
PACCAR & DEALER
TMC
Technical &
Maintenance
Conference

Kevin Gibson

Knorr-Bremse

Brushing up on Brake Maintenance

Worn or imbalanced brakes can have a devastating impact right when you need them most.
This session will discuss best practice brake ***inspection procedures*** *to keep your fleet in top shape.*
You'll take away information on recommended ***service intervals****, common brake* ***failure modes*** *and advice on getting the most from your* ***replacement parts****.*

1. Air Disc Brake systems
    - Calipers
    - Brake Pads
    - Disc (Rotors)
    - Slack Adjusters
    - Brake Actuators (Chambers)
2. Valves
3. Air maintenance (Air Dryers & Filters)

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Safety First - Working on Air Brake Systems

- PPE - Eyes, ears and feet
- Never attempt to install, remove, disassemble or assemble a device until you have read and thoroughly understood the recommended procedures. **READ the Maintenance Manual**
- Ensure all pressure related to the specific system is depleted to **0 bar** before commencing work.
- Keep away from brake actuator push rods, levers, suspension mechanisms unless they are isolated & secured/supported/guarded.
- Park the vehicle on a level surface, apply the parking brakes if required, and **always chock the wheels**.
- When working under or around the vehicle, isolate systems by **Lock-out tag** on or near the steering wheel advising that there is work in progress on the vehicle.
- Examine all **pipework** for signs of kinks, dents, abrasion, or overheating.

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Safety First - Working on Air Brake Systems

- **Replacement hardware, tubing, hose, fittings**, etc. must be of equivalent size, type and strength as **original equipment** and be designed specifically for such applications and systems.
- Components with stripped threads or d**amaged/corroded parts** must be **replaced** completely.
- Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle or component manufacturer.
- Ensure that adequate support or assistance is provided for the removal/installation of **heavy items**.
- Only use the recommended tools .
- The use of impact screwdrivers or impact wrenches with service tools for air disc brakes is not permitted.
- Do not use compressed air to clean the disc brake. Avoid air contamination of brake dust.
- Prior to returning the vehicle to service, **CHECK** that all components and the complete brake systems are leak free and restored to their proper **operating performance/condition**.

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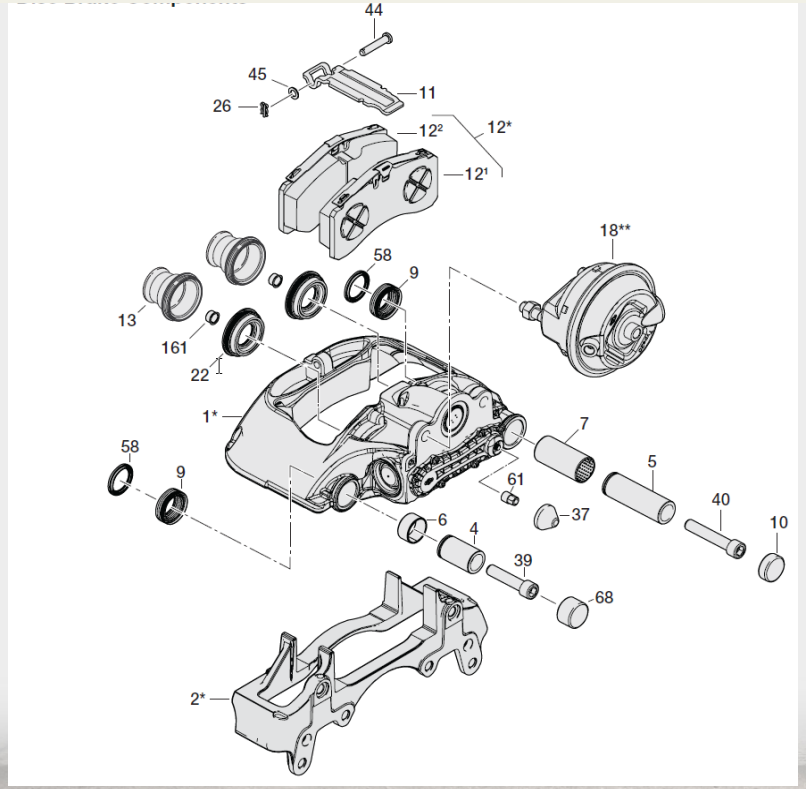
Serviceable Components - Air Disc Brakes



Legend

1	Caliper*	18	Brake Actuator**
2	Carrier*	22	Inner Seal
4	Guide Pin	26	Spring Clip
5	Guide Pin	37	Adjuster Cap
6	Guide Sleeve	39	Caliper Bolt
7	Brass Bush	40	Caliper Bolt
9	Inner Boot	44	Pad Retainer Pin
10	Cover	45	Washer
11	Pad Retainer	58	Ring
12	Brake Pad*	61	Shear Adapter
	12.1 Inboard Brake Pad	68	Cover
	12.2 Outboard Brake Pad	161	Tappet Bush
13	Tappet and Boot Assembly		

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Service Intervals & Inspection Points - Air Disc Brakes

Every 3 months

- The pad wear must be checked visually and independent of any wear indicator fitted to the vehicle.

With every pad replacement

- Check for the correct functioning of the adjuster and the smooth operation of the caliper over its full range of movement.
- Inspect the tappet and boot assemblies, the adjuster cap and the sealing elements for correct fitting and condition as well as the caliper bearing in the area of the rubber bush/guide sleeve.

Annually

- Check the caliper running clearance and the correct fitting and condition of the cover(plug), the adjuster cap and cover(plug).
- These inspection frequencies are a minimum and, depending on the vehicle application, a more frequent check of the components may be necessary.
- Refer also to vehicle and/or axle manufacturer's instructions in regard to service intervals.
- The discs should be checked according to the specification of the axle or vehicle manufacturer.

Wheel on/off Inspection opportunities

- Pads
- Discs

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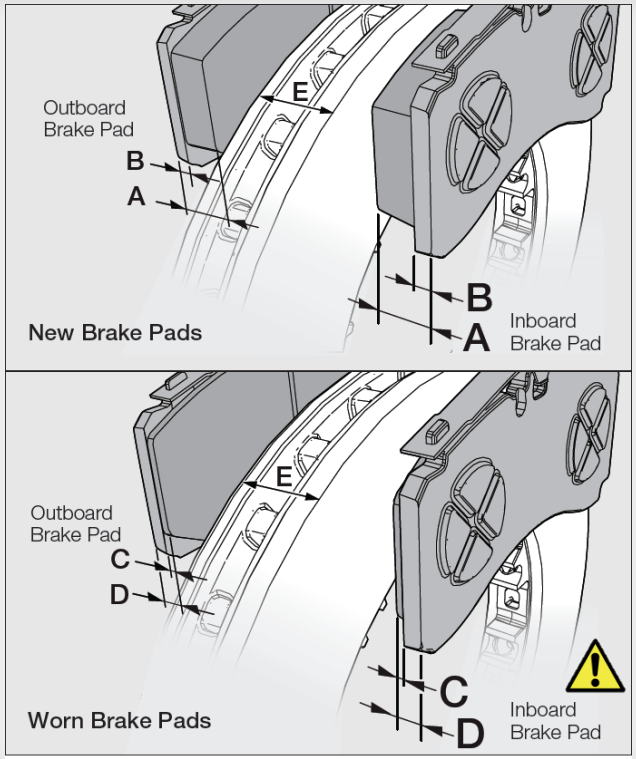
Functional & Visual Checks – Brake Pads



If the thickness of the friction material at its thinnes
2 mm (dimension C)the pads must be replaced.

A = Overall thickness of new brake pad 30 mm

B = new Back plate thickness is 9 mm

C = Minimum thickness of friction material 2 mm* (coin thickness)

D = Minimum allowed thickness in worn condition for back plate and friction material 11 mm*

*If these minimum allowed thicknesses are reached, brake pads must be replaced as an axle set.

Other Indicators for Worn Pads

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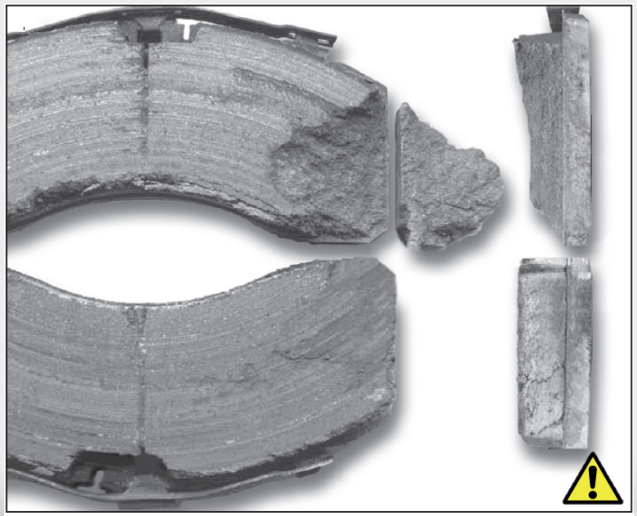
Functional & Visual Checks – Brake Pads

Brake Pad with minor damage (permitted)



Brake Pad with major damage (not permitted)

Possible causes (Failure Modes),

- Incorrect adjustment
- Faulty Adjuster
- Caliper performance (damaged components)
- System issues (leaking chambers)
- Pad Spring damage & fatigue
- Foreign material (rocks & road junk)
- Harsh & Abusive braking
- Non-genuine Pads
- Mixed Pad Brands
- Bearing run-out

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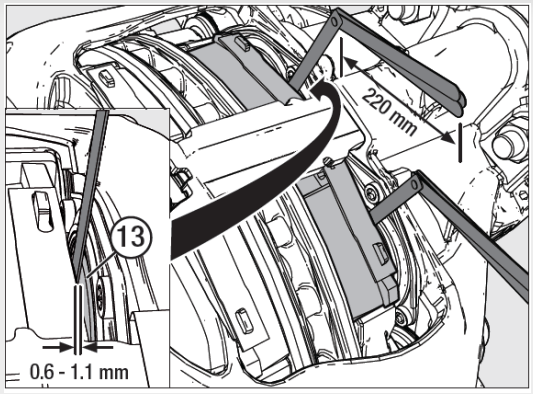
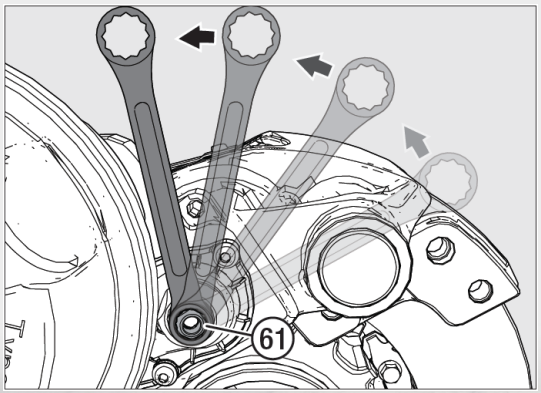
Functional & Visual Checks – Brake Pads



Checking the GAP between Tappets & Pad (0.6 -1.1mm)
If the gap difference between the two tappets is > 0.25 mm then the caliper bearing clearance must be checked.



If the GAP between Tappets & Pad is >1.1mm the Adjuster must be checked using Manufacture procedure.

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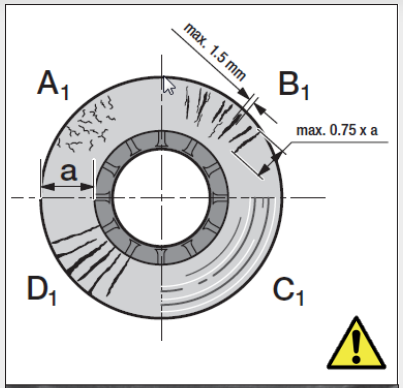
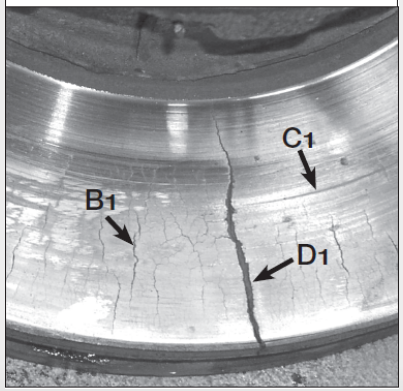
Functional & Visual Checks – Brake Discs (Rotors)





Check the condition of the brake disc
- every 12 weeks (quarterly) under harsh conditions.
- every 26 weeks (twice annually) under highway conditions.

Sections A - D (see figure) show the possible conditions of the disc surface:
A: Network-type tears = permissible
B: Radial cracks up to max. 1.5 mm width and depth = permissible
C: Uneven disc surface less than 1.5 mm = permissible
D: Continuous cracks = not permissible

Technical details:
- disc thickness, new = 45 mm
- minimum permissible disc thickness = 37 mm (check with slide gauge)

In the case of surface conditions **A - C**, the brake disc can be used until the minimum permissible disc thickness has been reached.

IMPORTANT!
To prevent damage to the brake discs, the brake pads should be replaced when their thickness (excluding backing plate) is **2 mm** or less.

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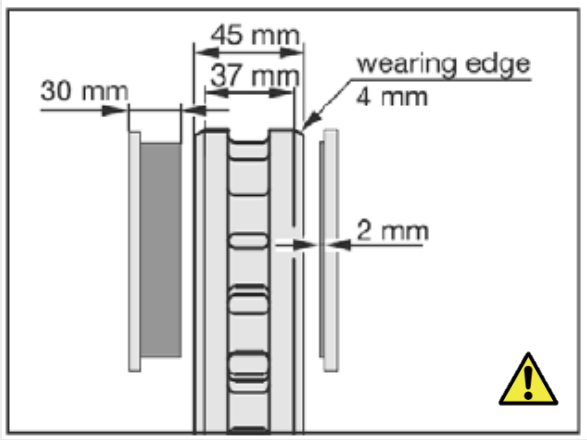
Functional & Visual Checks – Brake Discs (Rotors)



- Measure the thickness of the brake disc at the thinnest point.
- Be aware of possible burring at the edge of the disc.
- Refer also to any brake and/or axle manufacturer's recommendations.
- Total thickness of the brake disc
  new condition = 45 mm
  worn condition = 37 mm (the disc must be replaced)
  Check the Edge Gauge

- If the disc dimension thickness is ≤ 39 mm, it is recommended that the disc should be renewed when the brake pads are changed.

General Recommendations,

- The brake disc to be changed as an axle set.
- The Brake PADS to be changed as an axle set.
- The guide pins Fixed & Floating be changed as a caliper set.
- Use only Manufacturers recommended Grease
- The use of impact screwdrivers or impact wrenches in conjunction with Service Tools for air disc brakes is not permitted.
- Never turn Adjuster without Shear Adapter. If the shear torque of the shear adapter is exceeded, then it is designed to fail.
- Do not use an open-ended spanner as this may damage the adapter.

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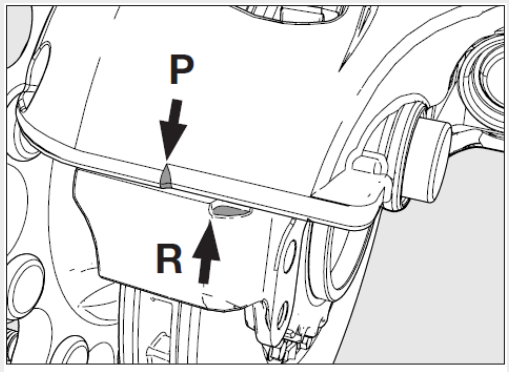
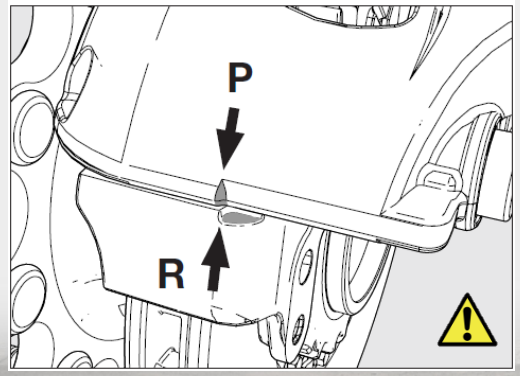
Brake Pad/Disc Wear Check (on vehicle) - Air Disc Brakes



NEW Brake Pads & Disc Indicator position example.



WORN Brake Pads & Disc Indicator position example.

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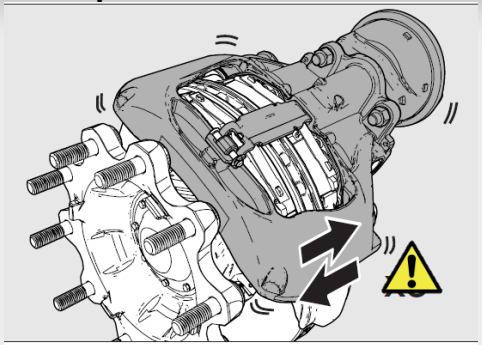
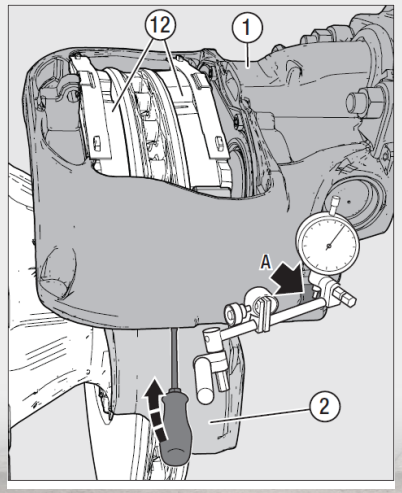
Caliper Movement & Running Clearance Check - Air Disc Brakes



Check for axial movement when brakes are in released position.



Measuring Guide Pin Bearing Clearance (max . 1mm).

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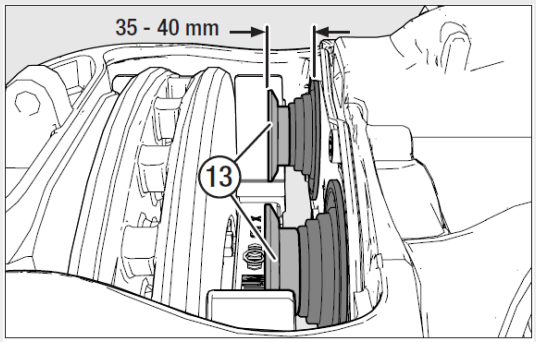
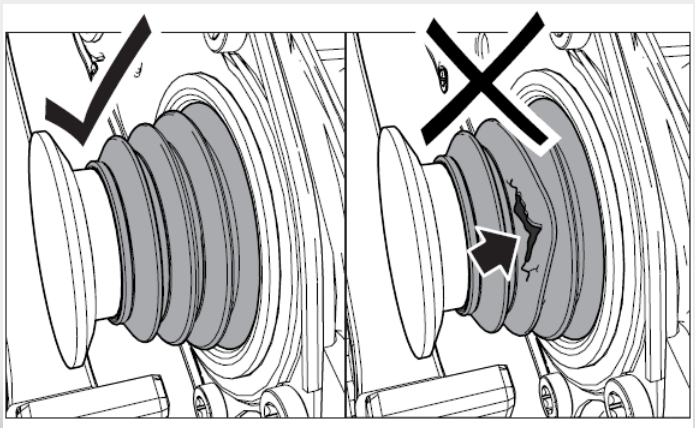
Checking Tappet & Boot Assemblies - Air Disc Brakes



If the gap difference between the two tappets is > 0.25 mm then the caliper bearing clearance must be checked.



Tappet Boots must not have any cuts/tears/damage.

The penetration of dirt and moisture into the brake will lead to corrosion and impair the function of the clamping mechanism and wear adjuster.

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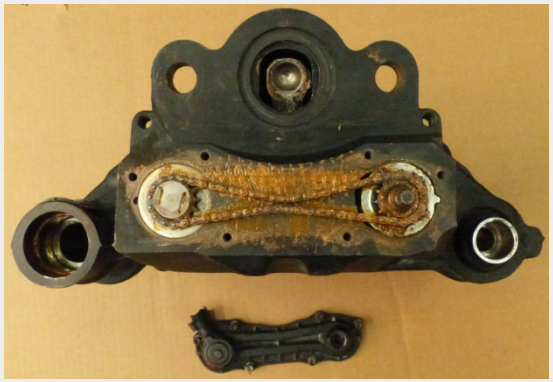
Slack Adjuster Mechanism - Air Disc Brakes



The Adjuster mechanism is unserviceable ⚠

Servicing the Factory set Adjuster Mechanism can lead to,

- Reduced or excessive clearances
- Uneven wear
- Uneven braking
- Over heating
- Wheel End Fires
- Reduced Braking
- Cracked & Glazed Rotors
- Void Warranty

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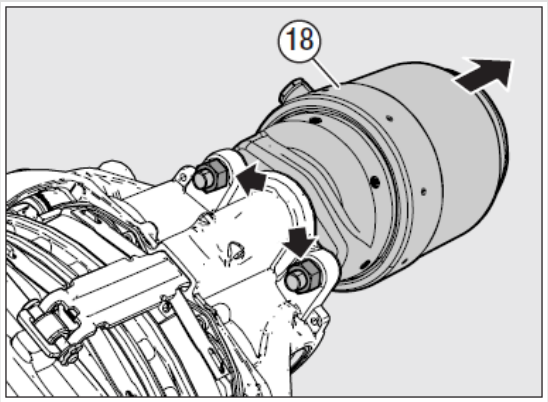
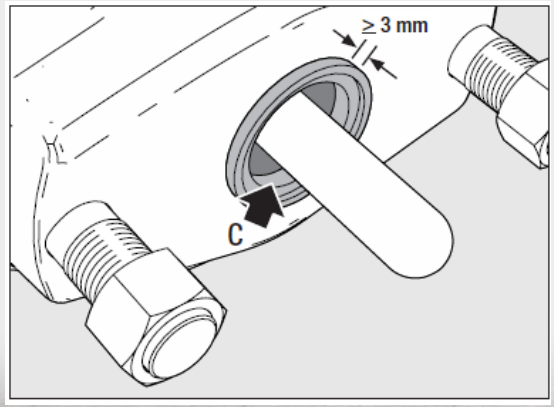
Functional & Visual Checks – Brake Actuators (Spring Brakes, Brake Chambers)

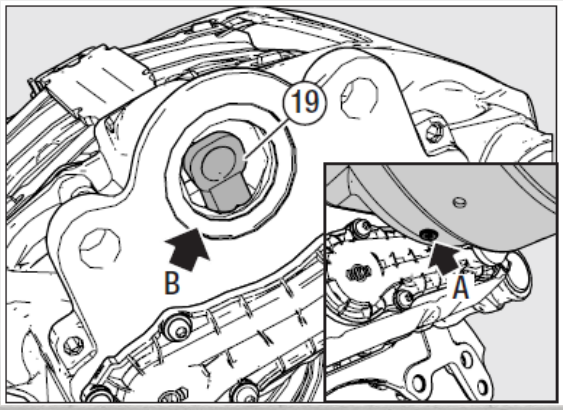


Check Seal, Flange Surface of Caliper, grease spherical cup & chamber vent plugs.
Matching OE Brake Actuators

Things to watch for,

- Ill fitting seal
- Fork cup condition and grease
- Breather hole
- Foreign matter in adjuster cavity





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Air system components - Valves

One knock off Valve can knock your whole braking system off spec.

Your brakes are a system, **not a set of individual parts**, which has been carefully designed by the Truck/Trailer OEM.

And all the Brake Control Valves – foot valves, relay valves and quick release valves – have all been **designed to work together** to deliver balanced, even air pressure to the brakes.

If you replace one valve with a **knockoff** that doesn't work right, the whole system can go **out of spec**.

This can be a real-world problem. By putting your **system out of spec**, you actually **reduce braking performance and stopping ability**.

Here's what can happen: the mismatched valve can cause **uneven air pressure** to your brakes, which **increases brake lining temperatures**. In fact, as little as a 2-psi differential in brake threshold pressure can result in a 200° F increase in the brake lining temperature in city driving and possibly higher in hilly terrain.

The increased temperature can cause a lining to **wear twice as fast** as another axle's linings.
And a higher temperature can **lead to brake fade**, which will **reduce braking performance**.

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Air system components – Valve Examples…

Quick Release Valve

Genuine Quick Release Valve
At 2,000,000 durability cycles,

- Near-new condition
- Valve functioning per specifications

Knockoff Quick Release Valve
At 450,000 durability cycles:

- Torn Diaphragm
- Leaked supply air to atmosphere

Result: High air leakage
Poor vehicle brake performance

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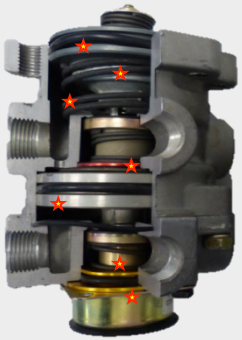
Air system components – Valve examples…

Foot Treadle Valve E6

What's to consider….

1. Springs
2. O-rings
3. Seals
4. Pistons
5. Diaphragms
6. Valves
7. Casting
8. Hardware
9. Performance
10. Durability
11. Traceability



Genuine Part

Imitation Part (knock off)

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Air system components – Valve examples…

Foot Treadle Valve E6

Genuine E-6 Valve Component
At 2,000,000 durability cycles, equal to ~1.6 million highway kilometers

Knockoff E-6 Valve Component
At 450,000 durability cycles:

- Excessive uneven surface wear
- Severe scoring on sealing surface

Result: High air leakage

Genuine E-6 Relay Piston
At 2,000,000 durability cycles, still meets OE specifications

Knockoff E-6 Relay Piston
At 450,000 durability cycles:

- Premature broken & cracked parts.
- Heavy surface abrasion om piston bore

Result: Unpredictable primary pressure delivery. High Air leakage & system imbalance. Poor vehicle Brake performance.

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Air system components – Air Treatment

Air Dryers & Filters

- Air dryer systems provide clean, dry air to the components of the brake system increases the life of the system and reduces maintenance costs.
- Air Dryer - Standard & Oil Coalescing Filters
- In-line Air Filters

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Legislation Australian Design Rules - ALL MODELS 1ST JAN 2015

ADR35/04 

1. ABS
2. Slack Adjusters

ADR38/04 

1. LSV's
2. ABS
3. Auto Slack Adjusters