A NAVISTAR COMPANY

Diamondlife™ Disc Brakes Update II

Study Guide
TMT-040601

©2006 International Truck and Engine Corporation,
4201 Winfield Road, Warrenville, IL 60555.
All rights reserved. No part of this publication may be
duplicated or stored in an information retrieval system
without the express written permission of
International Truck and Engine Corporation.

INTERNATIONAL®

Study Guide
Diamondlife™ Disc Brakes Update II
TMT-040601

Table of Contents

Introduction 2
Brake System Component Overview 6
Special Tools 11
Brake System Inspection Considerations 13
Brake System Preliminary Inspection 15
Brake System Inspection 17
Caliper and Brake Pad R&R 22
Caliper Rebuilding 35

Diamondlife™ Disc Brakes Update: II

Introduction

In terms of importance and safety, there is no service that is more important than brake service. It goes without saying that good brake performance is critical for driver confidence.

"International® is committed to this ideal by providing continuous training updates as components evolve and continuously improve."

International® is committed to this ideal by providing continuous training updates as components evolve and continuously improve.

This edition of Diamondlife™ Disc Brakes focuses on brake system product improvements that went into production on June 3, 2002.

But this program doesn't just apply to the latest product. It is recommended that current product improvements be retrofitted into earlier product as well.

As with the previous edition of this program, this program covers Diamondlife™ pin slide brake system components, inspection, service procedures, special tools, caliper diagnostics, and caliper rebuilding, all with the latest engineering changes in mind. These procedures assure the customer of complete and proper repair for long lasting brake performance.

NOTES

NOTES

Section 1 Brake System Component Overview

"Hydraulic pin slide disc brakes are two-piston sliding caliper brakes and are used at both the front and rear wheels."

Hydraulic pin slide disc brakes are two-piston sliding caliper brakes and are used at both the front and rear wheels. The pin slide caliper disc brake is made up of four major components: the rotor, disc brake pads, caliper assembly, and anchor plate.

The brakes are powered by the Hydro-Max booster and master cylinder system. This system has two independent hydraulic fluids–brake fluid and power steering fluid. The Hydro-Max booster amplifies pedal force, and the master cylinder converts this force to hydraulic pressure for the brakes.

The **dual chamber master cylinder** also includes a pressure differential valve and brake warning light switch. These devices can sense a pressure loss in either chamber and alert the driver of a loss of function.

Each **caliper assembly** has two disc brake pads. One pad is mounted on each side of the rotor. They grip the rotor when hydraulic pressure forces the two hydraulic pistons outward in their bores.

The caliper is a one-piece casting with an internal fluid passageway between the two hydraulic piston bores. Each piston bore contains a piston, piston seal and piston boot.

The caliper assembly attaches to and slides on sealed pins located within the anchor plate. The terms “floating caliper” and “pin slide” brakes come from this design.

“The caliper assembly attaches to and slides on sealed pins located within the anchor plate. The terms ‘floating caliper’ and ‘pin slide’ brakes come from this design.”

This sliding feature of the caliper provides equal pressure to both the inner and outer disc brake pads. It also allows both pads to back away from the rotor when hydraulic pressure is released.

There are two different sizes of caliper assembly: 66mm and 73mm. These calipers can be used in the following combinations: 66mm front and rear; 66mm front, and 73mm rear; 73mm front and rear.

The caliper combination depends on the specific load rating for the vehicle. Never change caliper size in the field.

The anchor plate includes lubricated floating guide pins sealed by rubber boots. Brake pads ride on anchor

plate abutments protected by stainless steel slippers. Specific to the 73mm assembly, a separate tie bar, is used to strengthen the abutments during high-load braking. And finally, a splash shield mounted on the inboard side of the rotor helps protect the rotor wear surface from direct road contamination.

"The anchor plate is mounted on the steering knuckle flange on front axles and on the axle flange on rear axles."

The anchor plate is mounted on the steering knuckle flange on front axles and on the axle flange on rear axles.

The rotor is bolted to the wheel hub assembly. Cooling fins cast between the machined braking surfaces of the rotor allow air to flow between the rotor surfaces. The Antilock Brake System, or ABS tone wheel is cast on the inboard side of the rotor.

International® offers three different types of disc brake pads.

Replacement of the original equipment pad with the proper type of service pad is vital to system performance and pad life.

It's somewhat obvious that light-duty pads will wear out prematurely if they are used in a heavy-duty or severe service application.

But what may not be as obvious is that heavy-duty pads will also wear out

prematurely if they are installed in a light-duty application. Why? New brake pads go through a key initial wear-in phase, called burnishing. A complete burnishing phase is required for long life. So, if heavy-duty pads are installed in a light-duty application, there may not be not enough heat developed during the initial wear-in to burnish the pads for long life. In this situation the pads can wear out prematurely.

Current production heavy-duty disc brake pads are chamfered on the edges, and have lining code HX-7A1-EE. The pads are marked with an arrow and the word forward for proper installation. The arrow indicates rotor rotation for a forward moving vehicle. Brake pads are not interchangeable from inboard to outboard side on the same wheel.

The second type of pad is a heavy-duty pad with lining code 7610.

The pad is non directional and can be identified by its unique backing plate that is smooth and free of dimples.

This pad is constructed of a softer composite material that reduces rotor wear.

The third type of pad is a light-duty pad with lining code HX-402-EE.

⚠ CAUTION:

With certain directional replacement brake pads the inboard and outboard disc brake pads are not interchangeable. The word "FORWARD" and the "ARROW" markings on the brake pad backing plate show forward rotational direction of the rotor. The arrow MUST point in the forward rotor rotational direction.

"Brake pads are not interchangeable from inboard to outboard side on the same wheel."

This pad is only intended for use under the following service situations (all must apply):

- The gross vehicle weight rating is 25,999 lbs. or less.
- Operation is on level or rolling terrain, not mountainous.
- For at least 50 percent of the operating time, the vehicle weight is under 70 percent of its gross vehicle weight rating.
- There is no continuous stop and go operation for the majority of the vehicle's operating time.

The pin slide brake system operates with the two pins being identified as **leading** and **trailing**. The leading pin is always the entry point of the caliper by rotation of the rotor in the forward direction. The trailing pin is always the exit point of the caliper by the rotation of the rotor in the forward direction.

"Understanding the difference between leading and trailing is important when reattaching the caliper housing onto the slide pins."

Understanding the difference between leading and trailing is important when reattaching the caliper housing onto the slide pins. It is important for two reasons: first, one pin is designed specifically for the leading position while the other is designed specifically for the trailing position; second, there is a required order for tightening of the pin bolts. Always tighten the leading guide pin bolt first.

Special Tools

There are a few special tools that are required to properly inspect and service brake components. The following is an overview:

- A magnetic-based dial indicator. This is used to check wheel-bearing end play. It is also needed to measure caliper radial free play.
- A brake rotor micrometer. The micrometer is necessary to measure the rotor both for adequate and consistent thickness.
- A plumber's 3/4-inch wire brush.
- A hand vacuum pump with a brake bleed adaptor is used to provide an effective means of bleeding the brakes after a caliper has been replaced.
- A small hand grease gun for dispensing Shell Albida PPS-1 grease. This will keep the grease from becoming contaminated.
- Both a 2-inch and a $2^1/_2$-inch solid wood block are required when checking for sticking caliper pistons.
- A syringe for the removal of excess brake fluid from the master cylinder.

Section 2

"There are a few special tools that are required to properly inspect and service brake components."

"For caliper rebuilding, a small fine wire brush, a wood block, and the appropriate size piston and boot installation tool are all needed."

- A flat piece of steel at least 1/4-inch thick and a C-clamp are both needed. These tools are used to push the caliper pistons back into the piston bores.
- For caliper rebuilding, a small fine wire brush, a wood block, and the appropriate size piston and boot installation tool are all needed.
- Safety glasses are required when doing work of any kind.

Brake System Inspection Considerations

Keep in mind that when performing service of any kind on Diamondlife™ pin slide brake systems, a complete inspection must be performed.

A good inspection starts with a thorough review of the customer's concerns. Always consult the service writer's notes and review all available information concerning operational symptoms.

It is difficult to determine an exact maintenance schedule for medium duty vehicles since they will be used in a wide variety of operational applications and conditions.

Vehicles operating under severe conditions, such as frequent stop-and-go driving or vehicles that are always fully loaded, will require more service maintenance checks than vehicles which are used over the road. Therefore, a regular schedule for periodic inspection should be established based on past experience, type of operation, and driver habits.

Except for servicing, disc brakes do not require any planned adjustment. By design the pistons automatically

Section 3

"Keep in mind that when performing service of any kind on Diamondlife™ pin slide brake systems, a complete inspection must be performed."

compensate for pad wear to maintain the correct running clearance.

"As a reminder, be sure that the two different hydraulic fluids used in the Hydro-Max booster and master-cylinder system are kept separate."

As a reminder, be sure that the two different hydraulic fluids used in the Hydro-Max booster and master-cylinder system are kept separate. Only add power steering fluid to the power steering pump reservoir, and only add brake fluid to the master-cylinder reservoir.

As we will see in the diagnostics portion of this program, it is critical that power steering fluid is not introduced into the brake system and vise versa. If this happens, the affected system would require extensive flushing and component replacement.

⚠ CAUTION:

All International® vehicles equipped with hydraulic disc brakes are equipped with a Hydro-Max brake booster and master cylinder system. This system has two independent hydraulic fluids. The two fluids are NOT compatible and if mixed, severe damage will occur to the contaminated components.

Wheel-Bearing Adjustment

It is important to the operation of disc brakes that proper wheel bearing adjustment be maintained to limit excessive lateral run out of the disc brake rotors.

Section 4

Brake System Preliminary Inspection

As we begin brake system inspection, diagnostics, and repair, keep in mind that proper service techniques, environmental concerns, and safety are the most important parts of the process.

Perform service inside a well ventilated, dry shop. Make sure the vehicle is parked on a flat surface, with the parking brake set and the wheels blocked.

"Perform service inside a well ventilated, dry shop."

When working on the brake system keep the work area and tools as clean as possible. Also, clean all connections or fittings before disconnecting or removing components. Use a suitable pan to catch any fluid when disconnecting components.

⚠ WARNING:

A jack must never be used alone to support a vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support the vehicle with suitable jack stands.

A jack must never be used alone to support a vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support the vehicle with suitable jack stands.

All brake component and hydraulic line openings should be immediately plugged during removal and remain so until reinstallation to prevent the entry of dirt, moisture and other foreign material.

"Wear safety glasses when performing work of any kind."

Even the slightest particle can cause unexpected problems within the brake system.

Wear safety glasses when performing work of any kind.

Brake System Inspection

Section 5

First, check the brake system for any signs of leaks. Leaks are evident by a wet appearance. Inspect the Hydro-Max Booster, Master-cylinder, ABS unit, hoses, and disc brake calipers.

Next, check for fluid contamination at the master-cylinder by inspecting the reservoir cap gaskets for swelling. When brought into contact with mineral or petroleum based oils, the rubber components in the brake system will exhibit substantial swelling, often exceeding 125 percent of their original size. A swelled cap gasket makes contamination very obvious.

Do not mistake silicone floating on the surface of brake fluid as contamination. If present, it will appear as a whitish substance floating in the master-cylinder reservoir.

“Do not mistake silicone floating on the surface of brake fluid as contamination.”

The silicone grease is used in the original assembly process. This silicone material has the consistency of a light grease and can migrate to the master cylinder reservoir. Since the silicone is lighter than the brake fluid, it floats on the surface of the brake fluid and is often mistaken as “foreign matter” or contamination. The presence of the

silicone is normal and does not affect operation of the master-cylinder.

If the reservoir cap gaskets are swollen, you need to drain and flush the system. Then, replace the master cylinder, hoses, calipers, and the ABS hydraulic control unit. Next install new brake fluid. Finally, bleed the system.

"Check for excessive power steering flow by starting the engine and looking for brake pedal drop."

Check for excessive power steering flow by starting the engine and looking for brake pedal drop. If there is excessive flow, the pedal will drop 1 to 2 inches. If this is found you will need to perform a power steering system flow and pressure test. Refer to group five entitled "Steering" in ISIS® for service procedures.

Verify that the brake pedal moves back and forth freely without binding. Check that the clevis pin can be rotated freely by hand. Check that no pedal force is exerted on the booster by verifying that the pedal rod can be pulled to the back of the booster input plug. There should be about 1/16-inch free travel.

If nothing is found at this point, raise the vehicle, and support it with proper jack stands.

Turn each wheel to check for unusual drag forces. If a wheel doesn't rotate

freely and brake drag is found, loosen the caliper bleed screw at the wheel end and look for a fluid spurt indicative of trapped pressure between the ABS unit and the wheel end or a crimped brake line or hose.

Examine the brake hoses and tubing for kinks, bends, and any other apparent damage. If no problems are found at this point, check for trapped pressure between the ABS unit and the master cylinder. Do this by loosening the brake fitting at the master cylinder. If nothing is found, bleed the brakes. Refer to group four entitled “Brakes” in ISIS® for the service procedure.

“Examine the brake hoses and tubing for kinks, bends, and any other apparent damage.”

After this procedure, if a wheel still exhibits brake drag, remove the rim and tire assembly.

NOTES

NOTES

Section 6 Caliper and Brake Pad R&R

Remove the hex nut and lock washer. Lift the brake line retaining clip off the threaded stud on the steering knuckle hose support bracket. This will allow the brake line hose to hang free.

"Cut and remove any TyRap® straps that support the ABS cable to the brake hose."

Cut and remove any TyRap® straps that support the ABS cable to the brake hose.

Remove the hex head bolt and the brake line retaining clip from caliper. This will allow the brake line hose to hang free while removing the caliper to replace the disc brake pads.

⚠ CAUTION:

If it becomes necessary to cut any of the TyRap® straps to remove the caliper, note the location of the TyRap® strap before cutting it off, so it can be replaced in the proper place after service is completed.

Remove the caliper mounting bolts and remove the caliper. Do not allow the brake line hose to become pinched or kinked. Visually inspect for heat damage, which will exhibit a whitish-blue to reddish ash appearance. Secure the caliper so that it does not hang by the brake hose.

Remove inboard and outboard disc brake pads from the anchor plate. Visually inspect for tapered pad wear, pad swell, heat damage, or pad corrosion.

Tapered pads will be thicker on one end in comparison with the other.

Typically, if pad thickness varies more than .080 to .100 of an inch, the pads should be replaced.

Swollen pads will have a bulging appearance that if present should be replaced.

"Swollen pads will have a bulging appearance that if present should be replaced."

The presence of a dusty appearance is normal due to the wear of the pad.

Pads with heavy corrosion have a rusty flaking condition around the perimeter of the pads. If this extends more than about 1/4-inch from the edge, or if there is less than 80 percent of the pad face remaining, or if there is separation of the pad from the shoe plate, then replacement is necessary.

If disc brake pads are not rusted, but simply eroded or pitted, they need not be replaced until any erosion or pitting becomes excessive These conditions are a normal characteristic of semi-metallic pad lining material. Should erosion reduce the polished contact area to less than 80 percent of total original surface area, replace the pads.

Disc brake pads must be replaced if contaminated by oil, grease or other foreign material which cannot be easily removed with a clean rag. Disc brake pads should never be cleaned with a solvent in an attempt to reuse them.

"If the pads are in good condition, measure pad thickness."

If the pads are in good condition, measure pad thickness. If pad thickness at the thinnest point appears to be 3/16-inch or less, the pads must be replaced. Or if the wear indicator grooves can no longer be seen, the pads will need to be replaced.

Inspect for excess run-out. Wheel bearing specified end play of .001-inch to .005-inch is most important. Check wheel bearings for wear or damage when servicing brakes.

Next is rotor inspection and service. Rotors either need to be replaced with a new rotor or they need to be machined to restore the surface.

First, check for cracks. Except for small surface cracks in the middle of the wear surface, any other cracks indicate a need for replacement.

⚠ CAUTION:

Rotors should only be turned by someone experienced with a brake lathe.

Check the ABS tone ring for corrosion. Some corrosion can be tolerated. However, if the tone ring teeth are starting to flake off, or if the machined edge of the teeth is deteriorated, the rotor needs to be replaced.

Scoring, Warping, Bluing, Heat Spots, Etc.

Check for scoring, warping, bluing, heat spots or other damage. If signs of damage are found, the rotor needs to be replaced.

Next, measure the rotor at four evenly spaced locations around the rotor to be sure the thickness is consistent and within minimum specification.

The minimum rotor specification will be cast into the rotor. This rotor is 1.320-inch.

Next compare your measurements to the minimum specification. This rotor measures 1.434-inch.

If the rotor is within specifications but has minor surface wear, it may be possible to machine the rotor to restore the rotor surface.

To machine the rotor, it must be removed from the vehicle. To do this, remove the wheel bearing retaining nut lock, retaining nut, and rotor assembly.

Visually inspect the calipers for brake fluid leakage. Check for damage to the pistons or piston boots. The molded steel piston cap should be

⚠ CAUTION:

After the brake rotor has been machined, the bearing area must be cleaned to ensure that all metal shavings from the machining process have been completely removed.

⚠ CAUTION:

Wheel bearings should always be thoroughly cleaned, inspected, and repacked with grease before reinstalling. Never reuse an axle wheel seal–always replace with a new seal.

"Visually inspect the calipers for brake fluid leakage."

perfectly flat. If there is leakage or damage, the caliper will need to be rebuilt or replaced. Caliper rebuilding will be covered in Section Seven of this program.

⚠ CAUTION:

Fluids have a way of winding up on parts other than where the actual leak is located. Always find the source of the leak before proceeding.

As the lining wears on disc brake pads, it is normal for the brake fluid level in the master-cylinder reservoir to gradually lower. Before servicing the calipers, inspect the fluid level. If the fluid level is at or near the proper fluid level, yet the brake pads are considerably worn, remove some brake fluid from the reservoir using a syringe.

⚠ CAUTION:

Discard used brake fluid according to your local environmental regulations. Never reuse brake fluid.

When the pistons are pushed back into the caliper piston bores the brake fluid will be pushed back into the reservoir. It may overflow if fluid is not removed.

Discard the used fluid removed from the master cylinder.

⚠ WARNING:

A proper sized block must be secured to the caliper. This will prevent the pistons from becoming dislodged from the cylinder which would require caliper rebuilding or replacement.

Using a C-clamp and a flat piece of steel, push the pistons back into the caliper. Check that the master-cylinder compensation valves allow fluid to flow freely back into the reservoir.

If pistons don't return easily, apply light pressure to the C-clamp screw. Check for obstruction in the lines by loosening the caliper bleed screw. If the

pistons return easily once the caliper bleed screw is loosened, inspect the lines for damage and replace damaged lines.

If the pistons don't return freely after the bleed valve is opened you must check for sticking pistons.

To check for sticking pistons, insert a 2-inch thick wooden block for 66mm calipers, and a $2^1/_2$-inch thick wooden block for 73mm calipers. Make sure the block is long enough to fully cover both pistons in the caliper.

Pump the brakes gently with your hands two or three times and check that the pistons extend freely until they contact the block.

Once the pedal is released, the block should be able to be removed easily. If not, the caliper should be rebuilt or replaced.

Make sure the piston boots are properly seated. A properly seated boot has its O-ring shaped bead located in the piston boot groove.

Also, the accordion style folds of the boot should be evenly nestled with no fold sticking above the other.

⚠ WARNING:

Piston movement may be hazardous. Do not attempt to hold the caliper during the following procedure. Serious personal injury could result. Be sure that the area around the caliper being tested is clear

⚠ WARNING:

Only apply light pressure to the pedal with your hand during the following procedure. Too much pressure will cause dangerous levels of outward piston force.

"If the boots are not seated or are damaged, the caliper will need to be rebuilt or replaced."

If the boots are not seated or are damaged, the caliper will need to be rebuilt or replaced. Caliper rebuilding will be covered in Section seven of this program.

If the piston and boots check out OK, push the pistons back into the caliper using a C-clamp and a flat piece of steel. Recheck the boot seal.

Remove the guide pins.

First, if the leading and trailing pins are the same, this indicates that the pins were produced before June 3, 2002. It is recommended that these pins be replaced with new pins when reassembling the caliper.

Second, if the existing pins are dry or have a rust build up, they must be replaced regardless of their apparent condition. The anchor plate must be checked for wear.

Third, if the pins are different, (for example the trailing pin includes a bushing, and the caliper to pin retaining bolts are fine thread) this indicates that the pins were produced after June 3, 2002. If these pins are still lubricated and free of rust, they can be inspected and reused if in good condition.

If the pins are current production pins and they appear to be properly lubricated, clean the leading pin with brake clean and dry it with compressed air. Clean the trailing pin with soap and water and dry it with compressed air.

"If the pins are current production pins and they appear to be properly lubricated, clean the leading pin with brake clean and dry it with compressed air."

Don't clean the trailing pin with brake clean. It will cause damage to the bushing.

Inspect the pins for wear. If wear is detected, the pins must be replaced.

⚠ CAUTION:

When using compressed air, use an air supply that is completely free of oil and moisture.

Finally, test thread each pin and bolt–if the bolts don't thread easily by hand, replace the bolt, pin, or both.

Never attempt to use a tap to clean pin threads; the tap will destroy the machine rolled threads.

Keep in mind that current production pins are not interchangeable–the trailing pin has a unique bushing, and as such must always be properly installed in the trailing position.

"Keep in mind that current production pins are not interchangeable–the trailing pin has a unique bushing, and as such must always be properly installed in the trailing position."

On some rear axle-spring combinations there may not be enough clearance to remove the top guide pin. If this is found DO NOT cut the guide pin or notch the spring to remove or install the pin. The anchor plate will need to be taken loose to remove and install the guide pin.

⚠ CAUTION:

Never cut a guide pin or notch a spring to remove or install a guide pin. If the guide pin will not come out, the anchor plate will need to be taken loose.

Remove the guide pin boots.

Then, remove the brake pad abutment slippers from the anchor plate by lightly tapping with a blunt nose drift. Be careful not to damage the brake pad abutment.

Clean the anchor plate with a wire brush and visually inspect for worn or damaged brake pad abutments. If there are signs of wear, damage or defects the anchor plate should be replaced. Refer to Group 4, entitled “Brakes” in ISIS for the service procedure.

Clean the guide pin bores with brake clean and dry them with compressed air. Using a wire brush, clean the guide pin bores. Rinse them with brake clean, and dry with compressed air.

Then, inspect for wear. If wear is indicated, the anchor plate can be checked by installing the caliper with new pins and measuring radial free play. This is done by mounting a dial indicator in the center, outboard side of the caliper and moving the caliper up and down by hand. The anchor plate is within specification as long as the movement is below 35-thousandths of an inch.

If the anchor plate is not within specification, it must be replaced. Refer

to Group 4, entitled “Brakes”, in ISIS® for the service procedure.

Wash the guide pin boots with soap and water and dry them with compressed air. If the boots are torn or damaged replace them.

“Wash the guide pin boots with soap and water and dry them with compressed air. If the boots are torn or damaged replace them.”

Do not attempt to wash guide pin boots with brake clean or any type of solvent.

If the rotor was removed for replacement or machining, reinstall the rotor at this time.

Refer to Group 2 entitled “Front Axles” and Group 14 entitled “Rear Axles” in ISIS® for the service procedure.

Adjust the wheel bearings before the tire and rim are reinstalled.

Evenly lubricate each guide pin and bore with Shell Albida PPS-1 grease part #2585384C1.

⚠ CAUTION:

When replacing disc brake pads, be sure to use the same lining material type on both axles. Mixing lining types can result in unbalanced braking and pad wear.

Never use anti-sieze lubricant on any pin slide component. Anti-sieze lubricants do not meet Diamondlife™ pin slide brake requirements because they don’t remain stable under high guide pin pressures.

Install the guide pin boots. Install the leading guide pin in the leading position

on the anchor plate. Install the trailing guide pin in the trailing position on the anchor plate.

It is recommended that all disc brake pads be replaced at the same time since this will maintain balanced braking of the vehicle. If complete replacement is not desirable, be sure that all disc brake pads on the same axle are replaced at the same time. The brake pads come in axle sets.

When replacing pads, always replace the anchor plate abutment slippers supplied with the new pads.

Rotate each of the pins so that the flat of the pin flange is parallel with the flat surface of the nearest pad abutment. This provides caliper installation clearance.

"Make sure both caliper pistons are fully bottomed into the caliper piston bores to provide clearance for new disc brake pads before the caliper is reinstalled."

Position the inboard and outboard disc brake pads onto the anchor plate pad abutment slippers with the friction material facing toward the rotor.

Make sure both caliper pistons are fully bottomed into the caliper piston bores to provide clearance for new disc brake pads before the caliper is reinstalled.

Prepare the caliper for installation by verifying that the guide pin caliper ear

mounting surfaces are clean and dry. It is very critical that these surfaces stay clean and dry to assure proper torque during final assembly.

Carefully install the caliper. Use care when positioning the caliper over the disc brake pads, rotor, and guide pins to avoid tearing, cutting, or dislodging the piston boots or the guide pin boots.

Don't allow the brake line hose to become twisted, pinched, or kinked.

Install the leading and trailing guide pin bolts by hand. Again, it is critical that the bolt threads and flange area be kept dry and free of any type of lubricant to achieve proper torque. Never use products such as anti-sieze in these areas.

⚠ CAUTION:

Before reinstalling the bolts, apply a small patch of liquid Loctite® 2440 to the shaded area indicated below.

"Current production guide pin mounting bolts can be used up to four times."

Current production guide pin mounting bolts can be used up to four times. However, if in question, replace the bolts.

Torque the leading guide pin bolt first, then the trailing guide pin bolt. The proper torque is 100 foot-pounds. It is critical that the bolt be torqued in a smooth and complete 45 degree sweep.

Position the brake line retaining clip on the caliper, install the hex head bolt,

and tighten it. Position the brake line retaining clip over the threaded stud on the steering knuckle hose support bracket. Make sure the brake line hose is not twisted, pinched, or kinked. Install the hex nut, lock washer, and tighten the nut.

CAUTION:

If any of the TyRap® straps were cut off during disc brake pad replacement, install the new TyRap® straps in the proper places after the caliper and the brake line hose have been secured.

If any of the TyRap® straps were cut off during disc brake pad replacement, install the new TyRap® straps in the proper places after the caliper and the brake line hose have been secured.

Recheck the brake fluid level and add fluid as needed.

Reinstall the rim and tire assembly.

Caliper Rebuilding

Section 7

Disassembly of Caliper Components

With the caliper removed, begin by inspecting the caliper casting for any visible damage. If there is casting damage, don't rebuild the caliper– replace it.

Remove the protective plug from the caliper inlet port.

Place a block of wood between the caliper and the caliper pistons. Leave approximately 2 inches of clearance between the caliper pistons and the block of wood.

Using a rubber tipped air nozzle, insert the nozzle into the hydraulic line inlet port of the caliper and apply light air pressure. This will push the caliper pistons out of the caliper piston bores.

Remove the block of wood and remove the pistons from the caliper.

Discard the old pistons; don't reuse them.

Remove each piston boot from each piston bore by prying them out with

⚠ CAUTION:

When using compressed air, use an air supply that is completely free of oil and moisture.

⚠ WARNING:

Use just enough air pressure to ease the pistons from the caliper bores. Keep your hands out of the area between the piston and the caliper to avoid personal injury. If high pressures are applied, the piston may pop out with considerable force. Also be careful to avoid the spray of brake fluid.

a small flat bladed screw driver. Be careful not to damage the piston bores.

Discard the old boot seals; don't reuse them.

Using a nonmetallic pointer, such as a blunt plastic stick, remove the piston seal from inside each piston bore.

"Discard the old piston seals; don't reuse them."

Discard the old piston seals; don't reuse them.

Clean each piston seal and piston boot groove area with a small fine wire brush.

⚠ WARNING:

If the caliper pistons are seized or cocked and do not come out, release air pressure and use a soft hammer to rap sharply on and around the end of the pistons. Then re-apply air pressure to remove the pistons.

Using a hand held wire brush, clean the machined surfaces of the caliper that are in contact with the guide pin heads, brake pads, and pin bolt flange.

Next, remove the brake bleed screw.

Clean the caliper, passages, and piston bores with brake clean. Use compressed air to dry the caliper.

Use 320–400 grit emery cloth to lightly sand the piston bores to remove any surface build up.

Never use a hone to clean piston bores.

Once again rinse the caliper, passages, and piston bores with brake clean. Use compressed air to dry the caliper.

Visually inspect the caliper piston bores, piston seal, and piston boot grooves. Make sure they are free of foreign matter, pitting, scoring or corrosion. If damage or defects are found, the caliper will need to be replaced.

"Visually inspect the caliper piston bores, piston seal, and piston boot grooves."

Assembly of Caliper Components

International® parts caliper-rebuild kits come complete with new pistons, piston seals, boot seals, and Batco grease.

Install the piston boot over the top end of the piston. Carefully pull the piston boot down until the inner bead of the boot is seated in the piston boot groove and the boot flange faces the cap of the piston. Pull the boot down and then back up. Inspect that the boot bead is properly seated.

Return the boot to the collapsed or folded position. Finally, make sure the boot bead is fully seated in the piston boot groove by grasping the piston boot flange and turning the piston.

Next, pour some brake fluid into a clean container.

Using new piston seals, dip them in clean hydraulic brake fluid and install them in the piston seal groove of the caliper piston bore.

"With the piston seal positioned in the groove, gently work around the groove with your finger until the seal is properly seated into the groove. Be sure the seal is not twisted or rolled."

With the piston seal positioned in the groove, gently work around the groove with your finger until the seal is properly seated into the groove. Be sure the seal is not twisted or rolled.

Apply a bead of Batco grease to the caliper bore seal land between the piston boot and seal grooves. Apply the grease around the entire circumference of the caliper bore seal land.

Apply clean hydraulic brake fluid to the outside of the caliper piston, and carefully position the piston with the piston boot into the caliper piston bore.

Position the piston and boot-installation tool on top of the piston so the word "boot" is on the bottom side toward the piston.

Using a C-clamp, gently push the piston into the bore. Avoid cocking or binding the piston during installation. If force is required to push the piston into the bore, stop and realign the piston to the bore. Keep in mind that the piston

may need to be realigned a number of times before it will seat properly. Continue pushing the piston and the piston boot into the piston bore until they are fully seated into the caliper. The piston should move into the bore very smoothly and with very little force.

Remove the C-clamp. Make sure that the piston boot flange rings are fully seated into the top groove of the piston bore. Wipe away any excess Batco grease.

"Make sure that the piston boot flange rings are fully seated into the top groove of the piston bore. Wipe away any excess Batco grease."

Install the bleeder screw and protective plug.

This concludes the caliper rebuild procedure.

If all of these procedures are carefully followed, you'll minimize problems and maximize customer satisfaction. You'll also give the customer the confidence and security they expect and deserve.

NOTES

NOTES