



Stratoflex

*Fire Resistance Testing of
Aerospace Hose*

*Catalog 106-FR
June 2001*



The World Standard

DANGER

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

Before selecting or using any Parker hose or fittings or related accessories, it is important that you read and follow Parker Safety Guide for Selecting and Using Hoses, Fittings, and Related Accessories (Parker Publication No. 106-SG)

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Fire Resistance Testing

Stratoflex Products Division provides these articles for information. These articles describe the FIRE TEST; FIRE RESISTANCE definitions; and qualifications of hose assemblies for Aerospace applications:

(Note: Most are reprints of Engineering Information Bulletins which may from time to time be revised prior to revision of this bulletin. The user should determine if a later revision of referenced documents is available.)

| | |
|--|---|
| 1. TSO and AS1055 Fire Testing (IB1034) | 2 |
| 2. FAA AC20-135 and No Flow Fire Test (IB1035) | 4 |
| 3. FAA TSO Approvals (IB1030) | 5 |
| 4. Integral Silicone Firesleeve (IB1032) | 8 |
| 5. Safety Guide..... | 9 |

Article #3 lists current TSO approvals for Stratoflex products. This is regularly revised and available through Stratoflex Customer Service. Ask for IB1030. (See also FAA AC20-36.)

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Fire Resistance Testing

"TSO" FAA - Technical Standard Order and AS1055 - Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings and Similar System Components

(SUBJECT TO REVISION - SEE IB1034)

GENERAL FIRE PROTECTION REQUIREMENTS

Hose assemblies located partially or totally in "Fire Zones" must be firesleeved. Stratoflex 2650, silicone covered fiberglass (AS1072, Type 2) or integral extruded (molded) silicone (code H or J and 101 hose) firesleeve provide fire protection.

FAA Technical Standard Orders (TSO) are the performance qualification standards for aircraft parts, materials, etc. Those that apply to hose assemblies are summarized below. A listing of current TSO approvals for Stratoflex hose assemblies is contained in Information Bulletin 1030.

The title of the respective TSO identifies the *application* for which the hose assembly is "qualified":

TSO-C42, Propeller Feathering Hose Assemblies
TSO-C53a, Fuel and Engine Oil System Hose Assemblies
TSO-C75, Hydraulic Hose Assemblies

To further identify the TSO "type" and "qualification/marketing" requirement additional information is needed. Such as: Is the assembly for installation in a fire zone? What are the temperature and pressure requirements? Is the system fluid petroleum base or a synthetic?

If the customer has not designated the "TSO" rating required, answers to the above questions will be necessary to properly define the specific TSO qualification. The following are the "Type" definitions for the hose assembly TSO's.

TSO-C53a

(Equal or More Severe Than TSO-C53)

Type A. Non-fire resistant "normal" temperature hose assemblies which are intended to be used in locations outside fire zones where the fluid and ambient air temperatures do not exceed 250°F. (Qualification reference MIL-H-8794)

Type B. Non-fire resistant "high" temperature hose assemblies which are intended to be used in locations outside fire zones where the fluid and ambient air temperatures do not exceed 450°F. (Qualification reference MIL-H-25579)

Type C. Fire resistant (Type A) "normal" temperature hose assemblies which are intended to be used in locations within fire zones.

Type D. Fire resistant (Type B) "high" temperature hose assemblies which are intended to be used in locations within fire zones.

Fire Resistance Testing

TSO-C75

| <u>TYPE</u> | <u>OPERATING PRESSURE</u> | <u>TEMPERATURE</u> |
|-------------|---------------------------|--------------------|
| IA | 1,500 PSI or less | 160°F |
| IB | 1,500 PSI to 3,000 PSI | 160°F |
| IIA | 1,500 PSI, or less | 275°F |
| IIB | 1,500 PSI to 3,000 PSI | 275°F |
| IIIA | 1,500 PSI or less | 400°F |
| IIIB | 1,500 PSI to 3,000 PSI | 400°F |

Type code also includes "P" (Petroleum) or "S/P" (Synthetic/Petroleum) and if fire resistant, an "F". Example: Type IIA-S/P-F.

TSO-C42

Type 1 (Pressure Line) Hose assemblies which are intended to be used in the line connecting the feathering pump outlet to the propeller governor.

Type 2 (Supply Line "fire resistant"): Hose assemblies which are intended to be used in the line connecting the oil supply to the feathering pump where this entire line is located aft of (behind) the firewall.

Type 3 (Supply Line "fireproof"): Same as Type 2 except hose assemblies are located wholly or in part forward of the firewall.

NOTE: Also must meet performance requirements of MIL-H-8790 or MIL-H-8795.

Summary of TSO application:

1. The TSO is the performance qualification standard.
2. A TSO approval may be specified with or without fire resistance.
3. TSO fire protection standard is "fire resistant" (5 minute) flame exposure *with fluid flow*.

AS1055

AS1055 Also Defines Types, By:

- Material - Type I is Rubber
Type II is Polytetrafluoroethylene (PTFE)
Type III is rigid (metal) tubing
- Function - a) is fuel and lube oil (similar to TSO-C53a)
b) is hydraulic (similar to TSO-C75)
(note: fluid flow(s) is specified)
- Compatibility - S is Synthetic fluid
P is Petroleum base fluid

Fire protection, fire resistant (5 minute) or fire proof (15 minutes) is designated as "Class A" or "Class B" respectively. Example: Type IIB-S/P, Class A.

SPECIAL FIRE PROTECTION REQUIREMENTS

Modifications or other fire protection requirements may also be specified. These normally deal with the duration of fire protection offered and/or fluid flow rate during test. See also, FAA AC20-135... in this bulletin.

These requirements for duration of fire protection may be stated TSO-C53a Type D, "except 15 minute fire test" or "except fire proof" (also defined as 15 minute test), etc. or they may refer to AS1055 which is fire test only; performance qualification is not a part of AS1055. FAA in AC (Advisory Circular) 23-2 acknowledges AS1055 testing.

Special low flow rate (fuel and lube oil is generally tested at $5 \times ID^2 = x \text{ GPM}$ or hydraulic at $1 \times ID^2 = x \text{ GPM}$) or no flow testing has been accomplished on selected type, size and configuration assemblies. Test reports or certifications can be supplied. Specify flow rate, duration of fire test and performance requirements.

Fire Resistance Testing

FAA AC20-135

(SUBJECT TO REVISION - SEE IB1035)

FAA Advisory Circular (AC) 20-135, POWERPLANT INSTALLATION AND PROPULSION SYSTEM COMPONENT FIRE PROTECTION TEST METHODS, STANDARDS, AND CRITERIA, provides guidance in demonstrating compliance of components with fire protection requirements of powerplants (engines) and APUs. "Since the methods of compliance presented in this AC are not mandatory...apply only to an applicant who chooses to follow this particular method of compliance." The AC addresses more than simply hose assemblies.

This Advisory Circular confirms the definitions of "fire resistant" and "fireproof"; i.e. that the only difference is duration of flame exposure during which a component "should maintain its integrity or perform its function."

It further affirms the burner equipment heat transfer characteristics, which match those of TSO-C53a, TSO-C75 and SAE AS1055.

Section 6. d. (3) cautions that the flow rates specified in the TSOs may not be representative of actual conditions, particularly if appropriate steps have been taken by the aircrew to shut down the engine and shut off liquid flow to the engine. "The lower flow rate should then be used for fire resistance or fireproof testing."

Care must be taken to evaluate the "to be tested" conditions. A small amount of flow makes a dramatic difference in the ability of a hose assembly to withstand the flame for a given period. Reduced pressure also contributes to success, however it is not as significant as is the flow rate.

The AC is general guidance and addresses general philosophy regarding fire resistance and the "real world" location and conditions for various components in a fire zone. It does not mandate test at zero flow and maximum pressure.

A copy of the AC may be obtained from FAA or by request of Stratoflex Customer Service.

Fire Resistance Testing

STRATOFLEX F.A.A. "TSO" APPROVALS

(SUBJECT TO REVISION - SEE IB1030)

FAA Technical Standard Orders (TSO) are the performance qualification standards for commercial and general aviation aircraft parts, materials, etc. Reference to TSO does not necessarily imply fire resistant or fire proof qualities.

To determine which of several TSO's and designations is appropriate, the application, working temperature, pressure rating and degree of fire "resistance", if any, must be determined. (Refer to Information Bulletin 1034 [was #629]).

Summarized below are current Stratoflex DOT-FAA TSO Approvals on file. Hose Assemblies are approved and indicated as 171(XXX), etc.; with 2650 firesleeve the part number becomes 171E(XXX), etc. [D also indicates firesleeve], with integral silicone firesleeve the part number is 171H(XXX) or 171J(XXX), etc. See Note 1 and specific assembly standard drawing for applicable TSO marking requirement(s). Also see FAA AC-20-35 (not current). FAA approval letters are on file in Product Engineering.

A new TSO is expected to be released shortly that will greatly improve on the ambiguities of the present TSO's. See SAE AS150 for "TYPE DESIGNATIONS" that best describe ALL performance, including fire resistance.

| Hose Assembly (Cat. Designation) | TSO | Type | Size | Remarks |
|-------------------------------------|-------------|------------------|------------------------|--|
| 104(XXX) | C53a C75 | B III-A-S/P | 3 thru 24 3 thru 24 | See 124 (104 IS 124 WITH 410XXX FITTINGS) |
| 104(F/J)(XXX) | C53a C75 | D III-A-S/P-F | 3 thru 20 5 thru 20 | For -3 and -4 to TSO-C75 E or other low flow applications contact SPD Engineering |
| 111(XXX) | C53a C75 | A I-A-P | 3 thru 32 3 thru 24 | (250° F LIMIT) |
| 111F (XXX) | C53a C75 | C I-A-P-F | 3 thru 32 3 thru 24 | (250° F LIMIT) |
| 112(XXX) | C75 | I-B-P | 4 thru 16 | |
| 112F(XXX) | C75 | I-B-P-F | 4 thru 16 | |
| 124 (XXX) | C53a C75 | B III-A-S/P | 3 thru 24 3 thru 24 | |
| 124F(XXX) | C53a C75 | D III-A-S/P-F | 3 thru 24 5 thru 24 | For -3 and -4 to TSO-C75 E or other low flow applications contact SPD Engineering |
| 124H(XXX) | C53a C75 | D III-A-S/P-F | 3 thru 16 5 thru 16 | "H" INACTIVE FOR NEW DESIGN, SEE 124J / -3, -4, -5 cancelled For -3 and -4 to TSO-C75 E or other low flow applications contact SPD Engineering |
| 124J(XXX) | C53a C75 | D III-A-S/P-F | 3 thru 24 5 thru 24 | For -3 and -4 to TSO-C75 E or other low flow applications contact SPD Engineering |
| 125(XXX) | C53a C75 | B III-A-S/P | 3 thru 24 3 thru 12 | |
| 125F(XXX) | C53a | D | 3 thru 24 | |
| 125H(XXX) | C53a C75 | D III-A-S/P-F | 3 thru 12 5 thru 12 | For -3 and -4 to TSO-C75 E or other low flow applications contact SPD Engineering |

Fire Resistance Testing

| Hose Assembly (Cat. Designation) | TSO | Type | Size | Remarks |
|-------------------------------------|-------------|-------------------|------------------------|--|
| 130(XXX) | C53 | TYPE A | 4 thru 12 | |
| 130F(XXX) | C53 | TYPE C | 4 thru 12 | |
| 156(XXX) | C53a C75 | A I/II-A-S/P | 3 thru 32 3 thru 24 | 176 DESIGNATION, INACTIVE FOR NEW DESIGN. SAME APPROVALS APPLY. |
| 156F(XXX) | C53a C75 | C I/II-A-S/P-F | 3 thru 32 4 thru 24 | 176 DESIGNATION, INACTIVE FOR NEW DESIGN. SAME APPROVALS APPLY. |
| 156H(XXX) | C53a C75 | C I/II-A-S/P-F | 3 thru 20 3 thru 20 | 176 DESIGNATION, INACTIVE FOR NEW DESIGN. SAME APPROVALS APPLY. |
| 170(XXX) | C53a C75 | B III-B-S/P | 4 thru 16 4 thru 16 | TSO-C75 IS MOST APPROPRIATE AND "MORE SEVERE" |
| 170F(XXX) | C53a C75 | D III-B-S/P-F | 4 thru 16 4 thru 16 | |
| 170H(XXX) | C75 | III-B-S/P-F | 4 thru 16 | |
| 170J(XXX) | C75 | III-B-S/P-F | 10 & 16 | |
| 171(XXX) | C75 | III-B-S/P | 4 thru 12 | |
| 171F(XXX) | C75 | III-B-S/P-F | 4 thru 12 | |
| 171H(XXX) | C75 | III-B-S/P-F | 4 thru 10 | INACTIVE FOR NEW DESIGN. SEE 171J PREFERRED. |
| 171J(XXX) | C75 | III-B-S/P-F | 4 thru 12 | |
| 175(XXX) | C75 | III-B-S/P | 4 thru 10 | |
| 175F(XXX) | C75 | III-B-S/P-F | 4 | |
| 175H(XXX) | C75 | III-B-S/P-F | 4 thru 10 | |
| 191(XXX) | C75 | II-B-S/P | -4 thru -12 | |
| 3162(XXX) | C75 | II-A-S/P | 16 & 24 | (-24 TYPE IIIA) |
| 3162F(XXX) | C75 | II-A-S/P-F | 16 & 24 | (-24 TYPE IIIA) |
| 3162J(XXX) | C75 | II-A-S/P-F | 16 & 24 | (-24 TYPE IIIA) |
| 3164(XXX) | C75 | III-B-S/P | 4 & 6 | -8, -10, -12 PENDING |
| 3164J(XXX) | C75 | III-B-S/P-F | 4 & -6 | -8, -10, -12 PENDING |

Fire Resistance Testing

NOTES:

1. All SPD hose assemblies of above "Catalog" types (including "AXXX" assemblies using the same fitting attachment) fabricated by factory or authorized Distributor may be marked with the noted TSO marking, see HOSE000; e.g. 124000, etc. If customer does not specify which TSO applies, mark all that are applicable.
CAUTION: Always confirm. Subject to revision without notice.
2. Authorized FAA TSO Distributors are listed in QCS-133.
3. All current TSO fire resistant tests are five (5) minute minimum duration. For special cases see Information Bulletin 1031, 1034 and 1035 or contact SPD Engineering. The new TSO will allow "FIRE PROOF", 15 minute ratings.
4. A "K" or other abrasion cover (non firesleeve assemblies) may alter the TSO "TYPE" (particularly C75) approval due to a lower recommended maximum continuous ambient temperature limit; e.g. 3164K(XXX), etc. changes from C75 III B-S/P to C75 II B-S/P. A confirming letter for some hose assembly types is approved by FAA; a general letter has been submitted for approval.

Fire Resistance Testing

Integral Silicone Firesleeve

(SUBJECT TO REVISION - SEE IB1032)

Stratoflex offers, as an alternative to 2650 (AS1072) type firesleeve, integral fire protection in the form of an extruded silicone cover. The designation "H" or "J" (or 101 style hose assemblies) signifies the cover both in bulk hose (124-XXJ) and hose assembly (124HXXX).

These designations were chosen as they are the designations for integral silicone firesleeve specified/defined in SAE Hose Assembly Standards such as AS115 (171_141). In this context they were intended to specify: 15 minute, fire proof (H); and 5 minute, fire resistant (J).

DO NOT ASSUME THIS RELATIONSHIP FOR STRATOFLEX DESIGNATIONS. Contact Stratoflex Customer Service for confirmation of qualification status (15 min/5 min) for each hose type/size. We have met the 15 minute (plus) protection with many of the "J" style (thinner) covered products. Thus, there are cases where the "J" style meets the most severe requirements yet offers weight and size advantage potential. (Note that there is no present FAA TSO for fuel, lube or hydraulic assemblies requiring 15 minute protection. AS1055 does provide for Class B of 15 minutes and SAE has recommended SAE AS150.

CONSULT STRATOFLEX FORT WORTH FOR SPECIFIC APPLICATIONS.

Parker Safety Guide for Selecting and Using Hose, Tubing, Fittings and Related Accessories



DANGER: Failure or improper selection or improper use of hose, fittings, or related accessories can cause death, personal injury and property damage. Possible consequences of failure or improper selection or improper use of hose, fittings, or related accessories include but are not limited to:

- Explosion or burning of the conveyed fluid.
- Contact with conveyed fluids, hot, cold, toxic and injurious.
- Dangerously whipping hose.
- Loss of control system.
- High velocity fluid discharge.
- Fittings thrown off at high speed.
- Injection by high-pressure fluid discharge.

Before selecting or using any Parker Hose or Fittings or related accessories, it is important that you read and follow the instructions below.

1.0 GENERAL INSTRUCTIONS

- 1.1 Scope:** This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) hose (including all rubber and/or PTFE products commonly called "hose" or "tubing"), fittings (including all products commonly called "fittings" or "couplings" for attachment to hose), and related accessories (including crimping and swaging machines and tooling). This safety guide is a supplement to and is to be used with, the specific Parker publications for the specific hose, fittings and related accessories that are being considered for use.
- 1.2 Fail-Safe:** Hose and hose assemblies can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the hose or hose assembly will not endanger persons or property.
- 1.3 Distribution:** Provide a copy of this safety guide to each person that is responsible for selecting or using hose and fitting products. Do not select or use hose and fittings without thoroughly reading and understanding this safety guide as well as the specific Parker publications for the products considered or selected.
- 1.4 User Responsibility:** Due to the wide variety of operating conditions and uses for hose and fittings, Parker and its distributors do not represent or warrant that any particular hose or fitting is suitable for any specific end use system. Most Parker Stratoflex Products Division products are qualified to Military or Industry Standards. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:
- Making the final selection of the hose and fitting.
 - Assuring that the user's requirements are met and that the use presents no health or safety hazards.
 - Providing all appropriate health and safety warnings on the equipment on which the hose and fittings are used.
- 1.5 Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, for telephone numbers of the appropriate technical service department.

2.0 HOSE AND FITTING SELECTION INSTRUCTIONS

- 2.1 Electrical Conductivity:** Certain applications require that a hose be nonconductive to prevent electrical current flow or maintain electrical isolation. Other applications require the hose to be sufficiently conductive to drain off static electricity; this is typical of rubber hose and of all aerospace fuel, oil and hydraulic PTFE hose. Extreme care must be exercised when selecting hose and fittings for these or any other applications in which electrical conductivity or non-conductivity is a factor.
- For applications that require hose to be electrically nonconductive, only special nonconductive hose can be used. The manufacturer of the equipment in which the nonconductive hose is to be used must be consulted to be certain that the hose and fittings that are selected are proper for the application. Do not use any Parker hose or fitting for any such application requiring nonconductive hose unless (i) the application is expressly approved in the Parker technical publication for the product, (ii) the manufacturer of the equipment on which the hose is to be used specifically approves the particular Parker hose and fitting for such use.
- The electrical conductivity or non-conductivity of hose and fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials, including fitting finish, used to make the hose and the fittings, how the fittings contact the hose, age and amount of deterioration of damage or other changes and other factors. Aluminum fitting finish effects "conductivity"; anodize is non-conductive, while alodine is conductive.
- 2.2 Pressure:** Hose selection must be made so that the published maximum recommended working pressure of the hose is equal to or greater than the maximum system pressure. Surge pressures in the system higher than the published maximum recommended working pressure would cause failure or shorten hose life. Do not confuse burst pressure or other pressure values with working pressure and do not use burst pressure or other pressure values for this purpose.

Hose assemblies are "proof pressure" tested (normally 2 x working rated pressure) to confirm proper fabrication of the assembly. Gaseous test, including air-under-water, shall be at rated working pressure only and see 4.7 caution below. Care must be exercised to prevent water, or other fluid contaminants from unnecessarily contacting reinforcement, etc.

- 2.3 Suction:** Hoses used for suction applications must be selected to insure that the hose will withstand the vacuum and pressure of the system. Improperly selected hose may collapse in suction application.
- 2.4 Temperature:** Be certain that fluid and ambient temperatures, both steady and transient, do not exceed the limitations of the hose. Temperatures below and above the recommended limit can degrade hose to a point where a failure may occur and release fluid. Care must be taken when routing hose near hot objects (e.g. manifolds) to properly insulate and protect the hose. Fire sleeve is not intended as insulation.
- 2.5 Fluid Compatibility:** Hose selection must assure compatibility of the hose tube, cover, reinforcement, and fittings with the fluid media used. Actual service life can only be determined by the end user by history or testing under all extreme conditions and other analysis.
- 2.6 Permeation:** Permeation (that is, seepage through the hose) may occur from inside the hose to outside when hose is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, fuel oil, natural gas, or refrigerant). This permeation may result in high concentrations of vapors, which are potentially flammable, explosive, or toxic, and in loss of fluid. Dangerous explosions, fires, and other hazards can result when using the wrong hose for such applications. The system designer must take into account the fact that this permeation will take place and must not use hose if this permeation could be hazardous. The system designer must take into account all legal, government, insurance, or any other special regulations, which govern the use of fuels and refrigerants. Never use a hose even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the hose assembly.
- Gaseous permeation, particularly through a PTFE hose, occurs primarily if the gas is "stored" at pressure in the hose. Most standards limit the amount of permissible permeation.**
- 2.7 Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum, and avoid damage due to heat generation or excessive fluid velocity.
- 2.8 Routing:** Attention must be given to optimum routing to minimize inherent problems (kinking or flow restriction due to hose collapse). See SAE AIR1569 for further information.
- 2.9 Environment:** Care must be taken to insure that the hose and fittings are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.
- 2.10 Mechanical Loads:** External forces can significantly reduce hose life or cause failure. Mechanical loads, which must be considered, include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type fittings or adapters may be required to insure no twist is put into the hose. Unusual applications may require special testing prior to hose selection.
- 2.11 Physical Damage:** Care must be taken to protect hose from wear, snagging and cutting, which can cause premature hose failure. See SAE ARP1658 for Visual Guide.
- 2.12 Proper End Fitting:** See instructions 3.2 through 3.5 below. Testing to industry standards such as MIL-A-5070, AS1339, J517, etc must substantiate these recommendations.
- 2.13 Length:** When establishing a proper hose length, motion absorption, hose length changes due to pressure, and hose and machine tolerances must be considered.

- 2.14 Specifications and Standards:** When selecting hose and fittings, government, industry, and Parker specifications and recommendations must be reviewed and followed as applicable.
- 2.15 Hose Cleanliness:** Hose components may vary in cleanliness levels. Care must be taken to insure that the assembly selected has an adequate level of cleanliness and compatibility for the application. See SAE AS611 for PTFE hose assembly cleanliness levels.
- 2.16 Fire Resistant Fluids:** Some fire resistant fluids require the same hose as petroleum oil. Some use a special hose, while a few fluids will not work with any hose at all. See instructions 2.5 and 1.5. The wrong hose may fail after a very short service. In addition, all liquids but pure water may burn fiercely under certain conditions, and even pure water leakage may be hazardous.
- 2.17 Radiant Heat:** Hose can be heated to destruction without contact by such nearby items as hot manifolds or molten metal. The same heat source may then initiate a fire. This can occur despite the presence of cool air around the hose.
- 2.18 Welding or Brazing:** When using a torch or arc-welder in close proximity to hydraulic lines, the hydraulic lines should be removed or shielded with appropriate fire resistant materials. Flame or weld spatter could burn through the hose and possibly ignite escaping fluid resulting in a catastrophic failure. Heating of plated parts, including hose fittings and adapters, above 450° F (232° C) such as during welding, brazing, or soldering may emit deadly gases.
- 2.19 Atomic Radiation:** Atomic radiation affects all materials used in hose assemblies. Since the long-term effects may be unknown, do not expose hose assemblies to atomic radiation.
- 3.0 HOSE AND FITTING ASSEMBLY AND INSTALLATION INSTRUCTIONS**
- 3.1 Pre-Installation and Periodic Inspection:** Prior to installation, a careful examination of the hose assembly must be performed. All components must be checked for correct style, size, part number, length, and minimum bend radius. In addition, the hose must be examined for cleanliness, broken wires, cuts, kinks, obstructions, blisters, cover looseness, or any other visible defects. Do not use any hose that has any of these conditions. See SAE ARP1658 for illustrations of damage conditions.
- 3.2 Hose and Fitting Assembly:** Do not assemble a Parker fitting on a Parker hose that is not specifically listed by Parker for that fitting unless authorized in writing by the Engineering/Technical Manager or Chief Engineer of the appropriate Parker division. Do not assemble a Parker fitting on another manufacturer's hose or a Parker hose to another manufacturer's fitting unless: (i) the Engineering/Technical Manager or Chief Engineer of the appropriate Parker division approves the assembly in writing, (ii) the user verifies the assembly and the application through analysis and testing or (iii) fabricating MILSPEC assemblies in accordance with proper instructions. See instruction 1.4 above. The Parker published instructions must be followed for assembling the fitting on the hose. These instructions are provided in the Parker fitting catalog for the specific Parker industrial fitting being used; most MILSPEC and Aerospace fitting to hose fabrication is closely controlled to authorized facilities.
- 3.3 Related Accessories:** Do not crimp or swage any Parker hose or fittings with anything but the proper listed Parker swage or crimp machine and dies and in accordance with Parker published instructions. Do not crimp or swage another manufacturer's hose fitting with a Parker crimp or swage die unless authorized in writing by the chief engineer of the appropriate Parker division.
- 3.4 Parts:** Do not use any Parker hose fitting part (including but not limited to socket, shell, nipple, or insert) except with the correct Parker mating parts. In accordance with Parker published instructions, unless authorized in writing by the Engineering/Technical Manager or Chief Engineer of the appropriate Parker division. Do not use hose or fitting components from Parker Stratoflex Division with any hose or fitting components from any other Parker Division without this specific authorization. SPD and HPD fitting components shall not be mixed.
- 3.5 Reusable/Permanent:** Do not reuse any reusable fitting product that blew off or pulled off a hose. Do not reuse any fitting component that is cracked or deformed beyond new part tolerance. Do not reuse hose. Do not reuse a Parker permanent (that is, crimped or swaged) hose fitting or any part thereof.
- 3.6 Minimum Bend Radius:** Installation of a hose at less than the minimum listed bend radius may significantly reduce the hose life and cause premature failure. Particular attention must be given to preclude sharp bending at the hose/fitting juncture. If any Stratoflex Products Division hose has been bent to any radius less than its minimum bend radius (minor exceptions from proper authority) or has been kinked during installation, do not use such hose. Such hose is damaged and cannot be used and should be discarded.
- 3.7 Twist Angle and Orientation:** Hose installations must be such that relative motion of machine components does not produce twisting. No twist in the hose is permitted during installation or use. See SAE AIR1569 for additional information.
- 3.8 Securement:** In many applications, it may be necessary to restrain, protect, or guide the hose to protect it from damage by unnecessary flexing, pressure surges, and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.
- 3.9 Proper Connection of Ports:** Proper physical installation of the hose requires a correctly installed port connection insuring that no twist or torque is transferred to the hose confirm proper fabrication of the assembly. Gaseous test, including air-under-water, shall be at rated working pressure only and see 4.7 caution below. Care must be exercised to prevent water, or other fluid contaminants from unnecessarily contacting reinforcement, etc.
- 3.10 External Damage:** Proper installation is not complete without insuring that tensile loads, side loads, kinking, flattening, potential abrasion, thread damage, or damage to sealing surfaces are corrected or eliminated. See instruction 2.10.
- 3.11 System Check-out:** All air entrapment must be eliminated (see 4.7) and the system pressurized to the maximum systems pressure and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.
- 3.12 Routing:** Hose should be routed in such a manner so if a failure does occur, oil or fuel mist will not come into contact with hot surfaces, open flame, or sparks, and the chance of personal injury is minimized.
- 4.0 HOSE AND FITTING INSPECTION INSTRUCTIONS**
- 4.1** Even with proper selection and installation, hose life may be significantly reduced without a continuing inspection program. The frequency of inspection should be determined by the system designer or end user taking into account the severity of the application and risk potential. An inspection program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.7, listed below.
- 4.2 Visual Inspection Hose/Fitting:** Any of the following conditions require immediate shut down and replacement of the hose assembly: (See also ARP1658 for illustrations.)
- Fitting slippage on hose;
 - Damaged, cut or abraded cover (any reinforcement exposed);
 - Hard, stiff, heat cracked, or charred hose;
 - Cracked, damaged, or badly corroded hose or fittings;
 - Leaks at fitting or in hose;
 - Kinked, crushed, flattened or twisted hose; and
 - Blistered, soft, degraded, or loose cover.
- System malfunction including but not limited to, over-pressurization or pressure spikes.
- 4.3 Visual Inspection All Other:** The following items must be tightened, repaired or replaced as required:
- Leaking port conditions;
 - Remove excess dirt buildup;
 - Clamps, guards, shields; and
 - System fluid level, fluid type and any air entrapment.
- 4.4 Functional Test:** Operate the system at maximum operating pressure and check for possible malfunctions and freedom from leaks. Personnel must avoid potential hazardous areas while testing and using the system.
- 4.5 Replacement Intervals:** Specific replacement intervals must be considered based on previous service life, government or industry recommendations, or when failures could result in unacceptable downtime, damage, or injury risk. See instructions 1.2 and 4.2 above.
- 4.6 Inspecting a Pressurized System:** Hydraulic power is accomplished by utilizing high-pressure fluids to do work. Hoses, fittings, and hose assemblies all contribute to doing work by transmitting fluids at high pressures. Fluids under pressure can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure and handling the hoses transporting the fluids. From time to time, hose assemblies will fail. Usually those failures are the result of some form of misapplication, abuse, or simply wear. When hoses fail, generally the high-pressure fluids inside escape in some sort of stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by "feeling" with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possibly loss of limb. Even seemingly minor hydraulic fluid injection injuries must be treated by a physician with knowledge of the tissue damaging properties of hydraulic fluid.
- If a hose failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the hose assembly. Simply shutting down the hydraulic pump may or may not eliminate the pressure in the hose assembly. Many times check valves, etc., are employed in a system and can cause pressure to remain in a hose assembly even when pumps or equipment are not operating. Tiny holes in the hose, commonly known as pinholes, can eject small, dangerously powerful but hard to see streams of hydraulic fluid. It may take several minutes or even hours for the pressure to be relieved so that the hose assembly may be examined safely.
- Once the pressure has been reduced to zero, the hose assembly may be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a hose assembly that has failed. Consult the nearest Parker distributor or the appropriate Parker division for hose assembly replacement information.
- Never touch or examine a failed hose assembly unless it is obvious that the hose no longer contains fluid under pressure. The high-pressure fluid is extremely dangerous and can cause serious and potentially fatal injury.
- 4.7 Gases:** Special care should be taken when working with gaseous systems. Gases are compressible, thus increase the danger of over-pressure, particularly during test. Sudden escape of gases can cause blindness if the escaping gases contact the eye and can cause freezing or other severe injuries if it contacts any other portion of the body.

Fire Resistance Testing

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