

Brake Hoses

Strength and Flexibility under Pressure

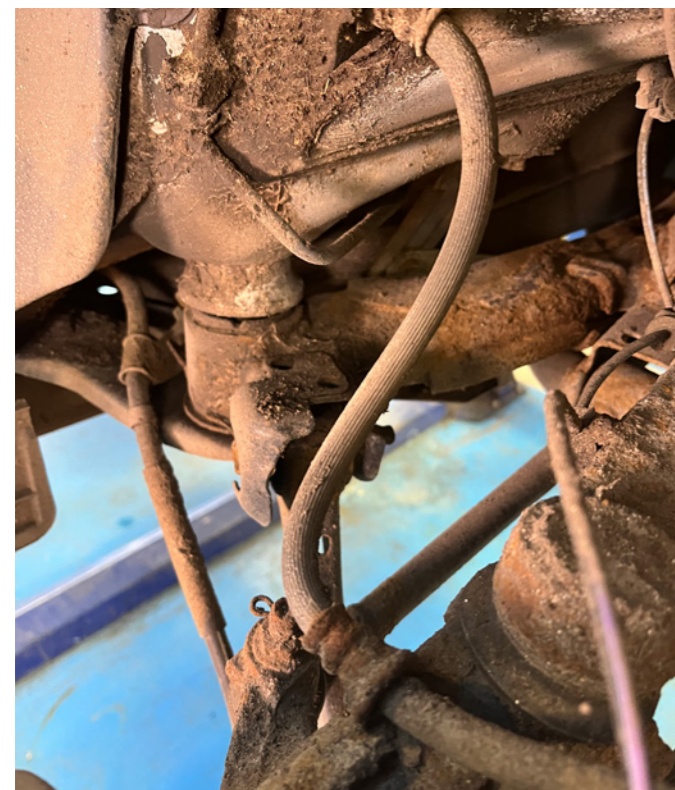


In the ever-evolving motor industry, the reliability and efficiency of vehicle brake systems are paramount. The brake circuit, a crucial component of automotive safety, has undergone significant advancements since its inception. Central to this system are the brake hoses, which, despite their seemingly simple function, play a critical role in ensuring the effective transmission of brake fluid from the master cylinder to the calipers and wheel cylinders. This article delves into the history of brake circuits, the essential role of brake hoses, their construction, and the common failures that can compromise vehicle safety.

Brake Circuits - from Mechanical to Hydraulic

The concept of braking has been integral to vehicular design since the early days of motoring. Initially, mechanical brakes which relied on a series of levers and rods were the norm. These were eventually replaced by hydraulic brake systems in the early 20th century thanks to the pioneering work of Malcolm Loughead (later changed to Lockheed), who introduced the first hydraulic brake system in 1918.

Hydraulic systems offered superior stopping power and consistency compared to their mechanical predecessors. Over time, advancements such as dual-circuit systems, anti-lock braking systems (ABS), and electronic brake force distribution systems were incorporated, all further enhancing safety and performance. Despite these advancements, the fundamental need for reliable brake hoses has remained unchanged.



Function and Importance of Brake Hoses

Brake hoses are flexible pipes that convey hydraulic brake fluid from the vehicle's rigid brake lines to the brake calipers or wheel cylinders. These hoses must withstand high pressure and continuous flexing, especially in the steering and suspension systems.

The key functions of brake hoses include:

Fluid Transmission: Brake hoses transfer brake fluid under pressure, ensuring responsive and effective braking.

Flexibility and Movement: They accommodate the movement of suspension and steering components without kinking or leaking.

Pressure Resistance: High-quality brake hoses resist the significant pressures generated during braking.

The integrity of brake hoses is critical. Any compromise can lead to brake fluid leakage, reduced braking efficiency, and potentially result in brake failure.

Common Failures of Brake Hoses

Despite their robust design, brake hoses are susceptible to various failures, often due to age, environmental factors, or mechanical stresses. Common issues include:

Cracking: Over time exposure to heat, UV rays, and Ozone can cause the rubber to dry out and crack. These cracks can lead to leaks and a loss of braking pressure.

Rubbing and Abrasion: Brake hoses that are improperly routed or unsecured can rub against vehicle components. This continuous friction can wear through the outer layer, exposing the reinforcement and inner tube to damage.

Internal Breakdown: The inner lining of the hose can deteriorate, causing blockages or internal leakage. This is often due to the chemical degradation of the rubber from prolonged exposure to contaminated brake fluid - which is hygroscopic - and has exceeded its recommended replacement interval.

Without regular maintenance the high moisture content held within the brake fluid corrodes the internal metal components of the brake system, contributing to seized brake calipers, failing anti-lock brake modulators, and deterioration of the internal brake hose rubber which can cause blockages within the braking system.

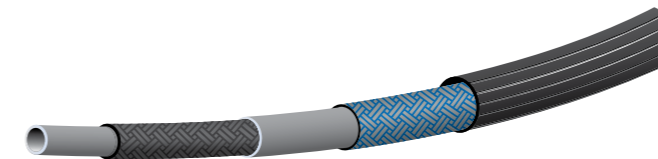
Construction and Testing of febi Replacement Brake Hoses

Brake hoses are engineered to meet stringent safety and performance standards. Typically, a brake hose is constructed from multiple layers:

Inner Tube: Made from oil-resistant synthetic rubber, the inner tube ensures a leak-proof channel for the brake fluid. They are typically made of synthetic rubber such as EPDM (Ethylene Propylene Diene Monomer), NBR (Nitrile Butadiene Rubber), or PTFE (Polytetrafluoroethylene); all of which are resistant to brake fluid and ensure the hose is flexible and durable.

Reinforcement Layer: Braided high-strength synthetic fibres such as Aramid (e.g. Kevlar), polyester, or wire braids made of stainless steel are used to reinforce the hose and provide the necessary strength to withstand the high pressures generated within the braking system

Outer Layer: A weather and abrasion-resistant synthetic rubber such as EPDM or CSM (Chlorosulfonated Polyethylene) covers the hose, protecting it from external elements like abrasion, heat, and chemicals.



The Manufacturing Process: This involves precision extrusion of the inner tube, braiding of the reinforcement layer, and final coating with the outer layer. Each hose undergoes rigorous quality control, including pressure testing, to ensure it meets industry standards.

The inner tube is formed by extruding synthetic rubber through a die to create a long, hollow tube. The extruded tube is inspected for uniformity and any defects that could affect performance. This is then covered with a reinforcing braid using a braiding machine that wraps synthetic fibres or metal wires around the tube. The tension and coverage of the braiding are carefully controlled to ensure consistent strength and flexibility.

An outer layer of synthetic rubber is extruded over the braided layer using a co-extrusion process to ensure proper adhesion between layers. The final hose is inspected for uniform thickness and any surface defects.

The hose is then cured in an autoclave or a continuous vulcanization line where heat and pressure are applied to cross-link the rubber molecules to provide the necessary elasticity and durability; carefully monitored throughout to ensure complete vulcanization.

The cured hose is cut to the desired lengths and end fittings are attached which are crimped or swaged onto the hose

ends. Each hose is pressure tested to ensure there are no leaks and the fittings are securely attached.

Testing and Quality Assurance of febi Brake Hoses

Finally, burst pressure, flexibility, and chemical resistance tests are performed to ensure the hose meets all required standards.

Detailed inspections and tests are documented and any hoses failing to meet standards are rejected. Therefore, ensuring the reliability of brake hoses involves rigorous testing protocols.

Pressure Testing: Hoses are subjected to high-pressure tests to ensure they can withstand the maximum operating pressure of the brake system.

Flexibility and Fatigue Testing: Repeated flexing tests simulate the movements of the hose during vehicle operation, ensuring durability and resistance to fatigue.

Environmental Testing: Hoses are exposed to various environmental conditions, including temperature extremes and UV and Ozone exposure to assess their resilience.

Brake hoses are vital components of the automotive brake circuit, ensuring the safe and efficient transmission of hydraulic pressure. Understanding their construction, the common modes of failure, and the rigorous testing they undergo is essential for vehicle technicians. Regular inspection and timely replacement of brake hoses can prevent potential brake failures, ensuring the safety and reliability of the vehicles on the road. As the automotive industry continues to innovate, the importance of maintaining high standards for brake hose quality and performance remains ever crucial.

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