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# Technical Manual

 Shaft Brake

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## **23:1 Intensifier Assembly SB30 Brake Installation Report**

# Revisions List

Rev	Date	Revision Description
<b>A-F</b>		<b>Previous Revisions were not documented.</b>
<b>G</b>	<b>7/11/00</b>	<b>1. Added SB38-08054 Drawing 11482 2. Added Revisions List</b>
<b>H</b>	<b>8/4/00</b>	<b>1. Added SB37-06619 Drawing 10665-B</b>
<b>I</b>	<b>12/5/00</b>	<b>1. Revised to ZF Mathers references and Cover.</b>
<b>J</b>	<b>5/7/01</b>	<b>1. Changed from S-172 to Part Number MMS-172 and revised to J. 2. Removed E-Mail Address off of cover. 3. Brought whole manual up to current Framemaker Standards and Fonts 4. Appendix C</b>



**ZF Mathers Disc Brakes are in operation worldwide and providing excellent service. Proper installation is the key to this success. When the installation instructions are followed, the shaft brake will provide years of reliable trouble free service. These instructions are to be used along with the Shaft Brake reference drawing.**

## **1.0 SYSTEM DESCRIPTION**

ZF Mathers Propeller Shaft Brakes are disc brakes using hydraulic actuated calipers. The calipers are spring retracted and are self-adjusting to compensate for pad wear.

Provided are:

- Disc
- Caliper Holder
- Calipers
- Control Component Kit

Refer to the Reference Drawing in Appendix A for the individual component part numbers.

A ZF Mathers Shaft Brake is sized to handle 80% of the full speed Ahead shaft torque. It will stop the shaft from full speed in two to five seconds.

The disc brake calipers operate with hydraulic pressure produced by an air over oil intensifier. The caliper and caliper holder assembly is designed to clamp on the disc during installation using shop air pressure.

Follow this procedure to properly align the caliper to the disc. The caliper holder must be mounted to a fabricated supporting bracket, a resin pour assures correct final alignment. The supporting bracket should be attached to the reduction gear foundation.

The caliper features a self-aligning friction pad with spring retraction. The spring retraction system automatically compensates for friction pad wear. Friction pad wear is checked by a visual inspection of the retraction pin.

## 2.0 PLAN THE INSTALLATION

**CAUTION:** When handling and installing ZF Mathers Shaft Brakes, keep Discs free of oil or salt water. Reference Figure 1:

### 2.1 PARTS DESCRIPTION

#### 2.1.1 Brake Disc

The Discs are:

- Heat-Treated
- The friction surfaces are ground flat and parallel
- There is a rough cut center hole

#### 2.1.2 Brake Caliper

The Disc Brake calipers are designed to operate with a **minimum** hydraulic pressure of 805 psi and a **maximum** hydraulic pressure of 1800 psi. Normal operating pressure is 1500 psi.

The hydraulic intensifier ratio is 23:1, therefore:

- A 35 psi brake air signal will give an 805 psi hydraulic brake signal
- A 65 psi brake air signal will give a 1495 psi hydraulic brake signal

The Shaft brake should be adjusted between 35 psi and 65 psi air signal. For further information refer to the Adjustments Section.

Each caliper is mounted to the caliper holder with four 7/8-14 Grade 8 Bolts and torqued to 625 ft. lbs.

The calipers are self-adjusting. When the brake is released, the brake pad is spring retracted for .015 inch (0,38mm) minimum clearance.

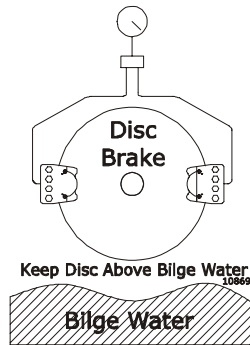
#### 2.1.3 Booster Assembly

The Booster Assembly consists of a Hydraulic Reservoir that prevents air from entering the system, and an Intensifier Assembly that boosts the air pressure to the calipers.



## 2.2 LOCATIONS

**CAUTION:** Ensure the installation locates the Shaft Brake so that the Disc will be above the bilge water. Reference Figure 1:

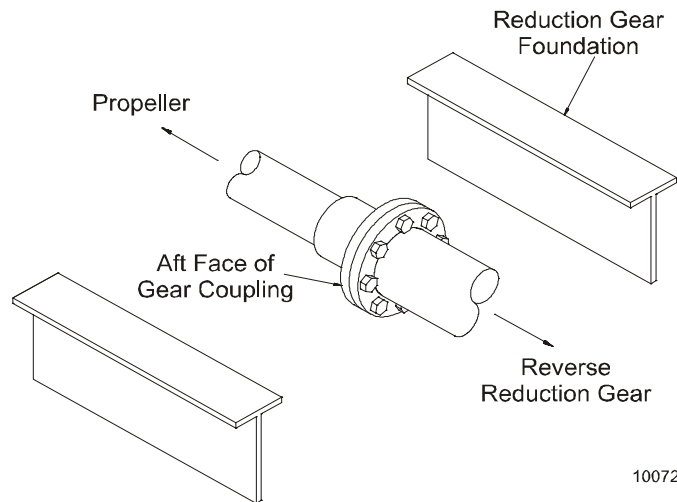


**Figure 1: Disc Brake Placement**

### 2.2.1 Disc Brake Assembly

**CAUTION:** Damage may occur when installation instructions are not followed.

The preferred Disc mounting location is the aft face of the propeller shaft coupling. Refer to Figure 2:.



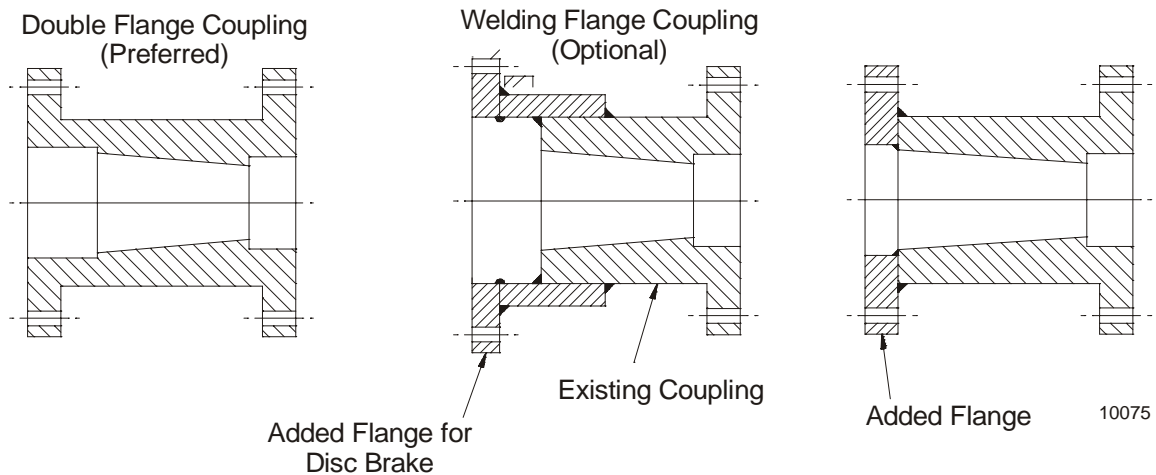
**Figure 2: - Preferred Disc Mounting Location**

Check to see if there is clearance for the brake installation.

Dimensions and location are specified on the Reference Drawing in Appendix A.

**NOTE:** The O.D. (outside diameter) of the Disc can be decreased, if necessary for clearance, although this will derate the torque rating of the brake. The installer should check with ZF Mathers, LLC before decreasing the Disc O.D. to ensure the torque rating will be adequate for the application.

In order to clear pumps and filters on some reverse reduction gears, it is necessary to move the brake Disc further aft than the coupling face. Three ways of doing this are shown in Figure 3:



**Figure 3: - Recommended Mounting Examples**

The preferred method is to use a double flange coupling.

Optionally, a standard coupling can have a flange added by welding. After welding, the coupling must be stress relieved and machined.

**NOTE:** The Disc outside diameter is flame cut and can be cleaned up during the machining operation to achieve concentricity.

It is necessary for the installer to machine the Disc to match to the reverse gear coupling.

The preferred mounting method is to machine the Disc to match the coupling bolt circle, and use longer **fit-ted** coupling bolts.

### 2.2.2 Booster Assembly Location

Locate the intensifier within 8 feet (2,44m) of the brake calipers.

Mount it horizontally with the reservoir up, as shown on the Reference Drawing. The intensifier should be level with, or higher than, the caliper manifold.

### 3.0 INSTALLATION

**CAUTION:** Ensure Shaft Brake Disc is clean and free of oil or salt water. Reference Figure 1:

#### 3.1 DISC INSTALLATION

**NOTE:** Verify that the Disc axial runout does not exceed .010 inch (0,25mm) measured 1-inch (25,4mm) radially from the Disc rim. Verify that the radial runout does not exceed .120 inch (3,05mm).

When Disc has been machined to match the reverse gear coupling, install the Disc and torque the bolts.

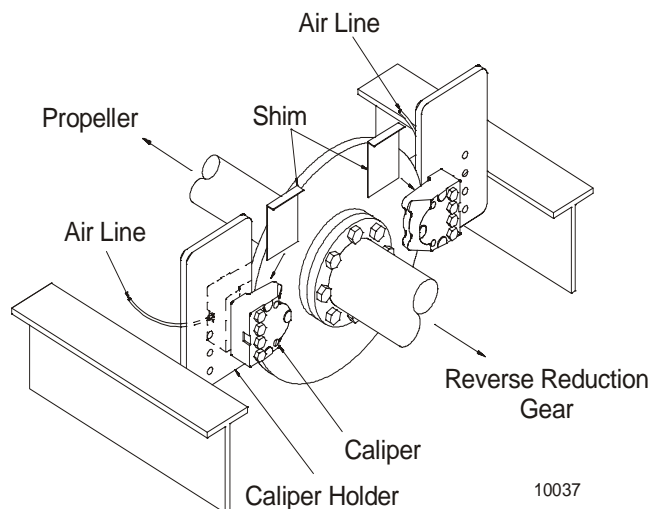
#### 3.2 CALIPER HOLDER

**NOTE:** Refer to Reference Drawing in Appendix A for all specific location information.

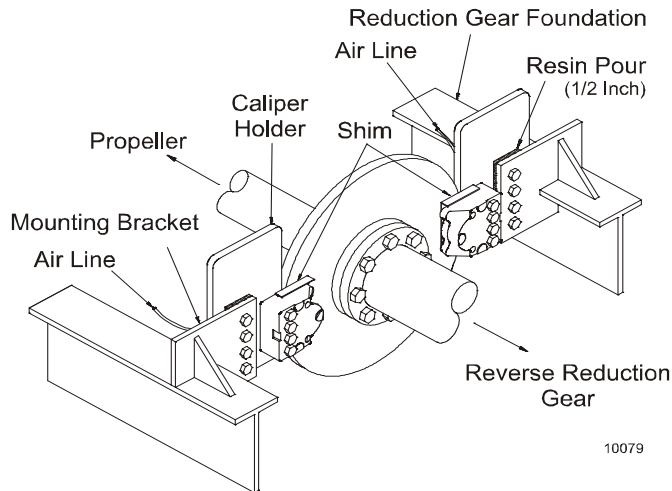
The calipers are factory mounted to the caliper holder, and the mounting bolts are torqued to the value specified on the Reference Drawing.

The caliper, and caliper holder assembly, is designed to clamp on the Disc during installation using shop air to only one caliper half. Refer to Figure 4: . Shop air pressure should be 150 psi to 200 psi. A shim, supplied with the caliper assembly, will set the clearance between the caliper not pressurized and the Disc.

Each caliper holder must have holes drilled into it by the installer to accommodate 7/8 inch SAE Grade 8 mounting bolts. These bolts are supplied by the installer and are used to mount the caliper holder to the holder-mounting bracket. Refer to Figure 4: and Figure 5: .



**Figure 4: - Brake Parts Names and Locations**



**Figure 5: - Caliper Holder Mounting**

### 3.2.1 Installation

- A) Position the caliper assembly over the Disc.

**CAUTION:** Locate so that the Disc covers the caliper pad (or as much of the pad is covered as possible) and the caliper holder does not touch on the outside diameter of the Disc.

- B) Place the shim between the caliper half that will **not** be pressurized and the Disc.
- C) Turn On shop air to the caliper half.
- The caliper will be held in place and in proper alignment
  - The caliper pad on the non-pressurized side will bottom out on the machined surface to set alignment
  - The shim will set the proper clearance for the caliper assembly

**NOTE:** The caliper assembly is now in position to locate an installer fabricated mounting bracket to support the caliper holder on the reduction gear foundation.

**CAUTION:** Material used for the mounting bracket should be a minimum of 3/4-inch (19,05mm) thick steel.

**NOTE:** The recommended installation method is to use a resin pour to assure correct final alignment between the caliper holder and the holder-mounting bracket.

- D) Weld the mounting bracket to the engine/gear foundation allowing approximately 1/2 inch (12,7mm) between the caliper holder, and the mounting bracket.

- E) Mark hole locations.
- F) Drill the 7/8-inch (22,23mm) holes in the mounting bracket.
- G) Install the 7/8-inch SAE Grade 8 bolts through the mounting bracket and caliper holder, coating them with parting agent.
- H) Make the resin pour. Refer to the resin manufacturer's recommendations for pouring procedure.

**IMPORTANT: The minimum required resin chock area for this application is specified on the Reference Drawing in Appendix A.**

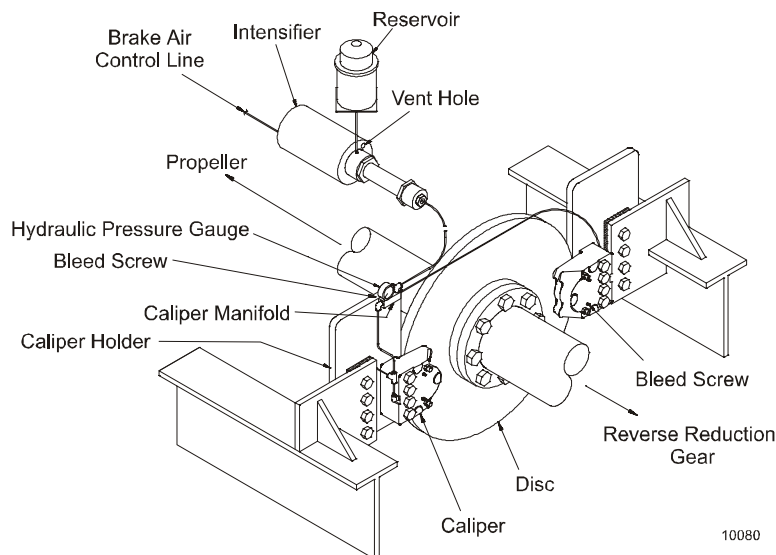
**CAUTION: Air pressure on the calipers must be maintained until the resin has cured.**

- I) After the resin has cured, dry torque the mounting bracket bolts to the torque value listed on the Reference Drawing.
- J) Shut the air OFF.
- K) Remove the airline.
- L) Remove shim from each of the calipers.
- M) Remove plugs from fittings and connect the tubes to both caliper halves.

### **3.3 BOOSTER ASSEMBLY INSTALLATION**

**CAUTION: Be sure to remove the plastic plug in the vent hole in the front of the air cylinder on the intensifier.**

Locate the Booster Assembly horizontally with the reservoir up, as shown in Figure 6:



**Figure 6: - Booster Assembly Location**

The Intensifier should be level with, or higher than, the caliper manifold.

### **3.4 TUBING INSTALLATION**

**NOTE: Refer to Reference Drawing in Appendix A for all specific location information.**

- A) Mount the caliper manifold on one caliper holder.
- B) Connect the brake air control line to the intensifier as specified.
- C) Connect the hose line supplied between the intensifier and the caliper manifold.
- D) Install the lines to all calipers and to the caliper manifold using the tubing kit provided.

## 4.0 TESTS AND ADJUSTMENTS

### 4.1 CHARGE THE HYDRAULIC SYSTEM

- A) Remove the cover and diaphragm from the reservoir.
- B) Fill the reservoir with the Dextron III ATF that is supplied with the Disc Brake assembly.
- C) It is important to bleed air from the brake system. This is best accomplished by engaging the brake using a low-pressure supply. Refer to the following Bleeding Procedure.

### 4.2 BLEEDING PROCEDURE

- A) Set the brake air supply pressure to 10 psi by means of the brake regulator on the Air Treatment Panel.
- B) Engage and release the brake several times using the ball valve before bleeding.
- C) Open the upper bleed screw on each caliper half.
- D) Allow the air to escape.
- E) Reseal the bleed screw.
- F) Bleed the air at the caliper manifold and at the intensifier.
- G) Turn the brake air signal OFF and then ON again.
- H) Repeat steps C) through G) until air is no longer visible in the oil.
- I) Adjust the brake air regulator on the Air Treatment Panel between 35 psi and 65 psi.

**NOTE: Final Air Pressure adjustment will be accomplished in the Gripper Adjustment Section.**

### 4.3 OPERATION TEST AND ADJUSTMENT

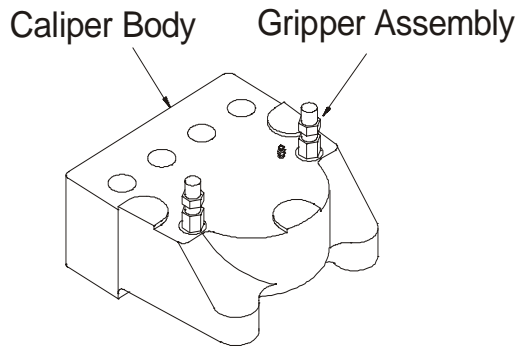
- A) Apply the brake at normal operating pressure (approximately 1500 psi hydraulic).
- B) Let stand for 10 to 15 minutes.
- C) Check all connections and bleed screws for any sign of an oil leak.
- D) Recheck the oil level in the Reservoir.

**IMPORTANT: Check for a minimum clearance of .015 inch (0.38mm) between the brake pad and the Disc.**

- If there is insufficient brake pad clearance when the brake is OFF, this could mean the retractor pin grippers are not properly adjusted. Gripper adjustment can be made with the caliper in place by doing the following adjustment.

#### 4.4 GRIPPER ADJUSTMENT

There are two gripper assemblies on each caliper body, as shown in Figure 7:.



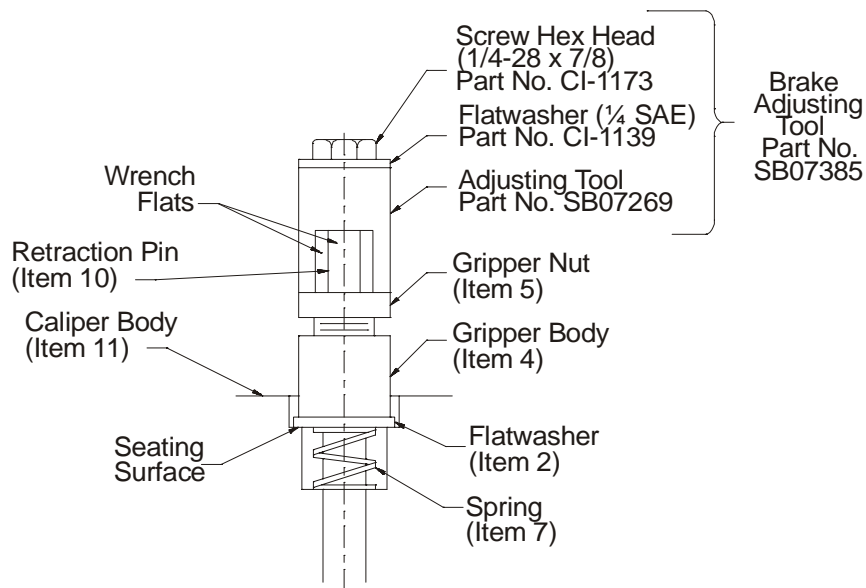
**Figure 7: - Gripper Assembly Location**

Perform the following for each gripper assembly with caliper installed, and brake OFF:

- A) Turn the brake OFF.

**CAUTION: Check the hydraulic gauge for zero hydraulic pressure.**

- B) Refer to Figure 8:



**Figure 8: - Gripper Assembly Breakdown**



- C) Loosen Gripper Nut and Gripper Body.
- D) Retighten to finger-tight.
- E) Install the ZF Mathers SB07385 Brake Adjusting Tool on the gripper assembly.
- F) Align wrench flats on Adjusting Tool and retraction pin.
- G) Hold with an adjustable wrench.
- H) Tighten screw until flat washer seats against seating surface of caliper body. This will compress the spring.
- I) Use a 5/8-inch wrench and a 9/16-inch wrench to hold Gripper Body and Gripper Nut. Torque Gripper Nut to approximately 5 ft-lbs.
- J) Remove Brake Adjusting Tool.

**NOTE: Repeat Steps A) through J) for all caliper bodies with less than 0.15-inch (3,81mm) clearance between the brake pad and the Disc.**

- The retractors will now automatically adjust when the brake is applied
- K) Set the brake air supply to 10 psi by means of the brake pressure regulator on the Air Treatment Panel.
- L) Turn the brake ON and OFF several times by using the ball valve on the Air Treatment Panel that controls the brake air supply.
  - Ensure the brake pads extend out when the brake is ON.
  - Ensure the brake pads retract with clearance when the brake is OFF.

Set the brake air pressure to its operational value by performing the following:

- The adjustment should be the amount of time to stop the propeller shaft from full speed (full weigh on the vessel). Time is measured from Shaft Brake Application until the propeller shaft is stopped.

<b><u>Horsepower Range</u></b>	<b><u>Stopping Time</u></b>
<b>700 – 1500 HP</b>	<b>Approximately 2 seconds</b>
<b>1500 – 4000 HP</b>	<b>Approximately 2 to 5 seconds</b>

Disc Brake application time should be one second or less. If the brake hydraulic pressure is slow in rising, it usually means there is air in the system. The bleed procedure described above should be repeated.

## 5.0 PERIODIC MAINTENANCE

**CAUTION:** Ensure Shaft Brake is free of oil or salt water.

### 5.1 DISC BRAKE ASSEMBLY

As the friction pad wears, the retraction pin will slide through the gripper assembly. When the end of the retraction pin is flush with the top of the gripper assembly, it is time to reline.

- A) Visually check amount of friction pad left as the pin approaches flush.
- B) Remove the calipers.
- C) Loosen the gripper assembly using two open-end wrenches (5/8-inch and 9/16-inch).
  - The gripper assembly will slip off the retraction pins.
- D) Disassemble and clean the caliper.
- E) Replace the Friction Pad and Seal Ring, which may be purchased through a ZF Mathers Distributor or ZF Mathers, LLC.
- F) Lubricate, reassemble, and push the friction pad to a fully retracted position.
  - The friction pad will bottom out in the caliper casting.
- G) Pull on the retractor pin and push the gripper assembly on the retractor pin until it contacts the flat washer.
- H) Tighten the gripper assembly.
- I) Reinstall the calipers.
- J) Torque the caliper mounting bolts to 625-ft/lbs (lubricated with light oil).
- K) Bleed the hydraulic system at low pressure.
- L) Follow Adjustment Procedure in Section 4.4, page 10.
- M) Torque the gripper assembly to 5-ft/lbs.
- N) Release the brake.
- O) Check there is .015 inch (0,38mm) minimum clearance between the friction pad and the brake disc.

### 5.2 INTENSIFIER AND RESERVOIR

#### 5.2.1 Intensifier

This unit requires only minimum maintenance.  
Refer to Appendix C for Service Kit information.

Reassemble and lubricate the following with Dow Corning III:

- Pneumatic cylinder bore
- Piston O-rings
- Rod

### **5.2.2 Reservoir**

It is recommended that a 10 weight ATF (Automatic Transmission Fluid) be used.

**CAUTION: Remove diaphragm when adding oil.**

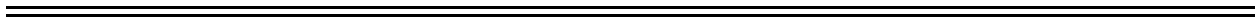
Once filled to insure clean oil, diaphragm should be in place and retainer in proper location on top of cover.



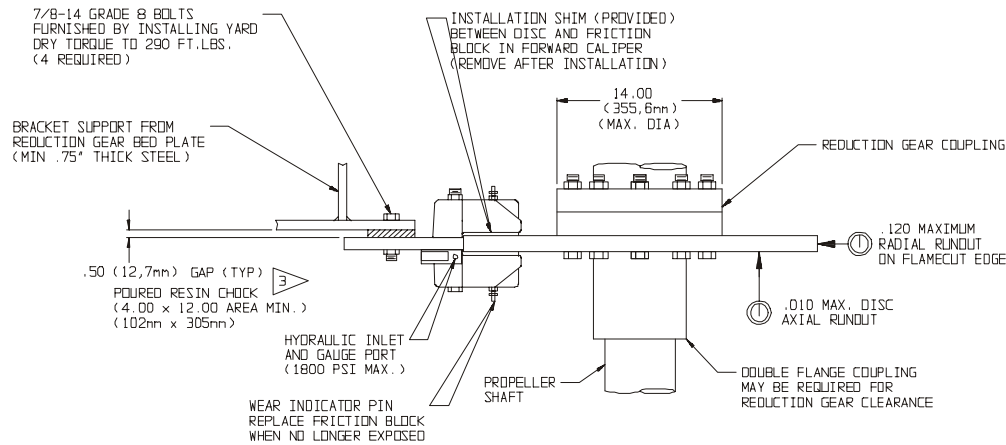
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## ***APPENDIX A.1***



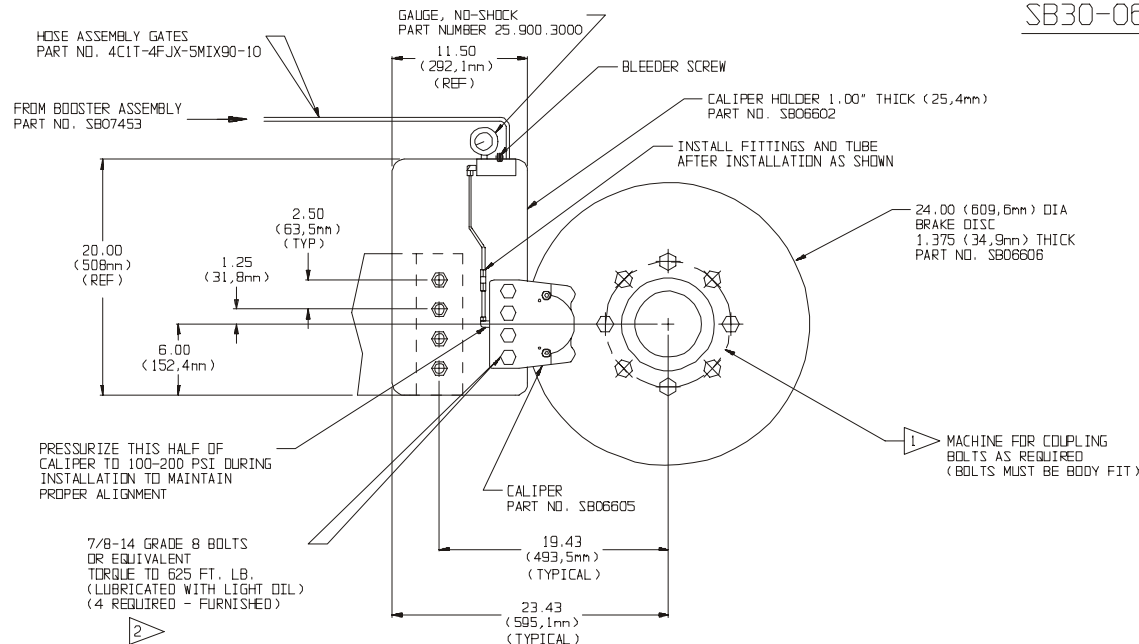
# SB30-06612 Drawing 10618



NOTES:

- 1 IF COUPLING BOLTS ARE NOT USED TO SECURE BRAKE DISC THEN BODY FIT BOLTS OF SIMILAR SIZE AND QUANTITY SHOULD BE USED WITH A BOLT CIRCLE EQUAL OR LARGER THAN THE COUPLING.
- 2 CALIPER BOLTS MUST BE TORQUED TO 625 FT. LB. (LUBRICATED WITH LIGHT OIL) BEFORE ANY PRESSURE IS APPLIED TO BRAKE.
- 3 ORANGE CHECKFAST (MFG: PHILADELPHIA RESINS CORP.) OR EQUIVALENT.

## SB30-06612 DISC BRAKE ASSEMBLY



$$WR^2 = 88 \text{ LB FT}^2$$

DISC WEIGHT: 175 LBS

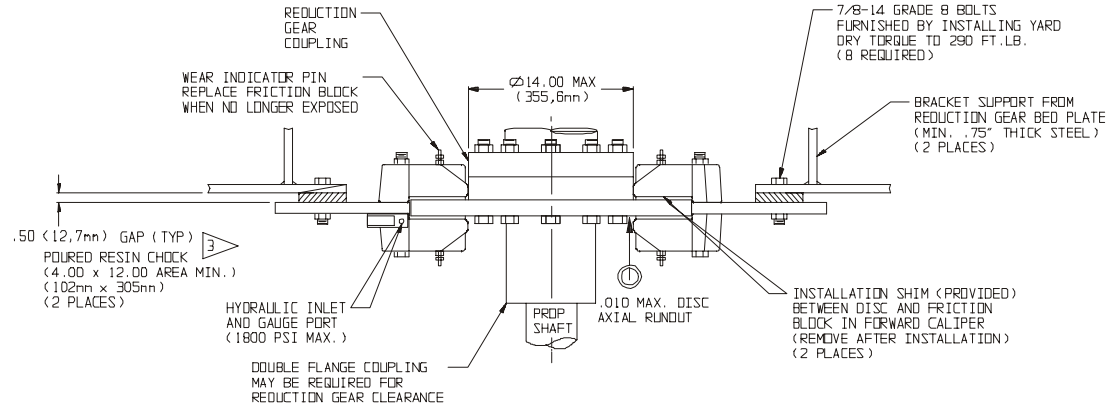
CALIPER & HOLDER WEIGHT: 128 LBS

MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB30-06612 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON		
CKD.	DATE 12-5-97		
SCALE: NONE	SHT. 1 OF 1		
		SIZE B	
PART NO. SB30-06612	DWG. NO. 10618		



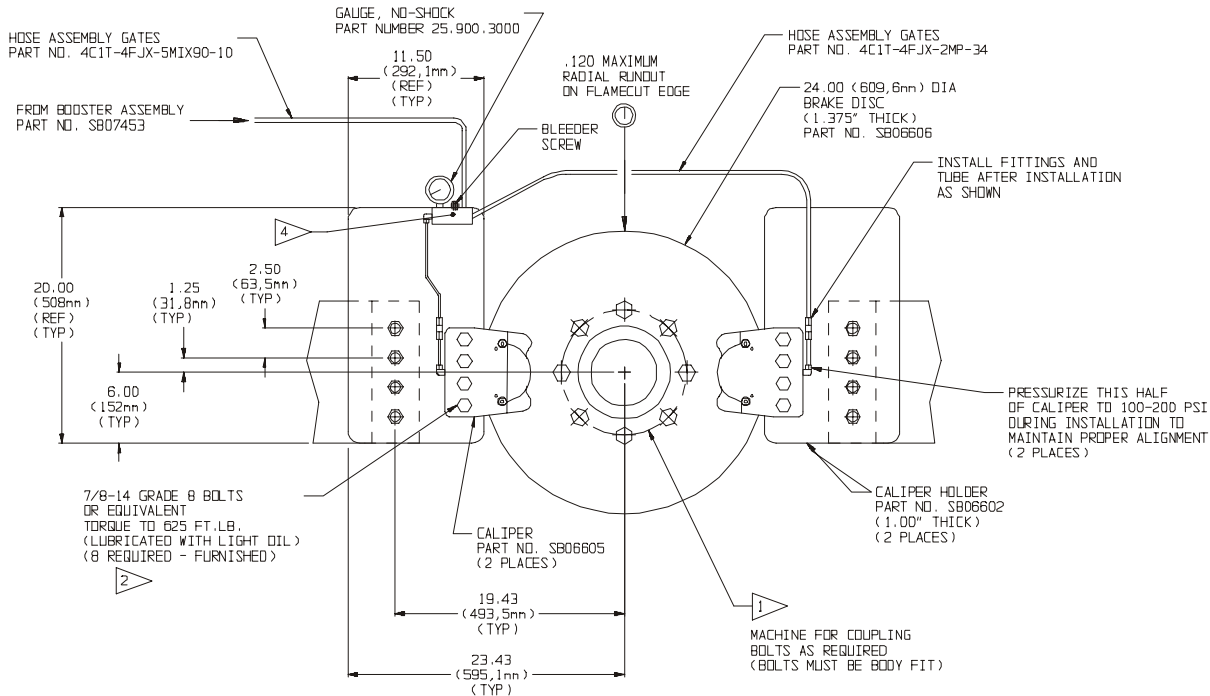


# SB31-06613 Drawing 10660



NOTES:

- 1 IF COUPLING BOLTS ARE NOT USED TO SECURE BRAKE DISC THEN BODY FIT BOLTS OF SIMILAR SIZE AND QUANTITY SHOULD BE USED WITH A BOLT CIRCLE EQUAL OR LARGER THAN THE COUPLING.
- 2 CALIPER BOLTS MUST BE TORQUED TO 625 FT. LB. (LUBRICATED WITH LIGHT OIL) BEFORE ANY PRESSURE IS APPLIED TO BRAKE.
- 3 ORANGE CHECKFAST (MFG: PHILADELPHIA RESINS CORP.) OR EQUIVALENT.
- 4 CALIPER MANIFOLD, MOUNTED TO ONE CALIPER HOLDER ONLY.



## SB31-06613 DISC BRAKE ASSEMBLY

$$WR^2 = 88 \text{ LB FT}^2$$

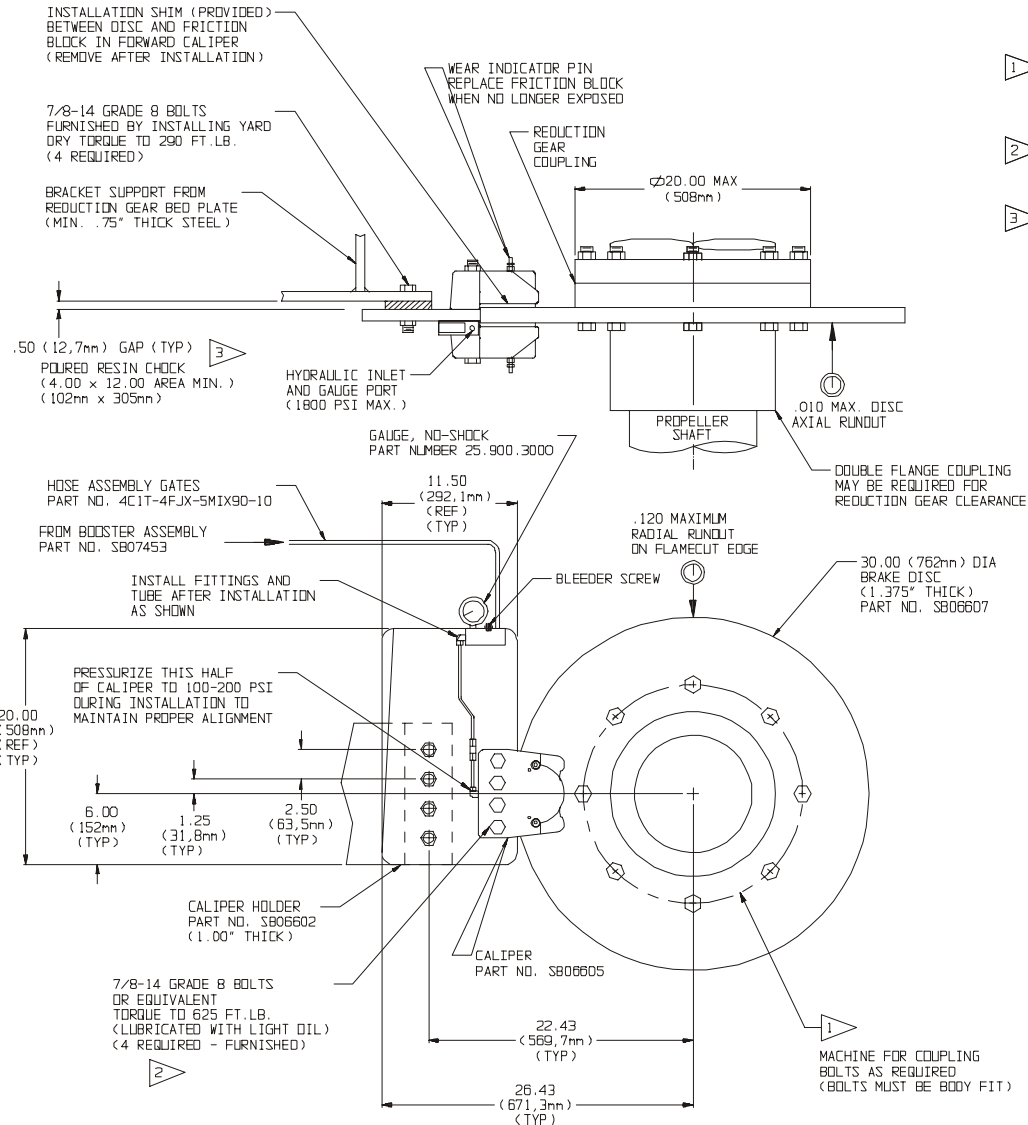
DISC WEIGHT: 175 LBS

CALIPER & HOLDER WEIGHT: 120 LBS EA. SIDE

MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB31-06613 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	CKD.	DATE 12-5-97
SCALE: NONE	SHT. 1 OF 1	SIZE	B
PART NO. SB31-06613	DWG. NO. 10660		



# SB32-07390 Drawing 10596



NOTES:

- 1 IF COUPLING BOLTS ARE NOT USED TO SECURE BRAKE DISC THEN BODY FIT BOLTS OF SIMILAR SIZE AND QUANTITY SHOULD BE USED WITH A BOLT CIRCLE EQUAL OR LARGER THAN THE COUPLING.
- 2 CALIPER BOLTS MUST BE TORQUED TO 625 FT. LB. (LUBRICATED WITH LIGHT OIL) BEFORE ANY PRESSURE IS APPLIED TO BRAKE.
- 3 ORANGE CHECKFAST (MFG: PHILADELPHIA RESINS CORP.) OR EQUIVALENT.

## SB32-07390 DISC BRAKE ASSEMBLY

$WR^2 = 215 \text{ LB FT}^2$

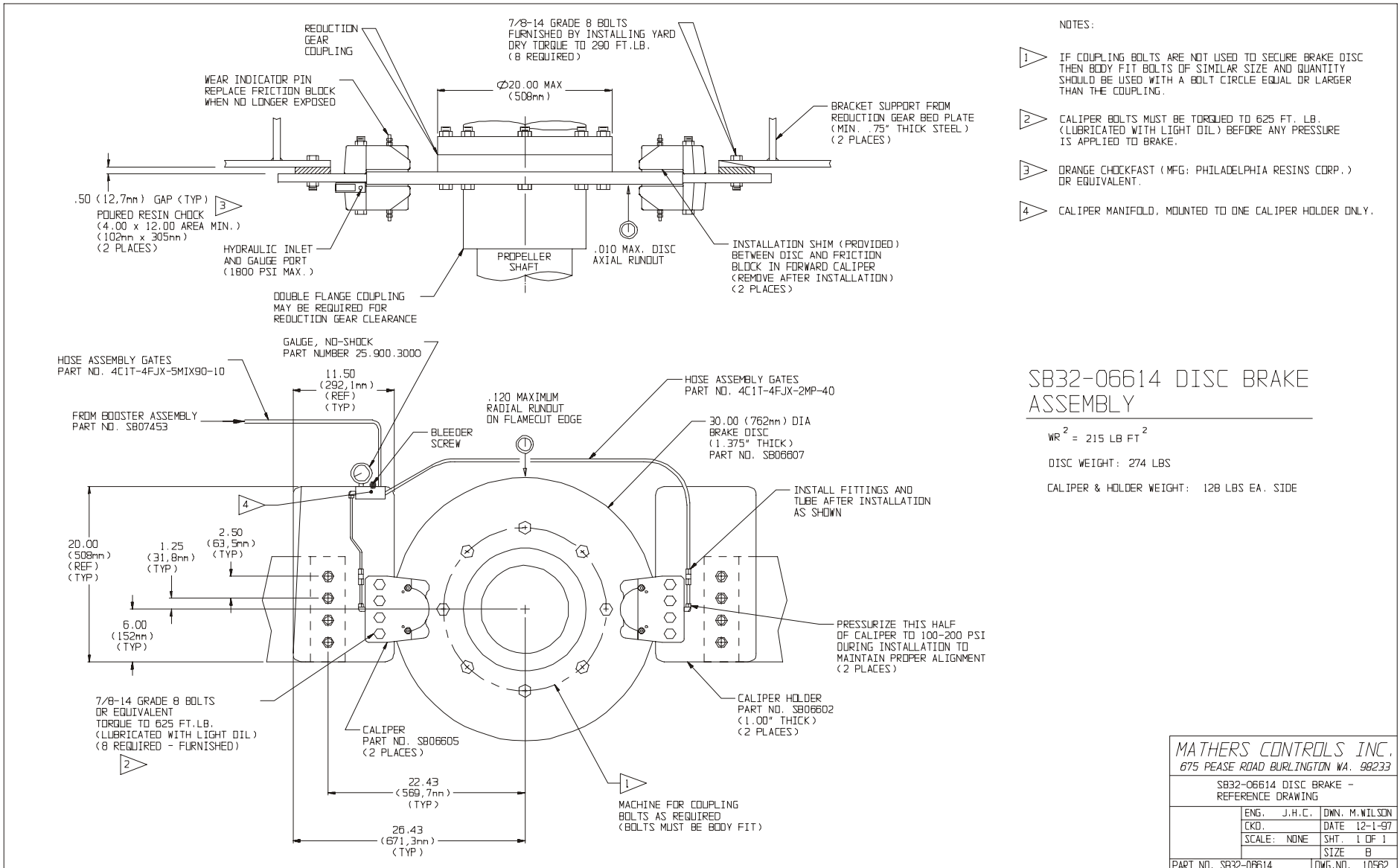
DISC WEIGHT: 274 LBS

CALIPER & HOLDER WEIGHT: 128 LBS

MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB32-07390 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	DATE 12-5-97	
CKD.		SHT. 1 OF 1	
SCALE: NONE		SIZE B	
PART NO. SB32-07390	DWG. NO. 10596		

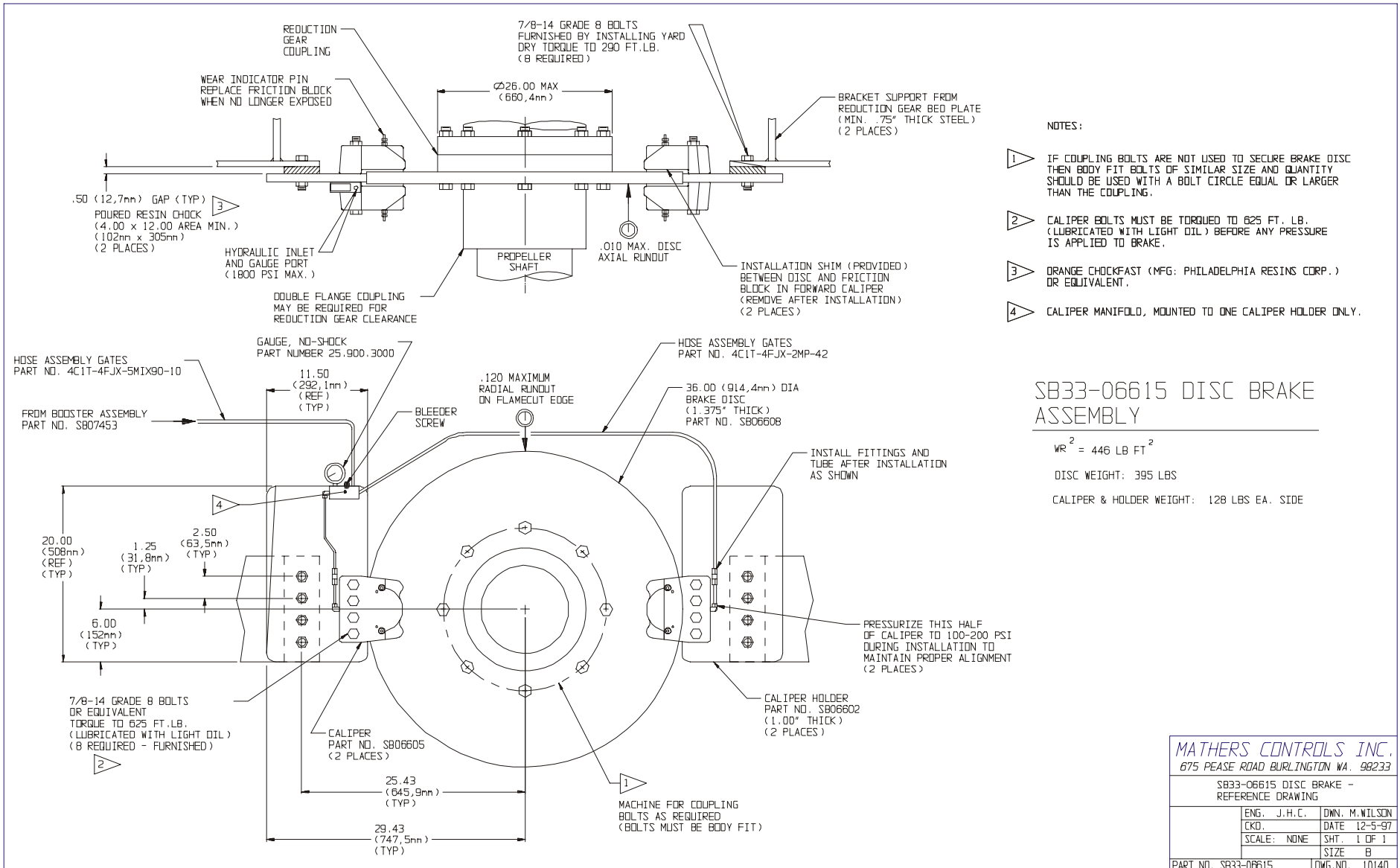


# SB32-06614 Drawing 10562





# SB33-06615 Drawing 10140



## SB33-06615 DISC BRAKE ASSEMBLY

$$WR^2 = 446 \text{ LB FT}^2$$

DISC WEIGHT: 395 LBS

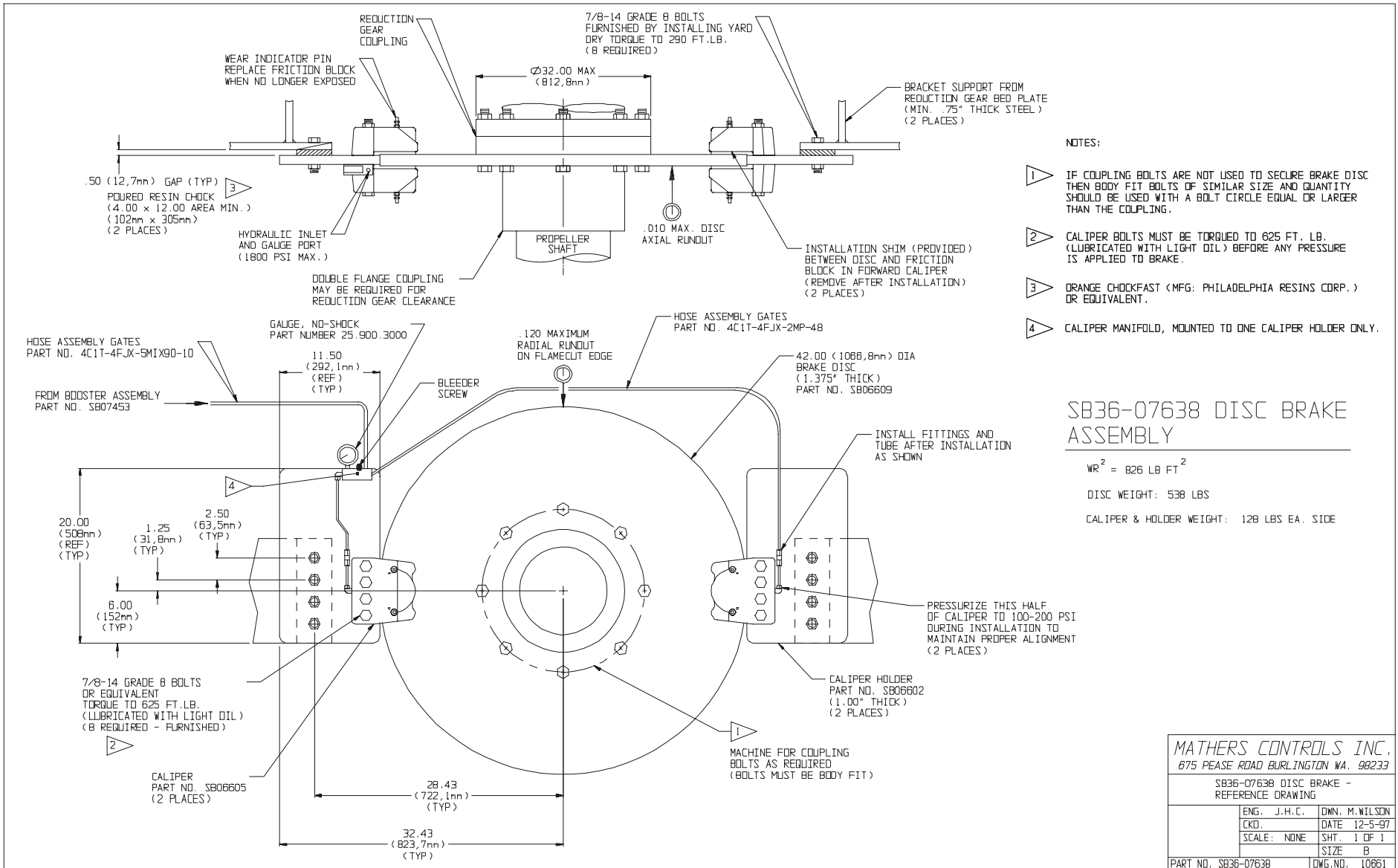
CALIPER & HOLDER WEIGHT: 128 LBS EA. SIDE

<b>MATHERS CONTROLS INC.</b>			
675 PEASE ROAD BURLINGTON WA. 98233			
SB33-06615 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	DATE 12-5-97	
CKD.		SHT. 1 OF 1	
SCALE: NONE		SIZE B	
PART NO. SB33-06615	DWG. NO. 10140		





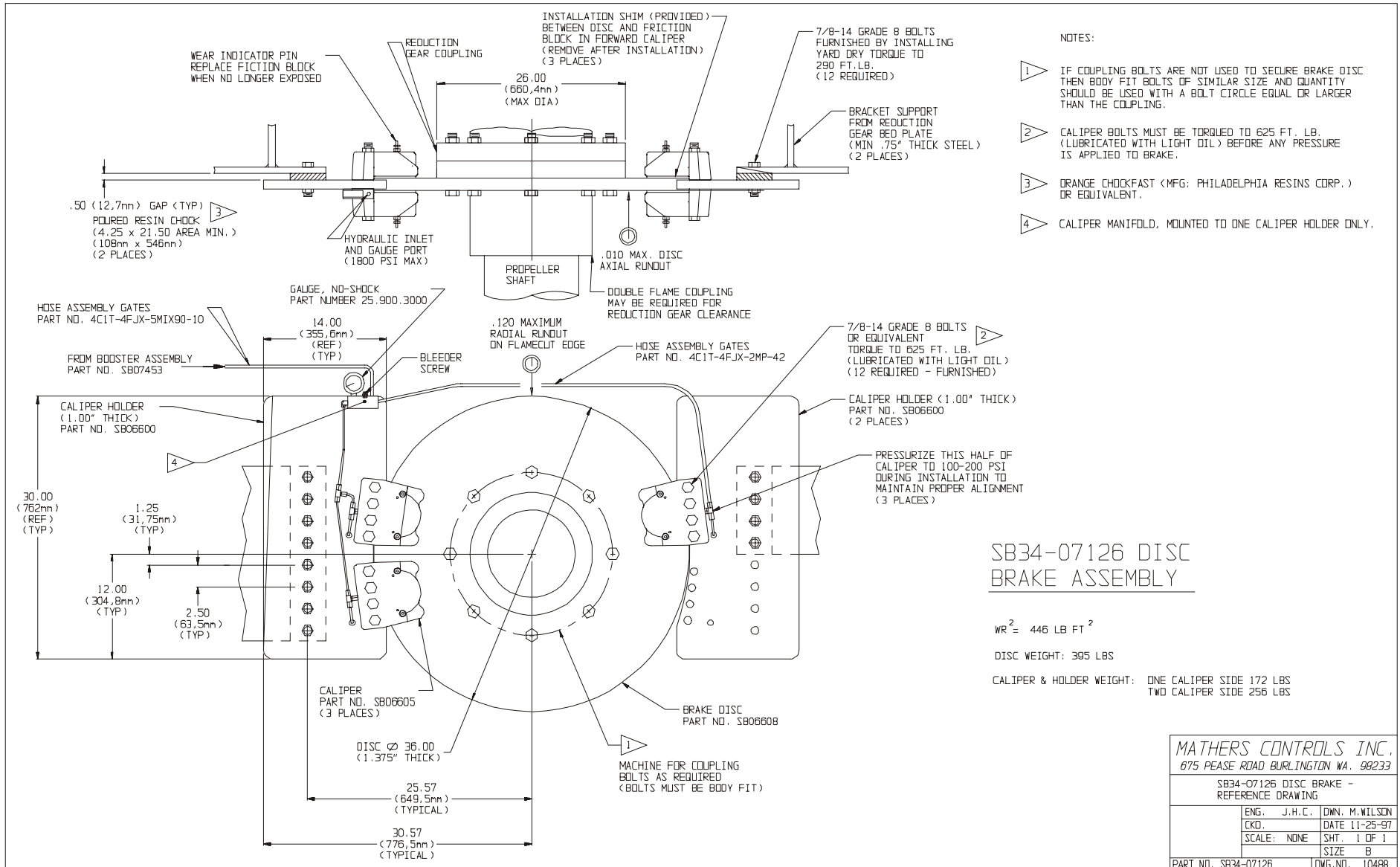
# SB36-07638 Drawing 10661



MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB36-07638 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	DATE 12-5-97	
SCALE: NONE	SHT. 1 OF 1	SIZE B	
PART NO. SB36-07638	DWG. NO. 10661		



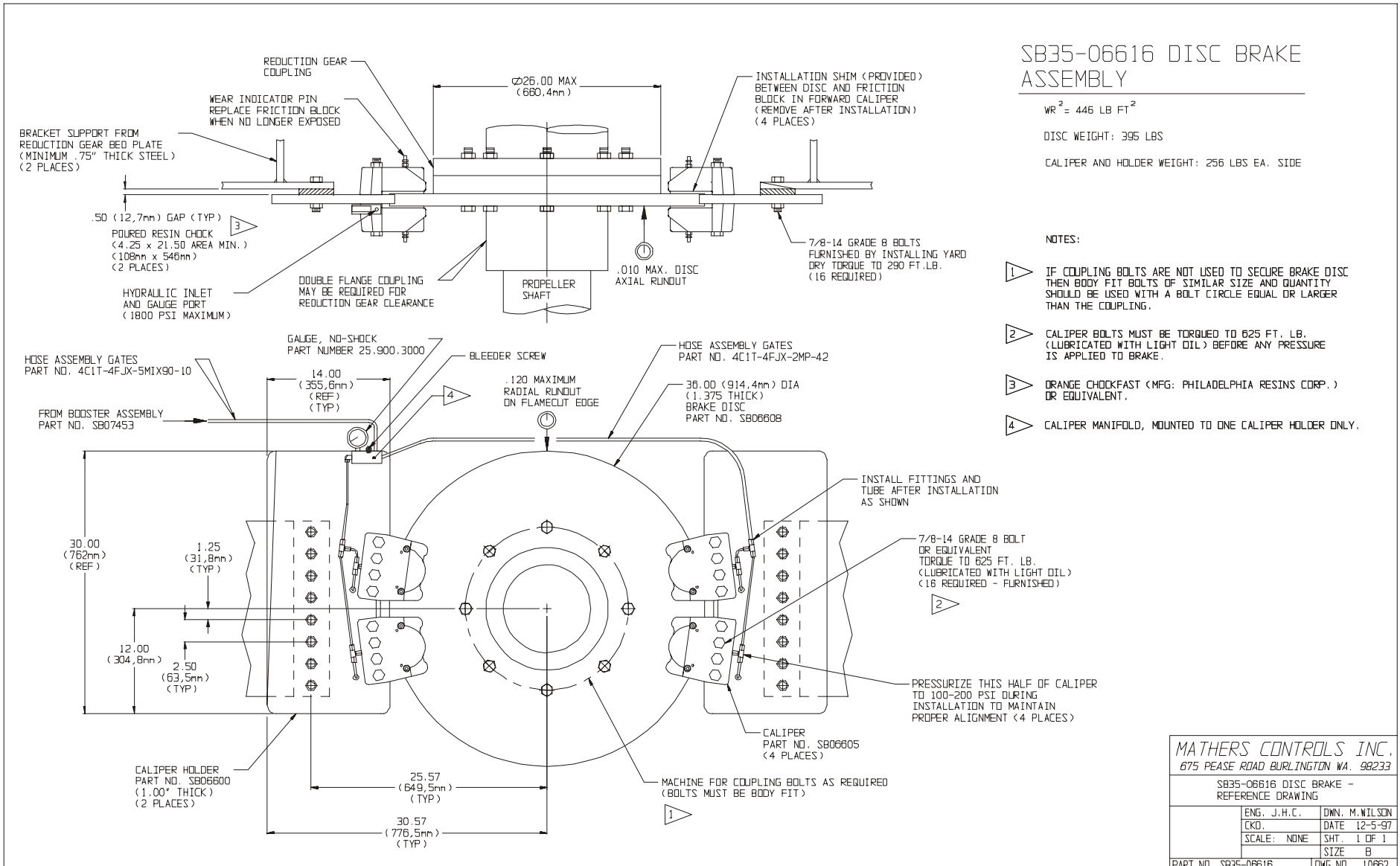
# SB34-07126 Drawing 10488



MATHERS CONTROLS INC.			
675 PEASE ROAD BURLINGTON WA. 98233			
SB34-07126 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	DATE 11-25-97	
CKD.		SHT. 1 OF 1	
SCALE: NONE		SIZE B	
PART NO. SB34-07126		DWG. NO. 10488	



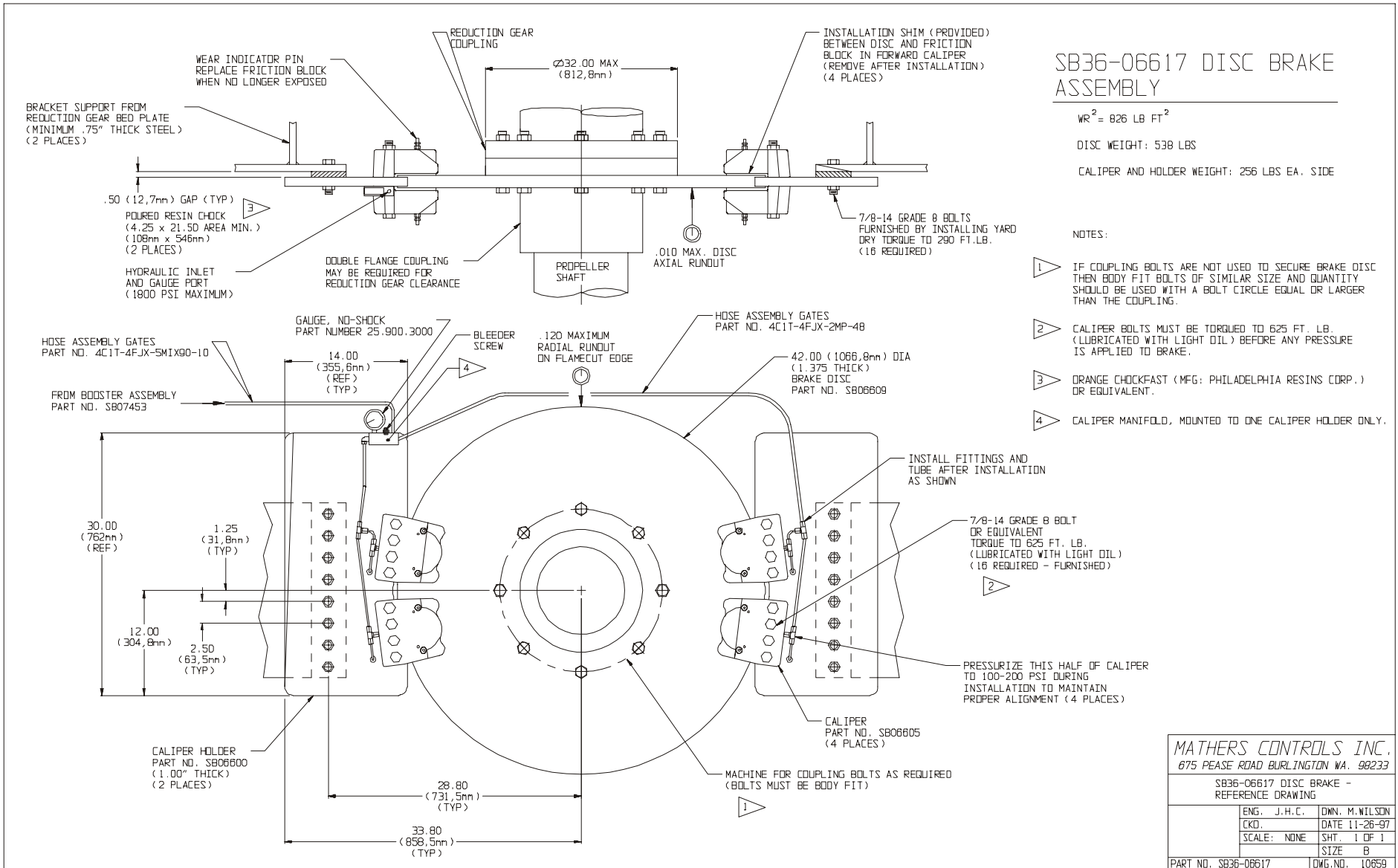
# SB35-06616 Drawing 10662



MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB35-06616 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	DATE 12-5-97	
CKD.		SHT. 1 OF 1	
SCALE: NONE		SIZE B	
PART NO. SB35-06616	DWG. NO. 10662		



# SB36-06617 Drawing 10659

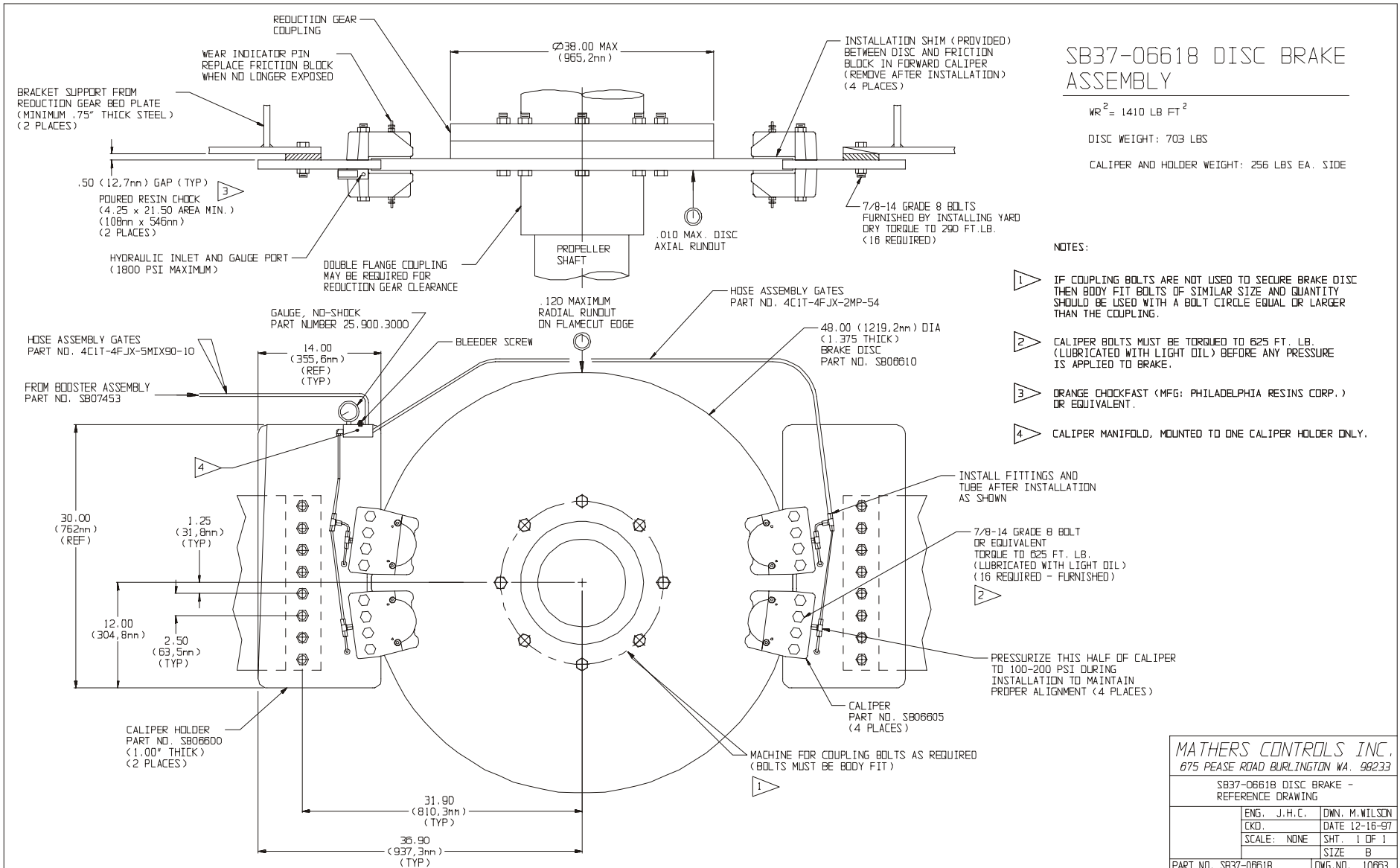


MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB36-06617 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	CKD.	DATE 11-28-97
SCALE: NONE	SHT. 1 OF 1	SIZE	B
PART NO. SB36-06617	DWG. NO. 10659		





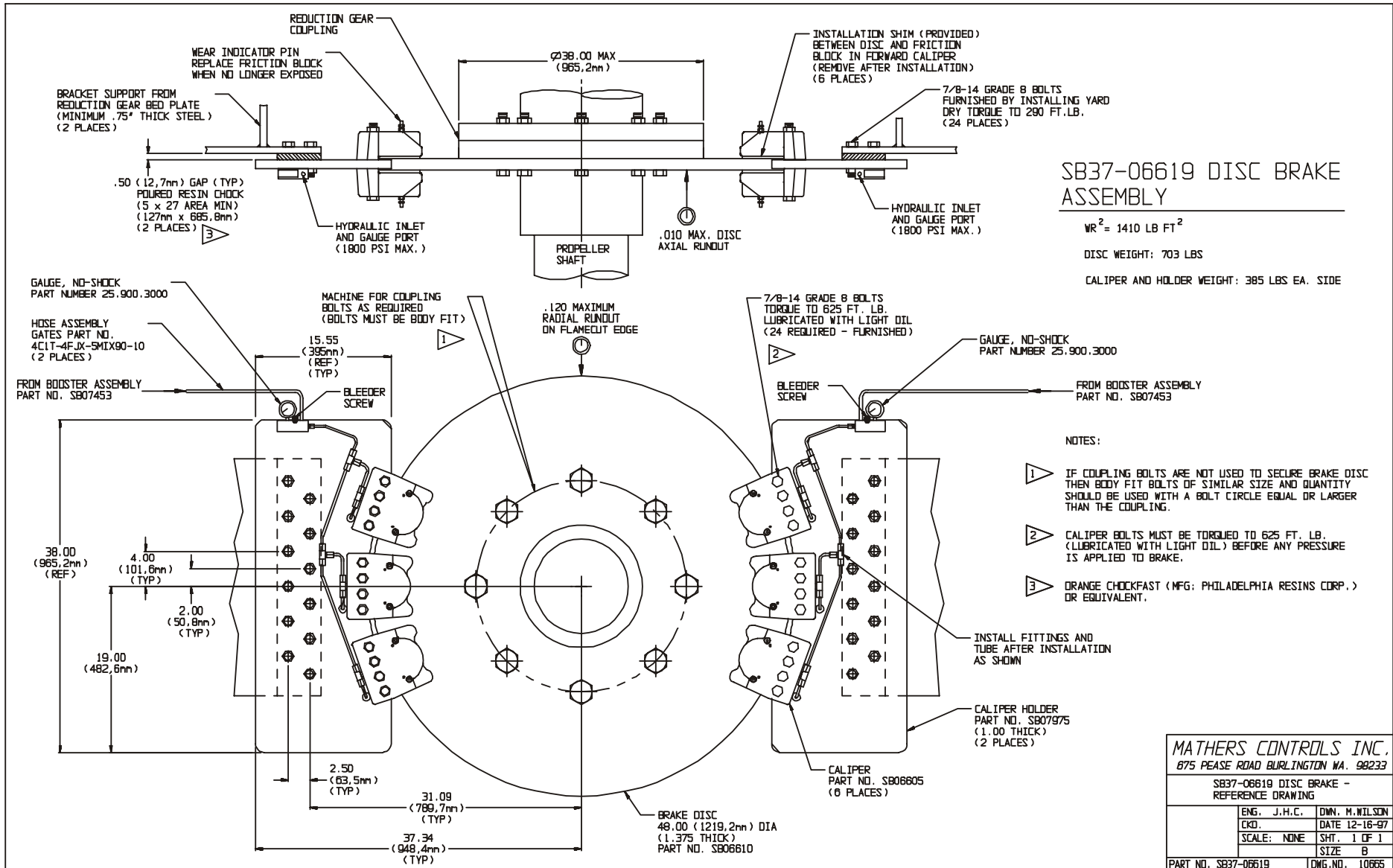
# SB37-06618 Drawing 10663



MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB37-06618 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON		
CKD.	DATE 12-16-97		
SCALE: NONE	SHT. 1 OF 1		
	SIZE B		
PART NO. SB37-06618	DWG. NO. 10663		



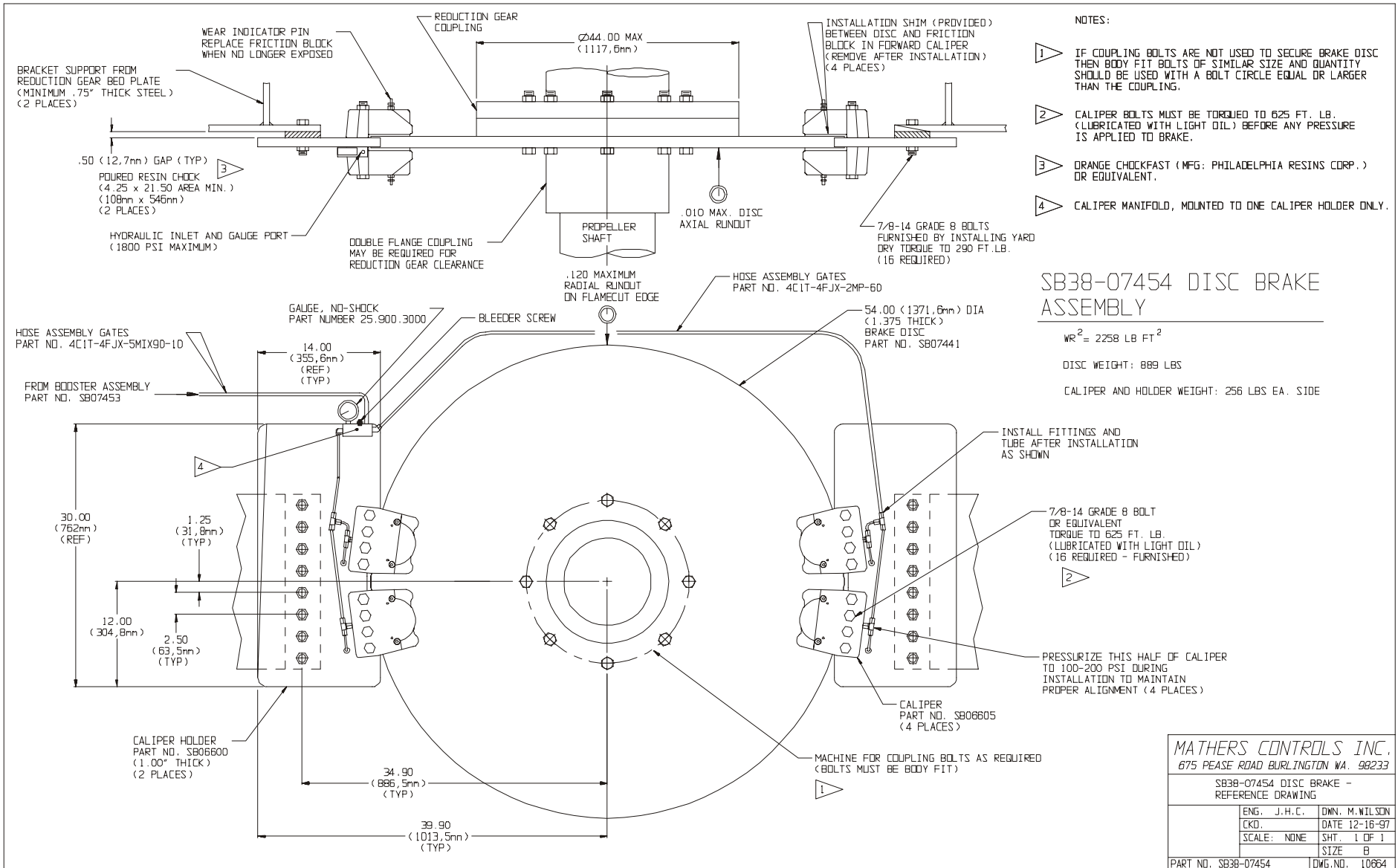
# SB37-06619 Drawing 10665



<b>MATHERS CONTROLS INC.</b>			
675 PEASE ROAD BURLINGTON WA. 98233			
SB37-06619 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON		
CHK.	DATE 12-16-97		
SCALE: NONE	SHT. 1 OF 1		
	SIZE B		
PART NO. SB37-06619	DWG. NO. 10665		



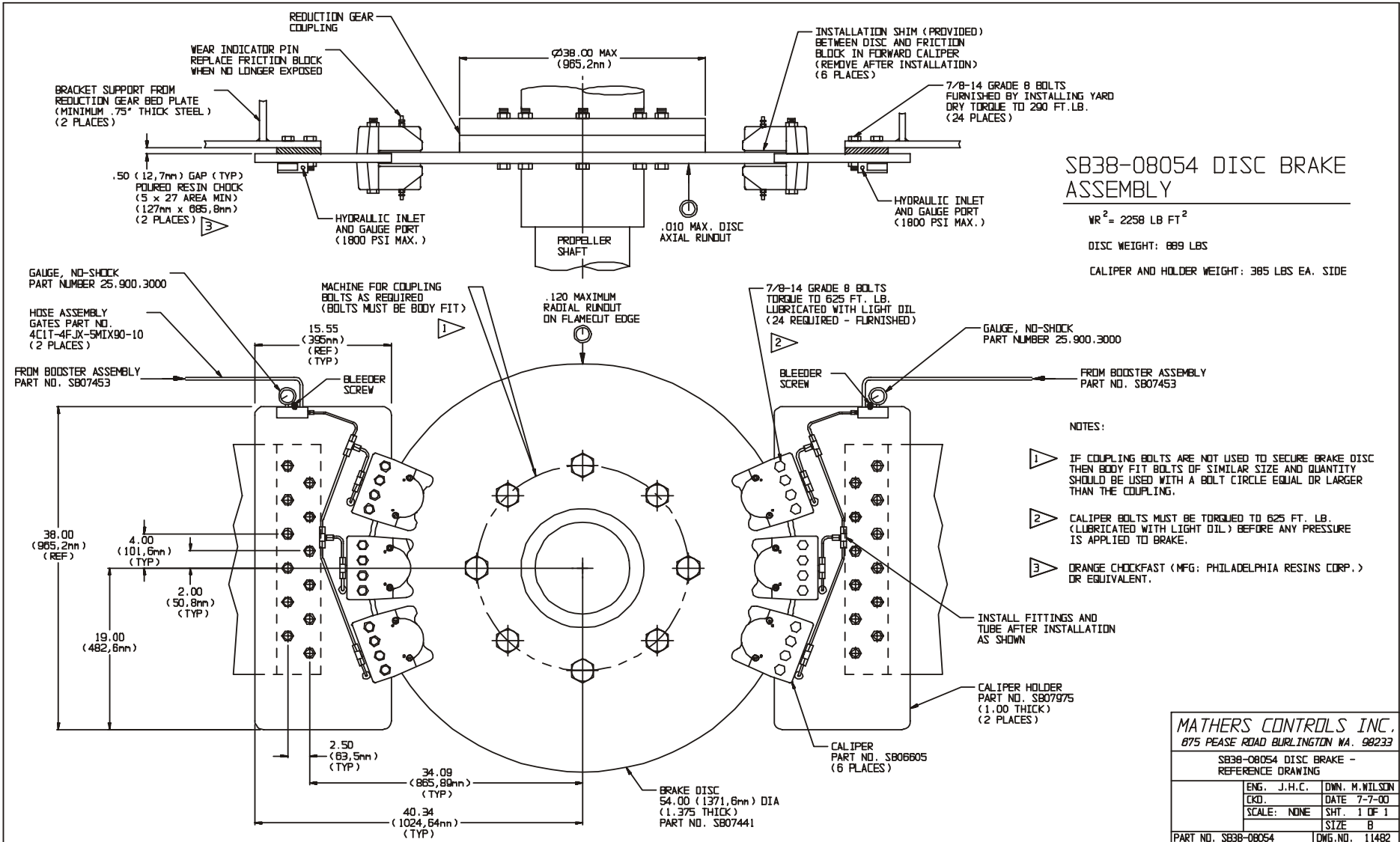
# SB38-07454 Drawing 10664



MATHERS CONTROLS INC.			
675 PEASE ROAD BURLINGTON WA. 98233			
SB38-07454 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON	CKD.	DATE 12-16-97
SCALE: NONE	SHT. 1 OF 1	SIZE	B
PART NO. SB38-07454	DWG. NO. 10664		



# SB38-08054 Drawing 11482



<b>MATHERS CONTROLS INC.</b>			
875 PEASE ROAD BURLINGTON WA. 98233			
SB38-08054 DISC BRAKE - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON		
CKD.	DATE 7-7-00		
SCALE: NONE	SHT. 1 OF 1		
	SIZE B		
PART NO. SB38-08054	DWG. NO. 11482		

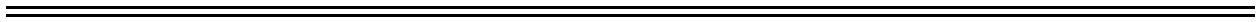




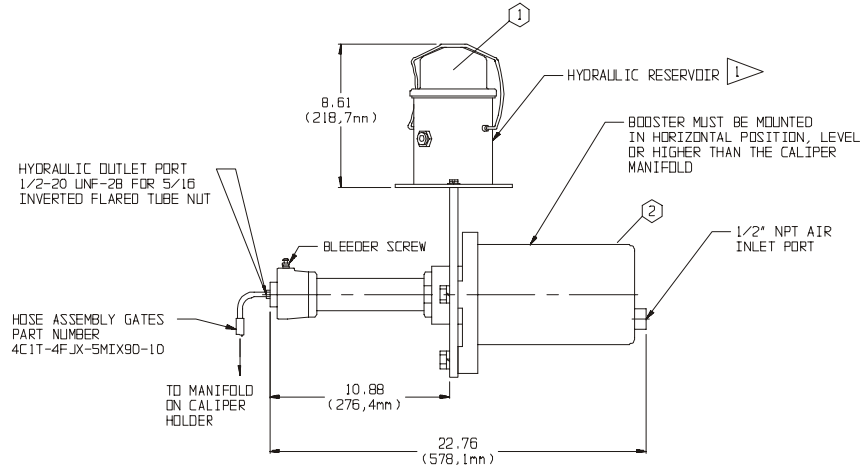
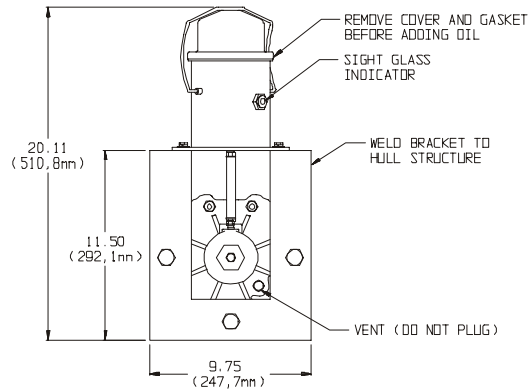
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
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## ***APPENDIX B.1***



# SB07453 Booster Assembly Drawing 10530

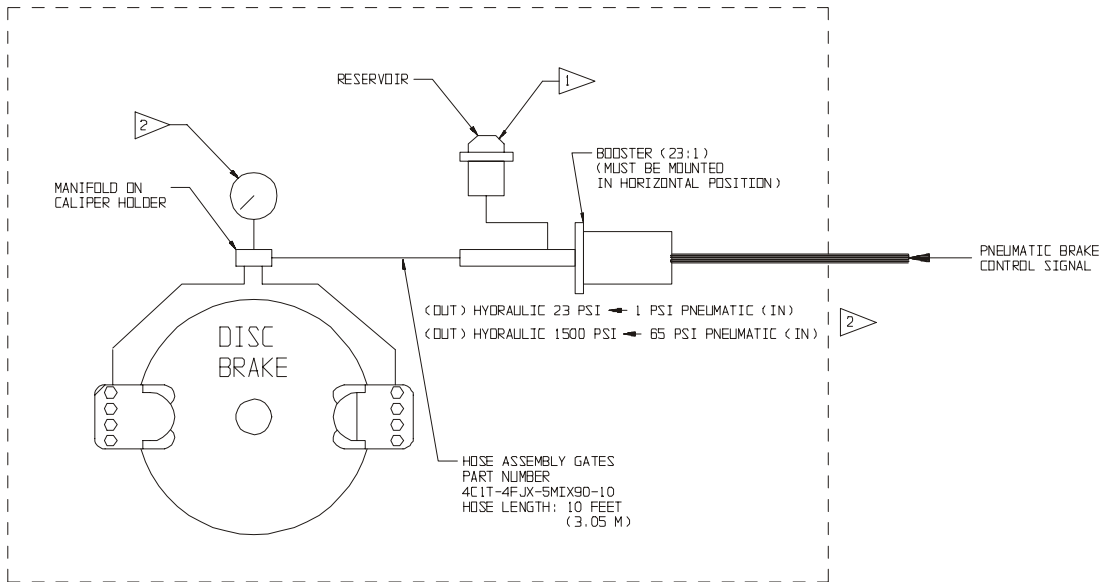


NOTE: ITEMS SHOWN WITH THIS SYMBOL  ARE LISTED IN THE COMPUTER GENERATED BILL OF MATERIALS IN THE MANUAL.

NOTES:

- 1 BRAKE SYSTEM MUST BE FILLED WITH 10 WT. ENGINE OIL OR MINERAL BASED HYDRAULIC OIL.
- 2 MAXIMUM HYDRAULIC PRESSURE NOT TO EXCEED 1800 P.S.I.

SB07453 BOOSTER ASSEMBLY  
INSTALLATION AND REFERENCE  
INFORMATION



MATHERS CONTROLS INC. 675 PEASE ROAD BURLINGTON WA. 98233			
SB07453 BOOSTER ASSEMBLY - REFERENCE DRAWING			
ENG. J.H.C.	DWN. M.WILSON		
CKD.	DATE 11-25-97		
SCALE: NONE	SHT. 1 OF 1		
		SIZE 8	
PART NO. SB07453			DWG. NO. 10530



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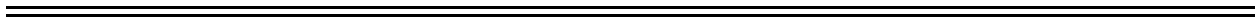
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# SB07453 Bill of Material

## BILL OF MATERIAL

### SB07453 BOOSTER ASSEMBLY

Item	Qty	Real Part Number	Description	Manufacturer	Service Sheet
1	1	N2780	RESERVOIR HYDRAULIC	MIDLAND ROSS	B4-23
2	1	N4294	BOOSTER HYDRAULIC (23:1)	MIDLAND ROSS	23:1 Intensifier

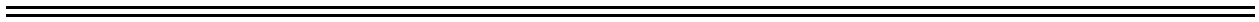


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## ***APPENDIX C.1***







**ZF Mathers, LLC**  
 1415 Pacific Drive  
 Burlington WA 98233-3103 U.S.A.  
 800-546-5455 / 360-757-6265  
 Fax: 360-757-2500

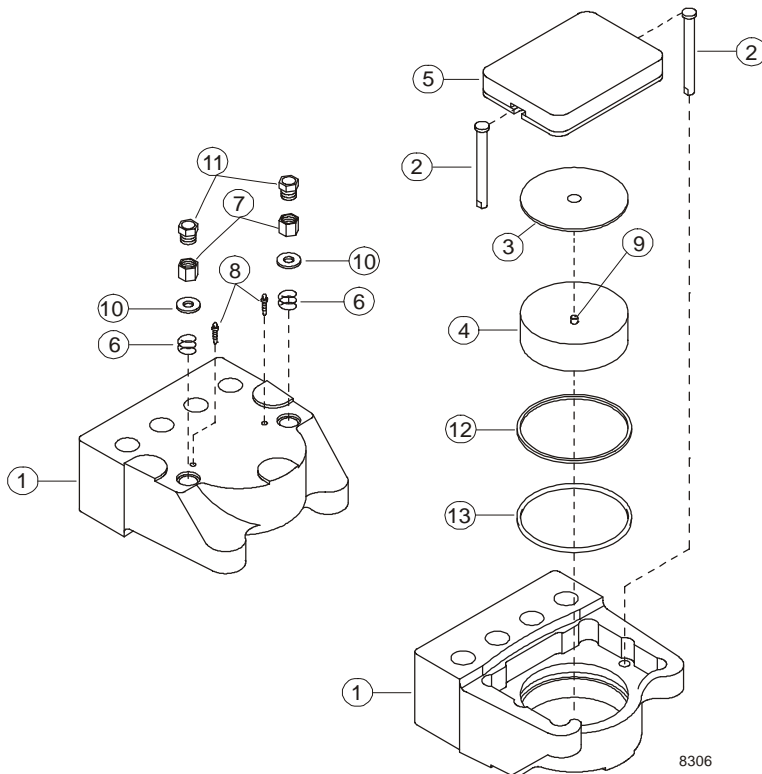
B6-2 Rev.G 5/01



## **Shaft Brake** **SB30 Brake Caliper Service Kits**

### **1.0 Kits Available**

	<b>DESCRIPTION</b>	<b>Piston Kit SB12260</b>	<b>Retractor Pin Kit SB12261</b>	<b>Reline Kit SB06652</b>
<b>1</b>	<b>Caliper Body</b>			
<b>2</b>	<b>Retraction Pin</b>		<b>X</b>	
<b>3</b>	<b>Alignment disc</b>	<b>X</b>		
<b>4</b>	<b>Piston</b>	<b>X</b>		
<b>5</b>	<b>Friction Block</b>			<b>X</b>
<b>6</b>	<b>Spring - Coil</b>		<b>X</b>	
<b>7</b>	<b>Grip - Body</b>		<b>X</b>	
<b>8</b>	<b>Bleeder Screw (1/4-28)</b>			<b>X</b>
<b>9</b>	<b>Pin</b>	<b>X</b>		
<b>10</b>	<b>Flatwasher-SS (3/8 SAE)</b>		<b>X</b>	
<b>11</b>	<b>Fitting - Nut</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>12</b>	<b>Back-up Ring</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>13</b>	<b>O-Ring, #242</b>	<b>X</b>	<b>X</b>	<b>X</b>



8306

## 2.0 Tools Required

- 5/8" Open End Wrench
- 9/16" Open End Wrench

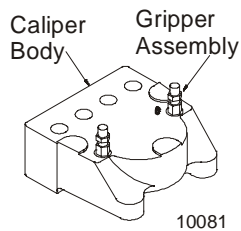
## 3.0 Maintenance

As the friction pad wears, the retraction pin will slide through the gripper assembly. When the end of the retraction pin is 1/4 inch from the top of the gripper assembly, it is time to reline.

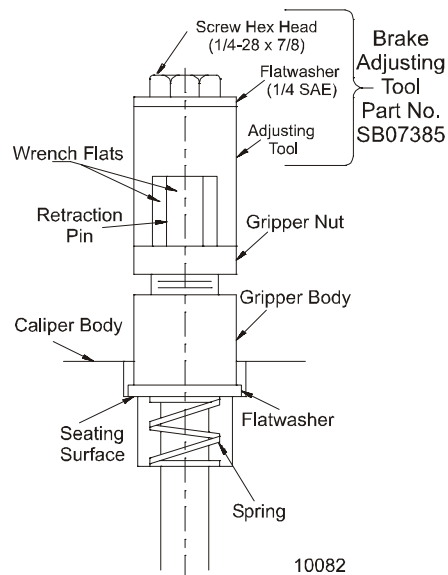
- A) Visually check amount of friction pad left as the pin approaches flush.
- B) Remove the calipers.
- C) Loosen the gripper assembly using the two open end wrenches (5/8" and 9/16"). The gripper assembly will slip off the retraction pins.
- D) Disassemble and clean the caliper.
- E) Replace the friction pad, o-ring and/or back-up ring.
- F) Lubricate, reassemble and push the friction pad to a fully retracted position. The friction pad should bottom out in the caliper casting.
- G) Pull on the retractor pin and push the gripper assembly on the retractor pin until it contacts the flat washer. Refer to step K) Gripper Adjustment.
- H) Torque the gripper assembly to 5 ft-lbs. Reinstall the calipers.
- I) Torque the caliper mounting bolts to 625 ft-lbs (lubricated with light oil).
- J) BLEED THE HYDRAULIC SYSTEM :
  1. Set the brake air supply pressure to 10 psi by means of the brake regulator on the air treatment panel. Engage and release the brake several times using the ball valve before bleeding.
  2. Open the upper bleed screw on each caliper half. Allow the air to escape and reseal the bleed screw. Also bleed the air at the caliper manifold and at the intensifier.
  3. Turn the brake air signal Off and then On again and repeat the above step until air is no longer visible in the oil.
  4. Adjust the brake air regulator on the air treatment panel for 65 psi.
- K) GRIPPER ADJUSTMENT:

**CAUTION: Check the hydraulic gauge for zero hydraulic pressure.**

Use ZF Mathers SB07385 Brake retraction tool (refer to Figure 2:) and the following procedure:



**Figure 1: Caliper**



**Figure 2: Brake Retraction Tool**

There are two gripper assemblies on each caliper body, as shown in Figure 1:. Perform the following for each gripper assembly with caliper installed, and brake Off:

Refer to Figure 3: and perform the following:

1. Loosen Gripper Nut and Gripper Body, and retighten to finger-tight.
2. Install the brake adjusting tool on a gripper assembly. Align wrench flats on adjusting tool and retraction pin. Hold with an adjustable wrench, then tighten screw until flat washer seats against seating surface of caliper body. This will compress the spring.
3. Use a 5/8 inch wrench and a 9/16 inch wrench to hold Gripper Body and Gripper Nut. Torque Gripper Nut to approximately 5 ft-lbs.
4. Remove brake adjusting tool.

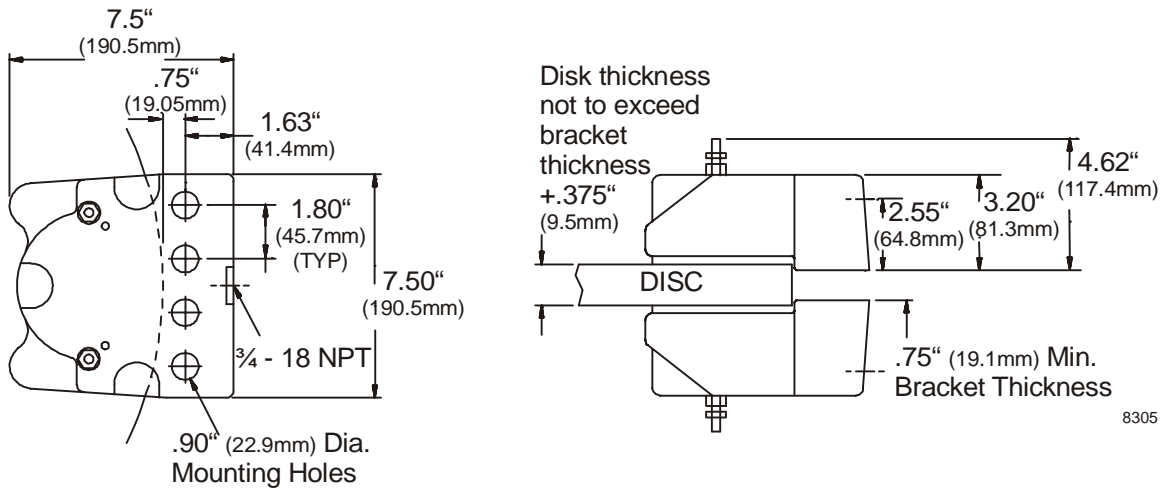
Repeat the above procedure for all caliper bodies with less than 0.15 inch clearance between the brake pad and the Disc. The retractors will now automatically adjust when the brake is applied

Set the brake air supply to 10 psi by means of the brake pressure regulator on the air treatment panel.

Turn the brake On and Off several times by using the ball valve on the air treatment panel that controls the brake air supply.

Ensure the brake pads extend out when the brake is applied and retract with clearance when the brake is Off.

Set the brake air pressure to its operational value.

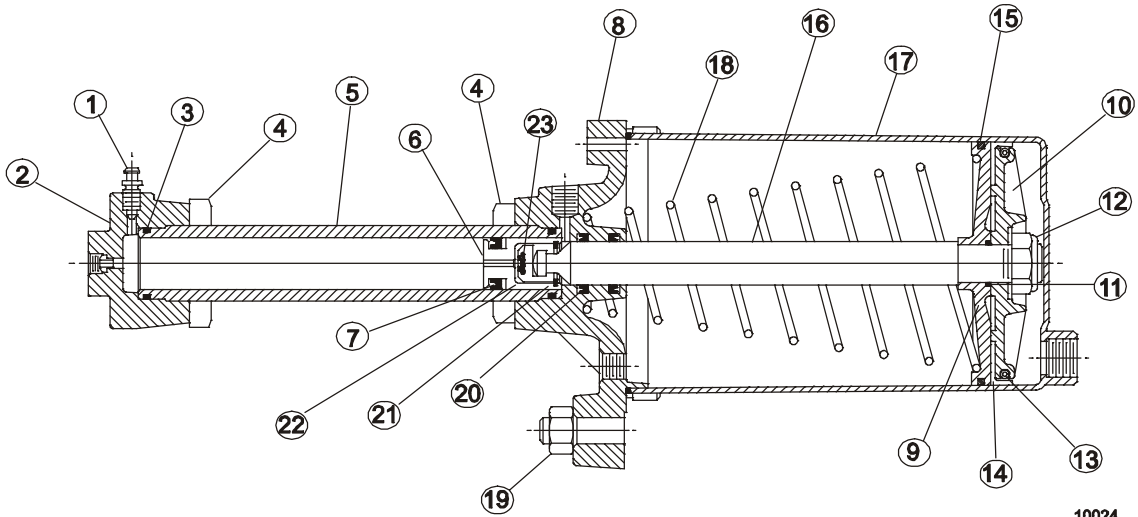


**Figure 3: Caliper Dimensions**

Disc Brake application time should be one second or less. If the brake hydraulic pressure is slow in rising, it usually means there is air in the system. The bleed procedure described above should be repeated.



## **Shaft Brake** **23:1 Intensifier Assembly**



	DESCRIPTION	CI-1074
1	Bleeder	
2	End Cap	
3	O-Ring	X
4	Nut	
5	Tube	
6	Piston	
7	U-Cup Seal	X
8	Cover	
9	Plate	
10	Follower	
11	O-Ring	X
12	Nut	
13	Ring	
14	U-Cup	X
15	Felt Strip	X
16	Rod	
17	Cylinder	
18	Spring	
19	Nut	
20	U-Cup Seal	X
21	Retaining Ring	X
22	Body	
23	Insert	X





**ZF Mathers, LLC**  
 1415 Pacific Drive  
 Burlington WA 98233-3103 U.S.A.  
 800-546-5455 / 360-757-6265  
 Fax: 360-757-2500

F-196 Rev.C 5/01



**Shaft Brake**  
**SB30 Brake Installation Report**

Owner \_\_\_\_\_ Vessel \_\_\_\_\_

Installer \_\_\_\_\_ Date \_\_\_\_\_ Serial Number \_\_\_\_\_

Brake Model \_\_\_\_\_ Brake Caliper Holder is Resin Mounted \_\_\_\_\_

Disc Axial Runout \_\_\_\_\_ in. Not to exceed .010" (measured 1 in. radially from Disc rim).

Radial Runout \_\_\_\_\_ in. Not to exceed .120".

Brake Installed per Installation Instructions S-172. \_\_\_\_\_

Caliper Mounting Bolts torqued per Brake reference drawing \_\_\_\_\_ Ft-lbs.

Caliper Holder Mounting bolts torqued per Brake reference drawing \_\_\_\_\_ Ft-lbs.

Disc Mounting Bolts Torqued \_\_\_\_\_

BRAKE OIL: Dextron ⇒ ATF \_\_\_\_\_ Reservoir Oil Level

Brake Air \_\_\_\_\_ psi (Maximum 78 psi) Brake Hydraulic \_\_\_\_\_ psi (Maximum 1800 psi)

Brake Hydraulic Application 0-1500 psi \_\_\_\_\_ seconds.

Brake Hydraulic release 1500-0 psi \_\_\_\_\_ seconds.

CLEARANCE: All calipers retract .015" or more \_\_\_\_\_.

Caliper pads are fully seating on Disc. \_\_\_\_\_

STOP TIME: Time to stop propeller from full speed \_\_\_\_\_ seconds. (Normal 2 to 4 seconds)

System check for hydraulic leaks. No Leaks \_\_\_\_\_.

**COMMENTS:**

REPORT BY: \_\_\_\_\_

