MAINTENANCE INFORMATION

Mi 97-13

DATE: August 1997	**SECTION: 12**
SUBJECT:	**Knorr-Bremse Brake Calipers**

APPLICATION:

Model	VIN 
H3-41, H3-45 and VIP-45 Model Year: 1994 and up	From 2P9H33404R1001020
All XL Series Vehicles Model Year: 1996 and up	From 2PCM33496T1025873

DESCRIPTION

On the above-mentioned vehicles equipped with Knorr-Bremse brakes, use the following procedure for brake calipers servicing. The procedure must be followed to ensure that only needed repairs or replacements are performed on calipers.

Due to the fact that some vehicles experienced cracked rotors, Allied-Signal, Knorr-Bremse and Prévost's Engineering Department performed numerous tests and concluded that cracked rotors were not necessarily due to defective rotors, it is a combination of three factors: Sticking calipers, small clearance between rotor and pad and possible trapped air pressure in the brake chamber.

Note: *If you have experienced a hot brake or cracked rotor, perform the following procedure before replacing the rotor to ensure that the problem is properly solved.*

PROCEDURE

Warning: *Park vehicle safely, apply parking brake, stop engine and set battery master switch(es) to the OFF position prior to working on the vehicle.*

IMPORTANT: IT IS NECESSARY TO FOLLOW THIS GUIDELINE, IN PROPER SEQUENCE, IN ORDER TO DETECT CAUSE FOR HOT BRAKES OR CRACKED ROTORS.

1. CHECKING THE PRESENCE OF RESIDUAL PRESSURE

To check if there is any residual air pressure at the brake chamber, make four or five brake application, then try to turn the wheel manually, if the wheel does not turn, use a wrench to crack the air line and listen for trapped air in the brake chamber then try to turn the wheel manually again. If you can observe trapped air in the brake booster, ensure that all pneumatic components in the braking system are functioning properly.

Note: A residual pressure of 2-3 PSI in the system is sufficient to prevent the brakes from releasing. Also the stop light switch can operate with as little as 1 PSI, therefore an illuminated brake light does not mean brakes are dragging.

2. PAD TO ROTOR CLEARANCE INSPECTION

Remove clip and washer (26 & 45), push down retainer bar (11), pull out pin (44) and remove retainer bar. Push caliper toward actuator (center of vehicle) for maximum clearance.

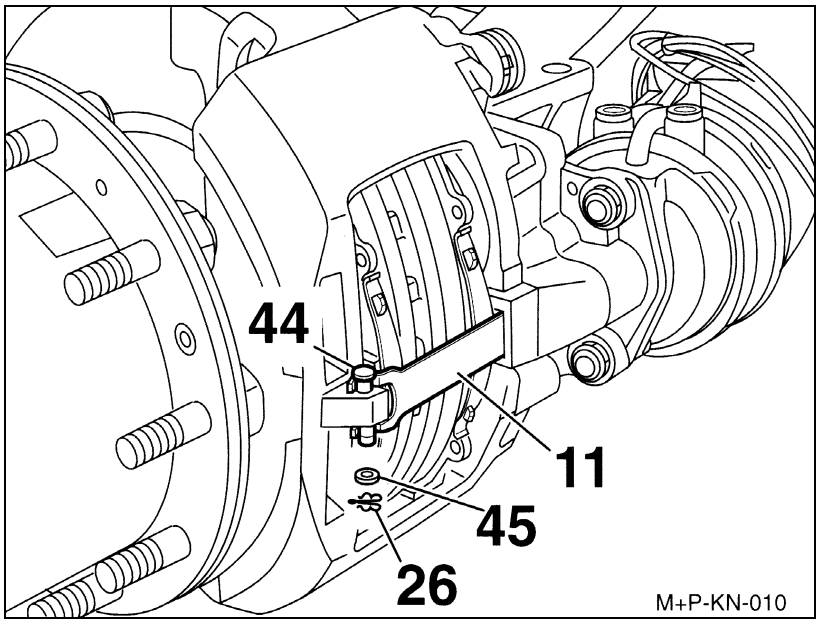

FIGURE 1: CLEARANCE INSPECTION 12119

MEASURE PAD TO ROTOR CLEARANCE

Place a long feeler gauge (long enough to measure across entire tappet surface) between the tappet and the backing plate of the pad, measure clearance at both tappets. Clearance should range between 0.020 and 0.035 inch (0.5 mm and 0.9 mm), with a maximum difference between tappet measure-ments on same brake of 0.008 inch (0.2 mm).

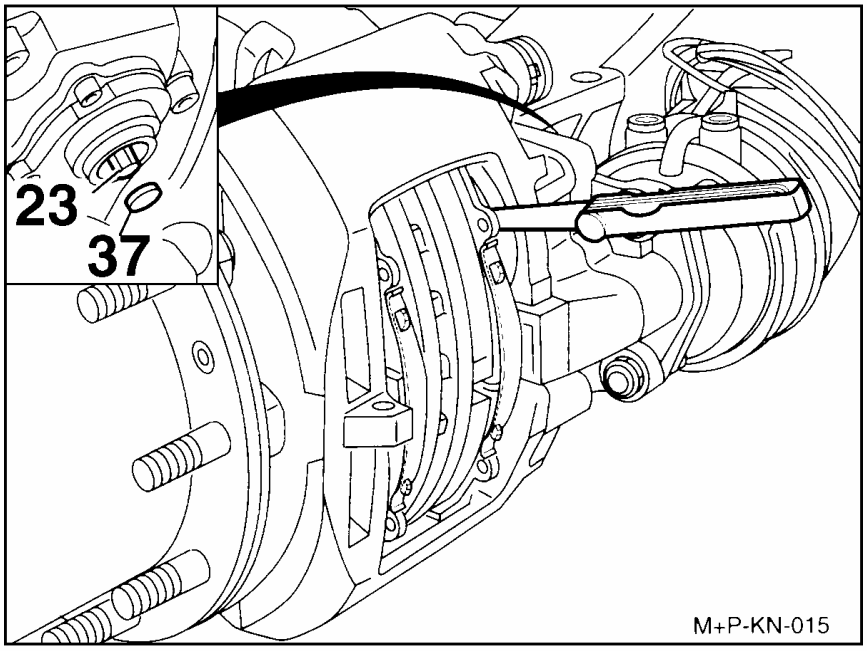

FIGURE 2: RUNNING CLEARANCE 12116

3. CHECKING THE ADJUSTER

Warning: *Use only a standard box wrench on the adjuster hexagonal pinion. Do not overtorque the pinion as overtorquing will damage the pinion.*

a. Remove cap (37).

b. Using a box wrench (8 mm), turn the adjuster pinion (23) counterclockwise about 2 - 3 clicks to increase running clearance. By operating the braking system about 5 - 10 times (30 PSI or 2 bar), the wrench should turn clockwise in small increments if the adjuster is functioning correctly (fig. 3 and 4).

Note: *With increasing number of applications, the incremental adjusment will decrease.*

c. In case of malfunction, i. e. the pinion or box wrench:

i) does not turn
ii) turns only with the first application
iii) turns with every application forward or backward.

In any of these cases, the automatic adjuster has failed, the caliper has to be replaced. In such cases the brakes can be adjusted manually to run a short distance.

d. Take the box wrench off. Replace the cap and check for proper sealing.

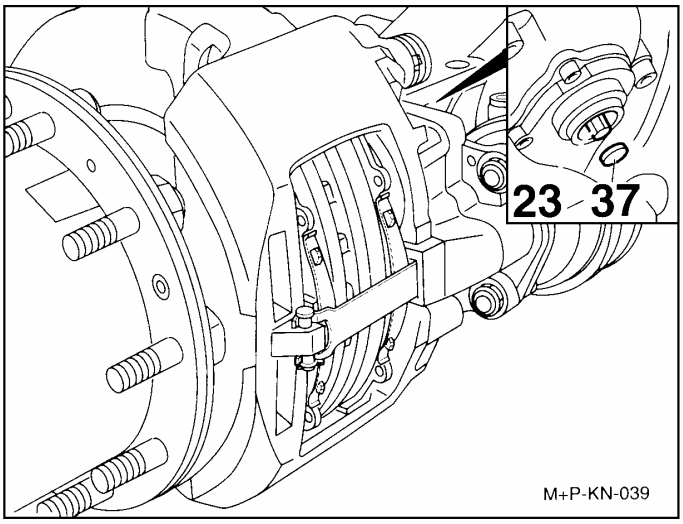

FIGURE 3: ADJUSTER PINION 12120

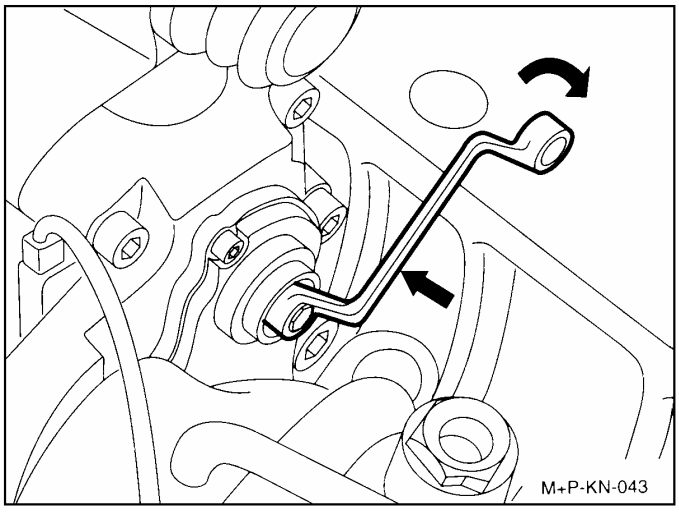

FIGURE 4: BOX WRENCH ON ADJUSTER PINION 12118

4. PAD WEAR INSPECTION

To determine if pads are worn to the point where replacement may be necessary, observe the position of the floating pin (4) to determine its position relative to the rubber bushing (6). If the sliding pin is extended beyond the end of the rubber bushing (dimension C), pad replacement is not necessary. However, if the sliding pin is close to or even with the rubber bushing (dimension D), the pads should be removed to determine if replacement is necessary.

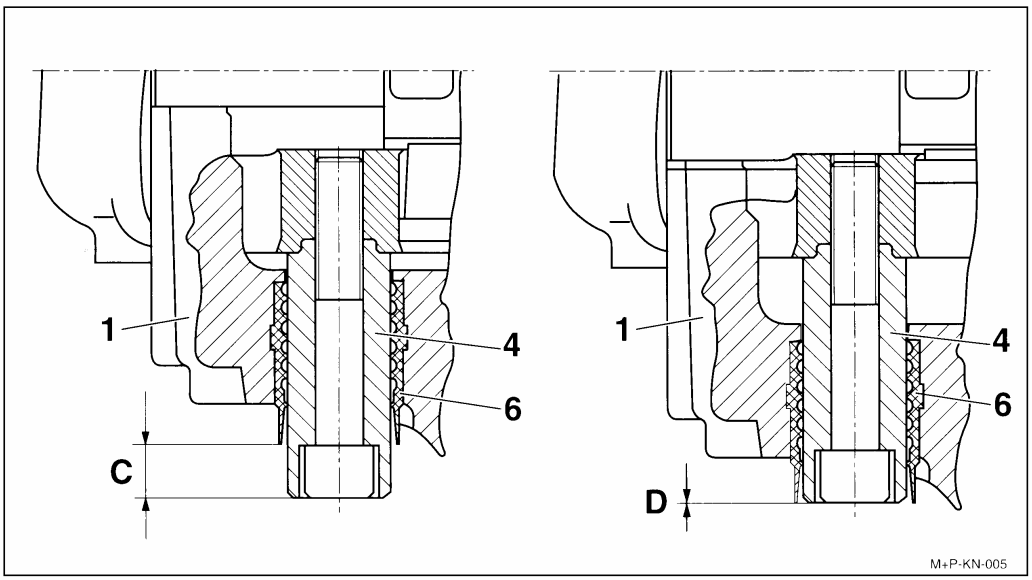

FIGURE 5: BRAKE PAD CHECK 12117

5. PAD REMOVAL

Turn adjuster pinion (23) counterclockwise to increase pad to rotor clearance (a clicking noise will be heard). Push caliper toward actuator and remove pads.

Warning: *Do not apply brakes while pads are removed as this could cause over stroke damage to the adjusting mechanism.*

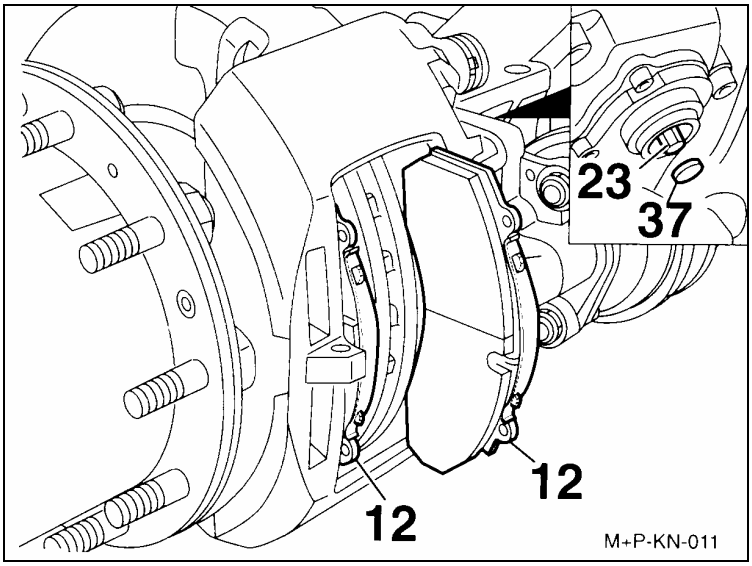

FIGURE 6: PAD REMOVAL 12111

CHECKING PAD WEAR

Minimum friction material thickness is 2 mm (A)

New friction material has a thickness of 21 mm (B)

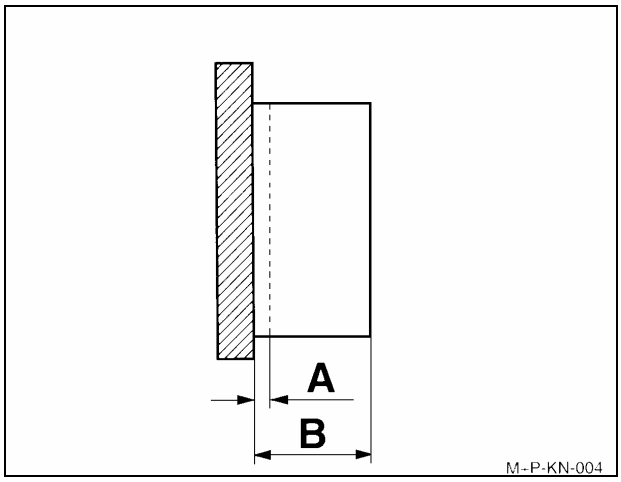

FIGURE 7: PAD WEAR 12112

IMPORTANT PAD AND ROTOR MEASUREMENTS

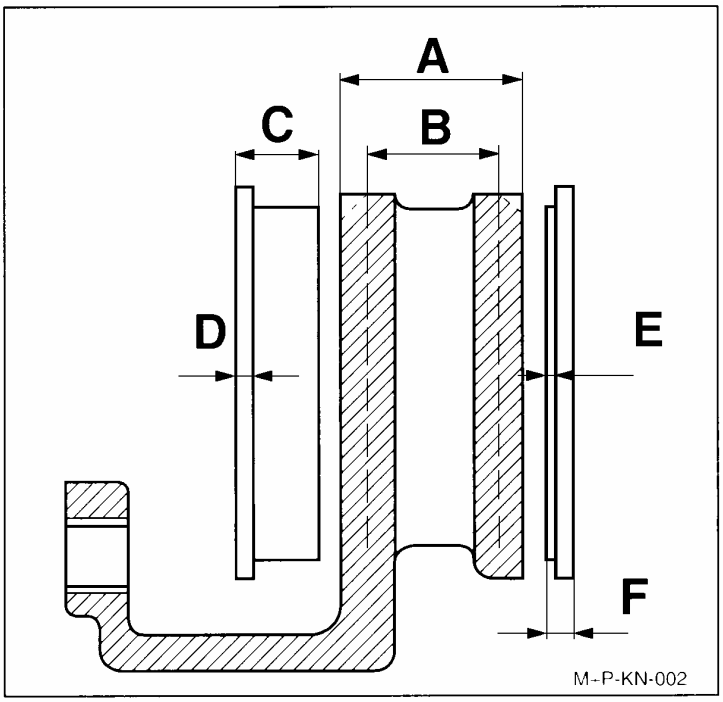

FIGURE 8: ROTOR AND PAD WEAR LIMITS 12113

A = ROTOR THICKNESS (NEW) 45 mm
B = ROTOR THICKNESS (WORN) 37 mm, REQUIRES REPLACEMENT
C = OVERALL THICKNESS OF PAD (NEW) 30 mm
D = BACKPLATE 9 mm
E = MINIMUM THICKNESS PAD MATERIAL 2 mm
F = MINIMUM ALLOWED THICKNESS OF OVERALL BACKPLATE AND FRICTION MATERIAL 11 mm, REPLACEMENT NECESSARY

6. CHECKING THE CALIPER GUIDANCE AND SEAL CONDITION

Perform sliding test, you must be able to slide the caliper easily all the time. Sliding test should be performed at least every three months or more often depending on the type of operation.

a. Using hand pressure only, the caliper (1) must slide freely with its guide pin arrangements (4-7) across a distance of 1 3/16 inch (30 mm) when the pads are removed. The sleeve (5) is sealed using the boot (9) and the cap (10).

b. The rubber components (9 and 10) should show no damage. The positioning must be checked. If necessary the caliper has to be repaired using the guide kit (part #611168) or with the seal and guide kit (part #611199). When repairing a caliper with the above kits, make sure all parts in the kit are used (fig. 9). Use special green grease (Prévost #683344) to reassemble the slide pin into the bushing, white or yellow grease (Prévost #683345) may be used for all other lubrication needs.

c. Depending on manufacturing date of caliper, black paint may be present on the unsealed pin (short pin). Paint on the slide pin can prevent the caliper from sliding properly especially when the pad starts to wear. If paint is present on the pin, separate the pin from the bushing, clean the pin and reinstall it according to procedure.

Note: *Do not attempt to use thinner or alcohol to clean the pin without removing it as it may damage the rubber bushing.*

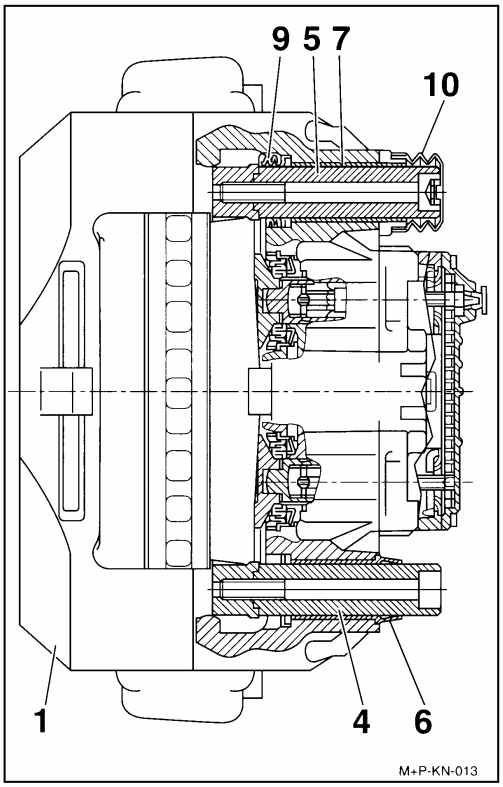

FIGURE 9: CALIPER GUIDANCE 12114

7. CHECKING THE TAPPET BOOTS

a. The rubber boots (13) should show no damage, check the attachment.

Note: *Any ingress of water and dirt will lead to corrosion and may affect the function of the actuation mechanism and adjuster unit.*

b. If boots are damaged but show no corrosion, the boots and tappets should be replaced (part #611177) (fig. 10).

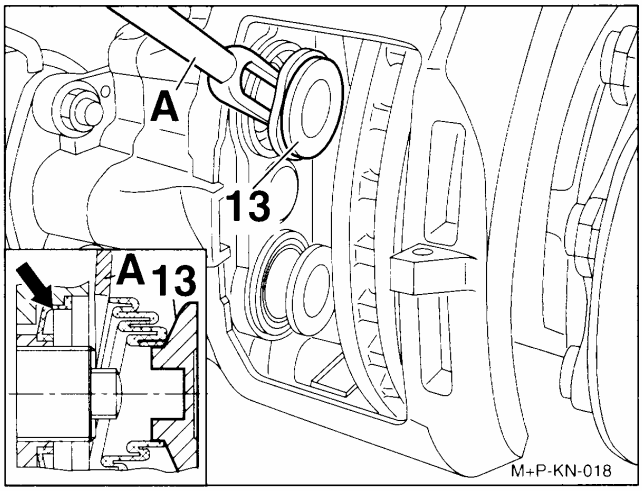

FIGURE 10: RUBBER BOOTS 12115

8. PAD INSTALLATION

Turn adjuster pinion (23) counterclockwise until tappets are fully retracted and clean pad seat area. Slide caliper to full outboard position and install outside pad. Slide caliper to full inboard position and install inside pad.

Warning: *It is recommended to change all pads on an axle at the same time.*

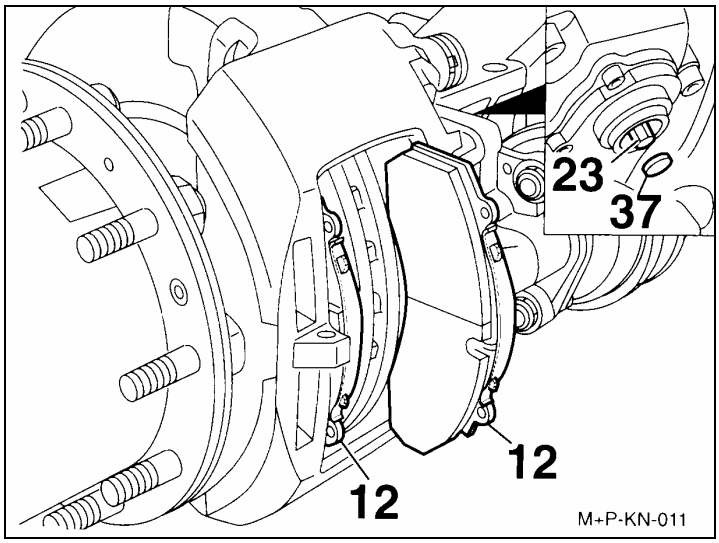

FIGURE 11: PAD INSTALLATION 12111

9. ADJUSTING THE RUNNING CLEARANCE

a. Insert a feeler gauge 0.028 inch (0.7 mm thickness) between tappet and pad backplate. Turn adjuster pinion clockwise until 0.028 inch (0.7 mm) clearance is achieved (fig. 12). Replace the cap (37) (Prévost # 641313).

b. To ensure a constant running clearance between the rotor and the pads, the brake is equipped with an automatic adjuster unit. When the pads and rotor wear, the running clearance between the pads and rotor increases. The adjuster (23) and turning device turn the threaded tubes by the amount necessary to compensate the wear.
Total running clearance should be between 0.020 and 0.035 inch (0.5 and 0.9 mm). Smaller clearances may lead to overheating problems.

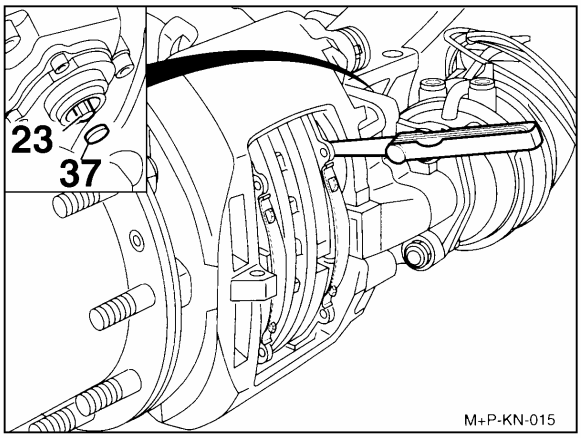

FIGURE 12: RUNNING CLEARANCE 12116

BRAKE TOOLS

There are four brake tools available to facilitate disc brakes maintenance:

1) 641321 Tool, Tappet with boot (items 8 & 13)
2) 641322 Tool, Caliper inner boot (item 9)
3) 641323 Tool, Caliper bushing (item 7)
4) 641435 Tool, Fork for boot tappet (items 8 & 13)

MAINTENANCE TIP

USING THE FOLLOWING PROCEDURE, PAD WEAR CAN BE DETERMINED WITHOUT REMOVING THE WHEEL.

10. CHECKING BRAKE PADS

Brake pads have to be checked on a regular basis depending on the vehicle operation. The remaining thickness of the pads should never be less than 3/32 inch (2 mm). To check pad condition without removing the wheel, verify the position of guide bushing (6) relatively to guide sleeve (4) (fig. 13). When guide sleeve is in alignment with guide bushing, brake pad thickness has to be checked more precisely with wheel removed. When replacing the brake pads, all four pads on an axle have to be changed at the same time. There is no inner or outer pad, since all pads are the same. Worn pads should be replaced in the same position.

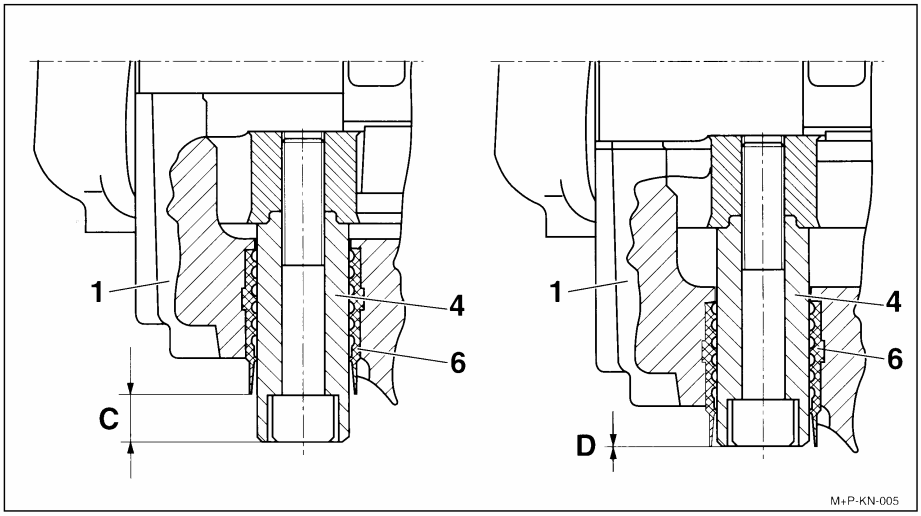

FIGURE 13: BRAKE PAD CHECK 12117