



# Technical Standard Order

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**Subject: TSO-C75, HYDRAULIC HOSE ASSEMBLIES**

## Technical Standards Orders for Aircraft Materials, Parts and Appliances

Part 514 which contains minimum performance standards and specifications for materials, parts, and appliances used in aircraft consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. Subpart B contains the technical standards and specifications to which a particular product must conform.

ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D.C.

### **Subpart A—GENERAL**

#### **§514.0 Definition of terms.**

As used in this part:

(a) "Administrator" means the Administrator of the Federal Aviation Agency or any person to whom he has delegated his authority in the matter concerned.

(b) "FAA" means Federal Aviation Agency.

(c) "Manufacturer" means a person who controls the design and quality of an article produced under the TSO system, including all parts thereof and processes and services related thereto obtained from outside sources.

(d) "Article" means the materials, parts, or appliances for which approval is required

under the Civil Air Regulations for use on civil aircraft.

#### **§514.1 Basis and purpose.**

(a) *Basis.* Section 601 of the Federal Aviation Act of 1958, and §§3.18, 4a.31, 4b.18, 5.18, 6.18, 7.18, 10.21, 13.18, and 14.18 of this title (Civil Air Regulations).

(b) *Purpose.* (1) This part prescribes in individual Technical Standard Orders the minimum performance and quality control standards for FAA approval of specified articles used on civil aircraft<sup>1</sup>, and prescribes the methods by which the manufacturer of

such articles shall show compliance with such standards in order to obtain authorization for the use of the articles on civil aircraft.

(2) The performance standards set forth in the individual Technical Standard Orders are those standards found necessary by the Administrator to assure that the particular article when used on civil aircraft will operate satisfactorily, or accomplish satisfactorily its intended purpose under specified conditions.

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<sup>1</sup>Articles may also be approved and manufactured for use on civil aircraft as a part of the type design of a type certificate for an aircraft engine or propeller.

### §514.2 TSO authorization.

(a) *Privileges.* No person shall identify an article with a TSO marking unless he holds a TSO authorization and the article meets the applicable TSO standards prescribed in this part.

(b) *Letters of acceptance issued prior to July 1, 1962.* An FAA letter of acceptance of a statement of conformance issued for an article prior to July 1, 1962, is an authorization within the meaning of this part and the holder thereof may continue to manufacture such article without obtaining an additional TSO authorization, but shall comply with the requirements of §514.3 through §514.10.

(c) *Application.* The manufacturer or his duly authorized representative shall submit an application for a TSO authorization together with the following documents (See Appendix A of this subpart for sample application) to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, in the region in which the manufacturer is located.<sup>2</sup>

(1) A statement of conformance certifying that the applicant has complied with the provisions of Subpart A and the article meets the applicable performance standards established in Subpart B of this part (See Appendix B

of this subpart for sample statement of conformance);

(2) Copies of the technical data required in the performance standards set forth in Subpart B of this part for the particular article;

(3) A description of his quality control system in the detail specified in §1.36 of this title (Civil Air Regulations). In complying with this provision the manufacturer may refer to current quality control data filed with the Agency, as a part of a previous application.

NOTE: When a series of minor changes in accordance with §514.5 is anticipated, the manufacturer may set forth in his application the basic model numbered article with open brackets after it to denote that suffix change letters will be added from time-to-time e.g., Model No. 100( ).

(d) *Issuance.* (1) Upon receipt of the application and adequate supporting documents specified in paragraph © of this section to substantiate the manufacturer's statement of conformance with the requirements of this part and his ability to produce duplicate articles in accordance with the provisions of this part, the applicant will be given an authorization to identify his article with the applicable TSO marking.

(2) If the application is deficient in respect to any requirements, the applicant shall, upon request by the Chief, Engineering and Manufacturing Branch, sub-

mit such additional information as may be necessary to show compliance with such requirements. Upon the failure of the applicant to submit such additional information within 30 days after the date of the request therefor, his application will be denied and he will be so notified by the Chief, Engineering and Manufacturing Branch.

NOTE: The applicant will be issued an authorization or notified of the denial of his application within 30 days after the date of receipt of such application or, in the event that additional information has been requested, within 30 days after the date of receipt of such additional information.

### §514.3 Conditions on authorizations.

The manufacturer of an article under an authorization issued under the provisions of this part shall—

(a) Manufacturer such article in accordance with the requirements of Subpart A and the performance standards contained in the applicable TSO of Subpart B of the part;

(b) Conduct the required tests and inspections, and establish and maintain a quality control system adequate to assure that such article, as

<sup>2</sup>Regional Offices are located at New York, Atlanta, Kansas City, Fort Worth, Los Angeles, Anchorage.

manufactured, meets the requirements of paragraph (a)

of this section and is in a condition for safe operation;

(c) Prepare and maintain for each type or model of such article a current file of complete technical data and records in accordance with §514.6; and

(d) Permanently and legibly mark each such article with the following information:

(1) Name and address of the manufacturer,

(2) Equipment name, type or model designation,

(3) Weight to the nearest tenth of a pound,

(4) Serial number and/or date of manufacturer, and

(5) Applicable Technical Standard Order (TSO) number.

#### §514.4 Deviations.

Approval for a deviation from the performance standards established in Subpart B may be obtained only if the standard or standards for which deviation is requested are compensated for by factors or design features which provide an equivalent level of safety. A request for such approval together with the pertinent data shall be submitted by the manufacturer to the Chief, Engineering and Manufacturing Branch of the Region in which the applicant is located.

#### §514.5 Design changes.

(a) *By Manufacturer*—(1) *Minor changes.* The manufacturer of an article under an authorization issued pursuant to the provisions of this part may make minor design changes to the article without further approval by the FAA. In such case the changed article shall retain the original model number and the manufacturer shall forward to the Chief, Engineering and Manufacturing Branch such revised data as may be necessary for compliance with §514.2(c).

(2) *Major changes.* If the changes to the article are so extensive as to require a substantially complete investigation to determine compliance with the performance standards established in Subpart B, the manufacturer shall assign a new type or model designation to the article and submit a new application in accordance with the provisions of §514.2(c).

(b) *By persons other than the manufacturer.* Design changes to an article by a person other than the manufacturer who submitted the statement of conformance for such article are not eligible for approval under this part, unless such person is a manufacturer as defined in §514.0 and applies for authorization under §514.2(c).

NOTE: Persons other than a manufacturer may obtain approval

for design changes to a product manufactured under a TSO pursuant to the provisions of Part 18 or the applicable airworthiness regulations.

#### §514.6 Retention of data and records.

(a) A manufacturer holding an authorization issued pursuant to the provisions of this part shall, for all articles manufactured under such authorization on and after July 1, 1962, maintain and keep at his factory:

(1) A complete and current technical data file for each type or model of article which shall include the design drawings and specifications. This technical data shall be retained for the duration of his operation under the provisions of this part.

(2) Complete and current inspection records to show that all inspections and tests required to ensure compliance with this part have been properly accomplished and documented. These records shall be retained for at least two years.

(b) The data specified in paragraph (a) (1) of this section shall be identified and copies transferred to the FAA for record purposes in the event the manufacturer terminates his business or no longer operates under the provisions of this part.

#### §514.7 Inspection and examination of data, articles or manufacturing facilities.

The manufacturer shall, upon request, permit an authorized representative of the FAA to inspect any article manufactured pursuant to this part, and to observe the quality control inspections and tests and examine the manufacturing facilities and technical data files for such article.

**§514.8 Service difficulties.**

Whenever the investigation of an accident or a service difficulty report shows an unsafe feature or characteristic caused by a defect in design or manufacture of an article, the manufacturer shall upon the request of the Chief, Engineering and Manufacturing Branch, report the results of his investigation and the action, if any, taken or proposed by him to correct the defect in design or manufacture (e.g., service bulletin, design changes, etc.). If the defect requires a design change or other action to correct the unsafe feature or characteristic, the manufacturer shall submit to the Chief, Engineering and Manufacturing Branch, the data necessary for the issuance of an airworthiness directive containing the appropriate corrective action.

**§514.9 Noncompliance.**

Whenever the Administrator finds that a manufacturer holding an authorization issued pursuant to the provisions of this part has identified an article by a TSO marking and that such article does not meet the applicable performance standards of this part, the Administrator may, upon notice thereof to the manufacturer, withdraw the manufacturer's authorization and, where necessary, prohibit any further certification or operation of a civil aircraft upon which such article is installed until appropriate corrective action is taken.

**§514.10 Transferability and duration.**

An authorization issued pursuant to the provisions of this part shall not be transferred and is effective until surrendered, or withdrawn, or otherwise terminated by the Administrator.

APPENDIX A  
SAMPLE APPLICATION FOR  
TSO AUTHORIZATION  
  
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(Date)  
(Addressed to: Chief, Engineering and Manufacturing Branch, Federal Aviation Agency, Region.)

Application is hereby made for authorization to use the Technical Standard Order procedures.

Enclosed is a statement of conformance for the article to be produced under TSO-C-----.

The required quality control data<sup>1</sup> are transmitted: (herewith) (under separate cover).

Signed-----

APPENDIX B  
SAMPLE STATEMENT OF  
CONFORMANCE

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(Date)  
(Addressed to: Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency.)

The undersigned hereby certifies that the article listed below by model, type of part number has been tested and meets the performance standards of Technical Standard Order C----- . In addition all other applicable provisions of Part 514 of the Regulations of the Administrator have been met.

The technical data required by the TSO in the quantity specified are transmitted: (herewith) (under separate cover).

Authorization to use TSO identification on the article is requested.

Signed-----

**§514.81 Hydraulic hose assemblies—TSO-C75.**

(a) *Applicability.* Minimum performance standards are hereby established for hydraulic hose assemblies which are to be used on U.S. civil transport category aircraft. New models of hydraulic hose assemblies manufactured on or after the effective date of this section, which are to be used on U.S. civil transport category aircraft shall meet

<sup>1</sup>Reference may be made to data already on file with the FAA.

the standards specified in Federal Aviation Agency Standard, "Hydraulic Hose Assemblies," dated December 15, 1962.

(b) *Marking.* Articles shall be marked in accordance with the requirements of § 514.3 (d) with the following exceptions:

(1) Trademark may be used in lieu of name, and manufacturer's address is not require;

(2) Size, type, and maximum operating pressure of the hose assembly shall be shown in lieu of weight in paragraph (d)(3) of § 514.3;

(3) Part number shall be shown;

(4) Date of manufacture in terms of month and year is to be shown and serial number omitted;

(5) In lieu of paragraph (d)(2) of § 514.3 hose assemblies suitable for use with synthetic base fluids shall be marked with the letter "S" immediately following the type designation. Assemblies suitable for use with petroleum base fluids shall be marked with the letter "P". Assemblies suitable for use with both synthetic and petroleum base fluids shall be marked with "S/P", i.e., Type II-B-S, Type II-B-P, or Type II-B-S/P; and

(c) *Data requirements.* In accordance with the provisions of §514.2 the manufacturer shall furnish to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency, in the region in which the manufacturer is located, six copies of the following technical data:

(1) Type;

(2) Size;

(3) Maximum operating pressure;

(4) Part number; and

(5) Installation instructions and limitations, if any.

(d) *Effective date.* September 4, 1963.



**Federal Aviation Agency Standard  
For  
Hydraulic Hose Assemblies**

**1.0 Purpose.** To specify the minimum airworthiness requirements for hydraulic hose assemblies intended for use on civil transport category aircraft.

**2.0 Scope.** This specification covers minimum airworthiness requirements for the following types of hydraulic hose assemblies:

<i>Type</i>	<i>Pressure</i>	<i>Temperature</i>
IA	Medium <sup>1</sup>	160° F.
IB	High <sup>2</sup>	160° F.
IIA	Medium	275° F.
IIB	High	275° F.
IIIA	Medium	400° F.
IIIB	High	400° F.

**3.0 General Requirements.**

**3.1 Materials.** Materials shall be uniform in quality and suitable for the purpose intended. The suitability of the materials shall be determined on the basis of satisfactory service experience or substantiating qualification test.

**3.2 Workmanship.** Workmanship shall be of the quality necessary to produce hose assemblies free from all defects which may adversely affect proper functioning in service.

**3.3 Qualification Tests, General.**

**3.3.1 Performance.** There shall be no evidence of leakage, wicking, imperfections or damage of the hose or end fittings when the assembly is subjected to the tests specified herein.

**3.3.2 Test Assemblies.** A sufficient number of each type and size hose assembly to be qualified shall be selected at random and

<sup>1</sup> The term "medium" is used herein to mean a nominal operating pressure of 1,500 p.s.i. or less.

<sup>2</sup> The term "high" pressure means a nominal operating pressure greater than 1,500 p.s.i. and up to and including 3,000 p.s.i.

satisfactorily tested to the applicable provisions specified herein.

**3.3.3 Fluid Aging.** In all the tests involving fluid aged assemblies, the assemblies shall be filled with a suitable test fluid<sup>3</sup> and soaked for 7 days in an air oven at the applicable temperature specified in paragraph 2.0.

**3.3.4 Air Aging.** In all the tests involving air-aged assemblies, the assembly shall be aged for 7 days in air at the applicable temperature specified in paragraph 2.0.

**3.3.5 Test Pressures.** Unless otherwise noted, all pressures specified herein are hydraulic pressures and shall not be less than the applicable pressure shown in paragraph 7.1.

**3.3.6 Test Temperatures.** Unless otherwise specified, the fluid and ambient temperatures shall be room temperatures.

**3.3.7 End Fitting Design.** If an end fitting incorporates a minor variation from the design of a similar fitting in a previously qualified hose assembly of the same type, then the hose assembly need not be retested. It is the responsibility of the manufacturer to determine that such a variation will not adversely affect the airworthiness of the hose assembly.

**3.3.8 Corrosion.** The design and manufacture of the hose assemblies shall be such that corrosive tendencies in any component part shall be effectively minimized.

**4.0 Test Requirements, Type IA, IIA, IB, and IIB Hose Assemblies.**

**4.1 Proof Pressure.** Hose assemblies shall be subjected, for at least 30 seconds, to a

<sup>3</sup> A suitable test fluid is one which is representative of that to be used with the applicable hose assembly in civil transport category aircraft operation.

proof pressure test of at least 1.5 times the applicable pressure shown in paragraph 7.1.

**4.2 Bending and Vacuum.** A hose assembly shall be fluid aged in accordance with paragraph 3.3.3. It shall then be proof pressure tested in accordance with paragraph 4.1. The unfilled assembly shall then be bent over a form so that the radius and length shall conform to Table I except that, for -16 and larger size hoses, the length shall be 30 inches. The hose shall not flatten or deform at any section to an amount greater than 10 percent or the outside diameter of the hose. While still bent in this radius, a vacuum of 28 inches of mercury shall be applied and held for 5 minutes during which time the hose shall be checked for additional flattening. Application of the 28-inch Hg vacuum shall not result in more than a 20 percent reduction in OD at any section for all sizes up to and including -24 and a 35 percent reduction for size -32. After the vacuum is released, and the hose is dissected longitudinally, there shall be no evidence of ply separation, blistering, collapse, or other damage.

**4.3 Hydraulic Leakage.** An unaged hose assembly, not less than 12 inches in length, shall be subjected to 70 percent of the hydraulic burst pressure specified in paragraph 4.4 for 5 minutes. The pressure shall then be reduced to zero, after which it shall be raised to 70 percent of the specified burst pressure for another 5-minute period. The outer surface of the hose assembly shall be carefully checked after this period for conformance with paragraph 3.3.1. After completion of the hydraulic leakage test, the hose assembly shall be subjected to the Room Temperature Burst Pressure test specified in paragraph 4.4.

**4.4 Room Temperature Burst Pressure.** An unaged hose assembly of the applicable length specified in Table I shall be subjected to a burst pressure of 4.0 times the applicable pressure shown in paragraph 7.1. The rate of

pressure rise shall be 20,000±5,000 p.s.i. per minute until the burst pressure is obtained.

**4.5 Hydraulic Impulses.** A fluid aged, air aged, and unaged hose assembly of lengths not less than those applicable lengths specified in Table I shall be proof pressure tested in accordance with paragraph 4.1 and then be connected to a manifold installed in an impulse test machine. The temperature of the test fluid shall be measured at the test manifold and shall be maintained at 120°±10° F. Hose assemblies of the -3 through -12 sizes shall be installed with the applicable bend radius shown in Table I and both ends shall be connected to a rigid support. Size -16 through -32 hose assemblies shall be installed straight with one end left free. Electronic measuring devices shall be used to measure the impulse pressures in the inlet manifold. Impulse cycling in accordance with Figure I shall be as follows:

Type	Size	No. of Cycles
IA and IIA	-3 through -16	100,000
IA and IIA	-20 through -32	50,000
IB and IIB	-4 through -6	100,000
IB and IIB	-8	75,000
IB and IIB	-10	50,000
IB and IIB	-12	35,000
IB and IIB	-16	45,000
IIIA	all sizes	100,000
IIIB	all sizes through -8	250,000
IIIB	Sizes -10 and -12	100,000
IIIB	-16	45,000

The following assemblies need not be subjected to any peak pressure greater than the applicable operating pressure:

Type	Size
IA and IIA	-20 through -32
IB, IIB and IIIB	-16
IIIA	-20 through -24

**4.6 Cold Temperature Flexing.** A fluid aged and an air aged hose assembly (reference paragraphs 3.3.3 and 3.3.4 respectively) shall be filled with a suitable test fluid and placed,

for a 72-hour period in a cold chamber which is controlled to  $-65^{\circ}$  to  $-70^{\circ}$  F. While at this temperature, the assemblies shall be bent through  $180^{\circ}$ , in opposite directions, to the applicable radius specified in Table I, within a 4-second period. After removal from the cold chamber, the assemblies shall be subjected to the applicable proof pressure test. Dash 16 and larger size assemblies may be tested at  $-40^{\circ}$  F. in lieu of the above-specified temperature.

### **5.0 Test Requirements, Type IIIA Hose Assemblies.**

**5.1 Room Temperature Burst Pressure.** Same as paragraph 4.4.

#### **5.2 Bending and Vacuum.**

a. An unaged assembly shall be filled with test fluid and cold soaked at  $-65^{\circ}$  to  $-70^{\circ}$  F. for 24 hours and then bent to the applicable bend radius, through  $180^{\circ}$ , in opposite directions. Five complete cycles shall be conducted at the rate of approximately one cycle in 4 seconds. The assembly shall then be subjected to the applicable proof pressure test while still at  $-65^{\circ}$  to  $-70^{\circ}$  F.

b. The assembly shall be emptied and heat soaked at  $400^{\circ}\pm 10^{\circ}$  F. for 4 hours while bent to the applicable bend radius and while being subjected to the following negative pressure:

28 inches of mercury for the -4 through -12 size.

18 inches of mercury for the -16 and -20 size.

14 inches of mercury for the -24 size.

The assembly shall then be cooled to room temperature while the negative pressure is maintained.

c. After this test and after the hose is dissected longitudinally and inspected, there shall be no evidence of damage or breakdown.

**5.3 Hydraulic Leakage.** A hose assembly of the applicable length specified in Table

I shall be subjected to the hydraulic leakage test specified in paragraph 4.3 after it has been pressurized, while at room temperature, to 25 p.s.i. for at least 5 minutes.

#### **5.4 High Temperature Burst Pressure.**

An assembly, of the applicable length specified in Table I shall be filled with test fluid at 50 p.s.i. and heat soaked for 1-hour wherein ambient and fluid temperatures are  $400^{\circ}\pm 10^{\circ}$  F. The pressure shall then be increased to the rated operating pressure and held for 5 minutes. The pressure shall then be raised to three times the applicable pressure shown in paragraph 7.1 at a rate of  $20,000\pm 5,000$  p.s.i. During this test, one end of the assembly shall be free.

**5.5 Hydraulic Impulses.** Same as paragraph 4.5 except that the fluid and ambient temperatures shall be at  $400^{\circ}\pm 10^{\circ}$  F.

### **6.0 Test Requirements, Type IIIB Hose Assemblies.**

**6.1 Hydraulic Leakage.** Same as paragraph 5.3.

**6.2 Hydraulic impulse.** Same as paragraph 4.5 except that, in addition, the assembly shall be temperature cycled from room temperature to the specified ambient and fluid temperature, and back to room temperature, for at least 2 cycles. This test shall be programmed so that at least 80 percent of the impulses shall be at  $400^{\circ}$  F. ambient and fluid temperatures.

#### **6.3 Thermal Shock.**

a. The test assembly shall be air aged in accordance with paragraph 3.3.4 and after aging shall be subjected to the applicable proof pressure for minimum of minutes.

b. The test assemblies shall then be mounted, empty, in a controlled temperature test set-up (typical set-up shown in Figure II) and the ambient temperature reduced to  $-67^{\circ}\pm 2^{\circ}$  F. for a minimum of 2 hours. At the

end of this period, while still at this temperature, high temperature test fluid at a temperature of 400° F. shall be suddenly introduced at a minimum of 50 p.s.i. Immediately after the hot fluid has filled the assembly, the pressure shall be raised to the applicable proof pressure for a minimum of 5 minutes. Not more than 15 seconds shall elapse between the introduction of the high temperature fluid at 50 p.s.i. and the raising of the pressure to proof pressure.

c. The assembly shall then be subjected to the High Temperature Burst Pressure test specified in paragraph 5.4.

**6.4 Flexing.** The assembly shall be mounted in the flex set-up as illustrated in Figure III, shall be filled with test fluid and subjected to the following test sequence. The temperatures indicated are both fluid and ambient. Flexing shall occur at a rate of 70±10 cycles per minute during portions c. d. and e.

a. The test assemblies shall be soaked, with no pressure or flexing at a temperature of -67°±2° F. for a minimum of one-hour.

b. With no flexing, the test assemblies shall be pressurized to the proof pressure with the temperature still at -67° F. for a minimum of 5 minutes (first cycle only).

c. Flexing shall begin while the test assemblies are pressurized to the operating pressure with the temperature still at -67° F. for a minimum of 4,000 cycles.

d. With the pressure reduced to zero p.s.i., flexing shall continue for 1,000 cycles at -67° F.

e. Increase the temperature to 400° F. and flex for 1,000 cycles with the pressure at zero p.s.i. The pressure shall then be increased to the operating pressure with the temperature held at 400° F. Flexing shall continue until an accumulated total of 80,000 cycles is reached.

f. Steps a. c. d. and e. shall be repeated for a total of 5 test sequences, i.e., 400,000 flexing cycles.

g. After completion of step f. and with no flexing, test assemblies shall be pressurized to the proof pressure with the temperature still at 400° F. for minimum of 5 minutes (last cycle only).

**7.0 Fire-resistant Hose Assemblies.** Fire-resistant hose assemblies which are intended to be used in locations within fire zones shall comply with the applicable requirements specified herein and in addition shall also comply with the fire test described in FAA report entitled, "Standard Fire Test Apparatus and Procedure" revised March 1961. The use of a protective sleeve over the hose and/or end fittings is permitted to facilitate compliance with the fire test requirements. Sleeve or protective covers shall be secured to the hose assembly so that fire-resistant properties will be maintained.

**7.1 Fire Test Parameters.**

Type Hose Assembly	Hose Size	Maximum Operating Pressure	Flow Rate GPM
IA and IIA	-3	1,500	7 x (ID) <sup>2</sup>
	-4	1,500	"
	-5	1,500	"
	-6	1,500	"
	-8	1,500	"
	-10	1,500	"
	-12	1,000	"
	-16	800	"
	-20	600	3 x (ID) <sup>2</sup>
	-24	500	1 x (ID) <sup>2</sup>
IB and IIB	All	3,000	1 x (ID) <sup>2</sup>
	IIIA	-3 to -10	1 x (ID) <sup>2</sup>
IIIB	-12	1,000	"
	-16	1,250	"
	-20	1,000	"
	-24	750	"
	All	3,000	"

**7.2 Criteria for Acceptability.** The hose assembly shall be considered acceptable if it successfully withstands the applicable fire test

for a period of 5 minutes without evidence of leakage. The pressure-time curve shall be confined to the shaded area indicated.

**TEST LENGTH AND MINIMUM BEND RADIUS**

Note: Cycling tolerance =  $35 \pm$  or  $70 \pm 10$  cycles per minute.

SIZE NUMBER	LENGTH OF TEST ASSEMBLY INCHES				MINIMUM BEND RADIUS AT INSIDE OF BEND INCHES			
	Type Hose Assemblies				Type Hose Assemblies			
	IA and IIA	IB and IIB	IIIA	IIIB	IA and IIA	IB and IIB	IIIA	IIIB
-3	14	--	--	--	3	--	--	--
-4	14	16	14	16	3	3	2	3
-5	16	18	16	--	3 $\frac{3}{8}$	3 $\frac{3}{8}$	2	--
-6	18	21	18	21	4	5	4	5
-8	21	24	21	24	4 $\frac{1}{2}$	5 $\frac{1}{4}$	4 $\frac{1}{2}$	5 $\frac{1}{4}$
-10	23 $\frac{1}{2}$	30	23 $\frac{1}{2}$	30	5 $\frac{1}{2}$	6 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$
-12	27 $\frac{1}{2}$	33	27 $\frac{1}{2}$	33	6 $\frac{1}{2}$	7 $\frac{3}{4}$	6 $\frac{1}{2}$	7 $\frac{3}{4}$
-16	18	24	18	24	7 $\frac{3}{8}$	9 $\frac{1}{8}$	7 $\frac{3}{8}$	9 $\frac{1}{8}$
-20	18	--	18	--	9	--	11	--
-24	18	--	18	--	11	--	14	--
-32	18	--	--	--	13 $\frac{1}{4}$	--	--	--

TABLE I

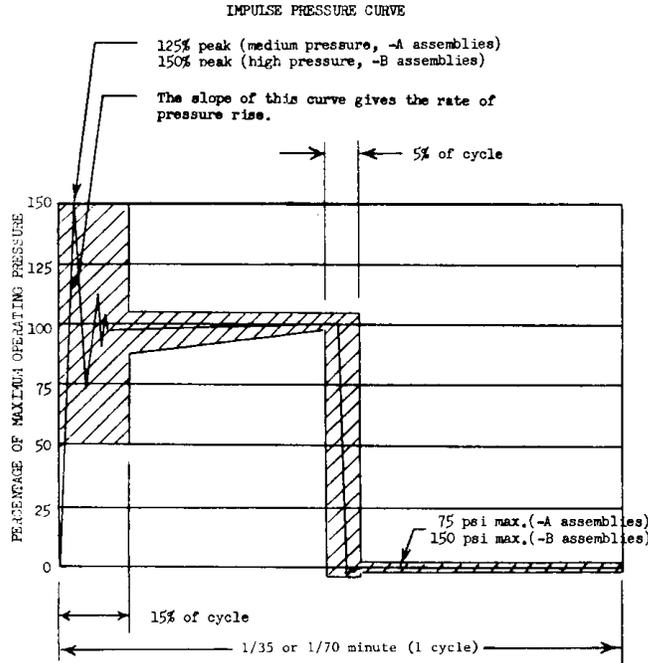


FIGURE I

The curve shown above is the approximate pressure-time cycle determined to be of proper severity for impulse testing of hose assem-

