The Engineering Society
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SAE J1873 MAR88

Moisture Transmission Test Procedure — Hydraulic Brake Hose Assemblies

SAE Recommended Practice
Issued March 1988

Submitted for Recognition as
an American National Standard

The Engineering Society For Advancing Mobility Land Sea Air and Space ®
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HIGHWAY VEHICLE PRACTICE

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MOISTURE TRANSMISSION TEST PROCEDURE - HYDRAULIC BRAKE HOSE ASSEMBLIES

1. PURPOSE:

The purpose of this recommended practice is to simulate in the laboratory the transmission of moisture into a brake hose.

2. SCOPE:

This recommended practice is intended for all vehicle hydraulic brake hoses. It is an accelerated test, which is intended to subject the hose to moisture transmission equivalent to that expected during the life of the vehicle.

3. NOTE:

This procedure is extremely sensitive and care must be taken to minimize the amount of unwanted moisture introduced into the system due to experimental error.

4. TEST APPARATUS:

4.1 Brake Hose Assemblies: 305 + 5 mm (12.0 + 0.2 in) free length with female threaded fittings no longer than 40 mm (1-1/2 in) on each end.

4.2 Threaded end plugs tapered to match fitting eyelet

4.3 Sample glass vials with appropriate caps to insure seal

4.4 Glass water bath container

4.5 Karl Fischer test apparatus

4.6 Squeeze bottle with "J" tube

4.7 Deionized or distilled water

4.8 Desiccator

4.9 Unopened can of brake fluid

4.10 Isopropyl alcohol

4.11 Standard room environmental conditions of 23.0 ± 2.0°C (73.4 ± 3.6°F), 50 ± 5% R.H.

5. TEST PREPARATION:

5.1 Precondition all the brake hose assemblies at 100 ± 2°C (212 ± 3.6°F) for 24 ± 2 hours. Precondition all glass sample vials and the "J" tube squeeze bottle at 70 ± 2°C (158 ± 3.6°F) for a minimum of one hour. This will assure that the hoses, vials and bottle initially will be relatively dry.

5.2 After removing the above items from the oven, place them in a desiccator at standard room environmental conditions for a minimum of 1 h or until the items reach room temperature. Keep these items in the desiccator until required to assure they stay in a dry state.

5.3 All phases of this test, where brake fluid is added to or removed from the brake hoses, shall be done at standard room environmental conditions as described in 4.11.

6. TEST PROCEDURE:

6.1 Remove the preconditioned brake hose assemblies from the desiccator and start the fill procedure. Open an unopened can of brake fluid and fill the "J" tube squeeze bottle. Fill the appropriate vials and brake hoses described below within 1 hour. This will assure that the test will be started with "dry" brake hoses and "unused" brake fluid, and keep the exposure to air and moisture at a minimum.

6.1.1 Fill one conditioned glass vial with brake fluid using the conditioned "J" tube squeeze bottle. The vial shall be totally filled to minimize air entrapment. Cap the vial securely within 30 s of filling to minimize exposure to air and moisture. This vial will be used as a control.

6.1.2 Fill three brake hose assemblies with brake fluid using the "J" tube squeeze bottle, and then plug each end tightly within 30 s to minimize exposure to air and moisture. This is easily accomplished by bending the hose into a "U" shape with both ends level and injecting brake fluid into one of the ends. The "J" tube should be small enough to fit inside the brake hose fitting eyelet. Plug the ends of the hose with a threaded plug tapered at the tip to seal properly against the brake hose fitting eyelet. Make sure no air is entrapped inside the hose when the ends are plugged.

6.2 Place the brake hoses in a desiccator at standard room environmental conditions until ready to start the immersion test.

6.3 Remove the brake hoses from the desiccator and immerse them in a glass water bath container. Place the container and hoses in an oven maintained at 70 ± 2°C (158 ± 3.6°F) for 72 ± 1 hour.

6.3.1 The hose assemblies shall be held in a U-shape such that their center lines are 76 ± 13 mm (3.0 ± 0.5 in) apart. This can be accomplished by designing the walls of the glass bath container to accommodate this or by using a wire to tie the ends together. Position the hose assemblies in the glass water bath container so that they are totally immersed in the water and not contacting each other.

6.3.2 Use deionized or distilled water. Maintain the volume of water to a minimum of 490 ml (30 in^3) per hose. Keep the complete hose assembly below the water line at all times.

6.3.3 Refill the water bath as required to compensate for evaporation and assure compliance with the above conditions. A lid for the water bath container will minimize evaporation and generally eliminate the need to add water during the test. If additional water is necessary, use water at 70 ± 5°C (158 ± 9°F).

6.4 After the required exposure interval, remove the three brake hose assemblies from the water bath and empty the brake fluid from each hose into separate conditioned glass vials.

6.4.1 Dry the outside of the brake hose thoroughly. Let cool to room temperature at standard room environmental conditions for a minimum of 30 minutes.

6.4.2 Wipe the hose assemblies just prior to cutting them using a cloth wetted with isopropyl alcohol.

6.4.3 Cut through the hose section within 13 mm (0.5 in) from one of the end fittings. While maintaining the longer hose section of the brake hose assembly in a vertical position with the end fitting up, cut the hose within 13 mm (0.5 in) from the remaining end fitting allowing the brake fluid to empty into a clean dry sample vial. Size the vial so that it will be totally filled. No attempt shall be made to recover or include the brake fluid remaining in either end fitting.

6.4.4 Cap the vial within 30 s after filling with brake fluid.

6.4.5 Repeat the above procedure for each hose.

6.5 Determine the percentage water content of the brake fluid in the brake hose assemblies and control vial to the nearest 0.01% using the Karl Fischer test method.

6.5.1 Run the brake fluid moisture content test on each brake hose assembly sample vial and control sample vial.

6.5.2 Calculate the percentage moisture transmission by subtracting the control vial sample percent water from the percent of water averaged from the three hose samples.

6.5.3 Report individual hose sample data points, three sample average, control point and net moisture transmission.

RATIONALE:

PURPOSE

The purpose of this task force was to develop a laboratory test method that would measure the permeation of moisture into a brake hose. The problem of moisture entering the brake hose is a concern expressed by many SAE members both in the United States and overseas. In fact, this activity was initiated at the request of ISO because of world wide interest in developing a test method to measure this property. Moisture that is permeated through a brake hose is a contributing factor in causing the corrosion of internal brake system components.

PARTICIPANTS

The work on this task force has been done by SAE members from all over the world. Active participants who have either participated in round robin tests or supplied test samples have generally included two or three members from various companies in the United States, one member from Japan, one member from Italy, and one member from England.

DEVELOPMENT PROCEDURE

The work on this task force started several years ago.

The initial round robins established the best approach to simulate moisture permeating into a brake hose. Methods of placing a hose in a humidity chamber were compared to methods of submerging the hose completely in water. In addition, various conditioning times and temperatures were evaluated. The submerging method was selected as the most consistent and repeatable.

In the next phase of development, the task force investigated each test variable and determined the amount of control that would be required. Some of the variables studied included preconditioning period, soak time, type wax, type bath container, method of removing the brake fluid, accuracy of Karl Fischer method, drying procedure for glass vials, how to minimize air entrapment, etc. This is a very sensitive test and there are many variables that can significantly affect the test data. Some of these variables had to be analyzed several times.

The last phase of development is intended to modify the test to obtain repeatable absolute values of moisture transmission. We have been able to obtain reliable correlation between laboratories (we'd rank order the hoses the same), but the absolute values would not correlate. Work will continue on this phase while this procedure is a recommended practice.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

Not applicable.

REFERENCE SECTION:

Not applicable.