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SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) OPTIONAL IMPULSE TEST PROCEDURES FOR HYDRAULIC HOSE ASSEMBLIES

***Foreword*—**This Document has also changed to comply with the new SAE Technical Standards Board format.

***1. Scope*—**The procedures contained in this SAE Recommended Practice have been developed to establish uniform methods for impulse testing of hydraulic hose assemblies under special conditions not specified in SAE J343 for SAE J517 hoses. Basic impulse test parameters are to be in accordance with SAE J343 except as modified in this document.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the lastest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J343—Tests and Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies
SAE J517—Hydraulicc Hose
SAE J1176—External Leakage Classifications for Hydraulic Systems

3. Option I - Comparative Flex Impulse Procedure

3.1 Purpose—To generate comparative impulse test data, with and without flexing. This test procedure minimizes impulse test variables to provide comparative data between flexing and nonflexing to determine the effect on the ultimate life of hose. This test is not a requirement for SAE J517.

3.2 Test Procedure—For optimum validity of comparison, test specimens should be cut from a continuous length of hose with alternate samples along the length designated for flexing and nonflexing impulse test.

Those specimens designated for nonflexing should be tested in accordance with SAE J343. Those specimens designated for flexing are to be made up with free hose length in accordance with the following equation:

$$\text{Free hose length} = 4.142\ (\text{minimum bend radius}) + 3.57\ (\text{hose O.D.}) \qquad \text{(Eq. 1)}$$

Performance of the flex-impulse test requires a supplementary rig capable of moving one test manifold in a continuous circular pattern as shown in Figure 1. This manifold is geared so that the center lines of the hose fittings at hose attachment stay parallel at all times. A variable drive is provided, and the number of revolutions per minute are to be controlled to $-36\% \pm 2$ of the impulse cycles per minute. This maintains a proportionality

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between the number of cycles of flexing and impulse and assures that the test specimen is in a different configuration of each succeeding impulse.

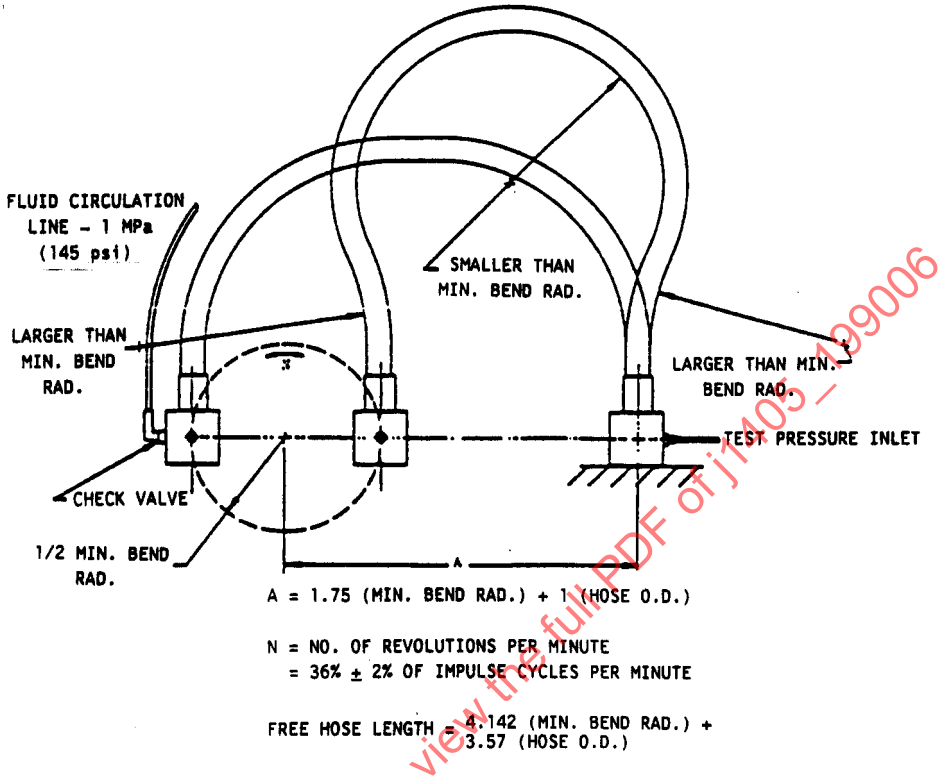

FIGURE 1—FLEX IMPULSE TEST HOSE GEOMETRY

The vertical centerline of a stationary manifold is positioned a distance "A" from the center of revolution of the revolving manifold. This distance was determined empirically such that the test specimen is subjected to back bending motion near each fitting with the radius of bend at that point being greater than the applicable SAE minimum bend radius. However, when the revolving manifold reaches the position nearest the stationary manifold, the bend [1] radius inside the loop is smaller than the applicable SAE minimum bend radius. Distance "A" is calculated with the following equation:

$$1.75 \text{ (minimum bend radius + hose O.D.)} \qquad \text{(Eq. 2)}$$

Specimens for flex-impulse testing should be mounted with straight end fittings on the rig as described above using care to avoid imparting twist to the hose. (Angular fittings may be used, provided they are installed in such a position to assure the hose travel and geometry of Figure 1.) A like number of samples, preferably not less than three, should be tested simultaneously and should be run to failure.

To accelerate completion of the test for comparative purposes, a pressure based on actual burst values of the hose is recommended, with flexing and nonflexing specimens to be tested at the same pressure. Suggested procedure is to first determine the average burst strength for the test length of hose and from this calculate the impulse test pressure as 35% of average burst. If this test procedure does not produce failures within the desired range, a higher or lower percentage may be used.

1. Violation of the minimum bend radius for this test does not imply that such violation is recommended in applications.

4. Option II - Flex Impulse Test

4.1 Purpose—To establish requirements for impulse testing with the addition of flexing. This is a specialized test which is not a requirement of SAE J517, nor is it specified in SAE J343. It is intended to provide a standard method to flex-impulse hose assemblies when flexing is deemed necessary.

4.2 Test Procedure—Four unaged hose assemblies for flexing are to be made up with free hose length in accordance with the following equation:

$$\text{Free hose length} = 4.142\ (\text{minimum bend radius}) + 3.57\ (\text{hose O.D.}) \quad \text{(Eq. 3)}$$

Performance of the flex-impulse test requires a supplementary rig capable of moving one test manifold in a continuous circular pattern as shown in Figure 1. This manifold is geared so that the centerlines of the hose fittings at hose attachment stay parallel at all times. A variable drive is provided, and the number of revolutions per minute are to be controlled to 36% ± 2 of the impulse cycles per minute. This maintains a proportionality between the number of cycles of flexing and impulse and assures that the test specimen is in a different configuration on each succeeding impulse.

The vertical centerline of a stationary manifold is positioned a distance "A" from the center of revolution of the revolving manifold. This distance was determined empirically such that the test specimen is subjected to back bending motion near each fitting with the radius of bend at that point being greater than the applicable SAE minimum bend radius. However, when the revolving manifold reaches the position nearest the stationary manifold, the bend radius inside the loop is smaller than the applicable SAE minimum bend radius. [2] Distance "A" is calculated with the following equation:

$$1.75\ (\text{minimum bend radius}) + \text{hose O.D.} \quad \text{(Eq. 4)}$$

Specimens for flex-impulse testing should be mounted with straight end fittings on the rig as described above using care to avoid imparting twist to the hose. (Angular fittings may be used provided they are installed in such a position to assure the hose travel and geometry of Figure 1.)

4.3 Test Requirements—The hose assemblies shall be tested at the impulse pressures, temperatures and minimum bend radii, for the minimum number of impulse cycles, as specified in SAE J517 for 100R series hoses. Other test parameters, as agreed upon by the supplier and/or user may be used.

5. Option III - Cool Down Leakage Test

5.1 Purpose—To establish requirements for performing a cold start leakage test to be used in conjunction with both flexing or nonflexing impulse tests.

5.2 Test Procedure—The impulse test unit shall be shut down at 40% ± 10 and 90% ± 10 of the required number of impulse cycles and allowed to cool until the test oil and hose assemblies reach a temperature of 30 °C ± 3 (85 °F ± 5). Accelerated cool down procedures, i.e. fans, heat exchangers, etc., may be used to speed the cooling process. Check test assemblies to assure they are clean and dry. With oil heater turned off, resume the test and observe and note leakage for 1000 impulse cycles. The acceptable rate of leakage shall be as agreed upon by the supplier and/or user. (See SAE J1176 for leakage classes.)

After completing the 1000 impulse cycles, turn on oil heater and continue the impulse test.

If leakage is noted during the cool down cycle, notation shall also be made as to whether or not a seal-off was effected as the temperature came back up. Results are applicable only to the specific hose construction and size, hose fitting design and size, and fitting assembly technique.

2. Violation of the minimum bend radius for this test does not imply that such violation is recommended in applications.

6. *Notes*

6.1 Marginal Indicia—The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE FLUID CONDUCTORS AND CONNECTORS TECHNICAL COMMITTEE S2—HYDRAULIC HOSE AND FITTINS SUBCOMMITTEE