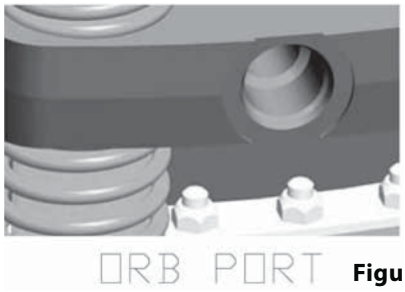


Figure 4

2.4.3 Each inlet and outlet coolant port in each pressure plate (116), reaction plate (30) and end plate (117) is designed with a 'fixed' orifice. The fixed orifice is designed to proportion the flow to what is required by each component. Thus, a reaction plate that requires a total of 100 GPM has the ports designed to pass 50 GPM per port. Similarly, a pressure plate that requires 50 GPM has the ports designed to pass 25 GPM per port. (The pressure plate and the end plate are designed for 50% of the flow of the reaction plate). It is recommended, however, that the flow rate from each section be verified with some type of flow metering device.

2.4.4 After measuring the flow from each coolant section, an adjustment may be required. Thus, it is recommended that each drain side (or return side) should be equipped with adjustable flow controls on each outlet hose. The flow for each size tensioner should be balanced as shown Table 6.

Table 6
Percentage of Flow Required for each Coolant Section Outlet 36WSB3

Tensioner Size	236	336	436
Pressure Plate 12 o'clock	25.00%	12.5%	8.00%
Pressure Plate 6 o'clock	25.00%	12.5%	8.00%
Reaction Plate 12 o'clock	n/a	25.0%	17.00%
Reaction Plate 6 o'clock	n/a	25.0%	17.00%
Reaction Plate 12 o'clock	n/a	n/a	17.00%
Reaction Plate 6 o'clock	n/a	n/a	17.00%
End Plate 12 o'clock	25.00%	12.5%	8.00%
End Plate 6 o'clock	25.00%	12.5%	8.00%
Total			**100.00%**

Note: Each Coolant Section has two Outlets. The Outlets are located at the 12 o'clock and 6 o'clock position. Flow controls (if required) should be installed in each outlet and adjusted to provde the percentage flow shown above.

2.4.5 Maximum allowable coolant pressure within the water cavity is 40 psig for size 36WCSB3 units. See Table 7 for coolant pressure limitations as measured at the inlets and outlets of water jackets.

⚠ **Caution**
High inlet pressures or surges exceeding the maximum allowable may result in damage to the tensioner.

Table 7
Coolant Pressure, psi (bar)

Size	Maximum Static	Maximum Inlet*
436WCSB3	40 (2,7)	40 (2,7)

*Under Dynamic flow Conditions

Note: Above ratings are for tensioning/winding type applications. For high cyclic application, consult the factory.

2.4.6 The coolant supply and discharge hose, pipe and fitting sizes, along with minimum flow rates for the tensioner rated horsepower, are listed in Table 8.

Table 8
36WCSB3 Coolant Supply Data

Number of Water Cooled Discs	Disc Size	Thermal Rating HP (kW)	Water Inlet and outlet Pipe Size	Min Flow Rate GPM (dm^3/min) 100%Water	Min Flow Rate GPM (dm^3/min) 50%Water, 50% Ethylene Glycol by Vol
3	36	3000 (2237)	SAE-20 J1926 ORB	300 (1135)	354(1340)

2.4.7 Coolant supply connections to the tensioner should provide a parallel flow through each section of the tensioner.

⚠ **Warning**
Series flow is not recommended as it can lead to overheating of the tensioner.

2.4.8 Inlet and outlet coolant manifolds must be provided by the customer. Manifolds should be constructed to allow for even flow through all ports. Hoses can be routed to the pressure plate (116), reaction plates (30) and end plate (117) to assist with balancing the pressure drop.

2.4.9 Inlet and outlet coolant manifolds and hoses must be sized to handle the maximum flow for each size tensioner per Table 8.

⚠ **Caution**
Do not plug any ports or plumb the cooling passages in series. Parallel arrangement of hoses similar to that shown in Figure 5 is required for proper coolant flow.

2.4.10 The number of flexible hoses required for both the inlet and outlet ports of each size tensioner is given in Table 9.

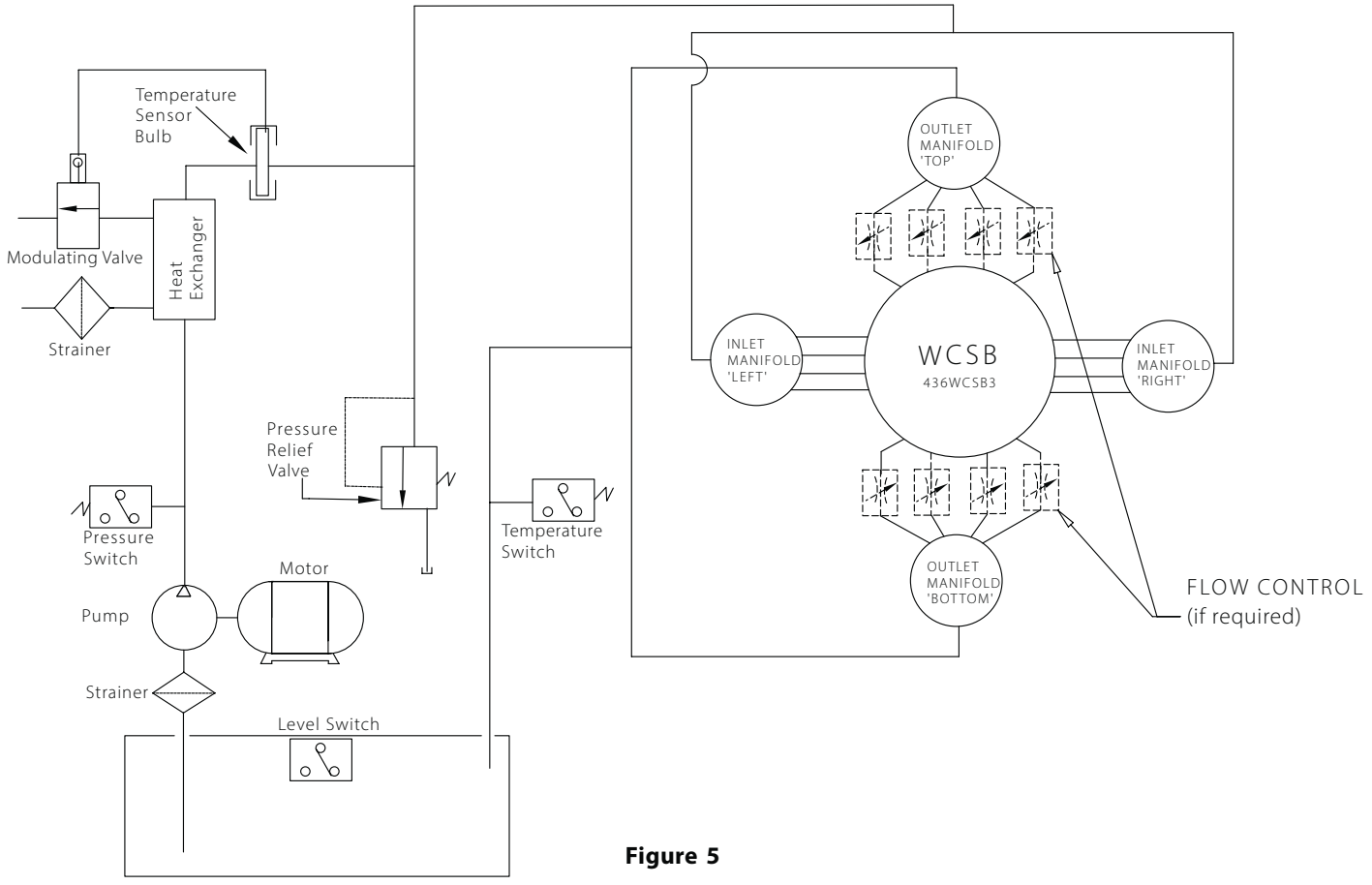


Figure 5

Table 9
Quantity of Cooling Water Hoses Required

Description	Quantity of Inlet Hoses*	Quantity of Outlet Hoses**
Reaction Plate (30)	2	2
Pressure Plate (116)	2	2
Pressure Plate (116)	2	2
End Plate (117)	2	2

* Inlet hoses are located at the 3 o'clock & 9 o'clock position.

** Outlet hoses are located at the 12 o'clock & 6 o'clock position. Supply & Drain hoses must have an ID equal to or larger than the port orifice.

2.4.11 Using flexible connecting hose to each tensioner coolant section will allow axial travel of the pressure plate (116), reaction plate (30) and end plate (117) during tensioner operation without restricting the movement of components. When determining hose lengths, consideration should be given to movement and location of the pressure plate and reaction plate as friction material wears. Hose lengths running between the manifolds and the inlet or outlet ports should be equal in length, if possible. Reductionsin the recommended line diameter should be avoided to prevent excessive line pressures.

⚠ **Caution**
Short or excessively rigid hoses may restrict proper movement of the pressure plate and reaction plates.

2.4.12 Avoid the use of sharp bends and elbows that will restrict water flow. Loops and bends in the lines may create air pockets, which substantially reduce the flow of coolant and can contribute to overheating.

2.4.13 Coolant and coolant supply lines should be free of foreign material (a 500 micron water filter is recommended). In the event that contaminated water is used as a coolant (not generally recommended), use of a multi-stage filter/strainer may be desirable to avoid the need for frequent cleaning of fine mesh filters.

2.4.14 Figure 5 illustrates a typical closed loop liquid to liquid coolant system. The heat exchanger and temperature control would be replaced with a radiator, fan and motor in a liquid to air system

2.4.14.1 The schematic in Figure 5 illustrates a four disc tensioner (436WCSB3). Eight coolant supply lines feed the ports at the 3 o'clock and 9 o'clock position. Eight coolant return lines drain or recirculate coolant from the ports at the 12 o'clock and 6 o'clock position. Reference Table 9 for the quantity of hoses requiredfor the 436WCSB3. Reference Table 6 for the percentage flow required at the outlet for the 436WCSB3.

2.4.14.2 Figure 5 illustrates the supply lines & hoses and the return lines & hoses are equal in length and flow controls are located on the return lines to balance flow.

2.4.15 The maximum coolant supply temperature at the inlet should be 100°F (38°C) or lower. The coolant outlet temperature should not exceed the values given in Table 10. However, in no event should there be more than a 50°F (28°C) temperature rise between inlet and outlet. See Table 10 for maximum allowable outlet coolant temperature with various water/ethylene glycol mixtures and other cooling media.

Table 10
Maximum Outlet CoolantTemperature

Size	Water/ Ethylene Glycol Mixture % by Volume	Maximum Inlet Coolant Temperature °F (° C)	Maximum Outlet Coolant Temperature °F (°C)	Maximum Ambient Temperature °F (°C)	Minimum Ambient Temperature °F (°C)
36WCSB3	100/0	100 (38)	150 (66)	110 (43)	0 (-18)
36WCSB3	50/50	100 (38)	170 (77)	110 (43)	0 (-18)

2.4.16 Open Loop Systems

2.4.16.1 For efficient operationof the WCSB3, an adequate supply of filtered fresh water is required. Excessive water hardness promotes the formation of scale deposits, which in time, will affect the service life of the WCSB3 unit. Water of high acidity or high in corrosive salts may cause electrolytic corrosion between the dissimilar metals used in the water cavities. Water treatment should be considered if the properties of the water exceed the following:

Equivalent calcium carbonate content hardness; Maximum = 100 ppm.

pH value = 7.0 to 9.0

⚠ **Caution**
Open loop systems should be thoroughlyflushed with clean fresh water after operation to reduce the corrosive effects of contaminants on internal components.

2.4.17 Closed Loop Systems

2.4.17.1 For efficient operationof the WCBD3 in a closed loop system, ethylene glycol coolant conforming to SAE Standard J1034 should be used. For preparation of the proper concentration of a water/ ethylene glycol mixture, use make-up water which is low in corrosive ions such as chlorides and sulfates.

Recommended pH value of the water ethylene glycol mixture is 7.5 to 10.5

3.0 OPERATION

3.1 Conditions of Operation

The following HAZARD Warnings shall be followed for proper WCSB3 functioning.

⚠ **Warning**
Friction lining must be worn-in to achieve product torque rating for new installations or after repair. Verify proper operation before putting the product into service. See Section 3.3 for additional burnishing procedures.

⚠ **Warning**
Protective means must be used to prevent oil, grease, dirt or coolant from coming into contact with the surfaces of the friction discs (8) or the wear plates (3). Oil or grease on these parts will significantly reduce the torque capacity of the unit. Dirt or coolant will produce erratic torque. Do not risk personal injury of damage to the equipment.

⚠ **Warning**
Maximum free-wheeling speed must not exceed the speeds listed in Table 11. Exposure to speeds in excess of these values may cause the friction discs (8) to burst and result in extensive damage to the tensioner and/or cause personal injury.

⚠ **Caution**
For proper cooling of the WCSB3 tensioner, it is required that the coolant inlet and outlet manifolds be located as close as possible to the tensioner. It is recommended that the inlet hoses are of the same length and all outlet hoses are of the same length.

⚠ **Caution**
For operation in subfreezing temperatures, ethylene glycol antifreeze must be added to the water. The antifreeze content of the mixture is critical and should not exceed 50% by volume. Excessive amounts of antifreeze will reduce cooling capacity and can cause coolant leakage due to overheating. Refer to Table 10 for the percentage of water/ethylene glycol mix and the corresponding maximum outlet coolant temperature.

⚠ **Caution**
The coolant outlet temperature should not exceed the values given in Table 10. However, in no event should there be more than a 50°F (28°C) temperature rise between inlet and outlet. See Table 10 for maximum allowable outlet coolant temperature with various water/ethylene glycol mixtures and other cooling media.

⚠ **Caution**
Maximum ambient temperature is 110°F (43°C). Minimum ambient temperature for closed loop systems using ethylene glycol antifreeze is 0°F (-18°C). For open loop systems using water as a coolant, the minimum ambient temperature is 45°F (7°C)

⚠ **Caution**
The tensioner is never to be operated without the coolant supply attached and coolant running through the unit.

Table 11
Maximum Disc Speeds

Size	Maximum Slip Speed (Rpm)	Maximum Free Wheeling Speed (Rpm)
36WCSB3	475	700

3.2 Pressure and Speed Limits

3.2.1 Maximum allowable coolant pressure is 40 psig (2.8 bar) for size 36WCSB3 units. The use of an accumulator or pressure relief valve may be desirable to reduce the effect of pressure spikes in the coolant system during operation.

⚠ **Warning**
Applied pressure or surges exceeding maximum allowable may result in damage to the tensioner.

3.2.2 Maximum slip speeds and free-wheeling disc speeds are shown in Table 11.

⚠ **Caution**
Excessive slip speeds will result in rapid friction material wear. For good life, the values in Table 11 should not be exceeded.

3.2.3 Maximum allowable air pressure is 120 psig (8,2 bar) in the spring set brake cylinder (19). Refer to the assembly drawing (available on request) for minimum pressure required for full release of the spring set brake. Release pressure is dependent upon the quantity of springs (22) (52) used in the specific brake.

Note: Maximum air pressure is 150 psig in the air applied tensioning cylinder for 2 and 3 disc 36WCSB3 tensioners. Maximum allowable air pressure is 120 psig For the 436WCSB3 tensioner with MIDCO friction discs. The WCSB3 mounting is designer for safe operation up To 2,500,000 in-lb. braking torque. Refer to the assembly drawing (available on request) for specific pressure and/or torque limits.

3.2.4 Maximum operating pressure of the cylinder (19) - air applied side of the tensioner- is 120 psig (8,2 bar). Minimum release pressure of the spring set brake is 120 psig (8.2 bar).

3.2.5 Maximum operating pressure of the mounting flange/cylinder (112) is 120 psig (8,2 bar).

⚠ **Warning**
Operating cylinder (19) or mounting flange/cylinder (112) at pressure above 120 psig (8,2 bar) may cause damage to the tensioner. Heat generated during operation could result in damage to brake components.

3.3 Wear-in Procedures

3.3.1 In order to improve initial operation and brake torque, it is suggested that the non-asbestos friction material used in WCSB3 brakes be worn-in prior to normal operation to improve contact of the mating friction surfaces.

⚠ **Caution**
Machine operation should be monitored closely until the friction couple wears in.

3.3.2 The shaft on which the brake discs are mounted should be free to rotate to allow for run-in. On draw-works applications, disconnect the wire rope from the draw-works drum to allow operation as described in the following paragraphs.

3.3.3 Ensure that the coolant system is operating prior to dynamic operation of the WCSB3 tensioner. Verify that coolant temperature, pressure and flow values are within required settings or limits during operation. See Table 6, Table 7 and Table 10.

⚠ **Caution**
Dynamic operation of the WCSB3 - including while in the fully released condition - is not recommended without proper coolant flow in the tensioner. Heat generated during operation could result in damage to brake components.

3.3.4 Release the brake by applying full release air pressure through the ports in the cylinder (19) to allow the brake to freely rotate. Apply no air pressure to the tensioner pressure ports in the mounting flange/cylinder (112).

3.3.5 Run the motor to achieve a brake disc speed listed in Table 12. Exhaust the air pressure in the brake rapidly to 90 psi (6,1 bar). Slip the brake for the time specified in Table 12, but DO NOT ALLOW THE BRAKE TO SLIP FOR MORE THAN THE TIME SPECIFIED.

⚠ **Caution**
Slipping the brake at increased time intervals, speeds or pressures other than specified will result in damage to brake components.

Table 12
Wear-In Parameters

Size	Operation Speed (RPM)	SlipTime (Seconds)	Wear-in Cycles Required
36WCSB3	60	20	30

3.3.6 After the brake has engaged/slipped for up to the maximum slip time specified in Table 12, quickly apply full air pressure to completely release the brake. Smoke rising from the brake should be expected. Free-wheel the brake discs at the speed listed in Table 12, allowing the brake disc (119) to cool to a temperature below 120°F (49°C). The use of fans or clean, dry compressed air can be used to accelerate the cooling process.

⚠ **Caution**
Use proper safety precautions when using forced ventilation.

3.3.7 Monitor the brake disc (119) temperature after slipping and cooling. Do not allow the brake disc temperature to exceed 180°F (82°C).

3.3.8 Repeat steps 3.3.4 thru 3.3.7 for the number of cycles shown in Table 12 to allow for adequate wear-in of the air-cooled brake. Allow the brake disc to completely cool to ambient temperature prior to testing the torque capacity of the brake or returning it to service.

3.4 Operational Sequence

3.4.1 Ensure that the coolant system is operating prior to dynamic operation of the WCSB3 tensioner. Verify that coolant temperature, pressure and flow values are within require settings or limits during operation.

⚠ **Caution**
Dynamic operation of the WCSB3 - including while in the fully released condition - is not recommended without proper coolant flow in the tensioner. Heat generated during operation could result in damage to brake components.

3.4.2 Air pressure is first applied through the ports in the mounting flange/cylinder (112) to apply force to the piston (33) in the tensioner. Adequate pressure should be applied to support the load the tensioner is controlling. Air pressure is then applied through the ports in the cylinder (19) on the spring set section of the unit, until it is fully released.

⚠ **Caution**
Observe all pressure and speed limits while operating the WCSB3 tensioner. See Section 3.2.

3.4.3 After release of the spring set brake, slowly relieve the air pressure within the mounting flange/cylinder (112) to reduce the clamp force applied to the friction disc assemblies (7), allowing the shaft to rotate. Modulation of the air pressure will vary the applied torque of the tensioner. Modulation control is dependent upon the specific pneumatic control system used. Refer to the manufacturers' information for operation of control valves or feedback systems.

3.4.4 WCSB3 tensioners with dual pressure pistons (33) provide a more finite range of control. Each chamber within the dual pressure piston can be pressurized independently or simultaneously.

⚠ **Caution**

When applying or exhausting operating pressure to only one of two ports on units with dual pressure pistons (33), the second piston pressure port must be open (vented) to atmosphere. Open ports should be filtered to avoid contamination of the piston and cylinder during piston operation.

3.4.5 Exhausting air pressure from the cylinder (19) of the spring set brake allows it to engage. Air pressure within the mounting flange/cylinder (112) can be exhausted simultaneously with that in the cylinder (19). For more rapid brake response, exhaust the air pressure in the mounting flange/cylinder (112) after engaging the spring set brake.

Note: The spring set brake is intended for parking or emergency braking only.

⚠ **Warning**
Dynamic braking with the air cooled, spring set brake is not recommended except for emergency stopping situations or during initial wear-in. High heat generated during dynamic braking can result in damage or failure of the brake components.

⚠ **Caution**
Rapid engagement of a fully released tensioner/brake could result in pressure spikes within the coolant cavities and subsequent leakage.

3.5 Periodic Maintenance

3.5.1 As the friction material wears, adjustment of the brake may be required to keep pistons and cylinders within the proper stroke range. See the MAINTENANCE section for wear adjustment procedures and component wear limits.

3.5.2 Periodically check for external air leakage in the area of the piston seals (21) (23) in cylinder (19) and mounting flange/cylinder (112) and internal leakage across the dual pressure piston seals (114) in mounting flange/cylinder (112). For replacement, refer to procedures in Section 4.0, Maintenance.

3.5.3 Moisture that may accumulate in the brake cylinder can be purged on size 36WCSB3 units. With air pressure exhausted from the cylinder, remove the pipe plug (105) at the 6 o'clock position on the cylinder, and apply low air pressure to assist in expelling any excess moisture. After draining the cylinder, reinstall the pipe plug, applying a pipe thread sealant on the threads prior to installation.

⚠ **Caution**
Applied air pressure greater than 10 psi (0.68 bar) should not be used when draining the cylinder. Use adequate shielding to avoid contact with direct spray from moisture being purged from the cylinder.

3.5.4 Periodically observe the rotating discs while the tensioner is fully released. Dragging discs may be caused by wear or contamination of the gear or disc splines, lack of spline lubrication, disc imbalance, warped discs, or misalignment. Correct as required.

3.5.5 Pneumatic and electrical control interlocks should be periodically checked for proper settings and operation.

3.5.6 If leakage or blockage of any water-cooled chamber is suspected, a static or dynamic test may be performed as follows:

3.5.6.1 Static Pressure Test:

a) Release the spring set brake by applying the proper air pressure.

⚠ **Warning**
Ensure that the machinery will remain in a safe position prior to releasing the brake.

b) Bleed all air from within the coolant cavity. Air bleeding must be accomplished by running coolant through the cavity with the tensioner secured in its proper operating position.

⚠ **Caution**
Bleeding air from each coolant cavity will require isolation of the drain ports. When static test is complete, all isolation shall be removed to maintain full flow through the system.

⚠ **Warning**
Removing any hoses for isolation of the supply or drain ports will require a compatible fitting for the ORB porting. Failure to do so will damage the porting and cause leakage, a loss of flow and possible damage to the tensioner.

Note: Avoid contaminating the friction material with coolant or water.

⚠ **Warning**
Contamination of the friction material could result in erratic or loss of torque.

c) After the air has been removed, install pipe plugs in the outlets and apply maximum allowable coolant pressure measured at the inlet to the water cavity. Maximum allowable is 40 psig (2.8 bar) for size 36" units. Maintain this pressure for 30 minutes. Check for leakage at all O.D. and I.D. wear plate sealing areas.

⚠ **Caution**
Be sure to apply and retain air pressure to the cylinder (19) of the tensioner to release the spring pressure on the tensioner / brake during static coolant pressure testing. Engagement of the brake during testing could develop surge pressures exceeding the maximum allowable within the coolant cavities resulting in possible damage to the seals.

3.5.6.2 Dynamic Flow Test:

a) Dynamic flow testing of the tensioner should be conducted at the required flow rate for the rated HP dissipation and coolant quality, as given in Table 8. Inlet and outlet pressures for the appropriate tensioner size should not to be exceeded.

b) There should be limited restrictions on the outlet ports of the brake to cause any back pressure to the unit (Refer to Section 2.4.4 adding flow controls). Coolant inlet and outlet sizes are listed in Table 8. Full size hoses and piping should be used. Check for low flow and/or leakage at all O.D. and I.D. wear plate sealing areas.

4.0 MAINTENANCE

⚠ **Warning**
Before performing any maintenance work on the WCSB3 tensioner, make sure that the machinery will remain in a safe position. Failure to do so could result in serious injury or possibly death.

⚠ **Warning**
Only qualified maintenance personnel should install, adjust or repair the WCSB3 units. Faulty workmanship will result in unreasonable exposure to hazardous conditions or personal injury.

⚠ **Caution**
Read these instructions thoroughly and review until you fully understand the parts replacement steps before proceeding with the work described in this section. Failure to follow these instructions can result in unreasonable exposure to hazardous conditions or personal injury.

4.1 Wear Limits

⚠ **Warning**
Periodically examine the tensioner for wear of friction linings, discs and wear plates. Failure to perform this examination will result in excessive wear, a significant reduction in torque, and may result in personal injury and/or damage to the machinery.

4.1.1 Wear limits for the WCSB3 components are shown in Table 13. If any wear limit has been reached or exceeded, that component must be repaired or replaced.

4.2 Wear Adjustment

Wear adjustment is periodically required as the friction material and mating surfaces wear. Wear adjustment reduces the running clearances between these surfaces to help maintain the holding force of the brake (for the spring applied feature), and to maintain the responsiveness of the brake by limiting the travel of components. Mechanical limits within the brake design require that the brake be adjusted when the adjustment points listed in Table 13 have been reached.

Table 13
Wear Limits for 436WCSB3 Components (Ref. Section 4.2 & Section 4.7)

Item	Item	Description	Figure	Wear Limit	Remarks
13 30	Pressure plate assembly Reaction plate assembly	Reaction Holes	1 & 13	Maximum ID is 2.877" (73,07mm)	Wear will be in the form of elongation of the original reaction hole diameter or enlarged hole.
54	Pressure plate & Reaction plate Bushing	Reaction Hole Bushing ID	13	Maximum wear is 0.031" (0,80mm)	Wear will be in the form of elongation of the bushing ID.
19	Cylinder	Seal Area	12	Maximum wear is 0.005" (0,13mm)	Wear will be in the form of grooves where the seals contact the cylinder wall
112	Mounting Flange/ Cylinder	Dual Piston Seal Area	12	Maximum wear is 0.005" (0,13mm)	Wear will be in the form of grooves where the seals contact the cylinder wall
34	Spring	Spring Free Height	1	Minimum free height is 4.130" (104,90mm)	Original free height is 4.250" (107,95mm) Springs must be replaced in complete sets
22	Spring	Spring Free Height	1	Minimum free height is 6.370" (939,80mm)	Original free height is 6.650" (168,915mm) Springs must be replaced in complete sets
52	Spring	Spring Free Height	1	Minimum free height is 6.500" (165,10mm)	Original free height is 6.780" (172,21mm) Springs must be replaced in complete sets

⚠ **Warning**
Failure to perform wear adjustments when required may result in loss of adequate brake torque and potential injury to personnel or damage to equipment. Be certain to inspect the brake periodically to evaluate for wear, and adjust as necessary.

4.2.1 Brake Inspection and Evaluation

To determine when brake adjustment is required, the brake should be evaluated as follows:

4.2.1.1 Visually inspect for friction material wear.

Note: The friction material is fully worn when the wear has reached the bottom of the wear groove as shown in Figure 6.
Note: If fully worn, replace the friction material and evaluate the condition of the mating wear surface.
Note: If the wear limits on any of the friction discs have been reached, determine if brake adjustment is Required by proceeding to the next steps.

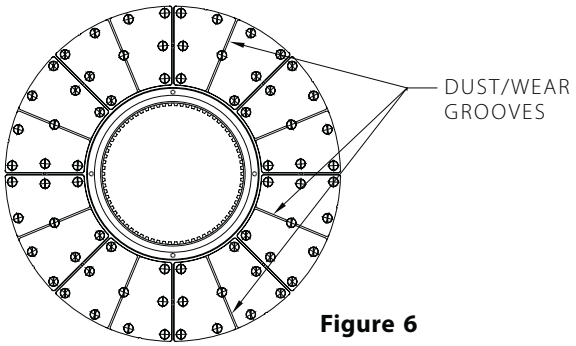


Figure 6

4.2.1.2 Measure for brake wear:

(a) Ensure that the load that the brake supports will be properly secured from possibility of movement when no pressure is being applied to the brake being inspected.

(b) Exhaust all air pressure from the pressure chambers on both ends of the WCSB3 brake being evaluated. Pressurized areas are located in the following:

- Cylinder (19)
- Mounting Flange (112).

If more than one WCSB3 brake is used in the driveline, exhaust all air pressure from those brakes also.

Note: Follow the reccomendations of the control system manufacturer to ensure that no air pressure is trapped in the brake or control system, and that the control system has been safely isolated from the brake while performing inspections.

(c) Verify that the air pressure has been fully exhausted from these chambers by checking any in-line gauges (they should read zero pressure), and also by inspecting specific gaps between components as noted below. Refer to Figure 7 & Figure 7A for the corresponding gap locations.

Pressure in the cylinder (19) has been exhausted if the measured gap Z-1 is greater than zero, and there is no clearance between each side of the disc (119) and the corresponding friction material. Pressure in the mounting flange (112) has been exhausted if gap Z-2 (See Figure 7A), located between the mounting flange and the pressure plate (116) is equal to .250" (6.35mm) and gap W is greater than zero.

(d) Measure gaps between the components at positions W, X, Y-1, and if applicable, Y-2, and Y-3. See Figure 7 & Figure 7A for the location of those gap positions.

For reference:

The W-gap is the measurement between the end plate (117) and the stop plates (125) and is used to determine when adjustment of the water-cooled section of the brake is required. This gap will increase as the brake wears.

The X-gap is the measurement between the end plate (117) and the pressure plate sub-assembly (13) and is used to determine when adjustment of the air-cooled section of the brake is required. This gap will decrease as the brake wears.

The Y gaps are measurements between the various wear plate sub-assemblies and are used to help evaluate the wear of the water-cooled friction discs and wear plates. These gaps will decrease as the brake wears. The wear limit for each of the Y gaps is the same for Y-1, Y-2 or Y-3.

Y-1 is the measurement between the mounting flange (116) and the reaction plate (30).

Y-2 is the measurement between the reaction plate (30) and the adjacent reaction plate (30). The Y-2 gap is found only on brakes that have three or more water-cooled' discs.

Y-3 is the measurement between the reaction plate (30) and the end plate (117).

(e) Record the W, X, Y-1, Y-2, and Y-3 values measured for each of the gaps, and compare them against the values listed in Table 14.

(f) If the value measured for any Y gap (Y-1, Y-2, Y-3) is equal to or less than the Y-min value, the brake should be removed from service and repaired with new wear components.

(g) If the value measured for all Y gaps (Y-1, Y-2 or Y-3) is greater than the Y-min value, proceed to evaluate the measurement for gap W as follows:

(h) If the measurement for gap W is equal to or greater that the adjust value shown on Table 14, wear adjustment is required. Adjust the brake per the procedures listed in section 4.2.2.

Note: If it is found that no wear spacers (29) exist between the clamp tube (12) and stop plate (125) before adjustment is attempted, all wear adjustments have been previously performed in the water-cooled section of the brake, and brake overhaul is required.

(i) If the gap measured for gap X is equal to or less than the adjust value, wear adjustment is required. Adjust the brake per the procedures listed in section 4.2.2. If it is found that no wear spacers (29) exist between the clamp tube (124) and stop plate (125), all wear adjustments have been previously performed in the air-cooled section of the brake and replacement of the friction discs (118) and disc (119) may be required. Remove the brake from service and evaluate the condition of those components, using Table 14 as a reference.

⚠ **Warning**
If wear adjustment is not made, the piston may extend out of the mounting flange/cylinder (112) beyond an acceptable operating range, resulting in loss of torque and/or seal (21, 23 and/or 114) damage.

If the "Y" or "Z" dimensions have been reached or any of the friction discs are worn to the bottom of the wear groove, the tensioner should be taken out of service and rebuilt with new components as required.

4.2.2 Adjustment Procedure for Water Cooled Tensioner

Wear adjustment can be conducted without full disassembly of the WCSB3 tensioner. Wear adjustment of the water cooled tensioner is accomplished by removing the support beam wear spacers (139) and the wear adjustment spacers (29). The wear adjustment spacers are slotted to allow for easy removal with a chisel. The support beam wear spacers are slotted to allow for positioning with alignment pins (hex screw, nut and washer 142, 143 & 145) and easy removal when the alignment pins are loosened (See Figure 1A, Section 'B' and Figure 1C, Section 'Z-Z').

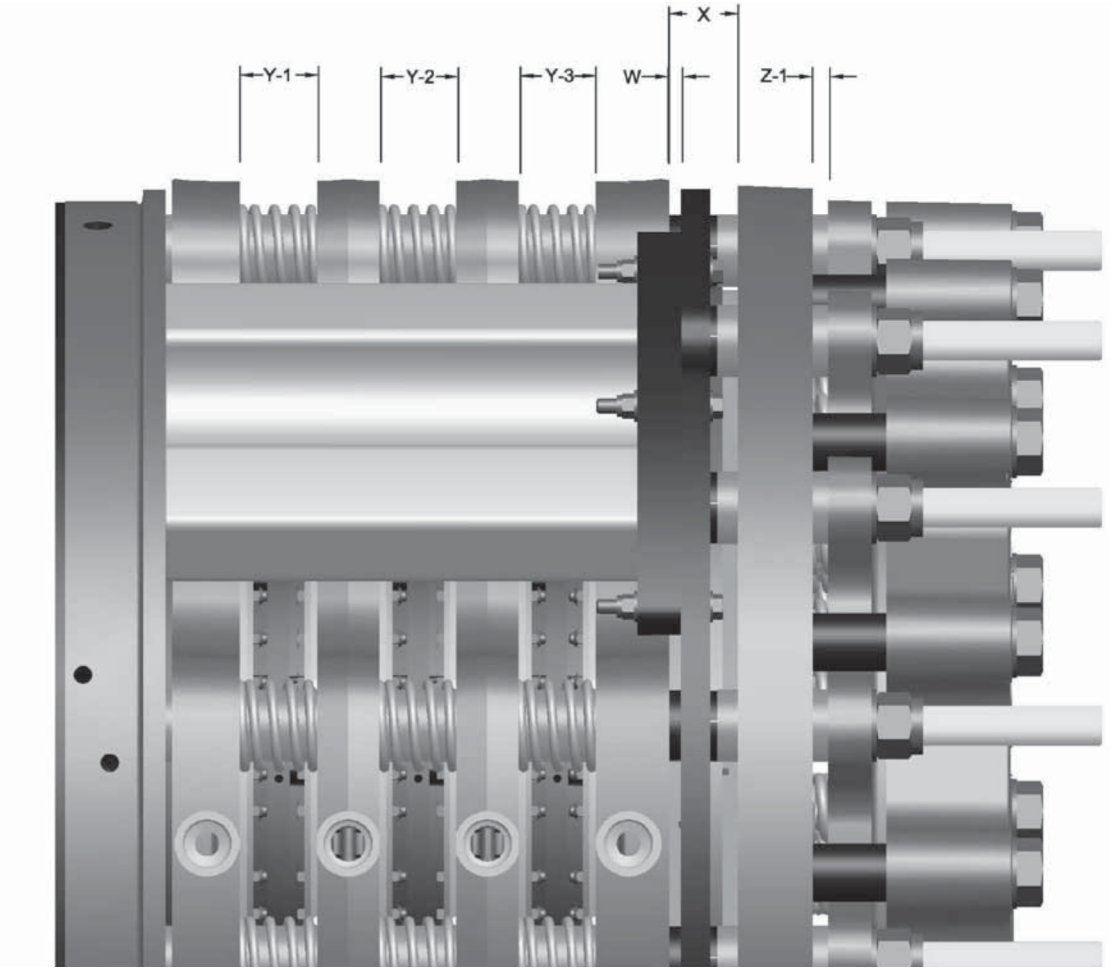


Figure 7

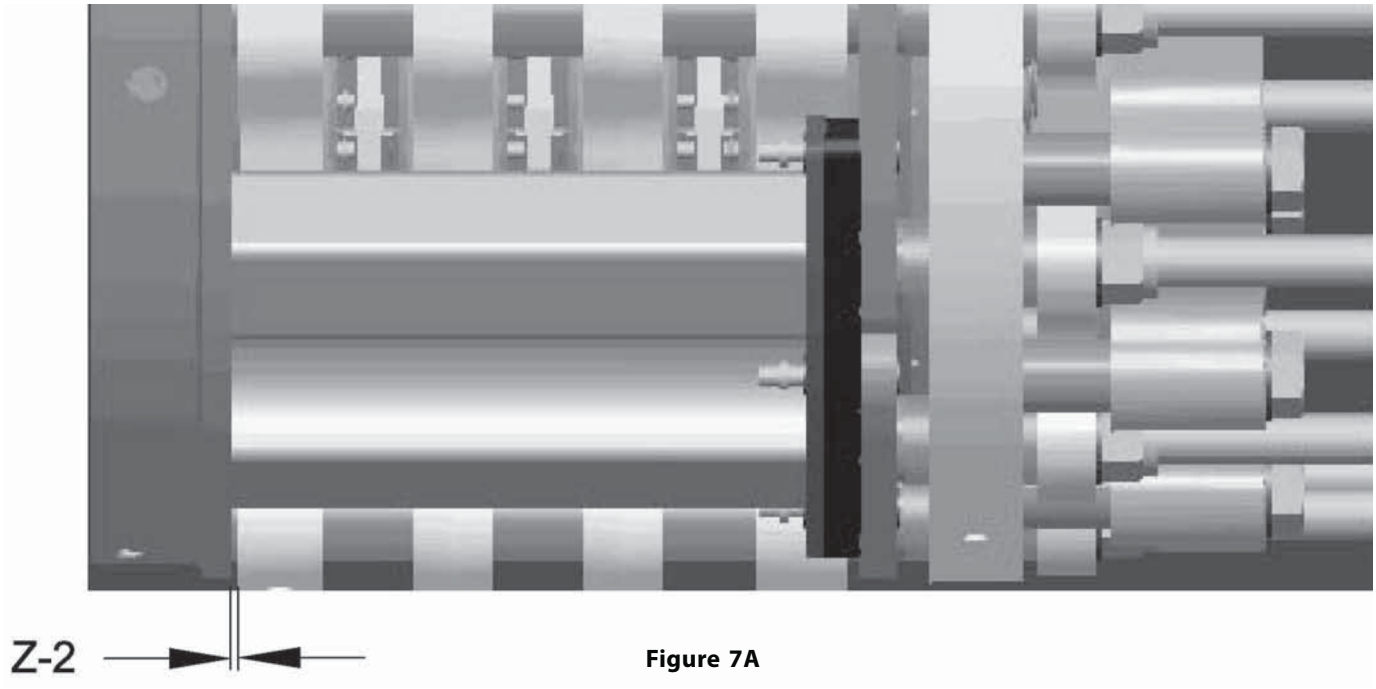


Figure 7A

Table 14
Wear Gap Values, - Inches (mm) W, X,Y, and Z Gaps

Size	Qty. of WC Discs	W New	W adjust	X new	X adjust	X min	Y min	Z-1 new
436WCSB3	3	.360/.480 (9,14/12,19)	.670 (17,01)	2.392 (60,75)	2.142 (54,40)	1.892 (48,06)	2.25 (57,15)	.540 (13,72)

* Value shown is GAP after wear adjustment. New or rebuilt brakes may vary slightly fromthis value due to tolerances.

Record of Wear Measurements

GAP	W	X	Y-1	Y-2	Y-3	Z-1	Z-2
Date:							
Date:							
Date:							
Date:							
Date:							
Date:							
If Recorded value is:	Equal or greater than W adjust	Equal or less than X adjust	Greater than Y min			Greater than Zero	Equal to .250" (6.35mm)
Then:	Adjust	Adjust	Inspect friction disc condition. Note if measured value is less than Ymin, rebuild the brake.			Check Z-2	OK to check for wear

⚠ **Warning**
Before performing any maintenance work on the WCSB3 unit, make sure that the machinery will remain in a safe position. Failure to do so could result is serious injury or possibly death.

4.2.2.1 Wear spacers (29) and support beam wear spacers (139) should be removed in complete sets only (one from each stud/beam support location). Mark the spacers to be removed to avoid confusion during removal.
Note: For wear adjustment of the spring set brake (gap X), remove the 16 slotted round spacers that are located closest to the short clamp tubes (124). For adjustment of the water-cooled tensioner (gap W), remove spacers (29) closest to the long clamp tubes (12) and remove the support beam wear spacers (139) located between the support beam (138) and the stop plate (125).

⚠ **Warning**
Removal of spacers in quantities other than complete sets (layers) will result in severe damage to WCSB3 components during reassembly, and could cause the brake to not function properly.

4.2.2.2 Loosen the locknuts (18) - ONE TURN AT A TIME and in an alternating (cross wise) pattern. Loosen each locknut only two or three turns to allow access to the wear spacers (29) and support beam wear spacers (139)

⚠ **Caution**
The locknuts (18) must not be loosened unless the hex head screws (20) are in place.

4.2.2.3 Wear spacers (29) are slotted to allow for in-place removal. Using a narrow chisel wedged into the slot of the wear spacer, as shown in Figure 8, pry the wear spacer until it fractures and is clear to be removed from the stud. Support beam wear spacers (139), Figure 8A, are designed with a slot to allow for positioning with alignment pins (Hex screw, nut and washer 142, 143 & 145) as shown in Figure 1B, Section Z-Z. Loosen the hex locknut (145) that captures the support beam wear spacers between the stop plate (125) and the wear spacer retainer (141). Slide out one support beam wear spacer. Reposition the remaining spacers and tighten the self-locking nut. Torque the locknuts to specification per values in Table 4.

Repeat for the remaining spacers (29) and support beam spacers (139) in the set that is to be removed.

⚠ **Warning**
Be sure to collect all wear spacers (29) and all support beam wear spacers (139) when removed. Spacers lodging in between tensioner components could prevent the tensioner from properly engaging or releasing.

4.2.2.4 Prior to tightening the locknuts, verify that the support beams and clamp tubes and support are located properly over the step on the mounting flange/cylinder and alignment bushings to prevent damaging them during the tightening process. While supporting the weight of the cylinder/piston assembly, tighten the locknuts (18) ONE TURN AT A TIME and in a crosswise pattern, alternating, until the cylinder is seated firmly against the clamp tubes and support beams. Torque the locknuts to the appropriate value. See Table 4.

⚠ **Warning**
Damage to the cylinder or support beam shims and support beams could occur if not positioned properly, possibly causing the tensioner to malfunction.

⚠ **Warning**
The locknuts (18) must be tightened gradually and evenly to prevent damage to the brake components.

4.2.2.5 Restore any piping or covers removed prior to operating the tensioner.

4.3 Disassembly Procedures

⚠ **Warning**
Ensure that the machinery is and will remain in a safe position prior to loosening fasteners or removing the tensioner.

4.3.1 Disconnect the air supply lines and water lines from the tensioner.

4.3.2 Remove the fasteners that secure the tensioner to the mounting structure.

4.3.3 Using soft slings, rig the tensioner and slide the WCSB3 off of the gear. Avoid placing slings or straps directly on the release springs (34).

4.3.4 Transport the tensioner to a clean working area and position the unit on a flat surface with the mounting flange (112) facing down.

4.3.5 If the gear (28) requires replacement, remove it from the shaft with a portable jack, using the threaded holes in the end of the gear for puller holes. Heating may be required to ease removal. Replace the gear and install per Section 2.2.

4.3.6 Match-mark the mounting flange (112), pressure plate (116), reaction plates (30), end plate (117), pressure plate (13), spring housing (16), and cylinder (19) to one another prior to disassembly to adequately show the proper orientation of components to one another.

4.3.7 Loosen the locknuts (18) - ONE TURN AT A TIME and in sequence until the release spring force is relieved.

⚠ **Caution**
The locknuts (18) must not be loosened unless the screws (20) are in place retaining brake spring tension.

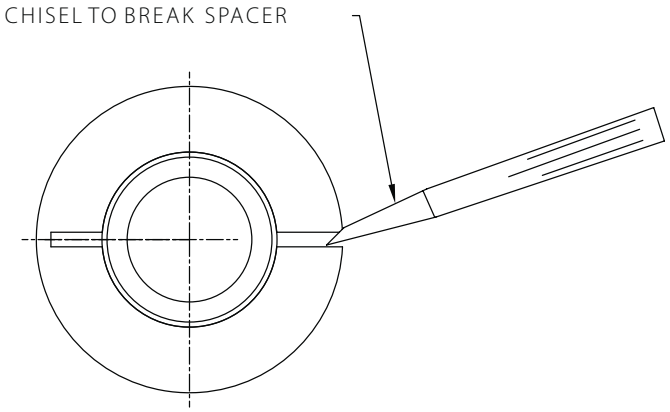


Figure 8

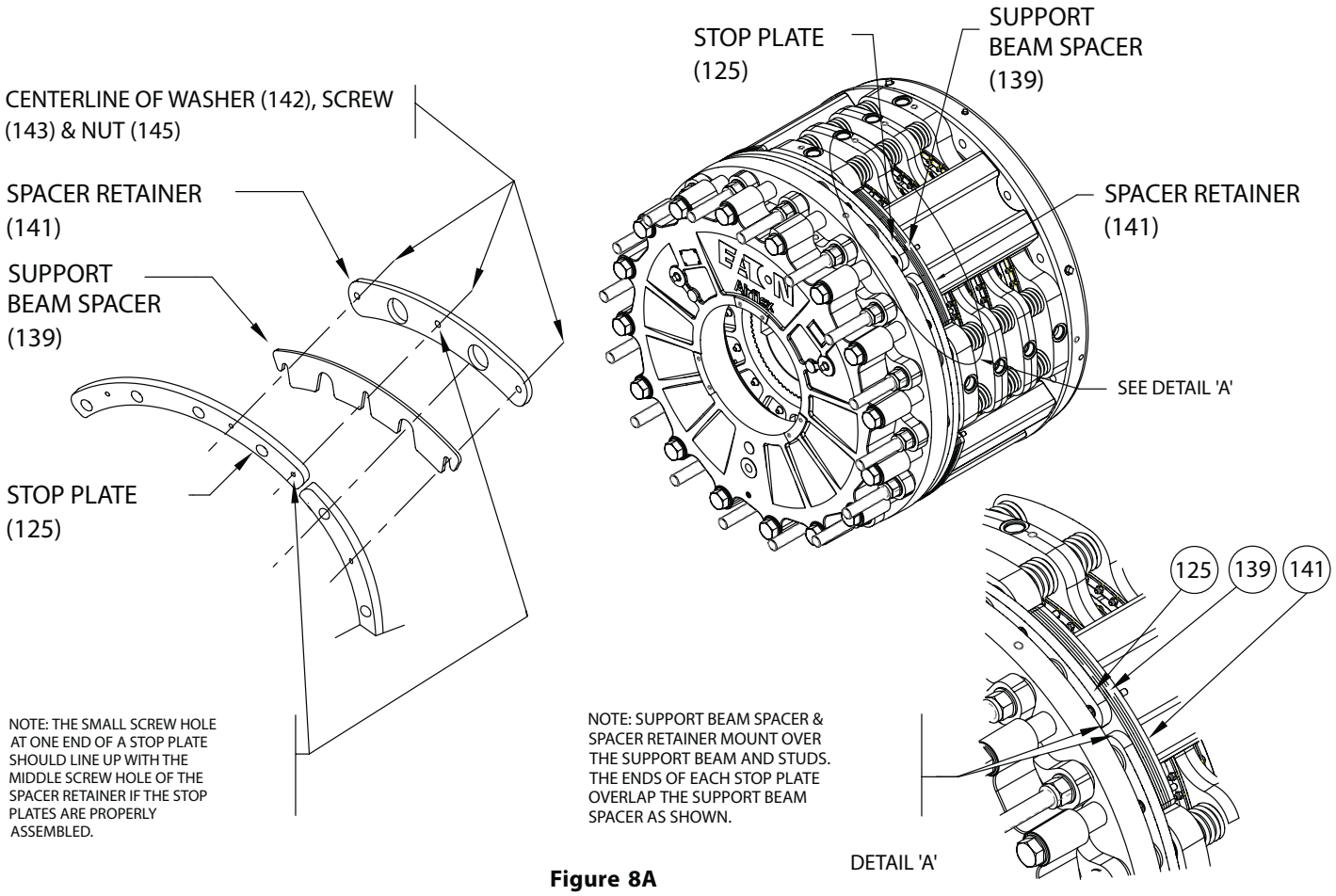


Figure 8A

4.3.8 Lift the cylinder, spring housing, and pressure plate off the studs as an assembly. Set the assembly aside on a clean, level area, making sure to avoid damaging the friction material surface.

4.3.9 Continue removing the remaining components if required.

4.3.10 Inspect all components using the wear limits in Table 13 as a reference.

4.3.11 For friction lining replacement refer to Section 4.4.

4.3.12 For wear plate (3) replacement, refer to Section 4.5.

4.3.13 Refer to Section 4.6 to replace seals (21), (23) & (114) for the mounting flange/cylinder (112) and seals (21) & (23) for the brake cylinder (19).

4.3.14 For spring (34) replacement, refer to Section 4.7.

4.3.15 For bushing (54) replacement, refer to Section 4.8.

4.3.16 Assemble the tensioner per Section 4.9.

⚠ **Caution**
After replacement of friction material, a minimum wear-in period is recommended for the friction couple to achieve rated torque. See Section 3.3 for wear-in procedures.

4.4 Friction Material Replacement

Note: When replacing friction material, it is recommended that the mating wear surface be inspected for wear. A light touch up of the wear surfaces may be performed to remove high spots or burrs to minimize wear-in if required. See Table 13 for wear limits.

4.4.1 Refer to Section 7.0 for the friction disc replacement part numbers.

⚠ **Caution**
Use only genuine, Airflex friction material. Use of material not of Airflex origin may result in unpredictable performance.

4.4.2 Disassemble the tensioner as per Section 4.3.

4.4.3 Remove the old screws and discard the old friction material.

Note: Use of a pinpoint torch to heat the screws and soften the Loctite® will ease removal of the screws.

4.4.4 Clean all burrs, corrosion etc. from the friction disc core or mounting surfaces. Chase all tapped holes with a tap to clean threads and remove any residual Loctite.

4.4.5 Position the new friction material to align the screw holes. Apply Loctite® #262 to the screw threads and tighten the screws to the proper torque value. For water-cooled disc assemblies, tighten screws to 15 ftlb. (20Nm). Screws securing the air cooled brake friction discs (118) or blocks mounted on the pressure plate (13) and end plate subassembly (117) should be tightened to 20 ft-lb (27 Nm) after application of Loctite® #262 to the screw threads. Install the screws in an even, crosswise pattern. Screws in friction blocks should be installed from the center most position in the block, then progressing towards the outer edges of the block. One at a time, install and torque each screw immediately after application of Loctite® then proceed to the next screw.

⚠ **Warning**
Loctite® may cure prior to properly tightening the screw if not tightened to the proper torque value immediately after installation.

⚠ **Caution**
Use only Airflex-suppliedscrews.

⚠ **Caution**
Loctite® #262 must be shaken prior to application.

⚠ **Caution**
Loctite® #262 may irritate sensitive skin. Refer to the product label for proper safety precautions.

4.4.6 After replacement of friction material, assemble the tensioner per Section 4.9. Observe wear-in procedures during start-up per Section 3.0, Operation.

4.5 Wear Plate Replacement

Note: When replacing wear surfaces, it is recommended that the mating friction material be replaced to ensure good contact between the mating surfaces. See Table 13 for wear limits.

4.5.1 Disassemble the tensioner per Section 4.3.

4.5.2 Remove the screws (4) and locknuts (5) holding the wear plates (3) and remove the wear plates. If the wear plates cannot be easily lifted off, gently tap the O.D. to break the gasket seal.

⚠ **Caution**
Do not attempt to break the gasket seal by prying between the wear plate and housing. Damage to the sealing surfaces may occur.

4.5.3 Internal Corrosion Protection

Note: Water-cooled tensioners used in both the open and closed loop operating modes are required to be painted with Flame Control TemperKote 1000 PRIMER and top coated with TemperKote 1000 TOPCOAT.

4.5.3.1 Lifting off the wear plates (3) in section 4.5.2 will expose the water passages. Inspect the water passages and, if necessary, use a wire brush to clean them. For best results, surfaces should be free from oil, grease, dirt, mill scale, rust corrosion products, oxides paint and foreign matter.

Note: If nubs in the water cavity are severely corroded, wear plates may not be properly supported. Replace the pressure plate (116), reaction plate (30) or end plate (117) if necessary.

4.5.3.2 The surfaces to be painted should be sand blasted prior to painting.

Note: Contact the paint manufacture for instructions on using their product. Read the manufacturer's instruction thoroughly for proper handling, preparation, application and spray of paint system.

⚠ **Caution**
Do not paint the clamp tubes (12), (124) or the springs (34), (22), (53) as this may hinder the engagement or disengagement of the tensioner.

⚠ **Caution**

Care must be taken to deal with painting in the 'water cavity area' to ensure that there is full coverage of paint with uniform thickness on the water cavity surface. Refer to Figure 10-A to mask the inner & outer lands that will receive the gasket tape for sealing.

4.5.3.3 Primer: One coat of Flame Control TemperKote 1000 Primer at approximately 5.0-7.5 mils wet film thickness to yield a dry film thickness of 2.0-3.0 mils dry. It is permissible and recommended that the top of the nubs and support ribs in the coolant cavity be painted.

4.5.3.4 Topcoat: Apply coat of Flame Control TemperKote 1000 paint (Topcoat) to achieve the total topcoat thickness of 6.0-8.0 mils dry.

4.5.4 **Assemble with Gasket Tape**

Note: The Pressure Plate (14), Reaction Plate(s) (30) and End Plate (117) will be referred to as IRON in the following paragraphs. Refer to Figure 14 for item number references shown in parenthesis (#).

4.5.4.1 Preparation and cleaning the IRON:

Ensure that the IRON surface is smooth and free of paint scale, burrs and corrosion. Thoroughly clean both the inner and outer lands which will receive the gasket. Use a solvent based cleaner such as acetone, mineral spirits or a general-purpose wax/oil/grease remover turning the wipe until it is free of new dark debris. Finish the cleaning process by blowing off lint on the sealing surface. If a paint touch-up is required, reference Figure 10-A to mask the inner & outer lands that will receive the gasket tape for sealing.

⚠ **Caution**
Use only clean, dry air for blow-off.

⚠ **Caution**
Follow manufacturer's instructions and proper safety precautions for the use of solvent based cleaners (acetone, mineral spirits or general-purpose) for oil/grease remover.

4.5.4.2 Preparation and cleaning the Copper Wear Plate:

Ensure that the wear plate surface is smooth and free of burrs and corrosion. Thoroughly clean both the outer and inner areas which will be in contact with the gasket tape. Use a solvent based cleaner such as acetone, mineral spirits, or a general-purpose wax/oil/grease remover. Finish the cleaning process by blowing off lint on the sealing surface.

⚠ **Caution**
Use only clean, dry air for blow-off.

⚠ **Caution**
Follow manufacturer's instructions and proper safety precautions for the use of solvent based cleaners

4.5.4.3 Preparation of the Gasket Tape Ends

Start with the leading end of the gasket tape and cut the end at 45 degrees per Figure 11. This initial step is required to insure a smooth transition of the tape when the tape is overlapped per section 4.5.4.4 (b) below. Also, cut the trailing end of the tape at 45 degrees after it is overlapped per section 4.5.4.4 (b) below.

4.5.4.4 Applying the Gasket Tape to the IRON

(a) Start with the sealing area nearest to the inner diameter on the IRON. Remove the adhesive backing on the gasket tape a little at a time to prevent the adhesive from picking up dirt during installation. Start by positioning one end of the tape at the center-line of a bolt hole as shown in Figure 9, using the edge of the water cavity as a guide, as shown in Figure 10-B. Proceed to apply the tape on the sealing surface following a smooth circular path, being sure to press the tape in place.

(b) After the gasket tape has been placed around the entire circumference, overlap the starting end of the end of the tape by a minimum of 0.44" (11.2mm). See Figure 11. Be sure to smooth the tape at the overlap transition in order to get a good seal. No air gaps or bubbles should be present.

(c) Repeat steps 'a' and 'b' in Section 4.5.4.4 for the outer sealing area nearest to the outer diameter of the IRON, again using the edge of the water cavity as a guide.

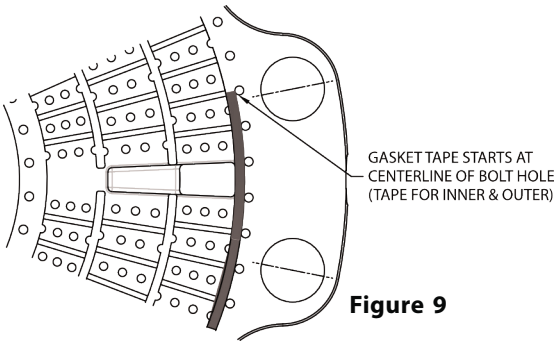


Figure 9

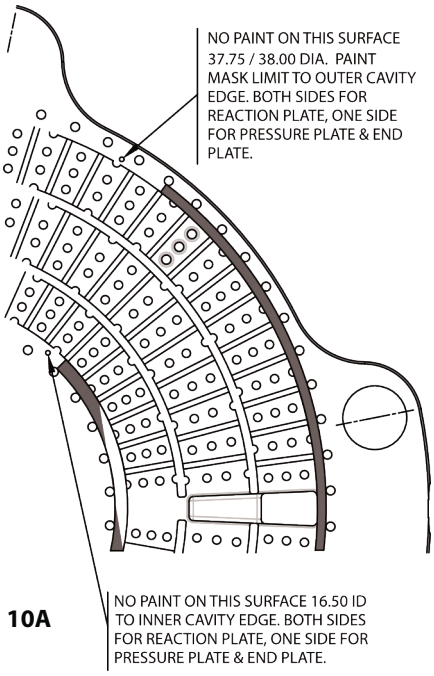


Figure 10A

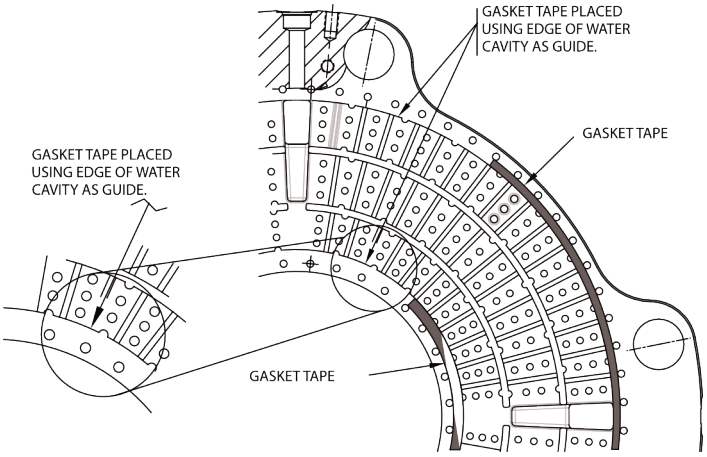


Figure 10B

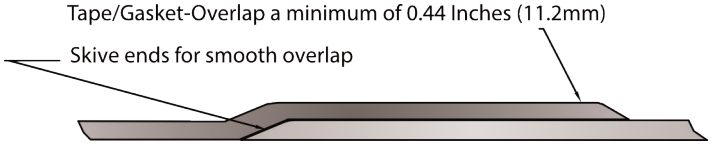


Figure 11

⚠ **Caution**
Before the gasket tape is covered with the wear plate, the sealing surface should be protected to prevent contamination from dust, dirt or oils. No additional cleaning or liquid should be applied to the surface of the IRON or gasket tape.

4.5.5 Inspect the new wear plates (3) and remove any scratches or raised edges with very fine sandpaper or steel wool. Position the smoothest side of the wear plate on the sealing surface, being careful to align the holes with those in the IRON.

4.5.6 Position the support rings (50) & (51) over the holes in the wear plates (3) and install the new hex head screws (4) and locknuts (5) provided, securing them finger tight.

Note: the Outer support Ring (51) is comprised of two sizes. A description of each ring and where to mount them is described in Section 4.5.6.1.

4.5.6.1 The Outer Support Ring (51) is comprised of two sizes. One section is shorter than the other and the shorter section has 7 holes. The longer section has 9 holes. The longer section has two holes separated by a larger gap than the others. The gap is to be mounted over each coolant port. Torque the mounting screws per Table 4 and follow the torque tightening instructions found in Section 4.5.7.

⚠ **Caution**
To prevent excessive warping of the wear plate and to endure a good seal, the following torque tightening procedure must be followed.

4.5.7 For each wear plate being replaced, the torque tightening instructions are as follows:

Note: The torque of the screws & nuts (4) (5) that attach the wear plate (3) to the mounting flange (1), reaction plate (30) & pressure plate (13) is a four step process.

(a) Step One: For the first 16 screws, bring the initial torque of each screw up to 33% of the torque value shown in Table 15 using the tightening sequence shown in Figure 12. Install and torque the remaining screws in any reasonable crosswise pattern to 33% of the torque value shown in Table 15.

(b) Step Two: Repeat the sequence of torque tightening on the first 16 screws as shown in Figure 12 and bring each screw up to 66% of the torque value shown in Table 15. Torque the remaining screws in any reasonable crosswise pattern to 66% of the torque value shown in Table 15.

(c) Step Three: Repeat the sequence of torque tightening on the first 16 screws as shown in Figure 12 and bring each screw up to 100% of the torque value shown in Table 15. Torque the remaining screws in any reasonable crosswise pattern to 100% of the torque value shown in Table 15.

(d) Step Four: Finish torque tightening by selecting a starting position (usually at the 12 o'clock position) and check the 100% torque of each screw going in a sequential clockwise or counterclockwise rotation. Mark or highlightscrew head or nut & shank after final torque check as a visual indication that the screw/nut has been tightened to specification shown in Table 15.

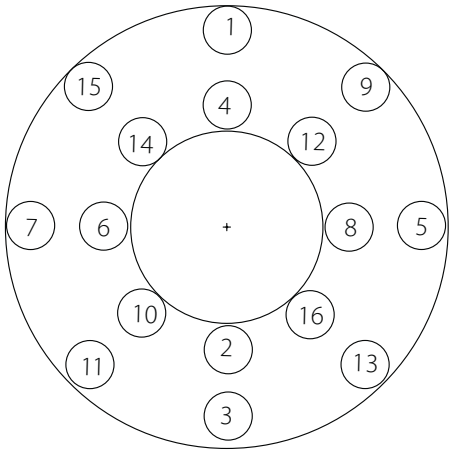


Figure 12

Table 15
Wear Plate Fastener Size & Torque

Model	Size	Torque Ft-lb (Nm)
36WCSB3	3/8-16NC2*	40 (54)

*Alloy Steel Grade 8

4.5.8 After completion of the assembly, each water cavity should be checked for leaks per static test in 3.4.6.1.

4.5.8.1 Using lifting straps, suspend each assembly with the water outlet port at the 12 o'clock and 6 o'clock position. Connect a water supply line to the inlet port at the 6 o'clock position. Plug the side ports and leave the 12 o'clock port open to purge air from the coolant cavity. See Table 16 for outlet port sizes.

Table 16
Inlet & Outlet Coolant Port Sizes

Model	Size O-ring Boss (ORB)
36WCSB3	SAE-20 J1926

4.5.8.2 Slowly fill with water to purge all air from water cavities

4.5.8.3 Install an ORB pipe plug in 12 o'clock port and apply appropriate water pressure (40 psig (2.76 Bar) for the 36WCSB3. Pressure is measured at the inlet. Maintain this pressure for a minimum of 30 minutes.

4.5.8.4 Check for leakage at the O.D. and I.D. seal areas. No leakage is allowed.

4.5.8.5 If the assembly leaks, check the torque on each screw and re-test. If leaks still occur, the wear plate(s) or sealant tape or iron surface may be damaged. Repair and repeat procedure from 4.5.2.

4.5.8.6 Follow steps in Section 4.8 to reassemble the tensioner.

⚠ **Caution**
After replacement of wear plates (3), a wear-in period is required per Section 3.3 for the friction couple to achieve rated torque.

4.6 Seal Replacement

Note: The cylinder piston seals (21) & (23) can be replaced with the brake fully assembled and simply removing the cylinder (19) while the rest of the brake remains assembled. If the piston seals in the mounting flange/cylinder (112) require replacement, full disassembly of the tensioner is required. See Section 4.3.

4.6.1 Cylinder Seals

4.6.1.1 Disconnect the air supply lines and match mark the cylinder to a stud or other component to ensure proper orientation during reassembly. Remove the screws (20), washers (17) and spacer tubes (27) attaching the cylinder (19) to the pressure plate (13).

4.6.1.2 Carefully slide the cylinder off of the spring housing (16) or piston (33) out of the mounting flange/ cylinder (112).

⚠ **Caution**
Do not use compressed air to remove the cylinder from the spring housing.

4.6.1.3 Remove the cylinder seals from the spring housing (16) or piston (33) and thoroughly clean the seal grooves in the piston or spring housing.

4.6.1.4 Insert new seals into the grooves, noting the orientation of the seals per Figure 13.

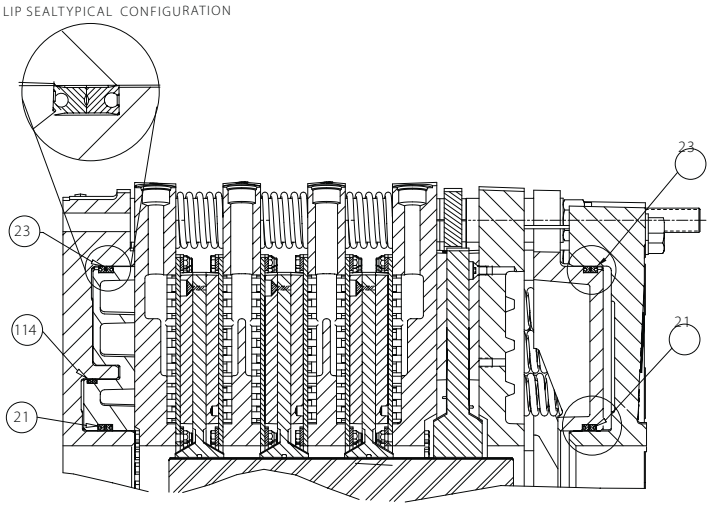


Figure 13

4.6.2 Mounting Flange/Cylinder Seals
Note: If the tensioner was completely removed and disassembled to replace seals, refer to Section 4.9 to assemble.

4.6.2.1 Carefully examine the seal surfaces in the water cooled cylinder or mounting flange/cylinder (112). If the surfaces have worn to point as indicated on Table 13, the cylinder must be replaced. Small nicks or scratches must be sanded smooth to prevent air leakage.

4.6.2.2 Lubricate the seal surfaces in the mounting flange/cylinder (112) with Molykote® O-ring lubricant and carefully slide the cylinder onto the spring housing. Take special care to avoid damaging the seal lips.

4.6.2.3 Attach the mounting flange /cylinder (112) to the pressure plate (116) with the screws, washers and spacer tubes removed in Section 4.6.1.1 Use Loctite® LocQuic® Primer Grade "T" to clean and prepare the screw threads and install with Loctite® #262. Using a crosswise pattern, torque the screws to the value shown in Table 4.

⚠ **Warning**
Loctite® Primer "T" contains harmful vapors. Refer to the product label for proper safety precautions.

⚠ **Caution**
Loctite® #262 must be shaken prior to application.

⚠ **Caution**
Loctite® #262 may irritate sensitive skin. Refer to the product label for proper safety precautions.

4.6.2.4 If mounting flange cylinder seals (21), (23) and (114) have been replaced, reassemble the tensioner/brake per Section 4.9.

4.6.3 Install air lines and air test the assembly for seal leakage per the following:

Apply 120 psi (8.2 bar) to an open port in the cylinder (19) to disengage the spring-set brake and check for release cylinder leakage. Apply 120 psi (8.2 bar) to the outer port in the mounting flange cylinder (112) and check for outer seal leakage. Allow the inner port in the mounting flange cylinder (112) to remain open to check for potential leakage from the outer cylinder area to the inner cylinder area in the mounting flange cylinder. Shut off the air supply and check for pressure drop from the cylinders. If air pressure does not drop below 100 psi (6.8 bar) within 10 minutes, the seals have been properly installed.

Continue the test by releasing the air pressure in the outer port in the mounting flange cylinder, and applying 120 psi (8.2 bar) to the inner port in the mounting flange (112). The outer port should remain open to atmosphere. Apply 120 psi (8.2 bar) to the cylinder (19) to disengage the spring set brake. Check for leakage from the inner cylinder area to the outer cylinder area in the mounting flange cylinder. Shut off the air supply and check for pressure drop from the cylinders. If air pressure does not drop below 100 psi (6.8 bar) within 10 minutes, the seals have been properly installed.

4.7 Spring Replacement of outer & inner apply springs (22) & (52) for Air Cooled Brake

4.7.1 Remove the tensioner as an assembly, and disassemble per Section 4.3.

4.7.2 Match mark the cylinder (19), spring housing (16), and pressure plate subassembly (13) to one another, to ease reassembly.

4.7.3 With the cylinder (19) facing up, disassemble the cylinder/spring housing subassembly by loosening the hex head screws (20) ONE TURN AT A TIME, following a crosswise sequence, until the spring force is relieved. Remove the hex head screws and washers.

⚠ **Caution**
Failure to loosen the screws (20) evenly and in small increments as described may cause the screws or cylinder to bind.

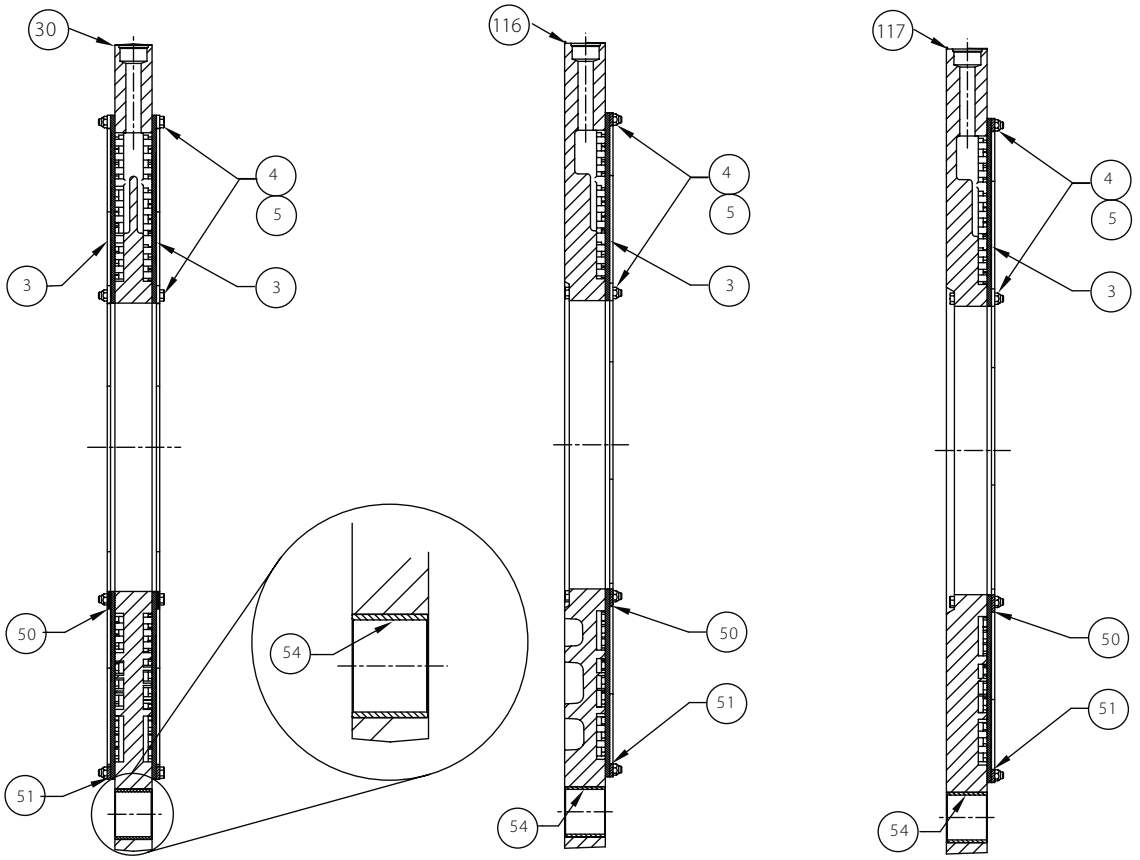
4.7.4 Lift and set aside the spring housing (16) and cylinder (19) as a subassembly to expose the springs. Note the locations of the springs and spring retainers (53) - if applicable - for reassembly purposes. See Figure 1, Figure 1A and Figure 1B.

4.7.5 Inspect the springs for distortion by checking the free height. If the free height of any spring is less than the value shown on Table 13, the entire set of springs must be replaced. Inspect the spring for any surface fractures or high temperature color change. Any conditions found require the entire set of springs to be replaced.

4.7.6 Reassemble the tensioner by following the procedures in Section 4.9, beginning with section 4.9.20.

⚠ **Caution**
The cylinder (19), spring housing (16) and end plate (117) should not be re-assembled as a separate subassembly. Improper assembly procedures may result in uneven contact of the friction material with the disc (119), resulting in low stopping torque.

4.8 Bushing Replacement
Note: The reaction plate (13), pressure plate (30) and end plate (117) have bushings (54) installed in the reaction holes (Figure 14). The reaction plate, pressure plate and end plate bushings are different lengths. Be sure to install the correct length bushing in the proper component. Refer to the reaction plate, pressure plate and end plate sub-assemblies in the parts list (Section 6) for the selection of the proper replacement bushing. Replacement of the bushings can be performed per the following procedures.



WCB REACTION PLATE SUB-ASSEMBLY WCB PRESSURE PLATE SUB-ASSEMBLY WCB END PLATE SUB-ASSEMBLY S/A

Figure 14

4.8.1 Disassemble per section 4.3.

4.8.2 Refer to Table 13 to determine if the reaction plate bushings (54), in Figure 14, require replacement.

4.8.3 Heat up the area around each bushing to soften the Loctite®. Drive out the old bushings.

4.8.4 Clean the bores in the mating component, removing any residual Loctite®.

4.8.4.1 Refer to the wear limits in Table 13 to determine if the original reaction hole is within specification. Inspect the ID of the reaction hole before installation of the new bushing (54). If the reaction hole is oblong or measures different from the wear specification (Table 13) then consult the factory.

4.8.5 Apply Loctite® #RC601, 635 or 680 to the bushing O.D. and mating hole in the reaction plate using a swab. Apply enough liquid to entirely fill the space between the parts. Install the bushings by twisting the bushing while pushing it down, until it is flush with the casting surface. Inspect to see that a ring of liquid adhesive is visible at the parting line. Reapply Loctite if required. Allow the Loctite to cure for 15 minutes before moving the sub assembly.

⚠ **Caution**
The bushing (54) shall be held in place so it is centered in the reaction hole. Do not allow the bushing to protrude beyond the surface of the reaction plate, pressure plate or end plate during installation. Allow the Loctite to cure for 15 minutes before moving the sub-assembly.

4.8.6 Assemble the tensioner per section 4.9, as required.

4.9 Assembly Procedures

Note: Friction discs (7) and water jackets (reaction plates (30), pressure plate (116) and end plate (117) should be assembled as sub-assemblies per the appropriate maintenance procedures prior to final assembly of the tensioner.

4.9.1 Position the mounting flange/cylinder (112) on a flat, level surface, mounting face down.

4.9.2 Lubricate the seals (21), (23) and (114) with Molykote O-ring lubricant, and install them into the seal grooves on the piston (33). Note the orientation of the seal lips, per Figure 13. Lubricate the seal surfaces in the mounting flange /cylinder (112) and evenly insert the piston into the mounting flange/cylinder.

4.9.3 Install the studs (6) into the mounting flange (112). The stud end with the shorter length of threads is to be assembled into the mounting flange. Clean the stud end to be assembled by applying Loctite LocQuic® Primer Grade "T" to the threads. After the threads have dried, apply Loctite® #271 to the threads and assemble the stud until it bottoms in the threaded hole in the mounting flange. Repeat for the remaining studs.

⚠ **Warning**
Loctite® Primer "T" contains harmful vapors. Refer to the product label for proper safety precautions.

⚠ **Caution**
The end of the stud (6) must not extend past the mounting surface of the mounting flange/cylinder (112).

4.9.4 Reference Figure 15 and Figure 15A and make the Danfoss Airflex logo the 12 o'clock position and the drain plug (105) the 6 o'clock position. The centerline of the tensioner running through the 12 o'clock position will land between two studs (6). Place one pair of clamp tubes (12) over the studs. Place the next pair of clamp tubes over the studs that split the 3 o'clock position and repeat for the 6 & 9 o'clock positions. Four pair of studs is required for a total of 8 studs.
Note: When building up the tensioner, the reaction plates (30) and the end plate (117) should be aligned so the coolant inlets and outlets are at the 12, 3, 6 & 9 o'clock positions with reference to the Danfoss Airflex logo and drain plug (105) as defined in 4.9.4 above and the reaction holes line up. The clamp tubes (12) are placed through the reaction holes of the reaction plates and the end plate.

4.9.5 Support Beam

4.9.5.1 Reference Figure 15 and Figure 15A Place a support beam (138) over each pair of studs that are located at 45 degrees to each pair of clamp tubes (12). Four support beams are required. Be sure that the support beam rests on the mounting flange/cylinder. There should be no gap.

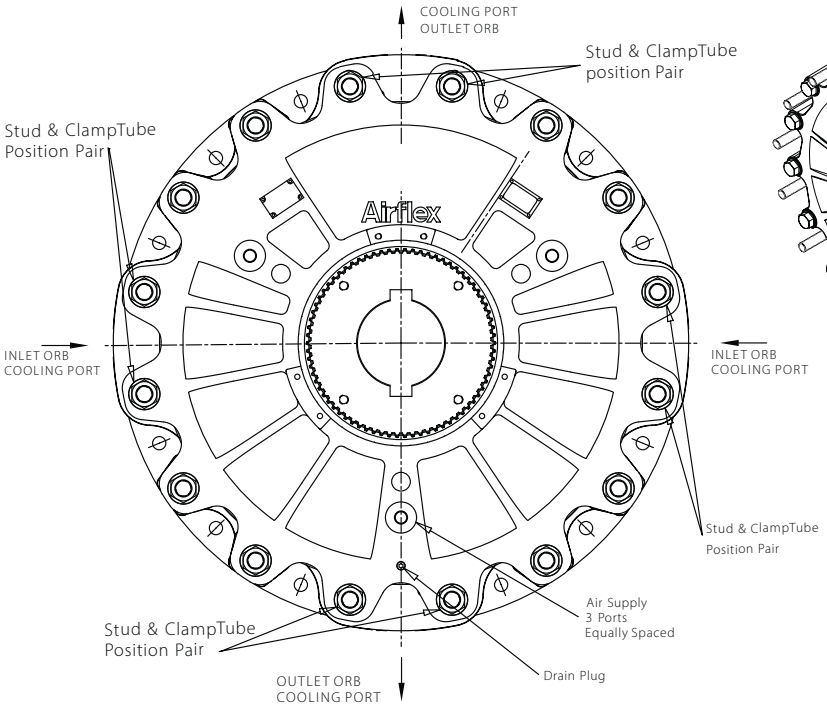


Figure 15

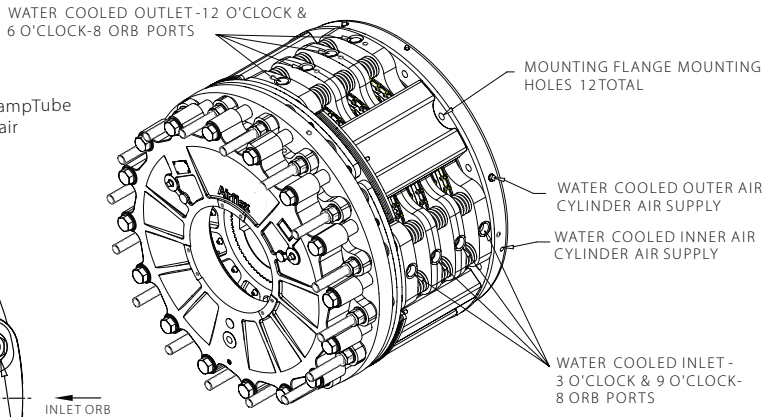


Figure 15A

4.9.5.2 Place one support beam bushing (144) in each 2" bore in the support beam (138).

4.9.5.3 Place one wear spacer retainer (141) over each beam bushing (144).
Note: The support beam bushing (144) should be recessed slightly from the surface of the wear spacer retainer (141). See Figure 1A Section B.

4.9.6 With the wear plate facing up, lower the pressure plate subassembly (116) over the clamp tubes so that the position of the cooling water inlets & outlets are at the 12, 3, 6 & 9 o'clock positions.

4.9.7 Pre-fill the grease channel in the friction disc sub-assembly (7) splines with MOLUB-ALLOY® 936SF grease, or equivalent, as shown on Figure 3.

4.9.8 Lower a friction disc subassembly (7) onto the pressure plate wear surface. Center the friction disc on the pressure plate (116).

4.9.9 Place a release spring (34) over every clamp tube. For single disc tensioners, proceed to section 4.9.13.

4.9.10 On multiple disc assemblies, lower a reaction plate subassembly (30) over the clamp tubes, noting the position of the water inlet in relation to the ports in the pressure plate (116).

4.9.11 Assemble a release spring (34) over every clamp tube, and lower a friction disc subassembly (7) onto the reaction plate (30). Align the disc splines with those in the previous disc assembled to ease installation after assembly.

4.9.12 Repeat Sections 4.9.9 through 4.9.10 until all reaction plates, friction discs and reaction springs are installed.

4.9.13 Lower the end plate subassembly (117) over the clamp tubes, noting the orientation of the coolant ports.

4.9.14 Wear Spacers & Beam Spacers

4.9.14.1 Assemble the wear spacers (29) over the studs (6) that have clamp tubes (12) installed. Refer to Table 17 for the quantity required at this location (adjacent to clamp tubes (12)) on each stud.

4.9.14.2 Assemble beam spacers (139) over the studs (6) with support beams (138) installed. Refer to Table 17 for the quantity required at this location (adjacent to support beam (138)) on each stud.

Table 17
Wear Spacers

Size	Description (Item Number)	Quantity per Position	Total Quantity perTensioner
436WCSB3	Clamp Tube Wear Spacer (29)[1]	4	32
	Support Beam Wear Spacer (139)[2]	4	32
	AC Wear Spacer (29)[3]	1	16

1. Locate between each clamp tube (12) and stop plate (125)
2. Locate over each stud (6) through support beam and between wear spacer retainer (141) and stop plate (125)
3. Locate at each stud (6) between stop plate (125) and clamp tube (124)_

4.9.15 Assemble the friction discs (118) to the end plate subassembly (117) and pressure plate (13) per the following:

Position the friction material to align the screw holes. Apply Loctite® #262 to the screw threads and tighten the screws (121) to 20 ft-lb (27 Nm). Install the screws in an even, crosswise pattern. Screws in friction disc should be installed from the center most position in the block, then progressing towards the outer edges of the block. One at a time, install and torque each screw immediately after application of Loctite®, then proceed to the next screw.

⚠ **Warning**
Loctite® may cure prior to properly tightening the screw if not tightened to the proper torque value immediately after installation.

⚠ **Caution**
Use only Airflex-supplied screws.

⚠ **Caution**
Loctite #262 must be shaken prior to application.

⚠ **Caution**
Loctite #262 may irritate sensitive skin. Refer to the product label for proper safety precautions.

4.9.16 Lower the disc (119) onto the friction material on the end plate subassembly (117), centering it on the friction blocks or disc. Align the splines with those in the tensioner friction disc sub-assemblies (7).

4.9.17 Assemble the stop plates (125) so that they rest against support beam wear spacers (139).

Note: Each stop plate (125) installs over four studs (6). Locate ends of stop plates (125) over support beam wear spacers (139). Refer to Figure 8A. The support beam spacer (139) and the spacer retainer (141) mount over the support beam (138) and studs (6). The ends of each stop plate overlap the support beam spacer as shown in Figure 8A. The small screw hole at one end of the stop plate should line up with the middle screw hole in the spacer retainer if the stop plates are properly assembled.

4.9.18 Install the remaining sixteen wear spacers (29) over the studs. One spacer should be placed over each stud. See Figure 1A, Section A.

4.9.19 Slide the 16 clamp tubes (124) over every stud.

4.9.20 Lower the pressure plate (13) over the clamp tubes (124), resting the friction material face against the disc (119).

4.9.21 Install the springs in a symmetrical pattern on the pressure plate subassembly (13), distributingthem as evenly as possible. Locate the springs over bosses or in the spring pockets in the pressure plate, as shown in Figure 16. If applicable, position the spring retainers (53) on top of the springs to hold the springs into position.

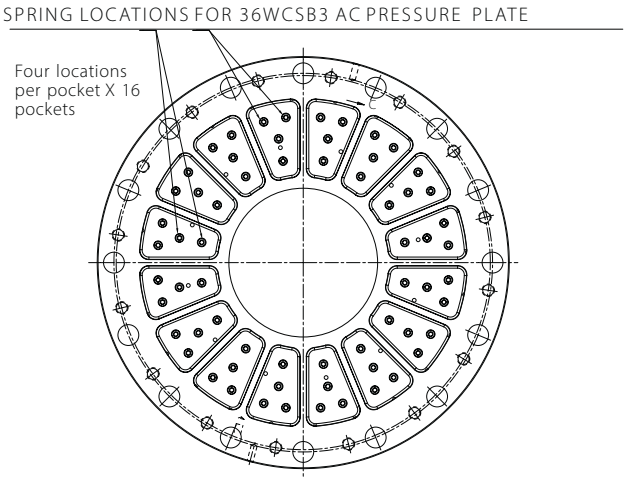


Figure 16

4.9.22 Lower the spring housing (16) over the springs and spring retainers, if applicable, aligning the match marks made during disassembly. Be sure to not overlap spring retainers such that they interfere with the ribs in the spring housing (16) when assembled.

⚠ **Caution**
Interference of the spring retainers with the casted ribs in the spring housing will damage the spring retainers and may prevent proper positioning of the springs.

4.9.23 Lubricate the ends of the studs (6) with 30 weight oil or an anti-seize compound, and assemble the locknuts (18) and flat washers (17) onto the studs. Tighten the nuts in an even crosswise pattern - one turn at a time - to evenly compress the springs. Tighten the nuts to the final tightening torque listed on Table 4.

⚠ **Caution**
The locknuts (18) must be tightened gradually to pre vent damage to the brake components.

4.9.24 Lubricate the seals (21) (23) with Molykote 55 O-ring lubricant, and install them into the seal grooves on the spring housing (16). Note the orientation of the seal lips, per Figure 13.

4.9.25 Lubricate the seal surfaces in the mounting cylinder (19) and lower the cylinder onto the spring housing. Orient the cylinder so that the Danfoss logo is near the "12 O'clock" position, in-linewith the water outlets.

4.9.26 Position the spacer tubes (27) in-linewith the bolt holes in the cylinder, and install the hex head screws (20) with lock-washers (17). Tighten the screws in a crosswise patternONE TURN AT A TIME untilthe spacer tubes are clamped between the cylinder and pressure plate. Make sure the cylinder slides over the seals properly to avoid damaging the seal lips.

4.9.27 Remove the screws (20) one at a time, apply Loctite® #262 to the screw threads, and reinstall the screw, tightening to the value shown in Table 4. Repeat for the remaining screws.

⚠ **Warning**
Loctite® may cure prior to properly tightening the screw if not tightened to the proper torque value immediately after installation.

⚠ **Caution**
Loctite® #262 must be shaken prior to application.

⚠ **Caution**
Loctite® #262 may irritate sensitive skin. Refer to the product label for proper safety precautions.

4.9.28 After assembly, check gaps "W" and "Z-1" to ensure that the brake will have adequate running clearances when released. Refer to Figure 7 and Table 14. Machining of friction discs or wear plates may be required to achieve proper running clearances if gaps W new and Z new are not found to be within the ranges shown on Table 14. Correct as required.

4.9.29 Prior to installation, air test the cylinder seals for leakage per section 4.6.3.

4.9.30 Install the WCSB3 tensioner per Section 2.0.

5.0 ORDERING INFORMATION / TECHNICAL ASSISTANCE

5.1 Equipment Reference

5.1.1 In any correspondence regarding Danfoss Equipment, refer to the information on the product nameplate and/or visit danfoss.com

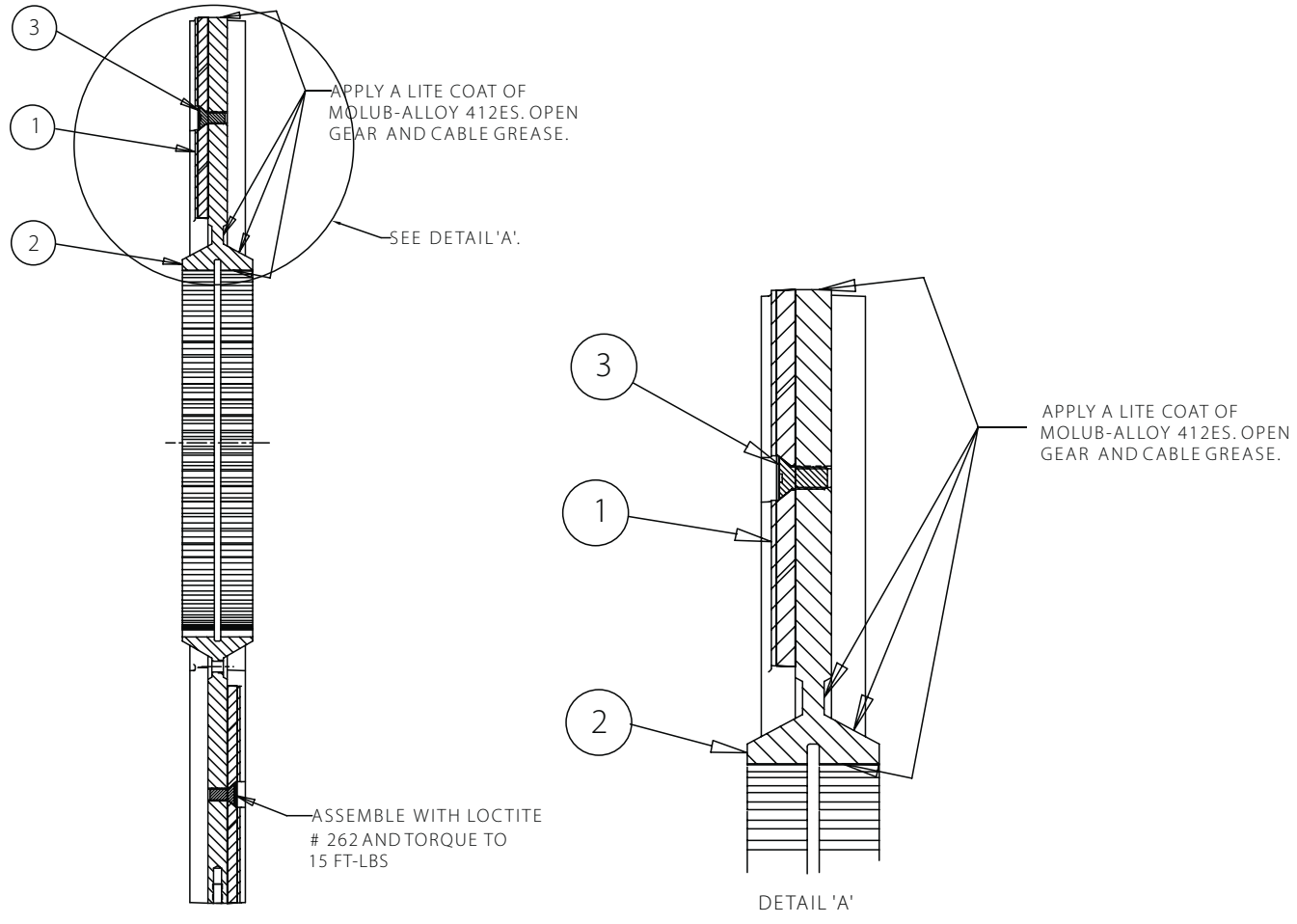
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36 WCB/WCS FRICTION DISC ASSEMBLY

Figure 17

6.0 PARTS

6.1 Basic Assemblies

Item	Description	436WCSB3 146576AE Part Number	Qty
6	Stud	307111-15	16
7	Friction Disc Assembly	515435	3
12	Clamp Tube	308608-07	8
13	Pressure Plate	515641	1
16	Spring Housing	515643	1
17	Flat Washer	000067x0042	32
18	Self Locking Nut	000110x0075	16
19	Cylinder	515711	1
20	Hex Head Screw	417178-01	16
21	PolyPak Seal (inner)	000402x0005	4
22	Outer Apply Spring	416751-07	64
23	PolyPak Seal (outer)	000402x0006	4
27	Spacer Tube	308150-06	16
28	Gear (Reference only, not included with Assembly)	417009-####	1
29	Wear Spacer (Clamp Tube)	308620	48
30	Reaction Plate	515635-02	2
33	Dual Piston	515657	2
34	Release Spring	416751-15	24
52	Inner Apply Spring	416751-08	64
53	Spring Retainer	416504	16
105	Pipe Plug	000077x0021	1
112	Mounting Flange / Cylinder	515645	1
114	Seal	000402x0040	2
116	Pressure Plate S/A	515635-03	1
117	End Plate S/A	515635-04	1
118	Friction Disc	513396	2
119	Disc	515336	1
121	Flat Head Screw	000294x0405	72
124	AC Clamp Tube	308608-08	16
125	Stop Plate	308618	4
138	Support Beam	417440-01	4
139	Wear Spacer (Support Beam)	308621	16
141	Wear Spacer Retainer	308619	4
142	Plain Washer	000067x00005	24
143	Hex Head Screw	000001x0419	12
144	Support Beam Bushing	308623	8
145	Self Locking Nut	000110x0024	12

6.1.1 Sub-Assemblies

6.1.1.1 Parts Breakdown of WCSB3 Reaction Plate/ Pressure Plate and End Plate Sub Assemblies (Reference Figure 14)

36 WCSB3 Reaction Plate Sub Assembly (30)

Item	Description	Part Number	Qty
	Reaction Plate	515630	1
54	Bushing	204240-01	8
3	Wear Plate	417437	2
4	Screw	000153x0843	108
5	Locknut	000153x0844	108
50	Inner Support Ring	414032	12
51	Outer Support Ring	417435	8
51	Outer Support Ring	417459	8

36 WCSB3 Pressure Plate Sub Assembly (116)

Item	Description	Part Number	Qty
	Pressure Plate	515632	1
54	Bushing	204240-02	8
3	Wear Plate	417437	2
4	Screw (4)	000153x0842	108
5	Locknut (5)	000153x0844	108
50	Inner Support Ring	414032-01	12
51	Outer Support Ring	417435	4
51	Outer Support Ring	417459	4

36 WCSB3 End Plate Sub Assembly (117)

Item	Description	Part Number	Qty
	End Plate	515634	1
54	Bushing	204240-03	8
3	Wear Plate	417437	2
4	Screw (4)	000153x0842	108
5	Locknut (5)	000153x0844	108
50	Inner Support Ring	414032-01	12
51	Outer Support Ring	417435	4
51	Outer Support Ring	417459	4

6.1.1.2 Parts Breakdown of WCSB3 Friction Disc Sub Assembly

36 WCSB3 Friction Disc Sub Assembly

Item*	Description	Part Number	Qty
7	Friction Disc Sub Assembly	515435	1
1	Friction Block	515387	16
2	Friction Disc Core	514139	1
3	Glat Head Screw (Brass)	000421x0407	144

*Reference Figure 1 and Figure 17 for Itemnumbers

7.0 WCSB3 REBUILD KITS

7.1 WCSB3 Cylinder Seal Kits

Mounting Flange/Cylinder (112)

Parts included in Kit		Lip Seal (Inner) (21)		Lip Seal (Intermediate) (114)		Lip Seal (Outer) (23)		Dow Corning Molykote O-ring Lubricant
Model	Kit P/N	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.
436WCSB3	107662CD	000402x0005	(2)	000402x0040	(2)	000402x0006	(2)	000153x1239

Note: All kits include one 5.3 oz tube of Dow Corning Molykote 55® lubricant. All kits include a quantity of one.

Cylinder (19)

Parts included in Kit		Lip Seal (Inner) (21)		Lip Seal (Intermediate) (n/a)		Lip Seal (Outer) (23)		Dow Corning Molykote O-ring Lubricant
Model	Kit P/N	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.
436WCSB3	107662C	000402x0005	(2)	n/a		000402x0006	(2)	000153x1239

Note: All kits include one 5.3 oz tube of Dow Corning Molykote 55® lubricant. All kits include a quantity of one.

7.2 WCSB3 Friction Disc Kits

Friction Disc Kit (MID-CO)

Model	Kit P/N	Loctite Sealant 262		Flat Head Screw (3)*		Friction Disc (1)*		Wear Spacer (Support Beam) (139)**		Wear Spacer (29)**		Grease		Washer (142)		Hex Head Screw (143)		Self Locking Nut (145)	
		Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)	Part No.	(Qty)
436	108166	000153x1168	(3)	000421x0407	(432)	515437	(48)	308621	(16)	308620	(16)	153x1182	(1)	67x0005	(24)	1x0419	(12)	110x0024	(12)

* Note: Reference Figure 17
** Note: Reference Figure 1A

7.3 36WCSB3 Wear Plate Kits

36WCSB3 Wear Plate Kits for Pressure Plate & End Plate

Parts Included in Kit		Screw (4)		Flair Nut (5)		Wear Plate (3)		Inner Support Ring (50)*		Outer Support Ring (51)*		PTFE Gasket (O.D.)		PTFE Gasket (I.D.)	
Model	**Kit Part No.**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**
36WCSB3	108163A	153x0842	(216)	153x0844	(216)	417437	(2)	414032-01	(12)	417435 417459	(8) (8)	308581-01	(2)	308581-02	(2)

Note: Ref:515635-03 S/A, 515635-04 S/A and *Figure 14

36WCSB3 Wear Plate Kits for Reaction Plate

Parts Included in Kit		Screw (4)		Flair Nut (5)		Wear Plate (3)		Inner Support Ring (50)*		Outer Support Ring (51)*		PTFE Gasket (O.D.)		PTFE Gasket (I.D.)	
Model	**Kit Part No.**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**	**Part No.**	**(Qty)**
36WCSB3	108164A	153x0843	(108)	153x0844	(108)	417437	(2)	414032-01	(12)	417435 417459	(8) (8)	308581-01	(2)	308581-02	(2)

Note: Ref:515635-03 S/A, 515635-04 S/A and *Figure 14

8.0 REVISIONS

IOM WSB 11210 for WCBD3 - Original Publication Date: October 2013

Revision Date	Change

ENGINEERING
TOMORROW

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- Electric motors
- Gear motors
- Gear pumps
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- Hydrostatic pumps
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