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Application of Hydraulic Brake Hose to Motor Vehicles

SAE Recommended Practice
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The Engineering Society For Advancing Mobility Land Sea Air and Space®
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HIGHWAY VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

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Ø APPLICATION OF HYDRAULIC BRAKE HOSE TO MOTOR VEHICLES

1. SCOPE:

This recommended practice covers the application of hydraulic brake hose (as defined by SAE J1401 JUN85, Road Vehicle - Hydraulic Brake Hose Assemblies for Use with Nonpetroleum Base Hydraulic Fluids) as used to provide a flexible hydraulic connection between the brake system components on motor vehicles.

2. PURPOSE:

The purpose of this recommended practice is to outline design, operating, and service factors in fitting a hydraulic brake hose assembly.

3. OBJECTIVES:

3.1 Minimize length, twist, tension, and severe bends.

3.2 Provide sufficient clearance to hostile components.

3.3 Minimize exposure to harmful elements such as heat, petroleum products, battery fluid, etc.

3.4 Minimize exposure to mechanical damage due to operating the motor vehicle over underbrush, high curbs, loose gravel or sand, in mud, snow, ice, ruts, etc.

3.5 Minimize the possibility of damage to hose during brake (and other component) assembly to vehicle.

4. DESIGN FACTORS:

4.1 Length: Length is determined by the extremes of relative movement of the hose assembly and connection points. The two connection points are located by consideration of the following factors: clearance, manufacturing feasibility (vehicle assembly), vehicle servicing, vertical and rotational (steering) movement of wheel, and location of tie rod, suspension spring, shock absorber (strut or damper), suspension control arms, etc.

4.2 Twist: Twist may be inherent in hose attachment. Steering movements may accent the twist characteristic. A change in twist can also be minimized by vertical orientation of the fixed end connection.

4.3 Tension and Severe Bends: Tension and severe bends may be inherent in brake hose routings and should be minimized. The "fixed" frame or body attachment point for the hose is usually selected to balance jounce (wheel upward limit) and rebound (wheel downward limit) tensions, if other requirements permit. As noted in 4.1, the length may need to be adjusted to limit the minimum bend radius and/or minimize tension. In some routings, for example, where an intermediate attachment of the hose is made between end connections, a section of the hose may be in compression. Aside from inconvenience in assembling the hose, the compressive force is not detrimental to the hose and is usually relieved by an offset of the two ends, resulting in the hose having an elongated "S" curve shape.

4.4 Tire/Wheel Clearance: Because of the potential for sudden failure and eventual failure by wear-through, it is extremely important not only to route the hose for adequate tire, tire-chain, and chassis component clearances, but also to assure that dynamic factors do not induce interference.

To reduce the likelihood of unanticipated interference, it is recommended that the designer establish the most "natural" path from caliper (or wheel cylinder) or intermediate support point to bracket on frame or body. This will tend to avoid convolutions, which may cause the hose to suddenly take a new position influenced by wheel motion and torsional rate of hose. Sequence of motion or rate of change may be the dominant factor, e.g., if the left-hand wheel moves from rebound to jounce in left steer and then to right steer, a twist in the hose might produce interference with tire, whereas the opposite sequence (steer first, then elevate to jounce) would not cause hose-to-tire interference. Hose routings that produce a tight "S" curve are especially susceptible to a change in hose relative position, viz, the unsupported portion of the hose is capable of maintaining more than one stable position (generally "looped") depending on the sequence of suspension/steering motions just preceding these positions.

4.5 Dynamic Effects: Although adequate clearance may be obtained under static conditions, operating the vehicle over rough or "washboard" surfaces may produce hose contact with wheel/tire or chassis components, especially where long lengths of unsupported hose or looped sections are involved. If road simulator equipment is available, it may be desirable to investigate hose resonant effects by observing hose motion at varying frequencies.

4.6 Trapped Fluid Systems (Sustained High Pressure): Vehicle manufacturer's recommendations should be considered in any hydraulic brake hose application in which brake fluid can be trapped and result in sustained pressure, as in hydraulic parking brake or antitheft systems.

5. OPERATING FACTORS:

5.1 Heat: Deterioration of brake hose is generally an exponential function of temperature. Within the space limitations of the routing package, exposure to heat sources (engine compartment, exhaust manifold, catalytic converter, muffler, and pipe system) may be minimized by hose location or shielding.

5.2 Cold: Little can be done by means of routing to protect the hose from the effects of extreme cold beyond avoiding tight bends.

5.3 Other: Other elements, which the brake hose may be exposed to in operation, are as follows:

a. Mud - if in splash path

b. Water - rain water and salt water

c. Slush - ice and snow with or without salt and/or cinders and sand

d. Road oil

e. Sun and ultraviolet exposure

f. Ozone

g. Detergent, degreaser, wax, hot water and steam - vehicle wash operations

h. Rustproofing and undercoating materials - depending on proximity to the surfaces being treated or ease of protecting during undercoating

i. Road debris - If practicable, the brake hose should be routed to be protected by less vulnerable chassis components. For off-road vehicles this would include ruts, underbrush, tree stumps, tree branches, rocks, sand, gravel, barbed wire, etc. This requirement can usually be satisfied by keeping the lowest part of the hose above the wheel axis or skid plate.

Mechanical means may sometimes be added to the brake hose exterior to avoid abrasion when touch conditions are expected to occur. These may be plastic rings, helically-wound wire, or corrugated split or solid sleeves. Mud, slush, or abrasive material collecting within the open spaces of these devices may result in unsatisfactory durability.

6. VEHICLE SERVICING FACTORS:

A brake hose routing may provide adequate clearances and satisfactory operating conditions and yet fail suddenly or prematurely because of vulnerability to damage in servicing the vehicle. Some considerations are:

6.1 Hooking or Pinching: The hose may be hooked by towing or lifting equipment or pinched between a chassis component and service equipment.

6.2 Stretching or Twisting: The hose may be overstressed if allowed to support the axle or caliper weight during spring and shock absorber servicing or brake pad replacement.

The hose may be twisted 360 deg (and routing clearances negated) if the caliper is rotated upon reinstallation over the wheel disc. Hose end fittings and brackets should be designed for one-way-only installation.

6.3 Cutting or Abrasion: Sharp-edged tools, files, drills, grinding wheels, wire brushes, etc, should be used carefully when near brake hoses. The hose may also be vulnerable to damage by sharp-edged sheet metal forced into contact with the hose in order to gain access to some other vehicle part.

6.4 Misrouting: A satisfactory hose routing may be negated by inadequate strength of hose attachment brackets, which may be susceptible to bending during servicing of the hose or brake components, thereby adversely changing brake hose clearance.

6.5 Heat: Welding or cutting torches used carelessly near brake hoses can impair hose performance.

6.6 Degreasing Compounds, Penetrating Oil, etc.: Petroleum products and other chemicals used in vehicle service or repair to clean, remove rust, remove paint, or loosen bolts and nuts can adversely affect brake hose durability.

The phi (Ø) symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.