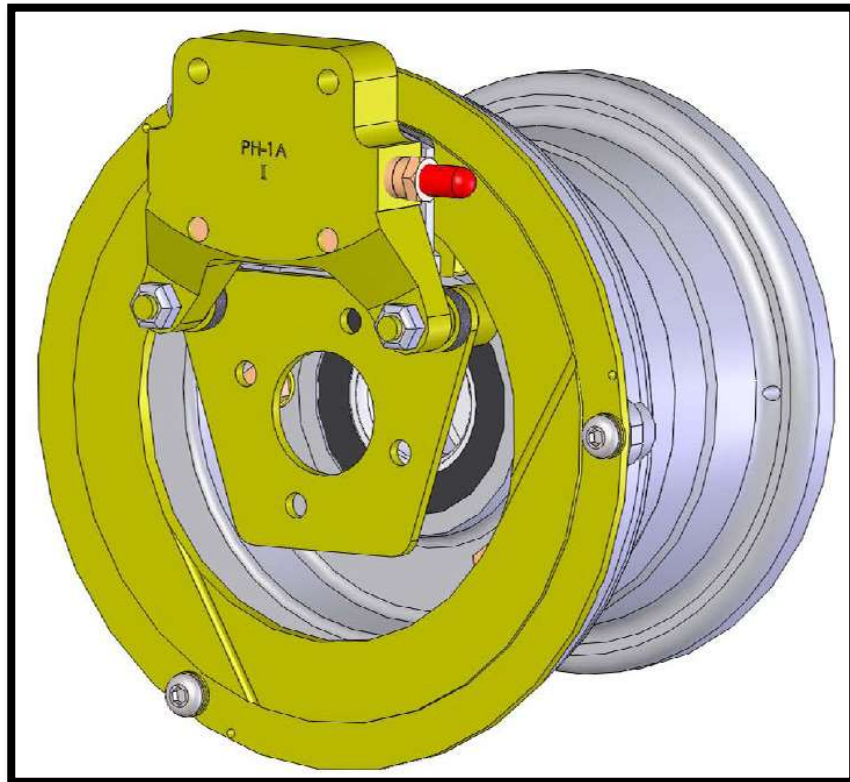


WI51 I SERIES

MATCO mfg

Wheels and Brakes



Technical Service Guide

REV F1 10/2023

Check Website for Latest Revision www.matcomfg.com

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A. WI51 SERIES WHEEL & BRAKE ASSEMBLIES

MATCO mfg produces outstanding narrow wheels for the LSA. The WI51L, WI51S1.25, WI51L30MM, & WI51L.75 wheel and brake assemblies are specifically designed for the (LSA) Light Sport Aircraft and combine light weight and superior braking power to provide a high performance wheel.

DIMENSIONS

The WI51 Series wheels are manufactured to rigorous specifications. These models have a 4.4-inch width with additional 1.11 inch caliper spacing. Bearing and axle spacing for the WI51L is 2.98 inches and 0.83 inches; 2.48 and 1.56 for the WI51S1.25; 2.55 inch and 1.14 for the WI51L.75; and 2.96 and 0.83 for the WI51L30MM. The bearing axle diameter is 1.25 inches for the WI51L & WI51S1.25, 0.75 inches on the WI51L.75 and 30mm for the WI51L30MM.

FEATURES

The WI51 series wheels are cast utilizing a 535.2 aluminum alloy for superior strength and corrosion resistance. This alloy provides a lightweight wheel and affords many years of efficient performance. The WI51 Series wheels utilizes tapered roller bearings (ball bearings on the WI51L30MM) that are rigorously tested and designed to resist bearing fatigue and provide a longer bearing life. The WI51 series wheels features a 1.50" piston in the WHLBI5 brake assembly for maximum torque.

The machining on this wheel produces a clean smooth surface to accommodate a variety of aircraft tires including Goodyear, McCreary, Michelin, and others. This WI51L series wheel can be used in conjunction with various bolt on axles for ease of installation. The axles are manufactured using high strength aluminum alloys.

PERFORMANCE

The WI51 Series wheels are designed for the following performance standards:

WI51L & WI51S1.25 WHEEL

| | |
|---|---|
| Static Capacity | 1420 pounds |
| Load Limit | 4260 pounds |
| Max Accel/Stop (Kinetic Energy) Rating @ 450psi | 105,000 foot-pounds Torque 1980 inch pounds |
| Weight | 5.9 pounds |

WI51L.75 WHEEL

(Same as above except)

| | |
|-----------------|-------------|
| Static Capacity | 1185 pounds |
| Load Limit | 3560 pounds |
| Weight | 5.8 pounds |

WI51L30MM WHEEL

(Same as above except)

| | |
|-----------------|-------------|
| Static Capacity | 660 pounds |
| Load Limit | 1320 pounds |
| Weight | 5.7 pounds |

TIRE & TUBE

Many five-inch tire and tube combinations can be used on the WI51 series wheels. The minimum recommendation being the 5.00-5 4 ply tire and 5.00-5 tube. A number of Aircraft Tires to include the 5.00-5 4 ply and 6 ply tires offer excellence in safety and performance. Also available is the 15X6-5 tire and tube combination. Tubes used with this wheel should have a long stem 90-degree valve stem (TR67) or equivalent.

B. WI51L SERIES WHEEL PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|-------------------|-----|---------------------------------|
| 1 | WHLBI5-8 | 1 | BRAKE ASSY, 5" I SERIES |
| 2 | MSC.25-20X.62BHCS | 3 | .25-20X.625 BUTTON HEAD SCREW |
| 3 | MSCNLX6 | 3 | NORDLOC WASHER SET NLX6 |
| 4 | WHLLM6700LA | 2 | ROLLER BEARING 1.25 |
| 5 | WHLD5LSA | 1 | BRK DISK, 5/6" WHEEL .175 THICK |
| 6 | WHLLM67010 | 2 | RACE 1.25 |
| 7 | MSAN4-22A | 3 | BOLT, HEX |
| 8 | WHLB51L/1.25 | 1 | WHEEL, BRAKE HALF |
| 9 | WHLW51/1.25 | 1 | WHEEL, VALVE HALF |
| 10 | MSCAN960-416 | 6 | WASHER, THICK |
| 11 | MSCAN363-428 | 3 | FLEX LOCK NUT / AN21045.4 |

B1. WI51L.75 SERIES WHEEL PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|-------------------|-----|---------------------------------|
| 1 | WHLBI5-7 | 1 | BRAKE ASSY, 5" I SERIES |
| 2 | MSC.25-20X.62BHCS | 3 | .25-20X.625 BUTTON HEAD SCREW |
| 3 | MSCNLX6 | 3 | NORDLOC WASHER SET NLX6 |
| 4 | WHLLM11900LA | 2 | ROLLER BEARING .75 |
| 5 | WHLD5LSA | 1 | BRK DISK, 5/6" WHEEL .175 THICK |
| 6 | WHLLM11910 | 2 | RACE .75 |
| 7 | MSAN4-22A | 3 | BOLT, HEX |
| 8 | WHLBI51S/.75 | 1 | WHEEL, BRAKE HALF |
| 9 | WHLWI51/.75 | 1 | WHEEL, VALVE HALF |
| 10 | MSCAN960-416 | 6 | WASHER, THICK |
| 11 | MSCAN363-428 | 3 | FLEX LOCK NUT / AN21045.4 |

C. WHLBI5-2 & 8 BRAKE - PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|----------------------|-----|----------------------------|
| 1 | MSC.25-20CRLOCK | 2 | NUT, CRLOCK |
| 2 | MSCF6446-S | 1 | VALVE, SEALED BLEEDER |
| 3 | MSC2-222 | 1 | O-RING, BUNA N |
| 4 | * See Fig G-2 | 1 | PISTON |
| 5 | WHLMB5I5 | 1 | PLATE I SERIES, MOVABLE |
| 6 | WHLM66-106 | 2 | LINING, BRAKE M66-106 |
| 7 | MSC4-4 | 3 | RIVET, SEMI-TUBULAR |
| 8 | WHLBSPI600 | 2 | SPACER, STAINLESS TUBULAR |
| 9 | MSC4-6 | 3 | RIVET, SEMI-TUBULAR |
| 10 | WHLBSBSI5 | 1 | SHOE, I SERIES, STATIONARY |
| 11 | MSCNL8 | 2 | WASHER, NORLOCK |
| 12 | WHLBSP6 | 2 | SPACER, STAINLESS TUBULAR |
| 13 | MSC.31-18X1.75HHBOLT | 2 | BOLT, HEX HEAD |
| 14 | MSC.25-20X1.75SHCS | 2 | SCREW, SOCKET HEAD |
| 15 | MSCV-250-8 | 1 | COVER, BLEEDER BLK |
| 16 | MSC2X | 1 | PLUG, CAP |
| 17 | For -2 WHLBPAE1.38S | 1 | PLATE, BRAKE "E" SERIES |
| 17 | For-8 WHLBPAE1.38SE | 1 | PLATE, BRAKE "E" SERIES |
| 18 | * See Fig G-2 | 1 | HOUSING, CALIPER |
| 19 | MSCBBS(S) | 1 | SEAT, SEALED BRAKE BLDR |

C1. WHLBI5-1 BRAKE - PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|----------------------|-----|----------------------------|
| 1 | MSC.25-20CRLOCK | 2 | NUT, CRLOCK |
| 2 | MSCF6446-S | 1 | VALVE, SEALED BLEEDER |
| 3 | MSC2-222 | 1 | O-RING, BUNA N |
| 4 | * See Fig G-2 | 1 | PISTON |
| 5 | WHLMB5I5 | 1 | PLATE I SERIES, MOVABLE |
| 6 | WHLM66-106 | 2 | LINING, BRAKE M66-106 |
| 7 | MSC4-4 | 3 | RIVET, SEMI-TUBULAR |
| 8 | WHLBSPI600 | 2 | SPACER, STAINLESS TUBULAR |
| 9 | MSC4-6 | 3 | RIVET, SEMI-TUBULAR |
| 10 | WHLBSBSI5 | 1 | SHOE, I SERIES, STATIONARY |
| 11 | MSCNL8 | 2 | WASHER, NORLOCK |
| 12 | WHLBSP6 | 2 | SPACER, STAINLESS TUBULAR |
| 13 | MSC.31-18X1.75HHBOLT | 2 | BOLT, HEX HEAD |
| 14 | MSC.25-20X1.75SHCS | 2 | SCREW, SOCKET HEAD |
| 15 | MSCV-250-8 | 1 | COVER, BLEEDER BLK |
| 16 | MSC2X | 1 | PLUG, CAP |
| 17 | WHLBPAE1.38 | 1 | PLATE, BRAKE "E" SERIES |
| 18 | * See Fig G-2 | 1 | HOUSING, CALIPER |
| 19 | MSCBBS(S) | 1 | SEAT, SEALED BRAKE BLDR |
| 20 | MSC2-008 | 1 | O-RING, BUNA N |

B2. WI51L30MM SERIES WHEEL PARTS

| # | PART NUMBER | QU. | DESCRIPTION |
|----|-------------------|-----|---------------------------------|
| 1 | WHLBI5-7 | 1 | BRAKE ASSY, 5" I SERIES |
| 2 | MSC.25-20X.62BHCS | 3 | .25-20X.625 BUTTON HEAD SCREW |
| 3 | MSCNLX6 | 3 | NORDLOC WASHER SET NLX6 |
| 4 | MSC6006DCTN | 2 | BEARING, SEALED 30MM |
| 5 | WHLD5LSA | 1 | BRK DISK, 5/6" WHEEL .175 THICK |
| 6 | See #4 | - | CONTAINED IN MSC6006DCTN |
| 7 | MSAN4-22A | 3 | BOLT, HEX |
| 8 | WHLBI51L/30MM | 1 | WHEEL, BRAKE HALF |
| 9 | WHLW51/30MM | 1 | WHEEL, VALVE HALF |
| 10 | MSCAN960-416 | 6 | WASHER, THICK |
| 11 | MSCAN363-428 | 3 | FLEX LOCK NUT / AN21045.4 |

C2. WHLBI5-7 BRAKE - PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|----------------------|-----|----------------------------|
| 1 | MSC.25-20CRLOCK | 2 | NUT, CRLOCK |
| 2 | MSCF6446-S | 1 | VALVE, SEALED BLEEDER |
| 3 | MSC2-222 | 1 | O-RING, BUNA N |
| 4 | * See Fig G-2 | 1 | PISTON |
| 5 | WHLMBIS5 | 1 | PLATE I SERIES, MOVABLE |
| 6 | WHLM66-106 | 2 | LINING, BRAKE M66-106 |
| 7 | MSC4-4 | 3 | RIVET, SEMI-TUBULAR |
| 8 | WHLBSP1600 | 2 | SPACER, STAINLESS TUBULAR |
| 9 | MSC4-6 | 3 | RIVET, SEMI-TUBULAR |
| 10 | WHLBSBSI5 | 1 | SHOE, I SERIES, STATIONARY |
| 11 | MSCNL8 | 2 | WASHER, NORLOCK |
| 12 | WHLBSP6 | 2 | SPACER, STAINLESS TUBULAR |
| 13 | MSC.31-18X1.75HHBOLT | 2 | BOLT, HEX HEAD |
| 14 | MSC.25-20X1.75SHCS | 2 | SCREW, SOCKET HEAD |
| 15 | MSCV-250-8 | 1 | COVER, BLEEDER BLK |
| 16 | MSC2X | 1 | PLUG, CAP |
| 17 | WHLBPAE1.38TEC | 1 | PLATE, BRAKE "E" SERIES |
| 18 | * See Fig G-2 | 1 | HOUSING, CALIPER |
| 19 | MSCBBS(S) | 1 | SEAT, SEALED BRAKE BLDR |
| 20 | MSC2-008 | 1 | O-RING, BUNA N |

D. WI51S1.25 SERIES WHEEL PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|-------------------|-----|---------------------------------|
| 1 | WHLBI5-5 | 1 | BRAKE ASSY, 5" I SERIES |
| 2 | MSC.25-20X.62BHCS | 3 | .25-20X.625 BUTTON HEAD SCREW |
| 3 | MSCNLX6 | 3 | NORDLOC WASHER SET NLX6 |
| 4 | WHLLM6700LA | 2 | ROLLER BEARING 1.25 |
| 5 | WHLD5LSA | 1 | BRK DISK, 5/6" WHEEL .175 THICK |
| 6 | WHLLM67010 | 2 | RACE 1.25 |
| 7 | MSAN4-22A | 3 | BOLT, HEX |
| 8 | WHLB51S/1.25 | 1 | WHEEL, BRAKE |
| 9 | WHLW51/1.25 | 1 | WHEEL, VALVE HALF |
| 10 | MSCAN960-416 | 6 | WASHER, THICK |
| 11 | MSCAN363-428 | 3 | FLEX LOCK NUT / AN21045.4 |

E. WHLBI5-5 BRAKE - PARTS LIST

| # | PART NUMBER | QU. | DESCRIPTION |
|----|----------------------|-----|----------------------------|
| 1 | MSC.25-20CRLOCK | 2 | NUT, CRLOCK |
| 2 | MSCF6446-S | 1 | VALVE, SEALED BLEEDER |
| 3 | MSC2-222 | 1 | O-RING, BUNA N |
| 4 | * See Fig G-2 | 1 | PISTON |
| 5 | WHLMBIS5 | 1 | PLATE I SERIES, MOVABLE |
| 6 | WHLM66-106 | 2 | LINING, BRAKE M66-106 |
| 7 | MSC4-4 | 3 | RIVET, SEMI-TUBULAR |
| 8 | WHLBSP1600 | 2 | SPACER, STAINLESS TUBULAR |
| 9 | MSC4-6 | 3 | RIVET, SEMI-TUBULAR |
| 10 | WHLBSBSI5 | 1 | SHOE, I SERIES, STATIONARY |
| 11 | MSCNL8 | 2 | WASHER, NORLOCK |
| 12 | WHLBSP6 | 2 | SPACER, STAINLESS TUBULAR |
| 13 | MSC.31-18X1.75HHBOLT | 2 | BOLT, HEX HEAD |
| 14 | MSC.25-20X1.75SHCS | 2 | SCREW, SOCKET HEAD |
| 15 | MSCV-250-8 | 1 | COVER, BLEEDER, BLK |
| 16 | MSC2X | 1 | PLUG, CAP |
| 17 | WHLBPAE1.25S | 1 | PLATE, BRAKE "E" SERIES |
| 18 | * See Fig G-2 | 1 | HOUSING, CALIPER |
| 19 | MSCBBS(S) | 1 | SEAT, SEALED BRAKE BLEED |
| 20 | MSC2-008 | 1 | O-RING, BUNA N |

F. WI51 SERIES WHEEL - DRAWING

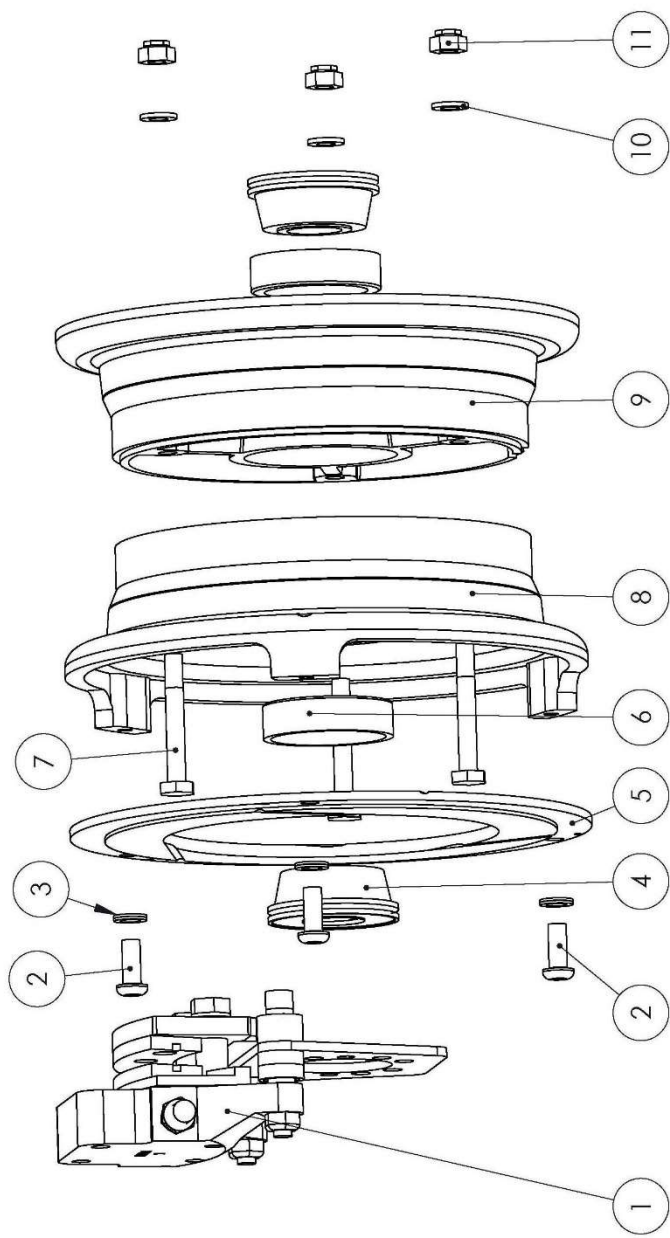


Fig. F-1

G. WHLBI5 BRAKE ASSY

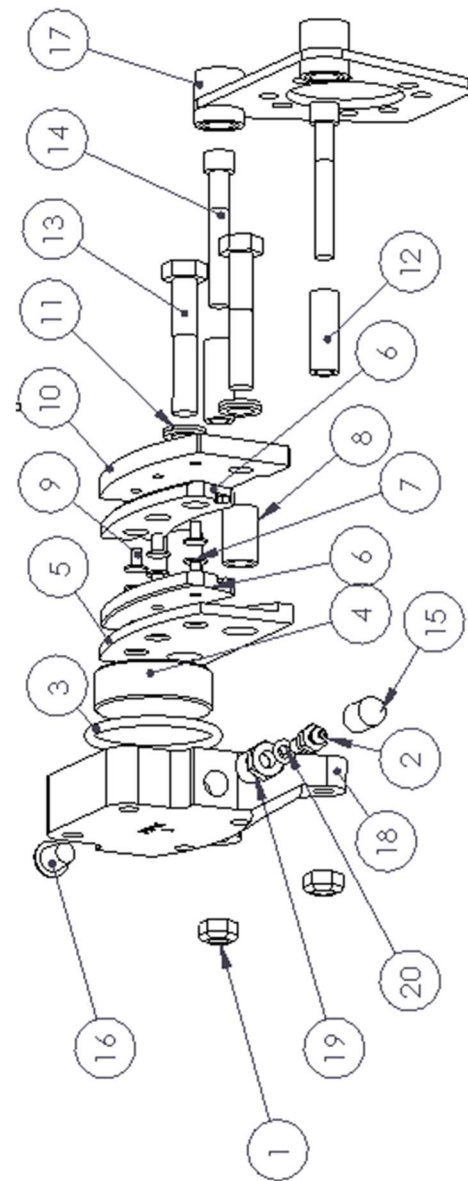


Fig. G-1

CALIPER HOUSING CONFIGURATIONS

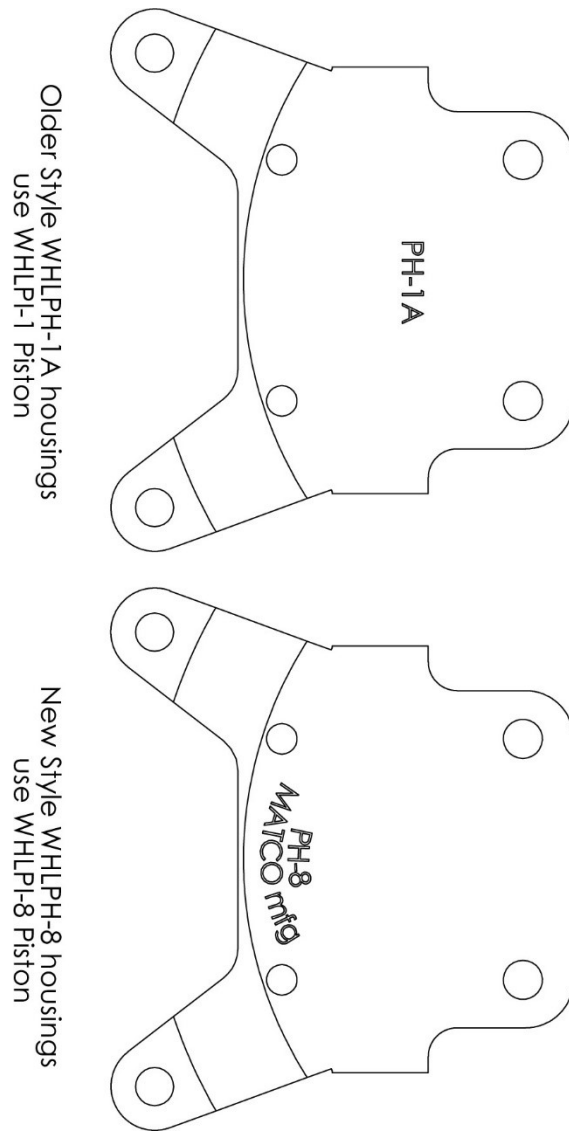


Fig. G-2

H. BRAKE LINING WEAR LIMITS

To eliminate wear on brake linings beyond design limitation and reduce possible piston damage or fluid leakage, the following information is presented. The WHLM66-106 lining found on the WI51 series should be replaced when the thickness of the remaining wear material reaches 0.100 IN.(2.54mm) See Fig. H-1 the brake lining has a visible wear notch (A) located on the side of the lining. The inside edge of the visible wear notch is at the minimum material condition.

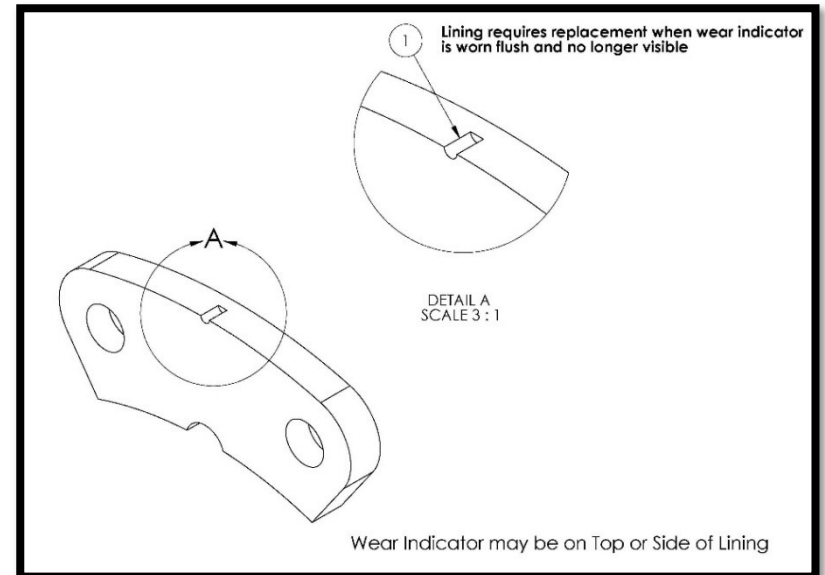


Fig. H-1

***SwiftLine* Pad Replacement Program**

- Simplifies pad replacement on MATCO mfg brakes saving you valuable time.
- Eliminate the need to rivet linings saving maintenance. & tooling.
- Provides a 20 % discount on reline kits.

For more information on Swiftline call 801-335-0582 or send an Email to tech@matcomfg.com

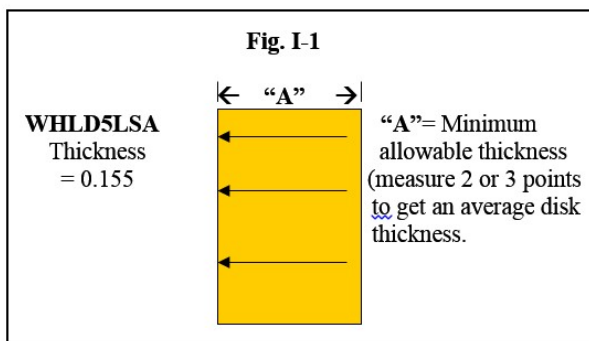
I. BRAKE DISK INSPECTION

Your MATCO brake disk will give years of trouble free service under normal field conditions. Conditions such as unimproved fields, standing water, industrial pollution, or frequent use of the aircraft may require more frequent inspection of the brake system and disk in order to prolong the life of the brake linings.

The disk should be checked for wear (**Fig. I-1 Dim. "A"**) and for any grooves, deep scratches, excessive pitting or coning of the brake disk. Although coning is rarely a problem with the MATCO disk, if it should occur, coning beyond 0.015 inch (0.381mm) in either direction is cause for replacement. Isolated grooves up to .030 inch (0.76mm) deep should not be cause for replacement. Any grooving of the disk however, will reduce the service life of the linings.

The WHLD5LSA disk is plated for rust prevention. After a few landings, the plating will be worn off where the linings rub against the disk. The remaining portion of the disk will remain plated and corrosion free for an extended period of time, under normal use. Chrome plated disks are available from MATCO mfg. for those demanding increased corrosion protection and wear.

Rust in varying degrees may form on the exposed portion of the disk. If powdered rust appears on this surface, one or two braking applications during taxiing should wipe the disk clear. Rust build up beyond this point, may require removal of the disk from the wheel to properly clean both surfaces. A wire brush followed by 220-grit garnet paper should restore the braking surface adequately. Do not remove plating in areas that are not contacted by the linings.



J. RELINING THE I-SERIES CALIPER

The I Series Caliper allows easy removal for lining change or inspection. It is not necessary or desired to remove the hydraulic connection to the brake assembly.

1. Remove the three MSC.25-20x.625BHCS that secure the disk to the wheel.

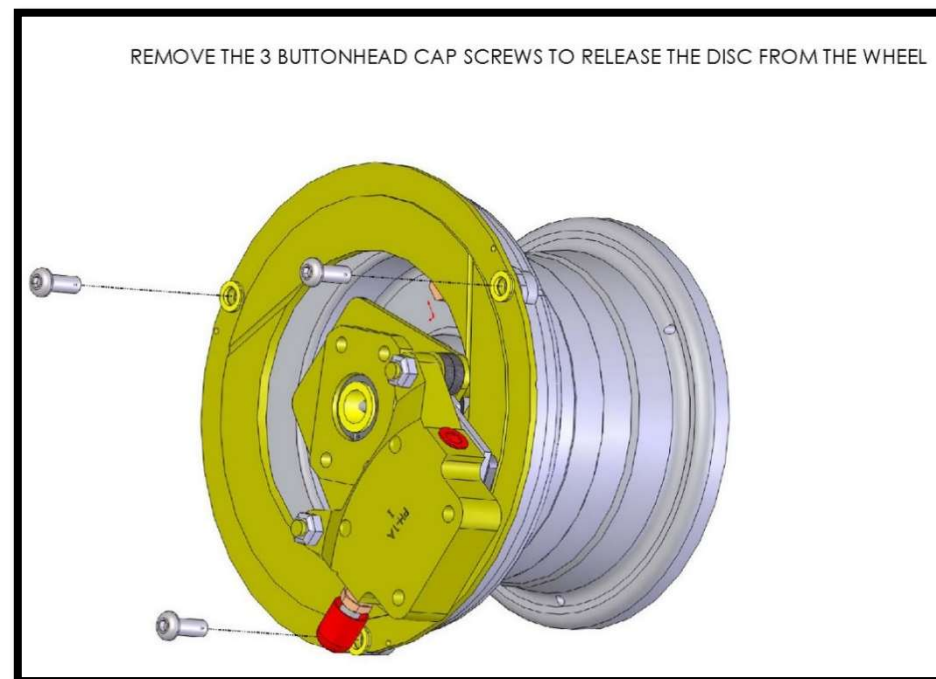


Fig. J-1

2. Maneuver the disk around the caliper so that the disk is no longer trapped between the linings.

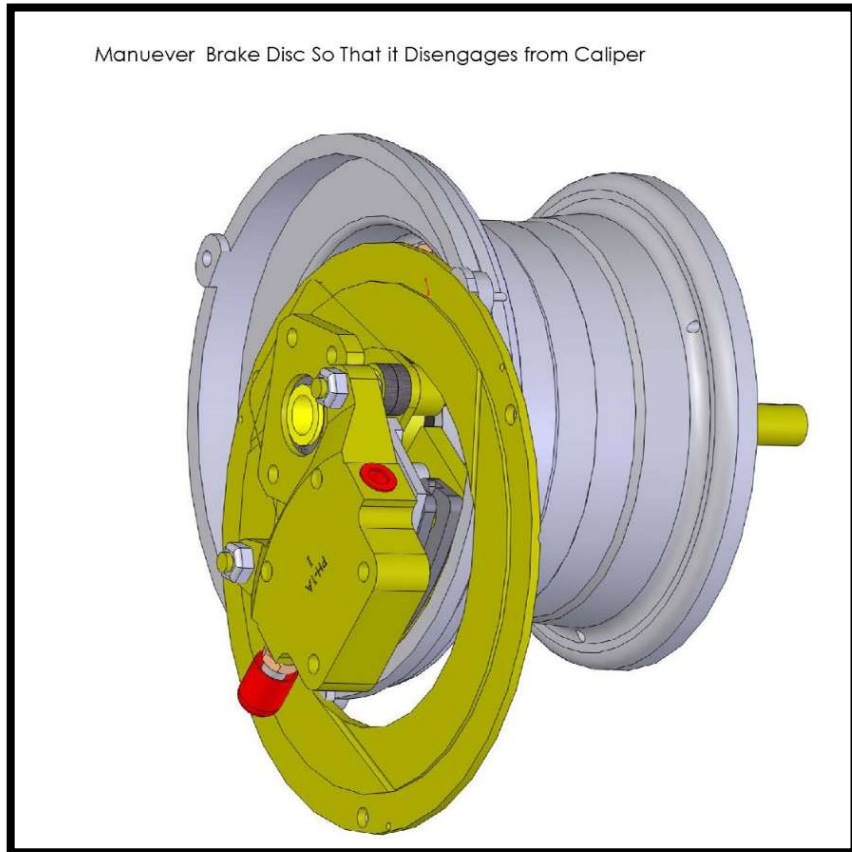


Fig. J-2

3. With the hydraulic line still attached, slide the caliper out of the brake plate.

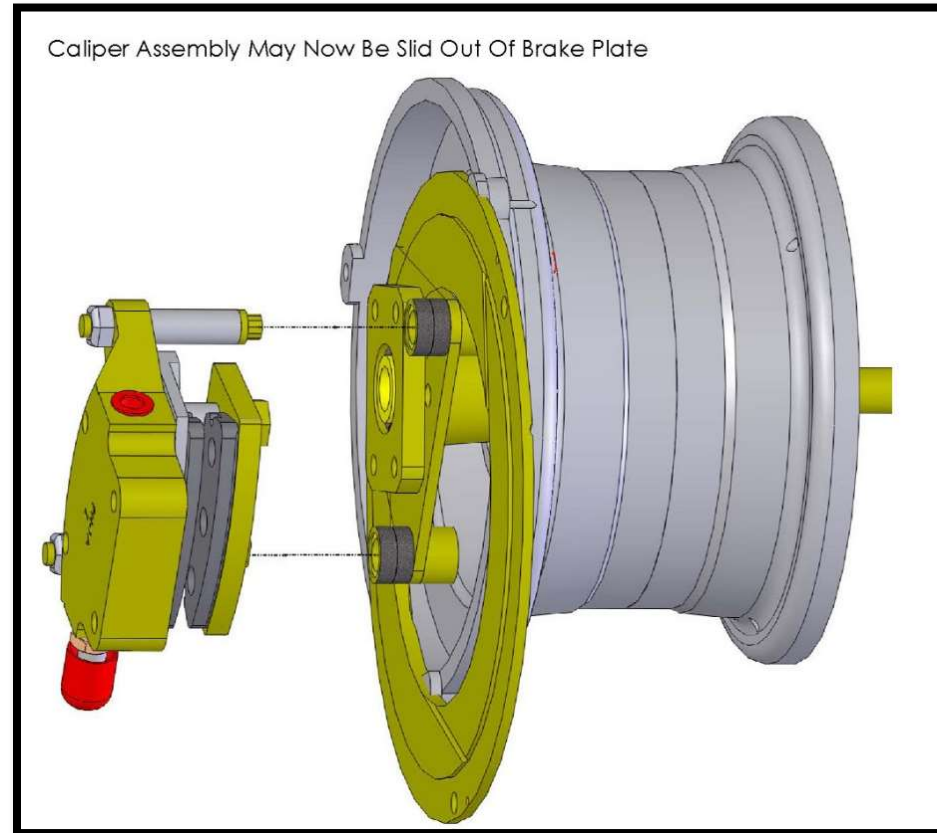


Fig. J-3

Note: If using the *Swiftline* replacement kit, skip steps 5 through 7; See section (H) page 12 for more information on the *Swiftline* program.

4. Disassemble the caliper by removing the two **MSC.31-18 x1.75SHCS** that hold it together, and remove the brake shoes.
5. Remove old linings by drilling the crimped side of the rivet (Do not use a punch & hammer). Using a #25 drill (0.1495 diameter), drill through rivet taking care to avoid damaging the rivet hole. After drilling crimped edge off rivets, lift old lining and remaining rivet pieces from the brake shoe.
6. Inspect the brake shoe for any bending or other damage that may have occurred during service. A shoe with more than 0.010 bend should be replaced. Inspect rivet holes to ensure that no damage has occurred during removal.
7. Using a brake relining tool (MATCO recommends a Threaded screw action such as the W404 from an Aircraft Tool Supply Co.) or pneumatic press, replace the lining using the brass rivets shown on the illustrated parts list.
8. Reassemble the caliper and torque bolts per table in Section M.
9. Slide the caliper onto the brake plate and maneuver disk back into position between the linings.
10. Install disk, attach bolts and torque per table in Section M.

K. MOUNTING THE TIRE & TUBE

NOTE: MATCO wheels are balanced at the factory and stamped with a chevron. The chevron should always be placed adjacent to and directly across from the valve hole. Verify alignment before mounting the tire.

Care should be taken to avoid pinching the tube between the wheel halves when mounting the tire and tube. To avoid this, slightly inflate tube after placing it in the tire. Tire mounting soap may also help. A preferred method for mounting the tires is to use 3 ratcheting bar clamps evenly spaced around the tire and tube to compress the tire. Compress sufficiently to allow the wheel halves to be seated against each other at the shiplap without contacting the tire. The tube can be visibly inspected.

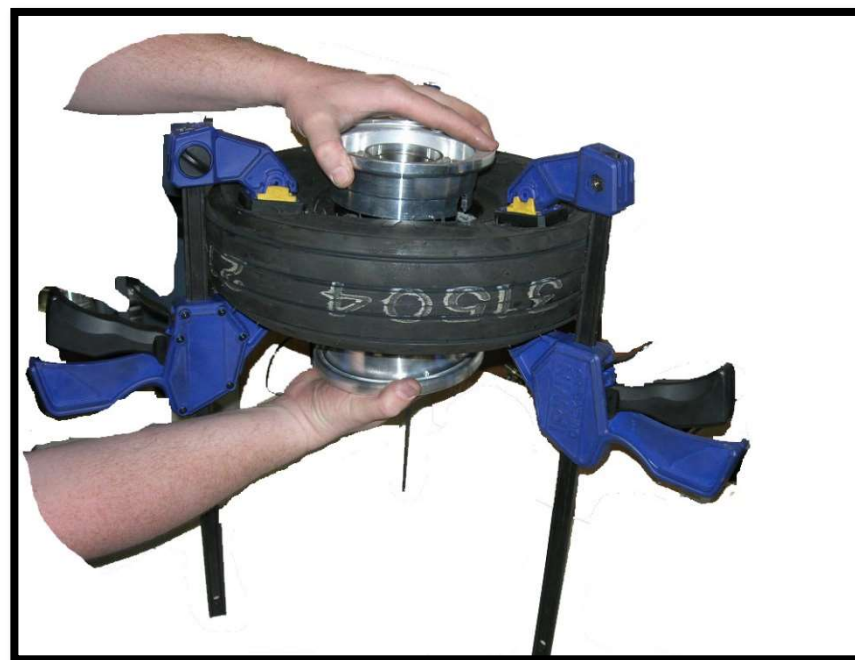


Fig. K-1

L. WI51 WHEEL ASSEMBLY

ASSEMBLY INSTRUCTIONS FOR WI51 SERIES WHEEL

1. The brake mounting plate (Fig. G-1, # 17) should be spaced from the bearing so that it aligns in the same plane and is parallel with the brake disc.
2. The tapered roller bearings should be packed with suitable grease. (*See Section "N" for suitable lubricants.*) Ball bearing wheels (like the WI51L30MM) come sealed and pre-lubricated and cannot be disassembled for inspection.

IMPORTANT NOTE: Axle Nut Torque

For MATCO mfg. wheel equipped with tapered roller bearings.

These tapered roller bearings are two piece and have integrated grease seals on the bearing cone half to ensure the longest possible life. This two piece bearing has the race pressed into the wheel and the cone with roller is separately removable. (NOTE: The WI51L30MM model has ball bearings) Torque procedures for bearings with this type of seal are different than for bearings without the seal or ball bearings. A common torque technique for ball bearings (single piece) or tapered bearings without seals is to tighten the axle nut until the wheel stops spinning freely then back off to the nearest locking feature. **THIS TECHNIQUE DOES NOT WORK ON TAPERED BEARINGS WITH AN INTEGRATED SEAL.** The reason for the different technique is that the grease seal produces some drag and makes the wheel feel somewhat stiff when rotated. Reducing the axle nut torque until the wheel spins freely will allow the grease seal and the bearing cone to rotate improperly with the wheel. **THE BEARING CONE MUST NOT ROTATE RELATIVE TO THE AXLE.** The higher rolling drag is completely normal for this bearing and allows for longer bearing life since the seal will keep most contaminants out.

Bearing specifications state that when new the two .75 inch tapered roller bearings used on the WI51L.75 can produce 8-15 inch pounds of torque (drag) when properly installed. A light coating of grease on the seal will help reduce the drag on initial installation. The drag will also reduce after the bearings have been installed and the seal relaxes in the bore. It is important that the axle nut torque be sufficient to keep the seal from rotating with the wheel. The following technique will ensure the longest possible bearing life.

3. Tightened the axle nut until all play is out of the assembly. Rotate the wheel back and forth while tightening the nut to help seat the bearings. When all play is out, and the wheel rotates freely, tighten to the nearest slot and insert cotter pin.
4. The rubber seal on the tapered roller bearing should remain stationary while the wheel rotates around it. If the seal is spinning on the axle, tighten the nut further until the seal stops spinning with the wheel. (*See Note Above*).
5. All O-rings in the brake and master cylinder assembly are Buna Nitrile and are NOT compatible with automotive glycol based brake fluids.

NOTE: Use only red aircraft fluid Mil-H-5606 or other suitable petroleum or silicon-based fluids.

6. The ideal mounting position for the brake caliper is on the trailing side of the wheel with the inlet and bleeder valve in a vertical axis. However, the caliper may be mounted at any location as long as air can be properly bled from the system.
7. When using MATCO bolt on axles, they can be shimmed for toe-in or toe-out conditions, and spaced out from the wheel if necessary for the brake disk attachment screws to clear the landing gear leg.

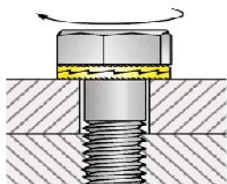
M. WHEEL ASSEMBLY TORQUE VALUES

| Fig. # | Item # | PART NUMBER | TORQUE (IN LBS) |
|--------|--------|-----------------------|-----------------|
| F-1 | 2 | MSC.25-20X.625BHCS(A) | 100 Inch Lbs |
| G-1 | 1 | MSC.25-28CRLOCK (NUT) | 100 Inch Lbs |
| F-1 | 11 | MSCAN363-428 (NUT) | 100 Inch Lbs |
| G-1 | 13 | MSC.31-18X1.75HH BOLT | 120 Inch Lbs |
| G-1 | 14 | MSC.25-20X1.75SHCS | 100 Inch Lbs |
| F-1 | 7 | MSCAN4-21A HH BOLT | 100 Inch lbs |

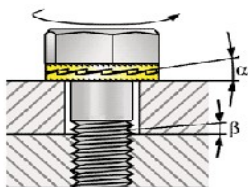
NORD-LOCK Washers



NORD-LOCK is a pair of washers with a wedge-locking action meeting DIN 25201 which is a unique method using tension instead of friction. The rise of the cams between the NORD-LOCK washers is greater than the pitch of the bolt. In addition, there are radial teeth on the opposite side. The washers are installed in pairs, cam face to cam face.



When the bolt and/or nut is tightened the teeth grip and seat the mating surfaces. The NORD-LOCK washer is locked in place, allowing movement only across the face of the cams. Any attempt from the bolt/nut to rotate loose is blocked by the wedge effect of the cams.



Here you see what happens when a bolt is untightened with a wrench. The pair of washers expand more than the corresponding pitch of the thread allows the bolt/nut to rise.

NORD-LOCK washers positively lock the fastener in a joint which is subjected to any kind of vibration or dynamic loads.

REPLACE the NORD-LOCK washers if the cam surface is worn and corners are rounded or if the pair does not seat cleanly against each other

NORDLOCK TORQUE VALUES

MSCNL5 #10 80 in-lb. MSCNL $\frac{1}{4}$ $\frac{1}{4}$ " Shoulder 100 in-lb.
 MSCNLX6 $\frac{1}{4}$ " All-Thread 100 in-lb. MSCNL8 $\frac{5}{16}$ " 120 in-lb.

Verify bolt bottoms against surface before installing Nord-Lock

N. CALIPER SPACING

Caliper spacing is determined by measuring the distance from the bearing face to the axle flange

- Spacing distance "L" for the:
 WI51L is 0.83 inches; W51S1.25 is 1.56 inch;
 W15L.75 is 1.14 inch

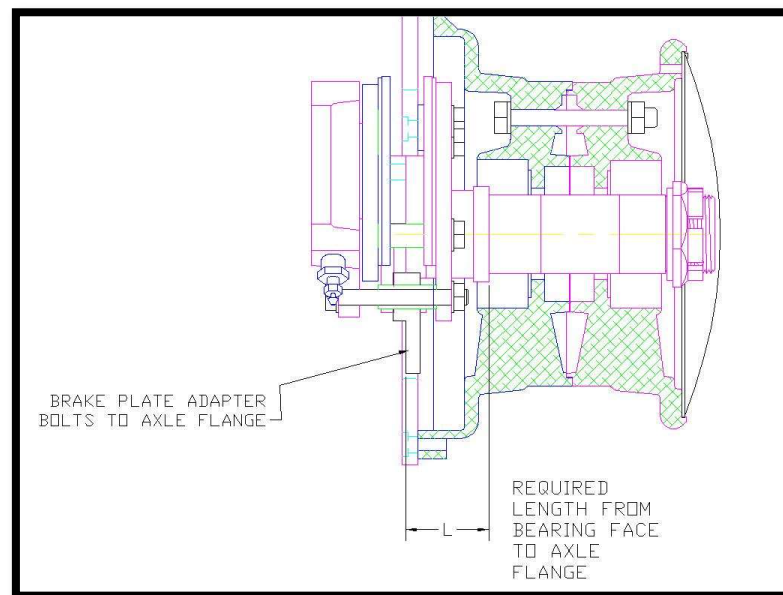


Fig. N-1

O. BLEEDING THE BRAKE SYSTEM

- Open the brake bleeder valve slightly (Fig. G-1 #2) to facilitate filling the system purging of air.
- Attach the tube from the nozzle of a squirt can to the nipple of the brake bleeder valve. Before attaching, purge the line by allowing oil to flow until it is bubble free from tube, then attach to brake bleeder valve.
- Make sure that the master cylinder shaft is fully extended to open up the internal bypass valve.

4. Inject brake fluid (Mil-H-5606) or equivalent, into the puck housing and continue injecting until the fluid travels through the system in to the master cylinder.
5. Air in the system will be pushed up and out into the master cylinder ONLY IF the master cylinder or remote reservoir is at the highest point in the system, and there are no loops in the brake lines.
6. Fluid should be pushed through the system until it reaches approximately $\frac{1}{4}$ inch from the top of the master cylinder or remote reservoir.
7. Close the brake bleeder valve, and remove the service hose.
8. GENTLY stroke each cylinder. When properly bled, (no air in the lines) the brake pedal will feel firm and not spongy. If spongy or not firm, repeat steps 1 through 7 until system is free of all trapped air.
9. Fluid leakage from the top of the MCMC-5 or 5A master cylinder during operation indicates too high a fluid level.

NOTE: The MCMC-5 is NOT approved for inverted flight.

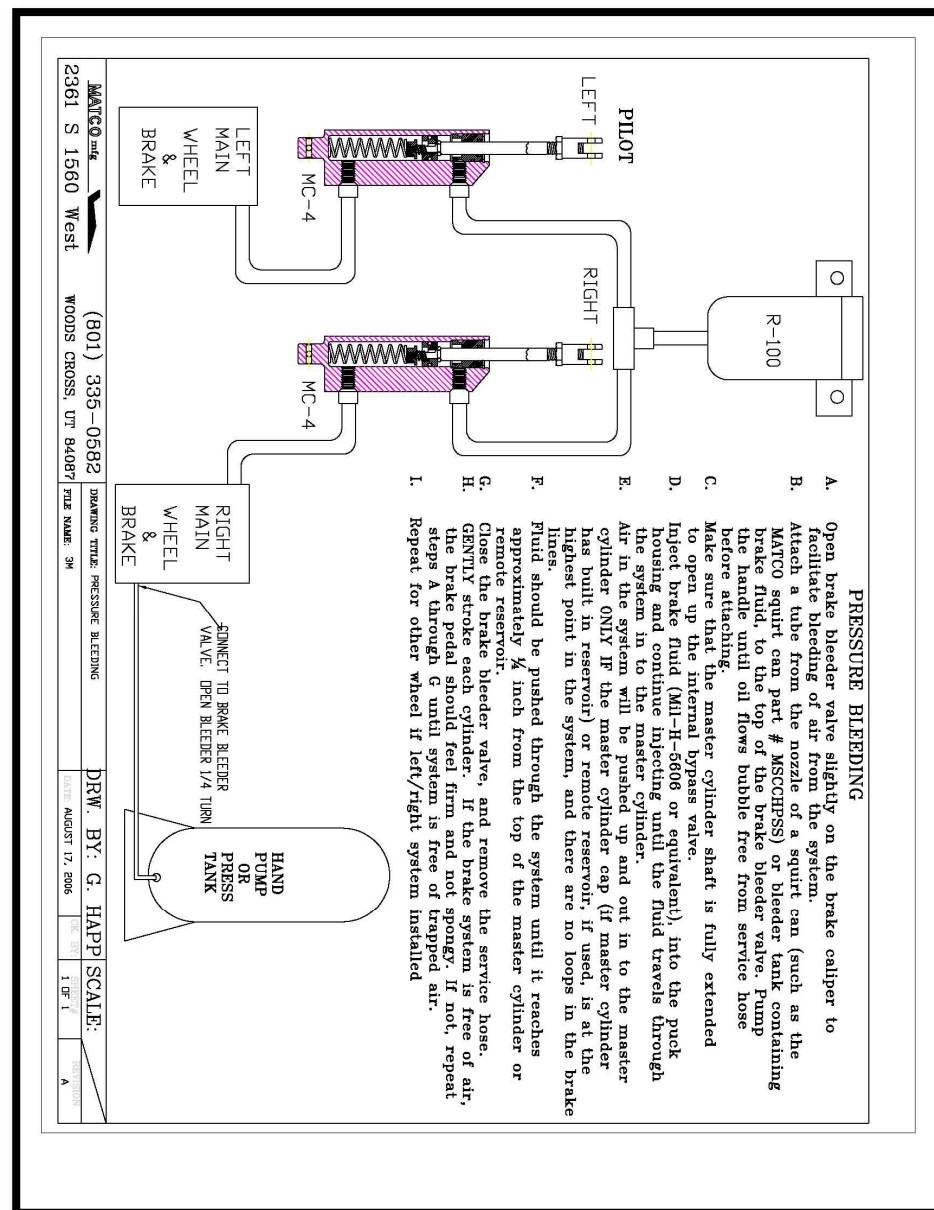


Fig. O-1 PRESSURE BLEEDING

P. CONDITIONING PROCEDURES

NOTE - It is important to condition the new linings after installation to obtain maximum service life and performance. The following procedures show when and how this should be done.

1. Apply brake pressure during high throttle static run up (Note: The RPM at creep, if any.)
2. Perform 2-3 high-speed taxi snubs to generate 300-400 degrees at brake pads and rotor by accelerating the aircraft to 30-40 mph. Remove power and apply firm braking pressure until slowed to 5 mph and release pressure. Do not bring aircraft to a complete stop during the taxi snubs. After accomplishing the snubs, do not drag the brakes. Allow the aircraft to roll as brake free as practicable until back to the tie down area. Avoid stopping the aircraft completely as much as practicable and park with brake pressure off.
3. Allow brakes to cool for 10-15 minutes.
4. Repeat step 1 and note RPM at creep if any occurs. There should be a noticeable increase in holding torque.
5. Repeat steps 1 through 3 if necessary.

NOTE - Forward movement of the aircraft while testing brakes, could be caused by skidding and not brake malfunction. Use caution when breaking heavy on aircraft with a tail-wheel as it could cause the tail to lift from the ground.

Conditioning removes high spots, and creates a layer of glazed material (shiny appearance) at the disk surface. Normal braking will produce enough heat to maintain glazing during the life of the lining. Glazing can be worn off during light use such as taxiing and occasional reconditioning may be required.

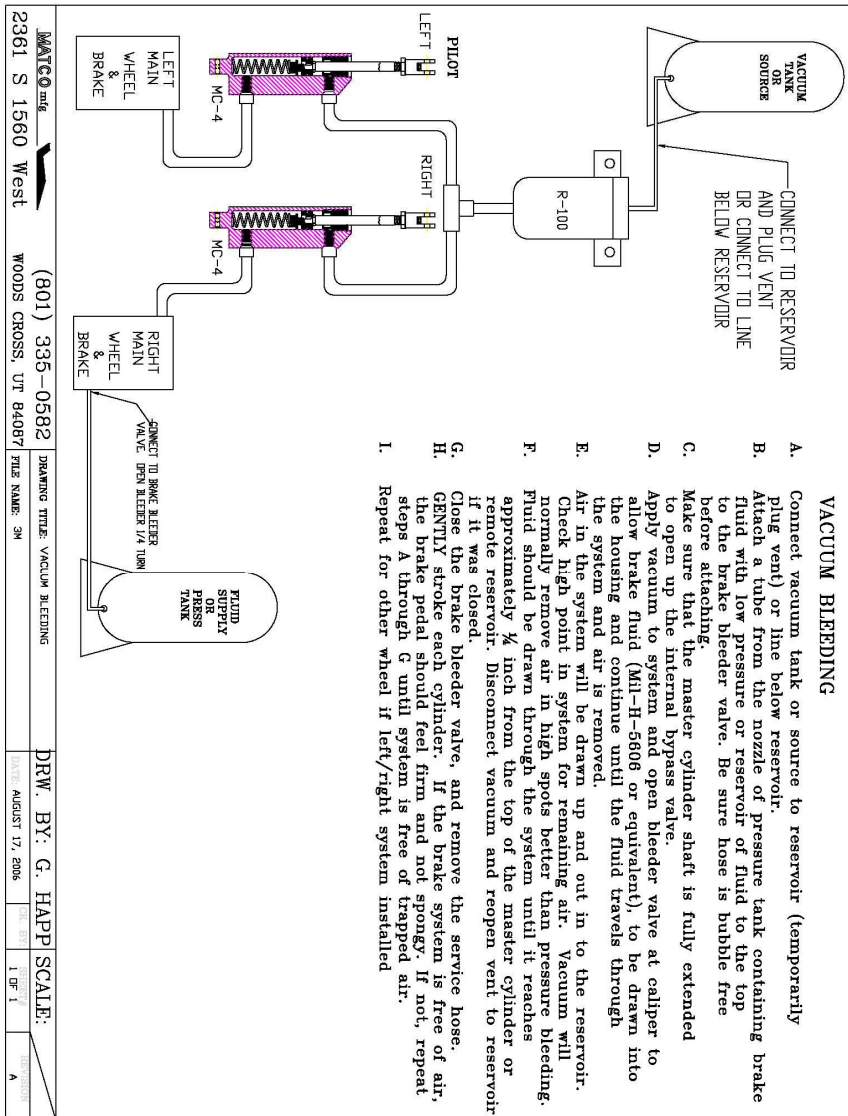


Fig. O-2 VACUUM BLEEDING

Q. MAXIMIZING BRAKE OUTPUT

GETTING YOUR PEDAL GEOMETRY RIGHT

BRAKE SPECIFICATIONS

All MATCO mfg. brakes have two specified ratings. The first is the energy rating which specifies the energy capacity of the brake. This value is used in selecting a brake that will be able to absorb the kinetic energy of the aircraft under the designers specified maximum energy condition (*generally maximum aircraft weight at a velocity above stall speed*). The energy rating is determined by the disc weight. Exceeding the energy capacity of a braking system leads to excessive disc temperatures. This can cause low friction coefficients and reduce brake torque and aircraft deceleration. Permanent damage to the disc can result in the form of warping or loss of corrosion protection.

BRAKE TORQUE

The second rating is for brake torque. The rated torque value is used to determine the deceleration and static torque for engine run-up that will be provided by the brake. A braking system using the same disc can have one energy rating and several torque ratings. This is possible by using different caliper configurations on the same disc. For example a braking system using a single caliper on a disc with a 189K ft-lb rating may have a torque rating of 1980 in-lb. The same braking system using two calipers would have the same energy rating of 189K ft-lb but would have a torque rating of 3960 in-lb. MATCO mfg. offers its customers a wide range of caliper configurations and disc sizes to allow for meeting both the energy and torque requirements of their aircraft.

The rated torque value assumes a nominally conditioned brake pad (see pad conditioning procedures section 'X'), rated pressure applied to the brake, free floating calipers, and pad contact on both sides of the disc. Brake pad conditioning allows a glaze to form on the pads and provides the highest friction coefficient and drag force.

MATCO mfg. Brake torque ratings are based on 450 psi applied pressure. Pressures below this value will generate proportionally lower torque. Pressures above this value will provide higher torque although pressures above 600 psi generally cause caliper deflections that reduce the torque increase. The torque rating assumes that all caliper force is used to squeeze the brake pads against the disc. If the caliper does not float freely, it is possible that only one side of the disc surface may be contacted resulting in 50% loss of torque.

GET THE PRESSURE RIGHT

Assuming the calipers are properly mounted so that the pads make contact on both sides of the disc (both new and worn) and are maintained so that the calipers float freely, the most common reason for under performance of the brakes is low pressure. MATCO mfg. Brakes need 450 psi to achieve their rated torque. Additional calipers can be added to get higher torque at lower pressures, but is often more weight efficient to modify the hydraulic system pedal geometry to generate higher pressures. Systems using hand or foot operated master cylinders require a minimum of 2.5 to 1 mechanical advantage when using master cylinder, MC, like the MC-4 or MC-5 which have .625 inch diameter pistons. (Systems using MC-4 or MC-5 with intensifiers have .500-inch pistons and require a 1.6 to 1 mechanical advantage). Mechanical advantage, MA, is the ratio of the force applied to the master cylinder shaft divided by the force applied by the hand or foot.

Dia. 1 shows two examples of pedal geometry. The first has an MA of 1 to 1 since the distance from the applied load to the pivot point is the same as the distance to the MC and is undesirable. The second shows a more favorable configuration that will easily provide the required pressure to the brakes with moderate toe force. It is often necessary to keep the foot pedal shorter than that shown in **Dia. 1**. An alternate geometry is shown in **Dia. 2**. This design would utilize a fork arrangement on the MC connection to allow clearance of the MC body and then a short linkage to the MC connect point. A design common too many aircraft uses linkage as shown in **Dia. 3**. This design also allows for a shorter brake pedal but has a major disadvantage. This linkage can be configured to have a proper MA

in the start position (with the master cylinder fully extended). The MA varies with rotation however, as shown in **Fig. 2 of Dia. 3**, a 15 degree rotation of the linkage reduces the MA at the start position from 1.5 to 1 down to only 1.12 to 1. In actual operation, this has the effect of causing a nearly constant brake torque even though increasing force is applied. For example, if the geometry is set for an initial MA 2.5 to 1. In the start position and the pilot applies pedal force, the MC will begin to stroke as pressure builds. As the rotation occurs, the MA decreases. If there is any air in the brake lines or if there are long brake line runs, hydraulic system expansion will occur as pressure increases requiring more MC stroke. If the pilot applies more pedal force, more MC stroke occurs, and the MA decreases further. Even though the pilot has now increased his pedal force, the force applied to the MC will be only marginally increased because more rotation will result and cause a further decrease in MA. A geometry like that in **Dia. 2** will provide the same reduced pedal height and is not prone to the effect of rotation since the MC is essentially connected to the brake pedal pivot. **Dia. 4** illustrates the benefit of pivot connect geometry during rotation. The MA remains virtually unchanged for expected rotation angles and results in a linear pressure increase with applied pedal force.

HEEL BRAKES

A common means of providing pilots with differential braking ability without resorting to a more complicated geometry of toe brakes is to use heel brakes. The same design requirements exist for the MA of a system using heel brakes as for toe brakes. It is not uncommon to see MC's configured to allow the pilot to apply heel force directly to the MC by means of a pad or button connected on the end of the shaft. This configuration is shown in **Fig. 1 of Dia. 5**. The MA of this system is 1 to 1 and produces very low pressure for reasonable heel force. Perhaps a larger concern however is the potential for causing damage to the MC. The MC is designed to accept loads applied along the length of the shaft. Loads applied off axis or perpendicular to the shaft cause bending moments in the MC shaft that it is not designed for. Damage to the MC end gland, or bending of the MC shaft may result if the off axis loads are high enough. A more desirable configuration for heel brakes is shown in

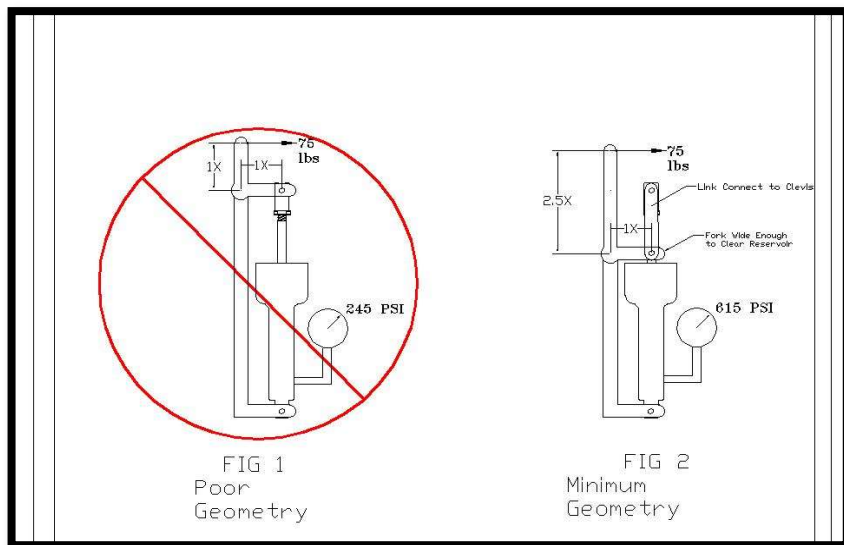
Fig.2 of Dia.5. This system uses a short linkage connected to the MC that provides the 2.5 to 1 MA while insuring that loads will be applied along the length on the MC and prevent any damage during actuation.

CONCLUSION

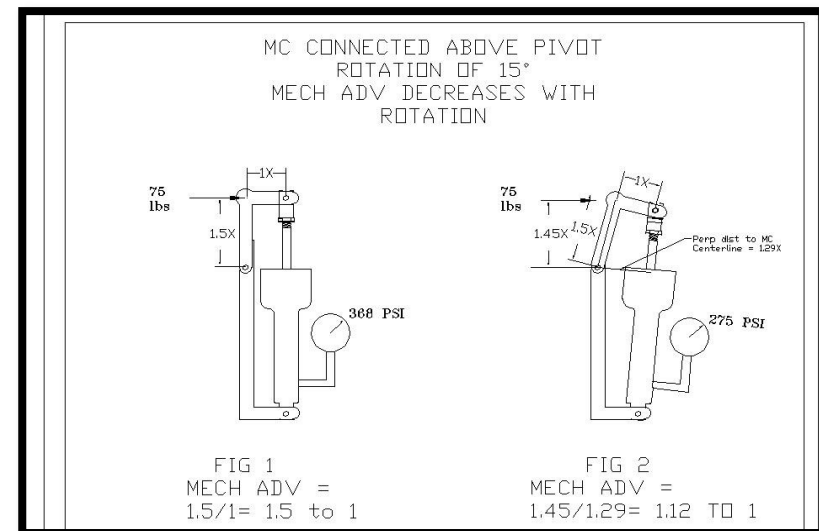
Like any system on an aircraft, the hydraulic system has many engineering options for providing the necessary requirements. The systems common on light aircraft must be engineered to provide adequate pressure to the brakes to achieve the rated torque.

| |
|---|
| <p>NOTE: MATCO mfg. Brakes require 450 psi to achieve their rated torque.</p> |
|---|

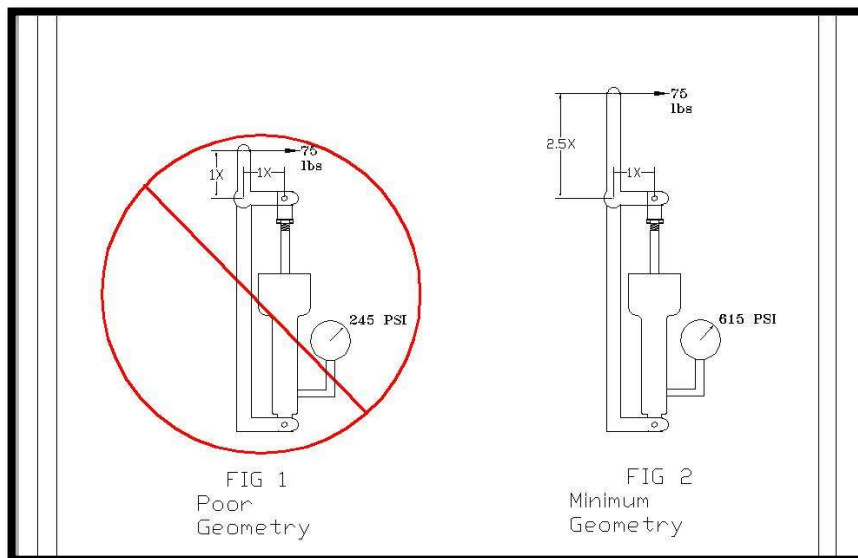
The pedal geometry whether hand, toe, or heel operated, requires a mechanical advantage of at least 2.5 to 1. This allows the pilot to easily generate the required 450-psi with moderate applied force. Pivot connected geometry provides the best means of accomplishing this requirement without the problem of rotational effect that reduces mechanical advantage.



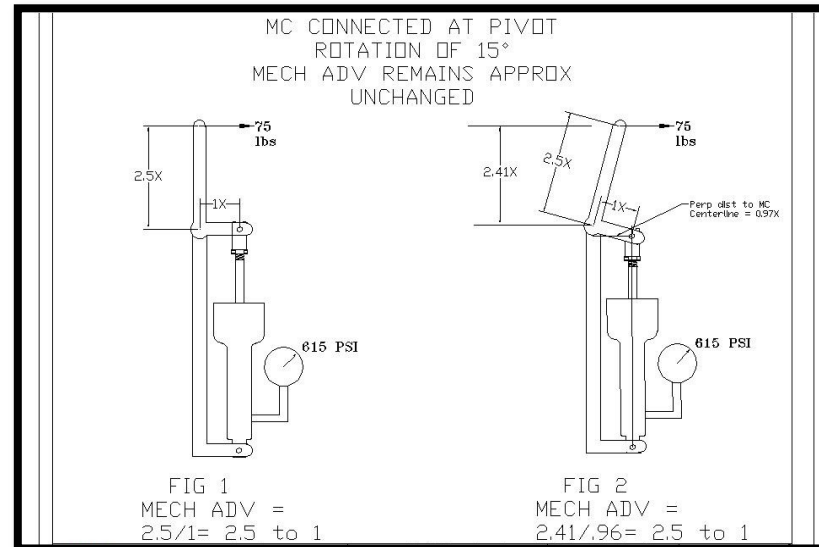
PEDAL GEOMETRY / POOR & MINIMUM
Dia. 1 Figures 1 & 2



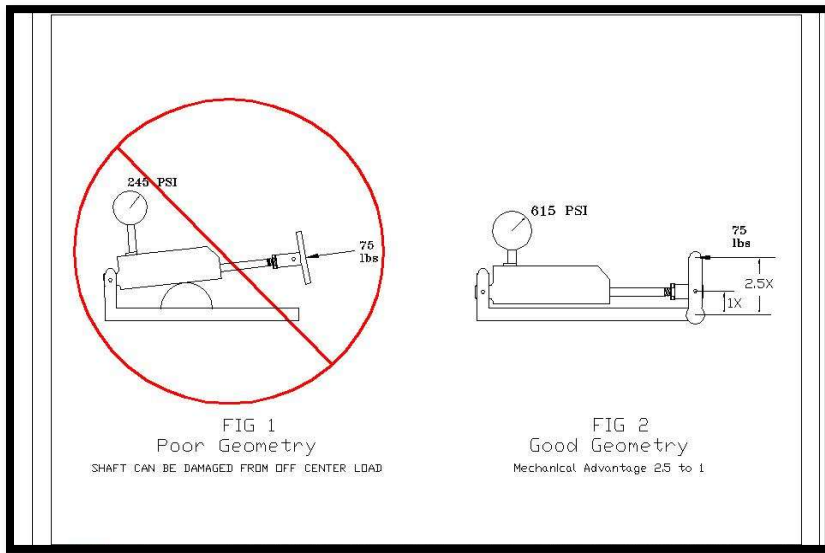
PEDAL GEOMETRY / MECHANICAL ADVANTAGE
Dia. 3 Figures 1 & 2



PEDAL GEOMETRY / POOR & MINIMUM
Dia. 2 Figures 1 & 2



PEDAL GEOMETRY / PIVOT CONNECT
Dia. 4 Figures 1 & 2



PEDAL GEOMETRY / HEEL BRAKES **Dia. 5 Figures 1 & 2**

R. LUBRICANTS

ELASTOMERIC COMPOUND LUBRICANTS

HYDRAULICS:

MIL-H-5606 / MIL-H-83282
Or equivalent (Red Oils)

NOTE: DOT 5.1 brake fluid is NOT compatible with MATCO mfg brakes, and will damage the Buna-N O-rings used in the system.

PETROLEUM LUBRICANTS

WHEEL BEARINGS:

MIL-G-81322
MOBIL 28
MOBIL SHC-100
AEROSHELL 22
Or equivalent lubricants

AMPHIBIOUS:

HCF Grease P/N 605
BG Products, Wichita, KS.

THREAD SEALANT

TAPERED PIPE THREADS

Loctite 567, or equivalent

S. TECHNICAL ASSISTANCE

TECHNICAL HOTLINE

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FAX: 801-335-0581

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