

International Standard



3996

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Road vehicles — Brake hose assemblies for hydraulic braking systems used with a non-petroleum-base hydraulic fluid

Véhicules routiers — Flexibles pour systèmes de freinage hydraulique utilisant un liquide de frein à base non pétrolière

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3996 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

This second edition cancels and replaces the first edition (ISO 3996-1978), of which it constitutes a technical revision, following publication of ISO 6120.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Road vehicles — Brake hose assemblies for hydraulic braking systems used with a non-petroleum-base hydraulic fluid

1 Scope

This International Standard specifies the test procedures for, and performance requirements of, hydraulic brake hose assemblies to be used in hydraulic braking systems of road vehicles, and the markings to be put on the brake hose assembly when manufactured according to these specifications.

2 Field of application

This International Standard applies to brake hose assemblies made of a hose fabricated from cord and natural or synthetic elastomers, and assembled with metal end fittings for use with non-petroleum-base brake fluids as specified in ISO 4925.

The nominal internal diameter of the hose shall be one of the following values :

3,2 mm 4,8 mm 6,3 mm

3 References

ISO 3768, *Metallic coatings — Neutral salt spray test (NSS test)*.

ISO 4925, *Road vehicles — Non-petroleum base brake fluid*.

ISO 4926, *Road vehicles — Hydraulic brake systems — Non-petroleum base reference fluids*.

ISO 6120, *Road vehicles — Brake hose assemblies for hydraulic braking systems used with a petroleum-base hydraulic fluid*.

ISO 7500/1, *Metallic materials — Verification of static uniaxial testing machines — Part 1 : Tensile testing machines*.

4 Definitions

4.1 brake hose assembly : Brake hose equipped with end fittings for use in a brake system.

4.2 brake hose : Flexible conduit manufactured for use in a brake system to transmit and contain the fluid pressure medium used to apply force to the vehicle's brakes.

4.3 brake hose end fittings : Coupling designed for permanent attachment to the ends of a brake hose by crimping or swaging.

4.4 free length : Linear measurement of brake hose exposed between the end fittings of a brake hose assembly while maintained straight.

4.5 leaks; burst : Loss of test fluid through the brake hose assembly other than by the designed inlet(s) and outlet(s).

4.6 cracking : Interruption of a surface due to environment and/or stress.

5 Construction

5.1 Hose

The hose shall consist of an elastomeric lining, two or more layers or plies of reinforcing cord embedded in, and/or bonded to, the elastomeric lining and outer cover. A cushion liner between the reinforcing cords is permitted. The cover shall be a black compound which will not crack when subjected to long periods of weather ageing. The lining of this hose shall be of a compound which will effectively resist deterioration by non-petroleum brake fluids as designated in clause 2.

5.2 Hose assembly

Each hydraulic brake hose assembly shall have permanently attached end fittings.

6 Performance testing for acceptance

6.1 Test schedule

The test schedule shall consist of all the tests listed in table 1. The complete test schedule shall be conducted for each separate brake hose assembly design. For the purposes of this test schedule, any changes in hose construction or materials, coupling crimp or swage design or end fittings shall be deemed to constitute a change in assembly design. Variations that do not influence the integrity of the hose coupling joint such as variation in thread size, port dimensions, hexagon size and the like shall not be considered a design change.

6.2 Requirements

Except for the 100 % pressure test and constriction test, in the event of a failure of one sample in performance testing, a double sample retest of that characteristic shall be performed as shown in table 1.

Table 1 — Hydraulic brake hose assembly performance test and quantity of samples required¹⁾

Sample size		Qualification test	Sub-clause
Original test	Retest		
All	All	100 % pressure test	7.2
All ²⁾	All ²⁾	Constriction	7.3
4	8	Volumetric expansion followed by burst	7.4 7.5
4	8	Brake fluid compatibility	7.6
4	8	Whip	7.7
4	8	Tensile	7.8
1	2	Cold bend	7.10
1	2	Ozone	7.11
1	2	Salt spray	7.12
Tests after water absorption			
4	8	Burst	7.9
4	8	Whip	
4	8	Tensile	
31	—	Total quantity of samples	

Failure of any one sample on retest shall be cause for disqualification or rejection of the lot³⁾.

7 Tests

7.1 Test conditions

The assemblies for the performance test shall be new and unused and shall be at least 24 h old.

For the last 4 h prior to testing, they shall be maintained at a temperature of 15 to 32 °C.

Prior to installation of the hose assembly on a whip test or cold bend test, all external appendages such as mounting brackets, spring guards, and metal collars shall be removed or long tubes shortened, or both.

The temperature of the test room shall be between 15 and 32 °C for all tests except cold bend, ozone, salt spray and brake fluid compatibility.

7.2 100 % pressure test

The hose assembly shall be subjected to a pressure test, using inert gas, air, water or brake fluid conforming to ISO 4925 as the pressure medium. The test pressure shall be 10,3 MPa minimum, 14,5 MPa maximum for inert gas and air, and 20,7 MPa minimum, 24,8 MPa maximum for water and brake fluid. Special care shall be taken when gas or air is used, as under the pressure specified, gas and air are explosive if a failure should occur in the hose assembly. The pressure shall be held for not less than 10 s and not more than 25 s. Hose assemblies showing leaks under this test shall be rejected and destroyed.

7.3 Constriction test

7.3.1 Requirements

The constriction of the hose assemblies shall be measured with a gauge plug as shown in figure 1, the *A* dimensions of which shall be as listed in table 2. The constriction requirements do not apply to that part of the brake hose end fittings which does not contain hose.

Table 2 — Constriction gauge dimensions

Dimensions in millimetres	
Hose internal diameter	Diameter <i>A</i> , min.
3,2	2,03
4,8	3,05
6,3	4,19

7.3.2 Procedure

Hold the assembly vertically at the fitting and insert the *A* diameter portion of the gauge plug into the end of the fitting for the full length of the probe. Repeat at the other end of the brake hose assembly.

Some hose assemblies have a fitting so designed that it is impossible to insert the gauge plug externally. For these assemblies, insert a special elongated gauge plug into the opposite fitting as above and pass the probe through the hose, into and through the crimped area of the fitting being tested. If the gauge plug becomes misaligned at the entrance to the second fitting, it may be necessary to align the hose to allow the gauge plug to pass through. The special gauge plug shall meet all the requirements of figure 1, with the exception of the 76 mm length, which shall be increased appropriately so that its tip will extend past the hose opening.

Some brake hose assemblies have fittings on both ends which cannot be entered with the gauge plug. Cut these assemblies 50 ± 2 mm from the end of the fitting and then test with the gauge plug (see table 1, note 2).

1) When the hose assembly configurations are such that it is impractical to conduct tests such as tensile, whip and constriction, hose assemblies produced from equivalent type end fittings, production type equipment and processes shall be used as substitute brake hose assemblies.

2) Four brake hose assemblies on original test and eight brake hose assemblies on retest may be used if assemblies must be cut to conduct constriction tests.

3) Lot : a defined quantity of brake hose or brake hose assemblies which is being qualified by the test.

7.4 Expansion test

7.4.1 Requirements

The expansion test is designed to measure, by fluid displacement, the volumetric expansion of the free length of a brake hose assembly when subjected to specified internal pressures. The free length is the length measured between the fittings. The maximum expansion of any of the hose assemblies so tested shall not exceed the values in table 3.

Table 3 — Maximum expansion of free length hose

Hose internal diameter mm	6,9 MPa		10,3 MPa	
	Regular expansion hose (HR) cm ³ /m	Low expansion hose (HL) cm ³ /m	Regular expansion hose (HR) cm ³ /m	Low expansion hose (HL) cm ³ /m
3,2	2,17	1,08	2,59	1,38
4,8	2,82	1,81	3,35	2,36
6,3	3,41	2,69	4,27	3,84

7.4.2 Apparatus

The apparatus shall consist essentially of the following :

- source for required fluid pressures;
- test fluid consisting of water without any additives and free of air or gas bubbles;
- reservoir for water pressure gauges;
- fittings in which the hose assembly may be mounted vertically for application of pressure under controlled conditions;
- graduated burette with 0,05 cm³ increments for measuring the volume of liquid corresponding to the expansion of the hose under pressure;
- plumbing hardware as required.

All piping and connections shall be smooth bore without recesses or offsets, so that all air may be freely removed from the system before running each test. Valves shall be capable of withstanding the pressures involved without leakage (see figure 2).

7.4.3 Calibration of apparatus

The apparatus shall be tested prior to use to determine its calibration correction factors established at pressures of 6,9 and 10,3 MPa using a simulated hose assembly that shall consist of 1,52 mm minimum wall hydraulic steel tubing with a free length of 305 ± 6 mm and an outside diameter of 6,3 mm. All fittings and adaptors used in the testing of the hose assembly shall be in this system. This may require the attachment of the tubing to the brake hose fittings in the case of special end configurations. The calibration correction factors shall be subtracted from the expansion readings obtained on the test specimens. The maximum permissible calibration correction factor shall be 0,08 cm³ at 10,3 MPa.

7.4.4 Procedure

7.4.4.1 If the specimen to be used in this test has been subjected to a pressure above 10,3 MPa using any medium prior to this test, allow it to recover for 15 min.

7.4.4.2 Carefully thread the hose assembly into the adaptors designed to seal in the same manner as in actual use. Do not twist. Maintain the hose vertical and straight without tension while under pressure.

7.4.4.3 Bleed all the air from the system by allowing approximately 0,25 l of water to flow from the reservoir tank through the hose assembly and into the burette. Removal of air bubbles may be facilitated by shaking the hose. Close the valve to the burette and apply $10,3 \pm 0,14$ MPa pressure to the hose assembly. Within 10 s inspect the hose assembly for leaks at the connections and then release the pressure completely in the hose. Adjust the water level in the burette to zero. With the valve to the burette closed, apply $6,9 \pm 0,14$ MPa to the hose assembly and seal this pressure in the hose within 5 ± 3 s.

Within 3 s open the valve to the burette for 10 ± 3 s and allow the water in the expanded hose to rise in the burette. The water level in the burette should become constant within that time period.

7.4.4.4 Repeat the preceding step twice, so that the amount of water in the burette will be the total of the three expansions. Measure this burette reading to the nearest 0,05 cm³.

7.4.4.5 The volumetric expansion is calculated by dividing the burette reading by three and subtracting the calibration factor. This figure divided by the free length in metres will give the volumetric expansion per metre of hose.

7.4.4.6 Readjust the water level in the burette to zero as above and repeat the procedure to obtain the expansion at a pressure of $10,3 \pm 0,14$ MPa. If the pressure in the hose should inadvertently be raised to a value above that specified, but not above 24 MPa, completely release the pressure and allow the hose to recover for at least 15 min and then repeat the test. If the hose was subjected to a pressure above 24 MPa, then repeat the test using a new brake hose. If, at any time during the test, an air bubble flows out of the hose, repeat the test after allowing at least 5 min for the hose to recover.

7.5 Burst strength test

7.5.1 Requirements

When tested under hydraulic pressure, each sample of hose assembly shall withstand a pressure hold of 2 min at the specified pressure and shall withstand the minimum burst pressure as shown in table 4.

Table 4 — Hold pressure and minimum burst pressure

Hose internal diameter mm	Pressure hold MPa	Minimum burst pressure MPa
3,2 — 4,8 — 6,3	27,6	34,5

7.5.2 Apparatus

The apparatus shall consist of a suitable pressure system in which the hose is so connected that controlled and measured fluid pressure may be applied internally. The pressure shall be obtained by means of a hand- or power-driven pump or an accumulator system and shall be measured with a calibrated gauge. Provision shall be made for filling the hose with water and allowing all air to escape through a relief valve prior to the application of pressure. This is important as a safety measure. The pressures shown in table 4 shall be applied at a rate of $172,5 \pm 69$ MPa/min.

Since this type of hose withstands a minimum bursting pressure of 34,5 MPa, care shall be taken that all piping, valves and fittings are sufficiently rugged and adapted to high pressure work. The apparatus described for the expansion test may be used when it conforms to these requirements.

7.5.3 Procedure

Connect the specimen to the pressure system and fill completely with water, allowing all air to escape. Removal of air bubbles may be facilitated by shaking the hose. Apply $27,6 \pm 1,3$ MPa pressure at the rate specified in 7.5.2 and hold for $2 \text{ min} \pm 10 \text{ s}$. At the expiration of this "hold period", increase the pressure to $172,5 \pm 69$ MPa/min until the hose bursts. Read the maximum pressure obtained on the calibration gauge to the nearest 0,69 MPa and record as the bursting strength of the hose assembly.

7.6 Brake fluid compatibility, constriction and burst strength test

7.6.1 Requirements

After having been subjected to a temperature of $93 \pm 5^\circ\text{C}$ for 70 to 72 h while filled with compatibility brake fluid as specified in ISO 4926, a hydraulic brake hose assembly shall meet the constriction requirements specified in 7.3.1. It shall then withstand water pressure of 27,6 MPa for $2 \text{ min} \pm 10 \text{ s}$ and shall not burst at less than 34,5 MPa.

7.6.2 Preparation

7.6.2.1 Attach a hose assembly or manifold to which multiple hose assemblies may be attached, below a 0,5 l reservoir filled, as shown in figure 3, with 100 ml of ISO 4926 compatibility brake fluid.

7.6.2.2 Seal the lower end, fill the hose assembly with brake fluid, and place the test assembly in an oven in a vertical position.

7.6.3 Procedure

7.6.3.1 Condition the hose assembly at $93 \pm 5^\circ\text{C}$ for 70 to 72 h.

7.6.3.2 After completion of the test period, remove the hose assembly and cool at room temperature for 30 ± 5 min.

7.6.3.3 Drain the brake hose and within 10 min verify the constriction requirements according to 7.3.1 and 7.3.2.

7.6.3.4 The brake hose assembly shall burst within 3 h using the test described in 7.5.3.

7.7 Whip test

7.7.1 Requirements

The minimum life on the flexing machine shall be 35 h for any one of the sample hose assemblies with free lengths ranging from 200 to 600 mm for a 3,2 mm internal diameter hose and 250 to 400 mm for 4,8 and 6,3 mm internal diameter hose.

7.7.2 Apparatus

The apparatus as shown in figure 4 shall provide the following motion to the specimens.

A movable header consisting of a horizontal bar mounted at each end on vertically rotating discs through bearings with centres placed 100 mm from the disc centres, and an adjustable stationary header parallel to the movable header in the same horizontal plane as the centres of the discs. The headers are each provided with end connections in which the hose assemblies are mounted in parallel. The discs are rotated at a frequency of $800 \pm 10 \text{ min}^{-1}$, whereby the hose ends fastened to the moving header are rotated at this frequency through a circle $203,2 \pm 0,25$ mm in diameter, while the opposite hose end remains stationary. The end connections on the movable header are tightly capped, while those on the stationary header are open to a manifold through which water pressure is supplied by a suitable means. The hose assemblies are subjected during testing to a constant water pressure which shall be maintained between 1,55 and 1,72 MPa. A limit switch shall be used to stop the machine when the water pressure drops, as in the case of hose failure, since it is essential that the machine stop if the pressure drops. An elapsed time indicator shall be provided.

7.7.3 Procedure

7.7.3.1 Measure the free length of each hose assembly with the assembly in a vertical position with a mass of 567 ± 3 g attached to one end. Use a vernier calliper scale or equivalent, and report the length between the fittings to 0,5 mm.

7.7.3.2 Equip the non-rotating header to permit attachment of each hose assembly with individual adjustment for length. When mounted in the whip test machine (see figure 4), the projected length of each hose assembly shall be less than the free length, l , by the amount indicated as slack in table 5 (see figure 5).

7.7.3.3 Since the whip test results are very sensitive to error in setting this length, the projected length on the machine shall be within the limits specified. Take the projected length parallel to the axis of the rotating head.

7.7.3.4 Install the test specimen assemblies in the apparatus without any twist. Apply the water pressure and bleed all hose and passages to eliminate air pockets or bubbles. Start the motor rotating the movable head and note the duration of the test. Check the rate of rotation periodically. Failure of the specimen assembly by water leakage and consequent loss of pressure terminates the test.

Table 5 — Free length and slack for whip test

Dimensions in millimetres

Internal diameter	Free length <i>l</i>	Slack hose
3,2	200 < <i>l</i> < 400	44 ± 0,40
	400 < <i>l</i> < 480	32 ± 0,40
	480 < <i>l</i> < 600	19 ± 0,40
4,8 and 6,3	250 < <i>l</i> < 400	25 ± 0,40

7.8 Tensile test

7.8.1 Requirements

The hose assembly is fixed in the test machine and pulled at a speed of approximately 25 mm/min. All the hose assemblies so tested shall withstand a minimum pull of 1 446 N without the end fittings pulling off or rupture of the hose.

7.8.2 Apparatus

A tensile testing machine conforming to ISO 7500/1 and having a capacity of 4,5 kN will be found suitable. The machine shall be provided with a recording device to give the total pull in newtons at the conclusion of the test. The specimen shall be so held that the hose and fittings have a straight centre line corresponding to the direction of the machine pull.

7.8.3 Procedure

Apply an increasing tensile load at a speed such that the moving head of the test machine travels at the rate of 25 ± 3 mm/min until failure. Record the total load at the time of failure and the type of failure.

7.9 Water absorption test

7.9.1 Requirements

Separate samples of coupled assemblies, after 70 to 72 h immersion in water at room temperature, shall pass all requirements for burst strength (see 7.5.1), whip (see 7.7.1), and tensile load (see 7.8.1), as outlined for non-aged brake hose coupled assemblies.

7.9.2 Preparation

Coupled assemblies shall have $28,6 \pm 2$ mm of the cover removed from the centre so that the outer braid is exposed. Care shall be taken during removal of the cover that the outer yarn is not damaged; nor shall the hose be elongated during the removal.

7.9.3 Procedure

7.9.3.1 Immerse the assembly with the portion of cover removed in water at room temperature for a period of 70 to 72 h.

7.9.3.2 All tests, except the whip test, shall be made within 10 min of removal from the water.

7.9.3.3 The whip test shall be started within 10 to 30 min after removal from the water.

7.10 Cold bend test

7.10.1 Requirements

After conditioning in accordance with 7.10.3.1 and without removal from the cold box, the brake hose shall be bent around the mandrel specified in 7.10.2. The hose cover shall not crack (visible without magnification) or break.

7.10.2 Apparatus

Mandrel having a diameter of $76,2 + \frac{1}{0}$ mm for 3,2 mm hose and $88,9 + \frac{1}{0}$ mm for 4,8 and 6,3 mm hose.

7.10.3 Procedure

7.10.3.1 Condition the hose in a straight position, together with a mandrel of the diameter specified in 7.10.2, in air at -45 to -48 °C for 70 to 72 h. Then, while still at this temperature, bend the hose at least 180° around the mandrel at a steady rate within 3 to 5 s.

7.10.3.2 Examine the cover of the brake hose with the naked eye for cracks or breaks.

7.11 Ozone resistance test

7.11.1 Requirements

The outer cover of the hose shall show no cracking when examined under X 7 magnification, ignoring the areas immediately adjacent to, or within, the area covered by the binding.

7.11.2 Procedure

7.11.2.1 Bend the brake hose around a cylinder, the diameter of which shall be eight times the nominal outside diameter of the brake hose, and bind the ends. The cylinder and binding shall be made of metal or a material that minimizes the consumption of ozone. If the hose collapses when bent around the cylinder, provide for internal support of the hose.

7.11.2.2 Condition the hose, on the cylinder, for $24 \pm 0,5$ h at room temperature, and then place in an exposure chamber containing air mixed with ozone in the proportion of 50 ± 5 parts of ozone to 100 million parts of air by volume, for 70 to 72 h. Ambient air temperature in the chamber during the test shall be 40 ± 3 °C.

7.11.2.3 Examine the cover of the hose for cracks under X 7 magnification, ignoring the areas immediately adjacent to, or within, the area covered by the binding.

7.12 Salt spray test

7.12.1 Requirements

The hose assembly end connections shall withstand 24 h exposure to salt spray according to the conditions specified in ISO 3768. Following the 24 h exposure test, samples shall have no base metal corrosion. The area of the fitting where crimping or the application of labelling information has caused the displacement of the protective coating is exempt from the corrosion requirements. As brass fittings have adequate corrosion resistance, salt spray testing of brass fittings is not required.

7.12.2 Apparatus

Use the apparatus described in ISO 3768. The salt spray chamber shall be constructed so that :

- a) the construction material does not affect the corrosiveness of the spray;
- b) the hose assembly is supported or suspended between 15° and 30° from the vertical as shown in figure 6 and contained in a vertical plane parallel to the principal direction of the horizontal flow of spray through the chamber;
- c) the hose assembly does not contact any metallic material or any material capable of acting as a wick;
- d) condensation which falls from the assembly does not return to the solution reservoir for respraying;
- e) condensation from any source does not fall on the brake hose assemblies or the solution collectors;
- f) spray from the nozzles is not directed on to the hose assembly.

7.12.3 Preparation

7.12.3.1 Plug each end of the hose assembly.

7.12.3.2 Mix a salt solution 5 ± 1 parts by mass of sodium chloride to 95 parts of distilled water, using sodium chloride substantially free of nickel and copper, and containing on a dry basis not more than 0,1 % of sodium iodide and not more than 0,3 % total impurities. Ensure that the solution is free of suspended solids before it is atomized.

7.12.3.3 After atomization at $35 \pm \frac{1}{2}^{\circ}\text{C}$, ensure that the collected solution is in the pH range of 6,5 to 7,2. Make the pH measurements at $25 \pm 3^{\circ}\text{C}$.

7.12.3.4 Maintain a compressed air supply to the nozzle free of oil and dirt, and between 68,9 and 172,4 kPa.

7.12.4 Procedure

7.12.4.1 Subject the brake hose assembly to the salt spray continuously for $24 + \frac{0,2}{0}$ h.

7.12.4.2 Regulate the mixture so that each collector will collect from 1 to 2 ml of solution per hour for each 80 cm² of horizontal collecting area.

7.12.4.3 Maintain the exposure zone temperature at $35 \pm 2^{\circ}\text{C}$.

7.12.4.4 Upon completion, remove the salt deposit from the surface of the hoses by washing gently or dipping in clean running water not warmer than 37 °C and then drying with air within 2 min.

7.12.4.5 Examine the brake hose end fitting for base metal corrosion and record results.

8 Identification and marking

8.1 Hose identification

8.1.1 Identification

The brake hose of each manufacturer shall be identified by one or more coloured marker yarns incorporated in the construction. Embossed or imprinted (three-dimensional) marking on the brake hose cover may be used in lieu of marker yarn identification.

Marker yarn colour on cover designations for each brake hose manufacturer shall be registered with the international agency acting under authorization from ISO: RMA — Rubber Manufacturers Association, 1400 K Street, N.W., Washington, D.C. 20005, USA.

8.1.2 Marking of hose

8.1.2.1 Each hydraulic brake hose shall have at least two clearly identifiable stripes of a colour other than green¹⁾ of at least 1,6 mm width, placed on opposite sides of the brake hose parallel to its longitudinal axis. One stripe may be interrupted by the information required by 8.1.2.2 and the other stripe may be interrupted by additional information at the manufacturer's option.

The marking of the hose need not be present on the hose after it has become part of a hose assembly or after it has been installed in a motor vehicle.

8.1.2.2 Each hydraulic brake hose shall be marked with a colour other than green at intervals of not more than 150 mm,

1) Green labelling is used for hydraulic brake hose used with petroleum-base hydraulic fluid (ISO 6120).

measured from the end of one legend to the beginning of the next, in capital letters and numerals at least 3,2 mm high, with the following information :

- a) the symbol ISO 3996, constituting a certification by the hose manufacturer that the hose conforms to this International Standard;
- b) a designation that identifies the manufacturer of the hose (see 8.1.1); the marking may consist of a designation other than capital letters as required by 8.1.2.2;
- c) the year, month and day, or year and month of manufacture, expressed in numerals; for example 86-12-09 meaning 9 December 1986;
- d) the nominal inside diameter of the hose expressed in millimetres; for example, 3,2 mm;
- e) either "HR" to indicate that the hose is regular expansion hydraulic hose, or "HL" to indicate that the hose is low expansion hydraulic hose.

8.2 Hose assembly identification (optional)

8.2.1 The brake hose assembly of each manufacturer shall be identified by means of a band around the hose assembly as

specified in 8.2.2 or, at the option of the manufacturer, by means of a stamp on the brake hose end fitting as specified in 8.2.3.

8.2.2 The brake hose assembly band shall be etched, embossed or stamped, in block capital letters, numerals or symbols at least 3,2 mm high, with the following information :

- a) the symbol ISO 3996, constituting a certification by the hose manufacturer that the hose assembly conforms to this International Standard.
- b) a designation that identifies the manufacturer of the hose assembly (see 8.2.1); the marking may consist of a designation other than capital letters as required by 8.2.2.

8.2.3 At least one end fitting may, at the manufacturer's option, be etched, embossed or stamped, with a designation at least 1,6 mm high, that identifies the manufacturer of the hose assembly and is filed in accordance with 8.2.2 b).

8.2.4 The marking used by the brake hose assembly manufacturer (see 8.2.1) shall be registered with the international agency acting under authorization from ISO (to be determined).

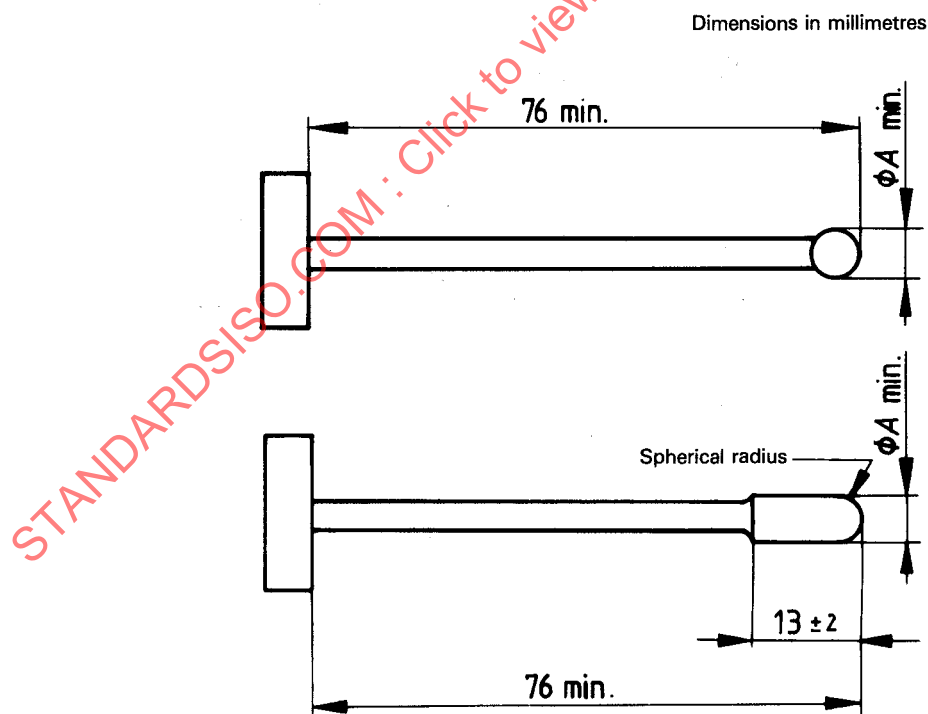


Figure 1 — Gauge plugs for testing constriction of bore of hose¹⁾

1) The tester may choose the gauge.

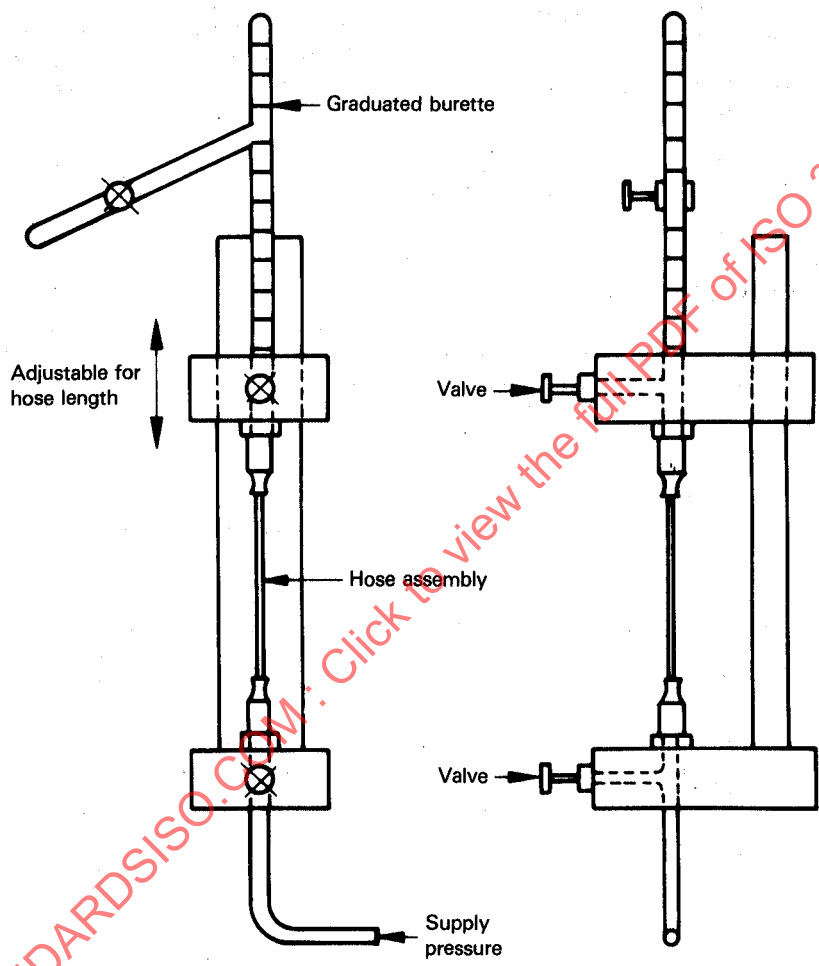


Figure 2 — Expansion test apparatus

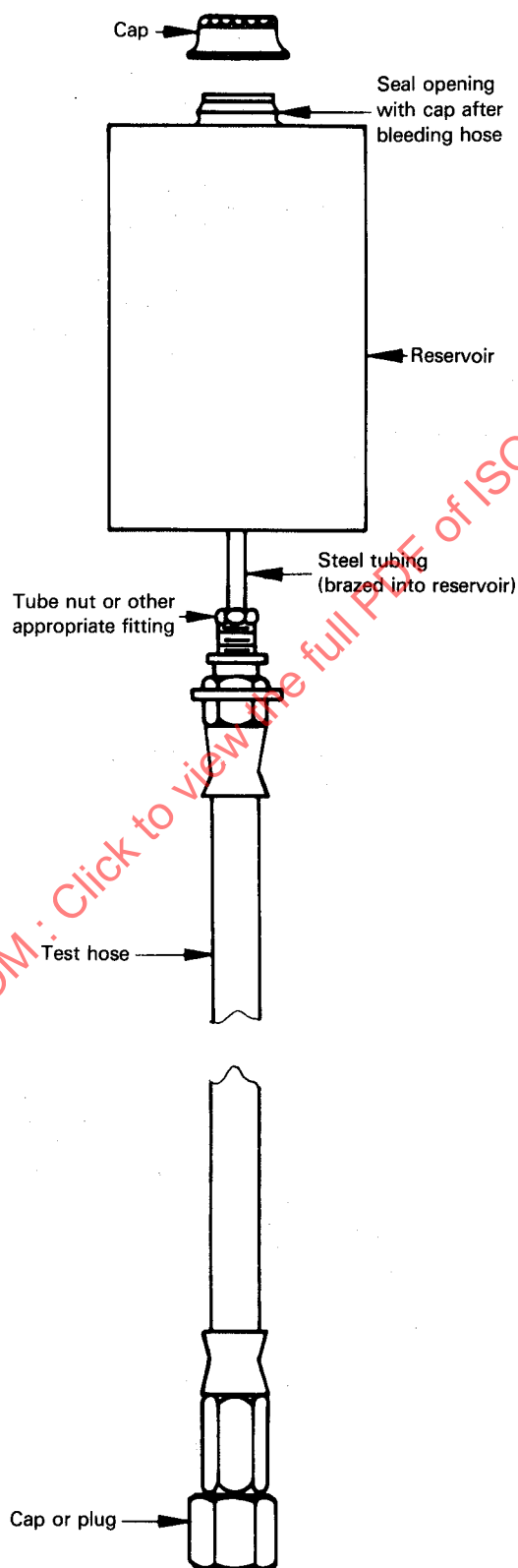


Figure 3 — Brake fluid compatibility test apparatus

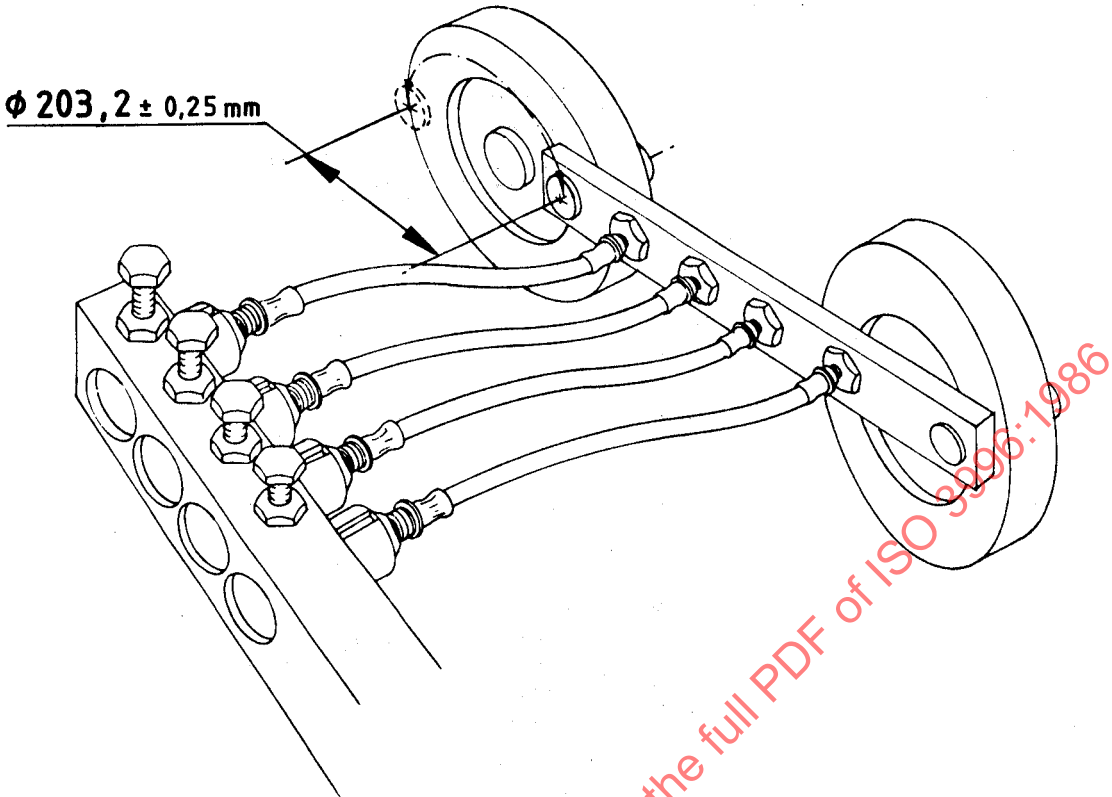


Figure 4 — Whip test machine

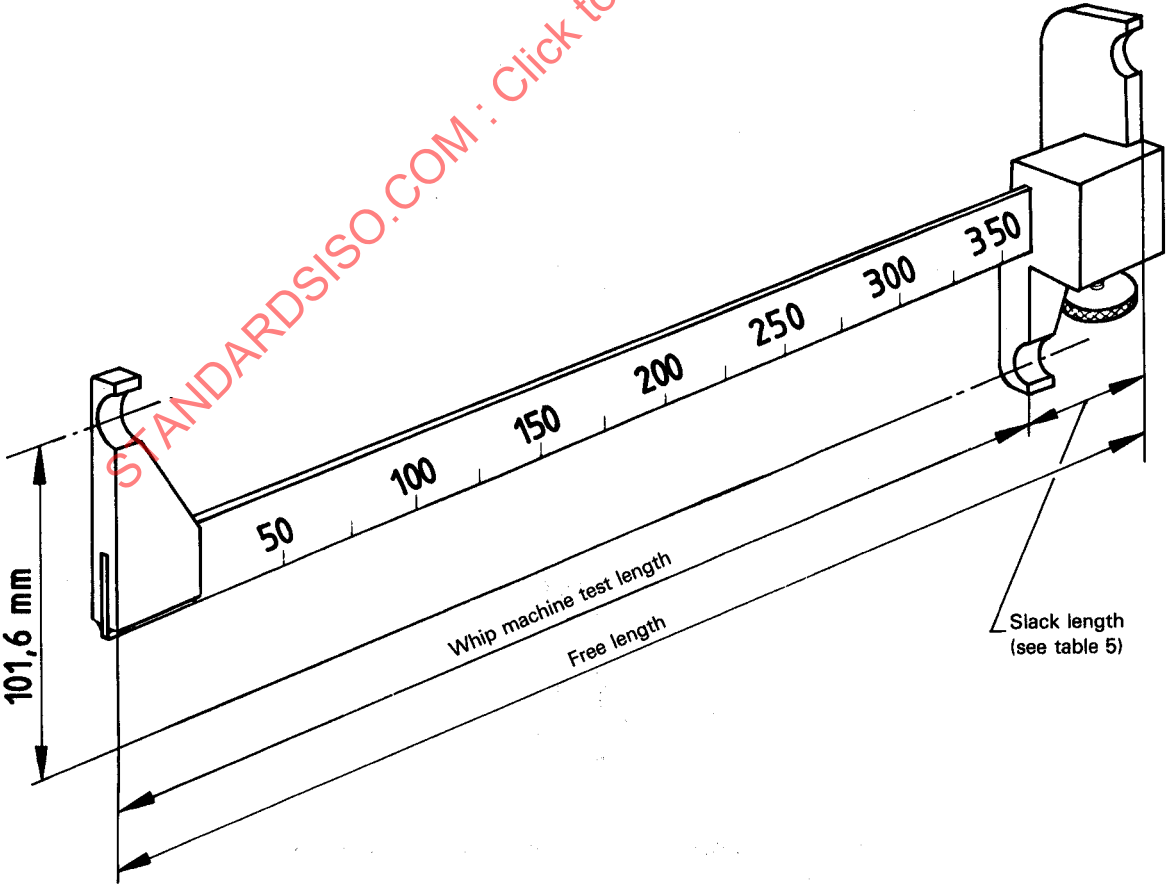


Figure 5 — Whip test slack setting fixture