

# Safety & Technical Information





## Parker Safety Guide for Selecting and Using Hose, Tubing, Fittings, Connectors, Conductors, Valves and Related Accessories

Parker Publication No. 4400-B.1

**WARNING:** Failure or improper selection or improper use of hose, tubing, fittings, assemblies, valves, connectors, conductors or related accessories (“Products”) can cause death, personal injury and property damage. Possible consequences of failure or improper selection or improper use of these Products include but are not limited to:

- Fittings thrown off at high speed.
- High velocity fluid discharge.
- Explosion or burning of the conveyed fluid.
- Electrocutation from high voltage electric powerlines.
- Contact with suddenly moving or falling objects that are controlled by the conveyed fluid.
- Injections by high-pressure fluid discharge.
- Dangerously whipping Hose.
- Tube or pipe burst.
- Weld joint fracture.
- Contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious.
- Sparking or explosion caused by static electricity buildup or other sources of electricity.
- Sparking or explosion while spraying paint or flammable liquids.
- Injuries resulting from inhalation, ingestion or exposure to fluids.

Before selecting or using any of these Products, it is important that you read and follow the instructions below. No product from any division in Parker Fluid Connectors Group is approved for in-flight aerospace applications. For hoses and fittings used in in-flight aerospace applications, please contact Parker Aerospace Group.

### 1.0 GENERAL INSTRUCTIONS

**1.1 Scope:** This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) these Products. For convenience, all rubber and/or thermoplastic products commonly called “hose” or “tubing” are called “Hose” in this safety guide. Metallic tube or pipe are called “tube”. All assemblies made with Hose are called “Hose Assemblies”. All assemblies made with Tube are called “Tube Assemblies”. All products commonly called “fittings”, “couplings” or “adapters” are called “Fittings”. Valves are fluid system components that control the passage of fluid. Related accessories are ancillary devices that enhance or monitor performance including crimping, flaring, flanging, presetting, bending, cutting, deburring, swaging machines, sensors, tags, lockout handles, spring guards and associated 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. Parker publications are available at [www.parker.com](http://www.parker.com). SAE J1273 ([www.sae.org](http://www.sae.org)) and ISO 17165-2 ([www.ansi.org](http://www.ansi.org)) also provide recommended practices for hydraulic Hose Assemblies, and should be followed.

**1.2 Fail-Safe:** Hose, Hose Assemblies, Tube, Tube Assemblies and Fittings 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, Hose Assembly, Tube, Tube Assembly or Fitting will not endanger persons or property.

**1.3 Distribution:** Provide a copy of this safety guide to each person responsible for selecting or using Hose, Tube and Fitting products. Do not select or use Parker Hose, Tube or Fittings without thoroughly reading and understanding this safety guide as well as the specific Parker publications for the Products.

**1.4 User Responsibility:** Due to the wide variety of operating conditions and applications for Hose, Tube and Fittings, Parker does not represent or warrant that any particular Hose, Tube or Fitting is suitable for any specific end use system. 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 Products.
- Assuring that the user’s requirements are met and that the application presents no health or safety hazards.
- Following the safety guide for Related Accessories and being trained to operate Related Accessories.
- Providing all appropriate health and safety warnings on the equipment on which the Products are used.
- Assuring compliance with all applicable government and industry standards.

**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 Products being considered or used, or call 1-800-CPARKER, or go to [www.parker.com](http://www.parker.com), for telephone numbers of the appropriate technical service department.

### 2.0 HOSE, TUBE AND FITTINGS SELECTION INSTRUCTIONS

**2.1 Electrical Conductivity:** Certain applications require that the Hose be nonconductive to prevent electrical current flow. Other applications require the Hose and the Fittings and the Hose/Fitting interface to be sufficiently conductive to drain off static electricity. Extreme care must be exercised when selecting Hose, Tube and Fittings for these or any other applications in which electrical conductivity or nonconductivity is a factor.

The electrical conductivity or nonconductivity of Hose, Tube and Fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials used to make the Hose and the Fittings, Fitting finish (some Fitting finishes are electrically conductive while others are nonconductive), manufacturing methods (including moisture control), how the Fittings contact the Hose, age and amount of deterioration or damage or other changes, moisture content of the Hose at any particular time, and other factors.

The following are considerations for electrically nonconductive and conductive Hose. For other applications consult the individual catalog pages and the appropriate industry or regulatory standards for proper selection.

**2.1.1 Electrically Nonconductive Hose:** Certain applications require that the Hose be nonconductive to prevent electrical current flow or to maintain electrical isolation. For applications that require Hose to be electrically nonconductive, including but not limited to applications near high voltage electric lines, 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, Tube and Fittings that are selected are proper for the application. Do not use any Parker Hose or Fittings for any such application requiring nonconductive Hose, including but not limited to applications near high voltage electric lines or dense magnetic fields, unless (i) the application is expressly approved in the Parker technical publication for the product, (ii) the Hose is marked “nonconductive”, and (iii) the manufacturer of the equipment on which the Hose is to be used specifically approves the particular Parker Hose, Tube and Fittings for such use.

**2.1.2 Electrically Conductive Hose:** Parker manufactures special Hose for certain applications that require electrically conductive Hose. Parker manufactures special Hose for conveying paint in airless paint spraying applications. This Hose is labeled “Electrically Conductive Airless Paint Spray Hose” on its layline and packaging. This Hose must be properly connected to the appropriate Parker Fittings and properly grounded in order to dissipate dangerous static charge buildup, which occurs in all airless paint spraying applications. Do not use any other Hose for airless paint spraying, even if electrically conductive. Use of any other Hose or failure to properly connect the Hose can cause a fire or an explosion resulting in death, personal injury, and property damage. All hoses that convey fuels must be grounded.

Parker manufactures a special Hose for certain compressed natural gas (“CNG”) applications where static electricity buildup may occur. Parker CNG Hose assemblies comply with the requirements of ANSI/IAS NGV 4.2; CSA 12.52, “Hoses for Natural Gas Vehicles and Dispensing Systems” ([www.ansi.org](http://www.ansi.org)). This Hose is labeled “Electrically Conductive for CNG Use” on its layline and packaging. This Hose must be properly connected to the appropriate Parker Fittings and properly grounded in order to dissipate dangerous static charge buildup, which occurs in, for example, high velocity CNG dispensing or transfer. Do not use any other Hose for CNG applications where static charge buildup may occur, even if electrically conductive. Use of other Hoses in CNG applications or failure to properly connect or ground this Hose can cause a fire or an explosion resulting in death, personal injury, and property damage. Care must also be taken to protect against CNG permeation through the Hose wall. See section 2.6, Permeation, for more information. Parker CNG Hose is intended for dispenser and vehicle use within the specified temperature range. Parker CNG Hose should not be used in confined spaces or unventilated areas or areas exceeding the specified temperature range. Final assemblies must be tested for leaks. CNG Hose Assemblies should be tested on a monthly basis for conductivity per ANSI/IAS NGV 4.2; CSA 12.52.

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Parker manufactures special Hose for aerospace in-flight applications. Aerospace in-flight applications employing Hose to transmit fuel, lubricating fluids and hydraulic fluids require a special Hose with a conductive inner tube. This Hose for in-flight applications is available only from Parker's Stratoflex Products Division. Do not use any other Parker Hose for in-flight applications, even if electrically conductive. Use of other Hoses for in-flight applications or failure to properly connect or ground this Hose can cause a fire or an explosion resulting in death, personal injury and property damage. These Hose assemblies for in-flight applications must meet all applicable aerospace industry, aircraft engine and aircraft requirements.

- 2.2 Pressure:** Hose, Tube and Fitting selection must be made so that the published maximum working pressure of the Hose, Tube and Fittings are equal to or greater than the maximum system pressure. The maximum working pressure of a Hose, or Tube Assembly is the lower of the respective published maximum working pressures of the Hose, Tube and the Fittings used. Surge pressures or peak transient pressures in the system must be below the published maximum working pressure for the Hose, Tube and Fitting. Surge pressures and peak pressures can usually only be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressures and cannot be used to determine surge pressures or peak transient pressures. Published burst pressure ratings for Hose is for manufacturing test purposes only and is no indication that the Product can be used in applications at the burst pressure or otherwise above the published maximum recommended working pressure.
- 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, Tube, Fitting and Seals. Temperatures below and above the recommended limit can degrade Hose, Tube, Fittings and Seals to a point where a failure may occur and release fluid. Tube and Fittings performances are normally degraded at elevated temperature. Material compatibility can also change at temperatures outside of the rated range. Properly insulate and protect the Hose Assembly when routing near hot objects (e.g. manifolds). Do not use any Hose in any application where failure of the Hose could result in the conveyed fluids (or vapors or mist from the conveyed fluids) contacting any open flame, molten metal, or other potential fire ignition source that could cause burning or explosion of the conveyed fluids or vapors.
- 2.5 Fluid Compatibility:** Hose, and Tube Assembly selection must assure compatibility of the Hose tube, cover, reinforcement, Tube, Plating and Seals with the fluid media used. See the fluid compatibility chart in the Parker publication for the product being considered or used. This information is offered only as a guide. Actual service life can only be determined by the end user by testing under all extreme conditions and other analysis. Hose, and Tube that is chemically compatible with a particular fluid must be assembled using Fittings and adapters containing likewise compatible seals. Flange or flare processes can change Tube material properties that may not be compatible with certain requirements such as NACE
- 2.6 Permeation:** Permeation (that is, seepage through the Hose or Seal) will occur from inside the Hose or Fitting to outside when Hose or Fitting is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, diesel fuel, gasoline, natural gas, or LPG). 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 or Fitting 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 or Fitting even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the Hose or Tube Assembly. Permeation of moisture from outside the Hose or Fitting to inside the Hose or Fitting will also occur in Hose or Tube assemblies, regardless of internal pressure. If this moisture permeation would have detrimental effects (particularly, but not limited to refrigeration and air conditioning systems), incorporation of sufficient drying capacity in the system or other appropriate system safeguards should be selected and used. The sudden pressure release of highly pressurized gas could also result in Explosive Decompression failure of permeated Seals and Hoses.
- 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, twisting of the Hose, proximity to hot objects or heat sources). For additional routing recommendations see SAE J1273 and ISO 17165-2. Hose Assemblies have a finite life and should be installed in a manner that allows for ease of inspection and future replacement. Hose because of its relative short life, should not be used in residential and commercial buildings inside of inaccessible walls or floors, unless specifically allowed in the product literature. Always review all product literature for proper installation and routing instructions.
- 2.9 Environment:** Care must be taken to insure that the Hose, Tube 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, Tube and Fitting 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. Use of proper Hose or Tube clamps may also be required to reduce external mechanical loads. Unusual applications may require special testing prior to Hose selection.
- 2.11 Physical Damage:** Care must be taken to protect Hose from wear, snagging, kinking, bending smaller than minimum bend radius and cutting, any of which can cause premature Hose failure. Any Hose that has been kinked or bent to a radius smaller than the minimum bend radius, and any Hose that has been cut or is cracked or is otherwise damaged should be removed and discarded. Fittings with damages such as scratches on sealing surfaces and deformation should be replaced.
- 2.12 Proper End Fitting:** See instructions 3.2 through 3.5. These recommendations may be substantiated by testing to industry standards such as SAE J517 for hydraulic applications, or MIL-A-5070, AS1339, or AS3517 for Hoses from Parker's Stratoflex Products Division for aerospace applications.
- 2.13 Length:** When determining the proper Hose or Tube length of an assembly, be aware of Hose length change due to pressure, Tube length change due to thermal expansion or contraction, and Hose or Tube and machine tolerances and movement must be considered. When routing short hose assemblies, it is recommended that the minimum free hose length is always used. Consult the hose manufacturer for their minimum free hose length recommendations. Hose assemblies should be installed in such a way that any motion or flexing occurs within the same plane.
- 2.14 Specifications and Standards:** When selecting Hose, Tube and Fittings, government, industry, and Parker specifications and recommendations must be reviewed and followed as applicable.
- 2.15 Hose Cleanliness:** Hose and Tube components may vary in cleanliness levels. Care must be taken to insure that the Hose and Tube Assembly selected has an adequate level of cleanliness for the application.
- 2.16 Fire Resistant Fluids:** Some fire resistant fluids that are to be conveyed by Hose or Tube require use of the same type of Hose or Tube as used with petroleum base fluids. Some such fluids require a special Hose, Tube, Fitting and Seal, while a few fluids will not work with any Hose at all. See instructions 2.5 and 1.5. The wrong Hose, Tube, Fitting or Seal 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 and Seals 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 or Seal. Performance of Tube and Fitting subjected to the heat could be degraded.
- 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 or Seal 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. Any elastomer seal on fittings shall be removed prior to welding or brazing, any metallic surfaces shall be protected after brazing or welding when necessary. Welding and brazing filler material shall be compatible with the Tube and Fitting that are joined.
- 2.19 Atomic Radiation:** Atomic radiation affects all materials used in Hose and Tube assemblies. Since the long-term effects may be unknown, do not expose Hose or Tube assemblies to atomic radiation. Nuclear applications may require special Tube and Fittings.
- 2.20 Aerospace Applications:** The only Hose, Tube and Fittings that may be used for in-flight aerospace applications are those available from Parker's Stratoflex Products Division. Do not use any other Hose or Fittings for

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in-flight applications. Do not use any Hose or Fittings from Parker's Stratoflex Products Division with any other Hose or Fittings, unless expressly approved in writing by the engineering manager or chief engineer of Stratoflex Products Division and verified by the user's own testing and inspection to aerospace industry standards.

- 2.21 Unlocking Couplings:** Ball locking couplings or other Fittings with quick disconnect ability can unintentionally disconnect if they are dragged over obstructions, or if the sleeve or other disconnect member, is bumped or moved enough to cause disconnect. Threaded Fittings should be considered where there is a potential for accidental uncoupling.

### 3.0 HOSE AND FITTINGS ASSEMBLY AND INSTALLATION INSTRUCTIONS

- 3.1 Component Inspection:** Prior to assembly, a careful examination of the Hose and Fittings must be performed. All components must be checked for correct style, size, catalog number, and length. The Hose must be examined for cleanliness, obstructions, blisters, cover looseness, kinks, cracks, cuts or any other visible defects. Inspect the Fitting and sealing surfaces for burrs, nicks, corrosion or other imperfections. Do NOT use any component that displays any signs of nonconformance.

- 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 manager or chief engineer of the appropriate Parker division. Do not assemble a Parker Fitting on another manufacturer's Hose or a Parker Hose on another manufacturer's Fitting unless (i) the engineering manager or chief engineer of the appropriate Parker division approves the Assembly in writing or that combination is expressly approved in the appropriate Parker literature for the specific Parker product, and (ii) the user verifies the Assembly and the application through analysis and testing. For Parker Hose that does not specify a Parker Fitting, the user is solely responsible for the selection of the proper Fitting and Hose Assembly procedures. See instruction 1.4.

To prevent the possibility of problems such as leakage at the Fitting or system contamination, it is important to completely remove all debris from the cutting operation before installation of the Fittings. The Parker published instructions must be followed for assembling the Fittings on the Hose. These instructions are provided in the Parker Fitting catalog for the specific Parker Fitting being used, or by calling 1-800-CPARKER, or at [www.parker.com](http://www.parker.com).

- 3.3 Related Accessories:** Do not crimp or swage any Parker Hose or Fitting with anything but the listed swage or crimp machine and dies in accordance with Parker published instructions. Do not crimp or swage another manufacturer's Fitting with a Parker crimp or swage die unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division.
- 3.4 Parts:** Do not use any Parker 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 manager or chief engineer of the appropriate Parker division.
- 3.5 Field Attachable/Permanent:** Do not reuse any field attachable Hose Fitting that has blown or pulled off a Hose. Do not reuse a Parker permanent Hose Fitting (crimped or swaged) or any part thereof. Complete Hose Assemblies may only be reused after proper inspection under section 4.0. Do not assemble Fittings to any previously used hydraulic Hose that was in service, for use in a fluid power application.
- 3.6 Pre-Installation Inspection:** Prior to installation, a careful examination of the Hose Assembly must be performed. Inspect the Hose Assembly for any damage or defects. DO NOT use any Hose Assembly that displays any signs of nonconformance.
- 3.7 Minimum Bend Radius:** Installation of a Hose at less than the minimum listed bend radius may significantly reduce the Hose life. Particular attention must be given to preclude sharp bending at the Hose to Fitting juncture. Any bending during installation at less than the minimum bend radius must be avoided. If any Hose is kinked during installation, the Hose must be discarded.
- 3.8 Twist Angle and Orientation:** Hose Assembly installation must be such that relative motion of machine components does not produce twisting.
- 3.9 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.
- 3.10 Proper Connection of Ports:** Proper physical installation of the Hose Assembly requires a correctly installed port connection insuring that no twist or torque is transferred to the Hose when the Fittings are being tightened or otherwise during use.
- 3.11 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.

- 3.12 System Checkout:** All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Hose maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.

- 3.13 Routing:** The Hose Assembly should be routed in such a manner so if a failure does occur, the escaping media will not cause personal injury or property damage. In addition, if fluid media comes in contact with hot surfaces, open flame or sparks, a fire or explosion may occur. See section 2.4.

- 3.14 Ground Fault Equipment Protection Devices (GFEPDs): WARNING! Fire and Shock Hazard.** To minimize the danger of fire if the heating cable of a Multitube bundle is damaged or improperly installed, use a Ground Fault Equipment Protection Device. Electrical fault currents may be insufficient to trip a conventional circuit breaker.

**For ground fault protection, the IEEE 515:** ([www.ansi.org](http://www.ansi.org)) standard for heating cables recommends the use of GFEPDs with a nominal 30 milliampere trip level for "piping systems in classified areas, those areas requiring a high degree of maintenance, or which may be exposed to physical abuse or corrosive atmospheres".

### 4.0 TUBE AND FITTINGS ASSEMBLY AND INSTALLATION INSTRUCTIONS

- 4.1 Component Inspection:** Prior to assembly, a careful examination of the Tube and Fittings must be performed. All components must be checked for correct style, size, material, seal, and length. Inspect the Fitting and sealing surfaces for burrs, nicks, corrosion, missing seal or other imperfections. Do NOT use any component that displays any signs of nonconformance.

- 4.2 Tube and Fitting Assembly:** Do not assemble a Parker Fitting with a Tube that is not specifically listed by Parker for that Fitting, unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division. The Tube must meet the requirements specified to the Fitting.

The Parker published instructions must be followed for assembling the Fittings to a Tube. These instructions are provided in the Parker Fitting catalog for the specific Parker Fitting being used, or by calling 1-800-CPARKER, or at [www.parker.com](http://www.parker.com).

- 4.3 Related Accessories:** Do not preset or flange Parker Fitting components using another manufacturer's equipment or procedures unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division. Tube, Fitting component and tooling must be checked for correct style, size and material. Operation and maintenance of Related Accessories must be in accordance with the operation manual for the designated Accessory.

- 4.4 Securement:** In many applications, it may be necessary to restrain, protect, or guide the Tube to protect it from damage by unnecessary flexing, pressure surges, vibration, and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.

- 4.5 Proper Connection of Ports:** Proper physical installation of the Tube Assembly requires a correctly installed port connection insuring that no torque is transferred to the Tube when the Fittings are being tightened or otherwise during use.

- 4.6 External Damage:** Proper installation is not complete without insuring that tensile loads, side loads, flattening, potential abrasion, thread damage or damage to sealing surfaces are corrected or eliminated. See instruction 2.10.

- 4.7 System Checkout:** All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Tube Assembly maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.

- 4.8 Routing:** The Tube Assembly should be routed in such a manner so if a failure does occur, the escaping media will not cause personal injury or property damage. In addition, if fluid media comes in contact with hot surfaces, open flame or sparks, a fire or explosion may occur. See section 2.4.

### 5.0 HOSE AND FITTING MAINTENANCE AND REPLACEMENT INSTRUCTIONS

- 5.1** Even with proper selection and installation, Hose life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a possible Hose failure, and experience with any Hose failures in the application or in similar applications should determine the frequency of the inspection and the replacement for the Products so that Products are replaced before any failure occurs. Certain products require maintenance and inspection per industry requirements. Failure to adhere to these requirements may lead to premature failure. A maintenance program must be established and followed by the user and, at minimum, must include instructions 5.2 through 5.7

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- 5.2 Visual Inspection Hose/Fitting:** Any of the following conditions require immediate shut down and replacement of the Hose Assembly:
- Fitting slippage on Hose;
  - Damaged, cracked, cut or abraded cover (any reinforcement exposed);
  - Hard, stiff, heat cracked, or charred Hose;
  - Cracked, damaged, or badly corroded Fittings;
  - Leaks at Fitting or in Hose;
  - Kinked, crushed, flattened or twisted Hose; and
  - Blistered, soft, degraded, or loose cover.
- 5.3 Visual Inspection All Other:** The following items must be tightened, repaired, corrected or replaced as required:
- Leaking port conditions;
  - Excess dirt buildup/;
  - Worn clamps, guards or shields; and
  - System fluid level, fluid type, and any air entrapment.
- 5.4 Functional Test:** Operate the system at maximum operating pressure and check for possible malfunctions and leaks. Personnel must avoid potential hazardous areas while testing and using the system. See section 2.2.
- 5.5 Replacement Intervals:** Hose assemblies and elastomeric seals used on Hose Fittings and adapters will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Hose Assemblies and elastomeric seals should be inspected and replaced at specific replacement intervals, based on previous service life, government or industry recommendations, or when failures could result in unacceptable downtime, damage, or injury risk. See section 1.2. Hose and Fittings may be subjected to internal mechanical and/or chemical wear from the conveying fluid and may fail without warning. The user must determine the product life under such circumstances by testing. Also see section 2.5.
- 5.6 Hose Inspection and Failure:** Hydraulic power is accomplished by utilizing high pressure fluids to transfer energy and do work. Hoses, Fittings and Hose Assemblies all contribute to this 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 if they are not replaced at proper time intervals. Usually these failures are the result of some form of misapplication, abuse, wear or failure to perform proper maintenance. When Hoses fail, generally the high pressure fluids inside escape in a 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 immediately 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.
- 5.7 Elastomeric seals:** Elastomeric seals will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Elastomeric seals should be inspected and replaced.
- 5.8 Refrigerant gases:** Special care should be taken when working with refrigeration systems. Sudden escape of refrigerant 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.
- 5.9 Compressed natural gas (CNG):** Parker CNG Hose Assemblies should be tested after installation and before use, and at least on a monthly basis per instructions provided on the Hose Assembly tag. The recommended procedure is to pressurize the Hose and check for leaks and to visually inspect the Hose for damage and to perform an electrical resistance test.
- Caution:** Matches, candles, open flame or other sources of ignition shall not be used for Hose inspection. Leak check solutions should be rinsed off after use.
- 6.0 HOSE STORAGE**
- 6.1 Age Control:** Hose and Hose Assemblies must be stored in a manner that facilitates age control and first-in and first-out usage based on manufacturing date of the Hose and Hose Assemblies. Unless otherwise specified by the manufacturer or defined by local laws and regulations:
- 6.1.1** The shelf life of rubber hose in bulk form or hose made from two or more materials is 28 quarters (7 years) from the date of manufacture, with an extension of 12 quarters (3 years), if stored in accordance with ISO 2230;
- 6.1.2** The shelf life of thermoplastic and polytetrafluoroethylene hose is considered to be unlimited;
- 6.1.3** Hose assemblies that pass visual inspection and proof test shall not be stored for longer than 2 years.
- 6.1.4 Storage:** Stored Hose and Hose Assemblies must not be subjected to damage that could reduce their expected service life and must be placed in a cool, dark and dry area with the ends capped. Stored Hose and Hose Assemblies must not be exposed to temperature extremes, ozone, oils, corrosive liquids or fumes, solvents, high humidity, rodents, insects, ultraviolet light, electromagnetic fields or radioactive materials.

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## Safety Overview

It is important to employ safe practices in the use of industrial hose due to the number of potentially dangerous applications encountered and products conveyed, and the number of people that may be involved or exposed. Strictly observe these simple practices to help avoid accidents:

- **Training:** Train all operators thoroughly.
- **Evaluation:** Evaluate the application to determine the hose assembly performance requirements.
- **Selection:** Select the most appropriate hose and couplings for the application; ensure that the couplings are compatible with the media and hose, and securely attached to the hose.
- **Service:** Regularly inspect and maintain both the hose and couplings while in service.

## Industrial Hose Assemblies

### Coupling Compatibility and Maximum Working Pressure Rating

**NOTE: This advisory does not apply to hose, hose couplings, hose assemblies and related accessories manufactured by any other Parker Fluid Connector Division worldwide. Products from other Parker divisions must be assembled and applied in strict compliance with their respective catalog instructions, Safety Guide precautions, and other statutory, industry and regulatory requirements.**

Safety issues may develop due to the misunderstanding of the relationship between the maximum working pressure ratings of industrial hose assembly components, as well as how to obtain a maximum working pressure rating for a fabricated industrial hose assembly.

It is important to recognize that the pressure rating of any hose assembly is that of the lowest rated component. The three components of an industrial hose assembly that are subject to a maximum working pressure rating are the hose, the coupling/coupling end connection, and the hose-to-coupling attachment device. Many OEM- and distributor-fabricated assemblies incorporate the three components manufactured by different companies: These components are not designed and tested together as a compatible system. Confusion may occur because the hose is often boldly marked with its maximum rated working pressure while the coupling and/or attachment device are generally unmarked or difficult to read. Therefore, the pressure rating for the assembly may incorrectly be assumed to be the pressure rating of the hose.

Parker has tested, qualified and validated a group of specific hoses and specific couplings. When fabricated according to Parker-specified procedure and criteria,

Parker certifies the assembly pressure rating to be equal to that of the hose. These hose, coupling and attachment specifications are available online in the CrimpSource<sup>®</sup> section of the Parker Hose Products Division website: [www.parker.com/crimpsource](http://www.parker.com/crimpsource).

**! WARNING! When using components or assembly procedures not prescribed in the CrimpSource<sup>®</sup> specifications, the working pressure of the hose assembly may be less than the working pressure of the hose. Couplings and attachment devices that fall into this category are inserts/stems and bands or clamps; inserts and crimped brass ferrules; screw-together reattachable couplings; internally expanded couplings; and swaged couplings. Coupling end connections may also fall into this category. For these items, contact the hose or coupling manufacturer to determine the maximum working pressure rating of a specific hose or coupling and end connection. To determine an attachment device rating, test and validate the entire assembly.**

**! WARNING! When using components or assembly procedures not prescribed in the CrimpSource<sup>®</sup> specifications, it is the responsibility of the assembler to ensure the integrity and compatibility of the components and to inform the end user of the assembly's maximum working pressure rating by permanently marking the assembly with that rating.**

## Critical Applications

While many industrial hose applications are potentially dangerous, some are of particular concern because their danger may not be readily apparent. This is especially true for applications involving untrained or inexperienced operators.

### Chemical Hose

A chemical hose system failure could cause the release of poisonous, corrosive, or flammable material resulting in property damage, serious bodily injury or death. All reputable manufacturers of chemical hose recommend specific hose constructions to handle various chemicals. Refer to the chemical guides in this catalog, or contact Parker for technical assistance before using or recommending a hose product. Refer to ARPM publication IP-11-7 "Manual for Maintenance, Testing, and Inspection of Chemical Hose."

### Handling

- Use care to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement.
- Use proper hose suspension equipment when lifting or dragging a hose to ensure that the recommended

## Critical Applications (Continued)

curvature is not exceeded. Avoid sharp bends at the end fittings and at manifold connections.

### Operation

- Use safety precautions such as wearing eye or face protection, rubber gloves, boots, and other types of protective clothing.
- Monitor pressures and temperatures to ensure that the hose is not exposed to conditions above specified limits.
- Do not allow chemicals to contact the exterior of the hose or allow hose to lie in a pool of chemicals since the hose cover may not have the same level of corrosion resistance as the tube. Corrosive materials that come into contact with the reinforcing material will cause reduced service life and premature hose failure.

### Temperature

Do not use chemical hose at pressures or temperatures exceeding those as specified for the product. Many chemical resistance guides are based on temperatures of 70°F (21°C). Elevated temperatures can change the chemical resistance ratings. Many chemicals will become more aggressive as temperatures increase, reducing the ability of hose compounds to withstand them. Contact Parker for chemical compatibility data at elevated temperatures. If no data exists, end users are required to perform compatibility testing at the desired temperature.

### Couplings

- At any operating temperature, couplings attached with bands or clamps may reduce the working pressure of the hose assembly to less than the maximum rated working pressure of the hose. Refer to the NAHAD Industrial Hose Assembly Guidelines.
- At operating temperatures of 125°F and above, install only permanently attached couplings.
- Do not use internally expanded couplings with chemical hoses incorporating thermoplastic tubes. Refer to chemical hoses that incorporate a MXLPE tube.

### Gasoline Dispenser Hose

Millions of consumers operate gasoline pumps every day, increasing the concern for the safe use of dispensing equipment, including the hose. Since gasoline dispenser hoses are subject to frequent abuse, hose selection must include consideration of the rigors of the application. For maximum service life, select only the highest quality, most thoroughly tested UL listed hose and establish a regular inspection and maintenance program. Refer to ARPM publication IP-11-8 "Manual for Maintenance, Testing, and Inspection of Petroleum Service Station Gasoline Dispensing Hose and Hose Assemblies."

**Note: To avoid fuel contamination do not use gasoline dispenser or farm pump hose to fuel aircraft.**

### LP Gas (Propane) Hose

Many accidents involving LP Gas occur due to selection of an incorrect hose for the application. LP Gas hose must be specially designed and compounded to handle the media, with a perforated cover to prevent gas build-up amidst the layers of the hose.

**⚠ WARNING! Use ONLY LP Gas hose for LP Gas service. LP Gas possesses volatile characteristics that may produce fire or explosions causing property damage, serious bodily injury or death.**

- Do not use LP Gas hose for anhydrous ammonia service. It may fail suddenly and quickly. Anhydrous ammonia hose and LPG hose are frequently used in proximity and may be accidentally switched.
- Use only Parker permanent crimp couplings when fabricating LP Gas hose assemblies. Refer to CrimpSource<sup>®</sup> at [www.parker.com/crimpsource](http://www.parker.com/crimpsource). Couplings attached with bands or clamps may reduce the working pressure of the hose assembly to less than the maximum rated working pressure of the hose. Refer to the NAHAD Industrial Hose Assembly Guidelines.
- Do not use with couplings containing o-rings, which may dry out, crack and fail over time. Do not use with male swivel couplings or other couplings containing hidden o-rings.
- Do not use with screw-together reattachable couplings (except hose Series 7233).

LP Gas hose is designed to allow a limited amount of permeation of LP Gas through the wall of the hose when in service. The permeation is apparent when the hose is moist or in water, and bubbles may be perceived as leakage. However, a legitimate propane leak creates a frosting or icing on the surface of the hose or coupling. To verify the integrity of a hose in service, perform a hydrostatic test on the assembly; immediately remove from service any hose that fails the test. In the transfer of LP Gas, the allowable permeation rate is controlled by the Underwriters Laboratories Standard UL21 for LP Gas Hose.

### Department of Transportation (DOT) and LP Gas Hose

LP Gas hose assemblies installed on on-road vehicles must meet DOT requirements. Parker factory assemblies 3/4" ID and larger undergo pressure testing as standard procedure (smaller sizes are tested per customer request), one of the fittings is etched with a unique DOT certification number, and a document incorporating the identical certification number accompanies each assembly. Metal

## Critical Applications (Continued)

DOT identification bands are also available/attached for an additional charge at customer request. Contact Parker.

**NOTE: When using LP Gas hose in a mobile application such as delivery or service vehicles, the inspection procedures detailed in DOT regulation 49CFR 180.416 must be strictly followed.**

### Natural Gas and LP Gas Hose

The molecules of natural gas are small, enhancing their ability to permeate through standard rubber or PVC hose constructions. The permeation process is more rapid as the working pressure increases, and natural gas accumulates with potentially dangerous consequences. Series 7132, 7132XTC, 7170, 7231, 7232, and 7233 LP Gas hoses may be used for natural gas service to a 350 psi maximum, but **ONLY** under ALL of the following conditions:

- Use only in a well-ventilated environment: Outdoors, or indoors with significant continuous air movement.
- Do not use LP Gas hose to replace fixed/rigid pipe where that material is more appropriate due to reduced permeation, overall strength and durability. Use rigid pipe, non-permeable tubing or hose with barrier constructions to convey natural gas whenever possible.

### Compressed Natural Gas (CNG) and LP Gas Hose

- Do not use LP gas hose for CNG engine applications in on-road vehicles, or for high pressure CNG dispenser/transfer applications (typically 2900 psi or greater). In other applications—where CNG is regulated to pressures within the rating of the hose—apply guidelines for natural gas applications stated above. Always review and adhere to all applicable government and industry regulations and standards prior to installing LP gas hose in a CNG or natural gas application.

### Petroleum Transfer Hose

- Do not use for oil or fuel transfer service in or on open water. Hose damage or failure may result in spillage and environmental damage. Use hose specifically designed for this application.
- Do not immerse in fuel. The hose cover compound may not be of sufficient grade to resist attack by the fuel. Use hose specifically designed for this application.

### Steam Hose

Water changes to hot water and phases of steam when subjected to heat and pressure. The greater the pressure, the higher the temperature required to achieve and maintain a steam phase. If steam escapes, dangerous quantities of heat may be released very suddenly. Refer

to ARPM publication IP-11-1 “Guide for Use, Testing and Inspection of Steam Hose.”

**! WARNING! Use ONLY steam hose for steam service. Hot water, low pressure steam and high pressure steam may escape explosively and will scald skin, eyes and lungs, which may lead to severe bodily injury or death.**

- Many steam systems incorporate detergents or rust inhibitors which may attack steam hose. Prior to using a steam hose with detergents or rust inhibitors, refer to the chemical guides in this catalog, or contact Parker.
- Parker recommends using permanent crimp couplings when fabricating steam assemblies. Refer to CrimpSource<sup>®</sup> at [www.parker.com/crimpsource](http://www.parker.com/crimpsource). Couplings attached with bands or clamps may reduce the working pressure of the hose assembly to less than the maximum rated working pressure of the hose. Refer to the NAHAD Industrial Hose Assembly Guidelines.
- Drain steam hose after each use to reduce the possibility of hose popcorning while in service.

The chart at the right represents the three forms of water when subjected to various combinations of heat and pressure. The red line represents the point at which hot water becomes saturated steam. The area below the red line is hot water; the area above the red line is superheated steam.

### Welding Hose

Many accidents involving welding hose occur due to selection of an incorrect hose for the application. Welding hose must be specially designed and compounded to handle the media, with rubber compounds able to handle fuel gas and oxygen. Due to the extreme volatility of gases, the varying compatibility of gases with the various grades of hose, and the rough environment of many welding applications, it is crucial to select the correct welding hose. Refer to ARPM publications IP-7, “Specifications for Rubber Welding Hose” and IP-11-5, “Guide for Use, Maintenance and Inspection of Welding Hose.” Also refer to the Compressed Gas Association publications E-1, “Standard for Rubber Welding Hose and Hose Connections for Gas Welding, Cutting and Allied Processes” and Safety Bulletin SB-11 “Use of Rubber Welding Hose.”

**! WARNING! Welding gases possess volatile characteristics that may produce fire or explosions causing property damage, serious bodily injury or death. Use Grades R and RM ONLY with acetylene fuel gas; do not use with any other fuel gases.**

- Replace all assemblies that show signs of abrading, abuse, age, damage or fatigue. Do not attempt to re-couple, repair or splice hose assemblies.

## Critical Applications (Continued)

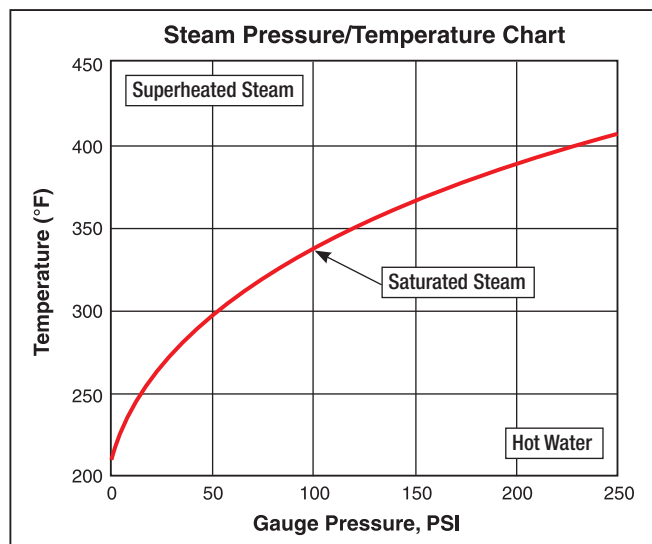
- Fabricate hose assemblies using only crimped-on ferrules at least one inch long to ensure coverage and support of the coupling stem inside the hose.
- Couplings attached with bands or clamps may reduce the working pressure of the hose assembly to less than the maximum rated working pressure of the hose. Refer to the NAHAD Industrial Hose Assembly Guidelines.

## PVC / Thermoplastic Hose and Tubing

Thermoplastic polymer compounds are designed to resist deterioration when exposed to a wide range of commercial chemicals and environmental conditions. The resistance to attack is based on many factors, including temperature, pressure, chemical concentration, exposure to ultraviolet light, velocity of the media and duration of exposure/service (intermittent or constant). The user is solely responsible for making the final selection of the hose and tubing, and meeting all endurance, maintenance, performance, safety and warning requirements of the application.

**NOTE: The rated maximum working pressures listed in this catalog for thermoplastic hose and tubing are based upon a pressure test temperature of 68°F (20°C) unless stated otherwise.**

**⚠ WARNING!** As temperature increases or decreases, burst pressure, safe working pressure, coupling retention properties, and other safety characteristics of the hose or tubing can significantly decrease. Failure to consider how temperature and other conditions affect hose and tubing performance may cause property damage, serious bodily injury or death.



# Guidelines for Cleaning and Sanitizing Food Hoses

The cleaning and sanitizing suggestions set forth below are guidelines only.

It is necessary that all applicable government regulations pertaining to the cleaning and sanitizing of the food hoses and food hose assemblies be followed and adhered to and which governmental regulations supersede the guideline contained herein.

The life of the hose is affected by the cleaning and sanitizing process due to the mechanical and chemical stresses which occur during the cleaning and sanitizing procedure. The service period of rubber hoses is dependent on their formulation and the environment of use which in turn is influenced by the product, process temperature, cleaning, bactericidal compounds, and time of exposure. Users should frequently monitor the physical condition of the rubber hose material product contact surfaces. Such observations are necessary to determinate the actual sanitary service period of rubber hoses. It is further recommended that the rubber hose be replaced before surface imperfections or sloughing occurs. Routine replacement schedules should be established and followed.

Food hose users should be guided by their own, if applicable, or specific industry cleaning and sanitizing procedures and standards. For example, the wine industry may have different standards than the dairy industry and any standards applicable to a specific industry supersede the guideline contained herein.

The cleaning and sanitizing of food hoses and hose assemblies is intended to remove any food particles or residues including detergents and/or disinfectants that may be the source of harmful bacteria microorganisms or other sources of contamination. The effectiveness of the guidelines contained herein are dependent upon the practices and care taken by the users.

## CLEANING AND SANITIZING STEPS

### 1. FREQUENCY

The frequency of the cleaning and sanitizing cycle is to be conducted based on the users internal and/or industry guidelines. Some food and beverage media may require more frequent cleaning and sterilization than others. Be sure to follow all applicable industry requirements. It is advisable that all Parker hoses are to be cleaned and or sanitized prior to initial use.

### 2. WASHING

First step in the process is to rinse the hoses with hot potable water. It is advisable to flush the hose as soon as possible after transference of the media and to drain the hoses completely for the next step. A potable water flush should be followed by utilizing the appropriate detergent for the media that was conveyed in the hose. Proper disinfection media should be utilized where necessary. The cleaners and sanitizers must be chemically compatible with the hose liner along with the appropriate temperature limits to maintain the integrity of the hose.

### 3. CLEANING/DISINFECTING

Select the appropriate detergent and disinfectant for the media. For an application such as with in-place cleaning, chemical compatibility of the hose should be verified. Please adhere to the detergent and disinfectant guidelines and recommendations per the manufacturer's instructions of the cleaning product along with applicable regulations and industry requirements. Following the cleaning product manufacture guideline as to concentrations, soak time, and temperature will aid in proper use of the cleaning chemical. Also, be mindful of any waste and disposal regulations and guidelines required for these procedures.

After cleaning the hose with detergent it is advisable to rinse the hose with potable water to prepare the hose for sterilization by either with steam or with chemical solution.

Steam can be categorized as a disinfectant, where its effectiveness in eliminating bacteria and other contaminants varies according to the material/products being conveyed and the procedure employed by the users.

Chemical disinfectant such as caustic soda, nitric acid, per-acetic, phosphoric acid, chloroacetic acid or other acids suitable for disinfecting food hoses must be carefully selected to ensure optimal effectiveness while also assuring maximum safety and health. When selecting a disinfectant, it is necessary to pay strict attention to concentration levels, temperature, cycle time, etc. The type of product/material being conveyed is to be taken into consideration when selecting a specific disinfectant.

After completion of the disinfecting treatment with a chemical solution, the hose must be flushed with potable water for a sufficient amount of time to eliminate any chemical residue from the disinfecting treatment. Refer to all chemical manufacturer's instructions.

### 4. PROCESS CONTROLS

The result of the cleaning and sanitizing process must be regularly checked to ensure that all contamination and residuals have been eliminated. It is advisable that any non-conformance to cleaning/sanitization procedures or industry guidelines is addressed in a corrective action.

## Guidelines Chart for Cleaning and Sanitizing Food Hoses

	Medium	Hose Tube	Concentration	Temperature
<b>RINSING</b>	Hot Water	NR /NBR / SILICONE EPDM / BIIR / UPE / PTFE	–	Max 90° C
<b>PHYSICAL DISINFECTANT</b>	Steam	NR / NBR	–	Max 110° C Max 10 min
		EPDM / BIIR / UPE / PTFE	–	Max 130° C Max 30 min
		SILICONE	–	Max 135° C Max 18 min
<b>CHEMICAL DISINFECTANT</b>	Acid (i.e. Nitric Acid)	NR /NBR / SILICONE	0.1%	Max 65° C
			2%	Max 25° C
		EPDM / BIIR / UPE / PTFE	0.1%	Max 85° C
			3%	Max 25° C
	Alkaline Solution (i.e. Caustic Soda)	NR /NBR / SILICONE	2%	Max 65° C
			4%	Max 25° C
		EPDM / BIIR / UPE / PTFE	2%	Max 85° C
			5%	Max 25° C
Disinfectant (i.e. Peracetic Acid)	NR /NBR / SILICONE	1%	Max 25° C	
	EPDM / BIIR / UPE / PTFE		Max 40° C	

The life of the hose is affected by the cleaning and sanitizing process due to the mechanical and chemical stresses which occur during the cleaning and sanitizing procedure. The service life of rubber hoses is directly dependent on frequency and time of exposure to PHYSICAL and CHEMICAL disinfectants. Users should frequently monitor the physical condition of the rubber hose material product contact surfaces. Such observations are necessary to determinate the actual sanitary service period of rubber hoses.

The present tabulation is based on tests and on generally available sources, and believed to be reliable. However, must be used as a guidance only since it does not take in consideration all variable that may be encountered in actual use such as and not limited to duration of exposure and stability of the fluid and possible contamination.

# Industry Publications

Listed below are the titles of publications issued by the Association for Rubber Products Manufacturers (ARPM). Information concerning the latest edition, prices, ordering procedure, etc., may be obtained by contacting them as shown below:



**Association for Rubber Products Manufacturers  
(ARPM)**

7231 Shadeland Station Way, Suite 285  
Indianapolis, IN 46256

**Phone:** 317-863-4072

**Fax:** 317-913-2445

**Web:** [www.arpminc.com](http://www.arpminc.com)

**Publication**

<b>Number</b>	<b>Title</b>
IP-2	Hose Handbook
IP-7	Specifications for Rubber Welding Hose
IP-8	Specifications for Rubber Hose for Oil Suction and Discharge
IP-14	Specifications for Anhydrous Ammonia Hose
IP-11	Complete Set of Hose Technical Bulletins
IP-11-1	Technical Bulletin - Guide for Use, Testing and Inspection of Steam Hose
IP-11-2	Technical Bulletin - Manual for Use, Maintenance, Testing and Inspection of Anhydrous Ammonia Hose
IP-11-4	Technical Bulletin - Manual for Maintenance, Testing and Inspection of Oil Suction and Discharge Hose
IP-11-5	Technical Bulletin - Guide for Use, Maintenance and Inspection of Welding Hose
IP-11-7	Technical Bulletin - Manual for Maintenance, Testing and Inspection of Chemical Hose
IP-11-8	Technical Bulletin - Manual for Maintenance, Testing and Inspection of Petroleum Service Station Gasoline Dispensing Hose and Hose Assemblies

# PARKER-HANNIFIN CORPORATION

## OFFER OF SALE

**1. Definitions.** As used herein, the following terms have the meanings indicated.

Buyer:	means any customer receiving a Quote for Products.
Buyer's Property:	means any tools, patterns, plans, drawings, designs, specifications materials, equipment, or information furnished by Buyer, or which are or become Buyer's property.
Confidential Information:	means any technical, commercial, or other proprietary information of Seller, including, without limitation, pricing, technical drawings or prints and/or part lists, which has been or will be disclosed, delivered, or made available, whether directly or indirectly, to Buyer.
Goods:	means any tangible part, system or component to be supplied by Seller.
Intellectual Property Rights:	means any patents, trademarks, copyrights, trade dress, trade secrets or similar rights.
Products:	means the Goods, Services and/or Software as described in a Quote.
Quote:	means the offer or proposal made by Seller to Buyer for the supply of Products.
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Seller's IP:	means patents, trademarks, copyrights, or other intellectual property rights relating to the Products, including without limitation, names, designs, images, drawings, models, software, templates, information, any improvements or creations or other intellectual property developed prior to or during the relationship contemplated herein.
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Software:	means any software related to the Goods, whether embedded or separately downloaded.
Special Tooling:	means equipment acquired by Seller or otherwise owned by Seller necessary to manufacture Goods, including but not limited to tools, jigs, and fixtures.
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**3. Price; Payment.** The Products set forth in the Quote are offered for sale at the prices indicated in the Quote. Unless otherwise specifically stated in the Quote, prices are valid for thirty (30) days and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices for any reason and at any time by giving ten (10) days prior written notice. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2020). All sales are contingent upon credit approval and full payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified in the Quote). Under any circumstances, Buyer may not withhold or suspend payment of any amounts due and payable as a deduction, set-off or recoupment of any amount, claim or dispute with Seller. Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law. Seller reserves the right to require advance payment or provision of securities for first and subsequent deliveries if there is any doubt, in Seller's sole determination, regarding the Buyer's creditworthiness or for other business reasons. If the requested advance payment or securities are not provided to Seller's satisfaction, Seller reserves the right to suspend performance or reject the purchase order, in whole or in part, without prejudice to Seller's other rights or remedies, including the right to full compensation. Seller may revoke or shorten any payment periods previously granted in Seller's sole determination. The rights and remedies herein reserved to Seller are cumulative and in addition to any other or further rights and remedies available at law or in equity. No waiver by Seller of any breach by Buyer of any provision of these terms will constitute a waiver by Seller of any other breach of such provision.

**4. Shipment; Delivery; Title and Risk of Loss.** All delivery dates are approximate, and Seller is not responsible for damages or additional costs resulting from any delay. All deliveries are subject to our ability to procure materials from our suppliers. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the carrier at Seller's facility. Unless otherwise agreed prior to shipment and for domestic delivery locations only, Seller will select and arrange, at

Buyer's sole expense, the carrier and means of delivery. When Seller selects and arranges the carrier and means of delivery, freight and insurance costs for shipment to the designated delivery location will be prepaid by Seller and added as a separate line item to the invoice. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions. Buyer shall not return or repackage any Products without the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

**5. Warranty.** The warranty for the Products is as follows:

(i) Goods are warranted against defects in material or workmanship for a period of twelve (12) months from the date of delivery or 2,000 hours of use, whichever occurs first; (ii) Services shall be performed in accordance with generally accepted practices and using the degree of care and skill that is ordinarily exercised and customary in the field to which the Services pertain and are warranted for a period of six (6) months from the date of completion of the Services; and (iii) Software is only warranted to perform in accordance with applicable specifications provided by Seller to Buyer for ninety (90) days from the date of delivery or, when downloaded by a Buyer or end-user, from the date of the initial download. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: EXEMPTION CLAUSE; DISCLAIMER OF WARRANTY, CONDITIONS, REPRESENTATIONS: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY, CONDITION, AND REPRESENTATION, PERTAINING TO PRODUCTS. SELLER DISCLAIMS ALL OTHER WARRANTIES, CONDITIONS, AND REPRESENTATIONS, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THOSE RELATING TO DESIGN, NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE SOFTWARE IS ERROR-FREE OR FAULT-TOLERANT, OR THAT BUYER'S USE THEREOF WILL BE SECURE OR UNINTERRUPTED, UNLESS OTHERWISE AUTHORIZED IN WRITING BY SELLER, THE SOFTWARE SHALL NOT BE USED IN CONNECTION WITH HAZARDOUS OR HIGH-RISK ACTIVITIES OR ENVIRONMENTS. EXCEPT AS EXPRESSLY STATED HEREIN, ALL PRODUCTS ARE PROVIDED "AS IS".

**6. Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to Seller within ten (10) days of delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the non-conformance is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

**7. LIMITATION OF LIABILITY.** IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCTS, RE-PERFORM THE SERVICES, OR REFUND THE PURCHASE PRICE PAID WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING ANY LOSS OF REVENUE OR PROFITS, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS.

**8. Confidential Information.** Buyer acknowledges and agrees that Confidential Information has been and will be received in confidence and will remain the property of Seller. Buyer further agrees that it will not use Seller's Confidential Information for any purpose other than for the benefit of Seller and shall return all such Confidential Information to Seller within thirty (30) days upon request.

**9. Loss to Buyer's Property.** Buyer's Property will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the Products manufactured using Buyer's Property. Also, Seller shall not be responsible for any loss or damage to Buyer's Property while it is in Seller's possession or control.

**10. Special Tooling.** Seller may impose a tooling charge for any Special Tooling. Special Tooling shall be and remain Seller's property. In no event will Buyer acquire any interest in the Special Tooling, even if such Special Tooling has been specially converted or adapted for manufacture of Goods for Buyer and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any Special Tooling or other property owned by Seller in its sole determination at any time.

**11. Security Interest.** To secure payment of all sums due from Buyer, Seller retains a security interest in all Products delivered to Buyer and, Buyer's acceptance of these Terms is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect Seller's security interest.

**12. User Responsibility.** Buyer, through its own analysis and testing, is solely responsible for making the final selection of the Products and assuring that all performance, endurance, maintenance, safety and warning requirements of the application of the Products are met. Buyer must analyze all aspects of the application and follow applicable industry standards, specifications, and any technical information provided with the Quote or the Products, such as Seller's instructions, guides and specifications. If Seller provides options of or for Products based upon data or specifications provided by Buyer, Buyer is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products. In the event Buyer is not the end-user of the Products, Buyer will ensure such end-user complies with this paragraph.

**13. Use of Products, Indemnity by Buyer.** Buyer shall comply with all instructions, guides and specifications provided by Seller with the Quote or the Products. If Buyer uses or resells the Products in any way prohibited by Seller's instructions, guides or specifications, or Buyer otherwise fails to comply with Seller's instructions, guides and specifications, Buyer acknowledges that any such use, resale, or non-compliance is at Buyer's sole risk. Further, Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, intellectual property infringement or any other claim, arising out of or in connection with: (a) improper selection, design, specification, application, or any misuse of Products; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of Buyer's Property; (d) damage to the Products from an external cause, repair or attempted repair by anyone other than Seller, failure to follow instructions, guides and specifications provided by Seller, use with goods not provided by Seller, or opening, modifying, deconstructing, tampering with or repackaging the Products; or (e) Buyer's failure to comply with these Terms, including any legal or administrative proceedings, collection efforts, or other actions arising from or relating to such failure to comply. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

**14. Cancellations and Changes.** Buyer may not cancel or modify, including but not limited to movement of delivery dates for the Products, any order for any reason except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage and any additional expense. Seller, at any time, may change features, specifications, designs and availability of Products.

**15. Assignment.** Buyer may not assign its rights or obligations without the prior written consent of Seller.

**16. Force Majeure.** Seller is not liable for delay or failure to perform any of its obligations by reason of any events or circumstances beyond its reasonable control. Such circumstances include without limitation: accidents, labor disputes or stoppages, government acts or orders, acts of nature, pandemics, epidemics, other widespread illness, or public health emergency, cyber related disruptions, cyber-attacks, ransomware sabotage, delays or failures in delivery from carriers or suppliers, shortages of materials, sudden increases in the price of raw material or components, shutdowns or slowdowns affecting the supply of raw materials or components, or the transportation thereof, oil shortages or oil price increases, energy crisis, energy or fuel interruption, war (whether declared or not) or the serious threat of same, riots, rebellions, acts of terrorism, embargoes, fire or any reason whether similar to the foregoing or otherwise. Seller will resume performance as soon as practicable after the event of force majeure has been removed. All delivery dates affected by an event of force majeure shall be tolled for the duration of such event of force majeure and rescheduled for mutually agreed dates as soon as practicable after the event of force majeure ceases to exist. The right to allocate capacity is in the Seller's sole discretion. An event of force majeure shall not include financial distress, insolvency, bankruptcy, or other similar conditions affecting one of the parties, affiliates and/or subcontractors. An event of force majeure in the meaning of these Terms means any circumstances beyond Seller's control that permanently or temporarily hinders performance, even where that circumstance was already foreseen. Buyer shall not be entitled to cancel any orders following its claim of an event of force majeure.

**17. Waiver and Severability.** Failure to enforce any provision of these Terms will not invalidate that provision; nor will any such failure prejudice either party's right to enforce that provision in the future. Invalidation of any provision of these Terms shall not invalidate any other provision herein and, the remaining provisions will remain in full force and effect.

**18. Duration.** Unless otherwise stated in the Quote, any agreement governed by or arising from these Terms shall: (a) be for an initial duration of one (1) year; and (b) shall automatically renew for successive one-year terms unless terminated by Buyer with at least 180-days written notice to Seller or if Seller terminates the agreement pursuant to Section 19 of these Terms.

**19. Termination.** Seller may, without liability to Buyer, terminate any agreement governed by or arising from these Terms for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate, in writing, if Buyer: (a) breaches any provision of these Terms, (b) becomes or is deemed insolvent, (c) appoints or has appointed a trustee, receiver or custodian for all or any part of Buyer's property, (d) files a petition for relief in bankruptcy on its own behalf, or one is filed against Buyer by a third party, (e) makes an assignment for the benefit of creditors; or (f) dissolves its business or liquidates all or a majority of its assets.

**20. Ownership of Rights.** Buyer agrees that (a) Seller (and/or its affiliates) owns or is the valid licensee of Seller's IP and (b) the furnishing of information, related documents or other materials by Seller to Buyer does not grant or transfer any ownership interest or license in or to Seller's IP to Buyer, unless expressly agreed in writing. Without limiting the foregoing, Seller retains ownership of all Software supplied to Buyer. In no event shall Buyer obtain any greater right in and to the Software than a right in a license limited to the use thereof and subject to compliance with any other terms provided with the Software. Buyer further agrees that it will not, directly or through intermediaries, reverse engineer, decompile, or disassemble any Software (including firmware) comprising or contained within a Product, except and only to the extent that such activity may be expressly permitted, either by applicable law or, in the case of open source software, the applicable open source license.

**21. Indemnity for Infringement of Intellectual Property Rights.** Seller is not liable for infringement of any Intellectual Property Rights except as provided in this Section. Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action

brought against Buyer based on a third-party claim that one or more of the Products infringes the Intellectual Property Rights of a third party in the country of delivery of the Products by Seller to Buyer. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of any such claim, and Seller having sole control over the defense of the claim including all negotiations for settlement or compromise. If one or more Products is subject to such a claim, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Products, replace or modify the Products to render them non-infringing, or offer to accept return of the Products and refund the purchase price less a reasonable allowance for depreciation. Seller has no obligation or liability for any claim of infringement: (i) arising from information provided by Buyer (including Seller's use of Buyer's Property); or (ii) directed to any Products for which the designs are specified in whole or part by Buyer; or (iii) resulting from the modification, combination or use in a system of any Products. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for claims of infringement of Intellectual Property Rights.

**22. Governing Law.** These Terms, the terms of any Quote, and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to the sale and delivery of the Products.

**23. Entire Agreement.** These Terms, along with the terms set forth in the Quote, forms the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale and purchase. In the event of a conflict between any term set forth in the Quote and these Terms, the terms set forth in the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. No modification to these Terms will be binding on Seller unless agreed to in a writing that is signed by an authorized representative of Seller, excluding email correspondence, 'clickwrap' or other purported electronic assent to different or additional terms. Sections 2-25 of these Terms shall survive termination or cancellation of any agreement governed by or arising from these Terms.

**24. No 'Wrap' Agreements/No Authority to Bind.** Seller's clicking any buttons or any similar action, such as clicking "I Agree" or "Confirm," to utilize Buyer's software or webpage for the placement of orders, is NOT an agreement to Buyer's Terms and Conditions. NO EMPLOYEE, AGENT OR REPRESENTATIVE OF SELLER HAS THE AUTHORITY TO BIND SELLER BY THE ACT OF CLICKING ANY BUTTON OR SIMILAR ACTION ON BUYER'S WEBSITE OR PORTAL.

**25. Compliance with Laws.** Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards, including those of the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act"), U.S. and E.U. export control and sanctions laws ("Export Laws"), the U.S. Food Drug and Cosmetic Act ("FDCA"), and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), each as currently amended. Buyer agrees to indemnify, defend, and hold harmless Seller from the consequences of any violation of such laws, regulations and standards by Buyer, its employees or agents. Buyer represents that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDCA and the FDA and certifies that Buyer will adhere to the requirements thereof and not take any action that would make Seller violate such requirements. Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly, to any governmental official, foreign political party or official thereof, candidate for foreign political office, or commercial entity or person, for any improper purpose, including the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller. Buyer further represents and agrees that it will not receive, use, service, transfer or ship any Products from Seller in a manner or for a purpose that violates Export Laws or would cause Seller to be in violation of Export Laws. Buyer agrees to promptly and reliably provide Seller all requested information or documents, including end-user statements and other written assurances, concerning Buyer's ongoing compliance with Export Law. Acceptance of these Terms is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect Seller's security interest.

# Basic Hose Constructions



## Construction Elements

A hose is generally composed of three elements, each with an important role in the overall performance of that hose. The three elements are:

**The Tube** must be compatible with and able to contain the media being conveyed. Many different materials are used for tube construction, depending upon the media the hose is designed to transmit.

**The Reinforcement** is the strength member of the hose. It enables the hose to withstand internal and external pressure and abuse. The reinforcement may be applied by several methods, and consists of synthetic yarns, wire or a combination of these. If suction or vacuum capability is a requirement, a helix wire may be part of the reinforcement.

**The Cover** protects the reinforcement from abuse or damage. The cover is usually a rubber compound selected for its resistance to the environment, although, in some cases the reinforcement will also act as the cover. Typical considerations in selecting a cover stock are the need to resist abrasion, ozone, weather and sunlight, chemical or oil spillage, etc.

## Construction Methods

Several methods are used to manufacture Parker hose. Application factors such as size and pressure requirements determine the selection of any particular hose style. The following is a description of the various construction methods employed by Parker.



### Non-Mandrel

Non-mandrel hose is constructed by passing long lengths of extruded tube material through a machine which adds the reinforcement in braided or spiraled layers. In this method, the hose is not built on a mandrel, therefore lengths are not restricted to the lengths of the mandrels.

**Typical Size Range:** 1-1/2" ID and smaller

**Typical Uses:** Air, water or general purpose service where operating conditions are not severe

**Advantages:** Economy and long lengths

**Disadvantages:** Requires wider ID and OD tolerance range than mandrel made hose, limited pressure capabilities



### Rigid Mandrel

Hose produced by this method is supported on a rigid metal mandrel and is handled horizontally during production. While a rigid mandrel limits the hose length, it ensures good control of the inside diameter. It also offers sufficient support to the tube that either wire or textile reinforcement may be applied at high tensions, which is necessary in high pressure constructions. After the cover is applied, the hose may be wrapped with nylon tape for curing, giving the familiar "wrapped" finish to the cover.

**Typical Size Range:** 3/4" ID and larger

**Typical Uses:** Air, chemical and petroleum transfer, LPG, steam, water

**Advantages:** Close tolerances on inside diameter, high pressure ratings, good length stability

**Disadvantages:** Higher cost than non-mandrel; lengths restricted to length of mandrels



### Flexible Mandrel

The flexible mandrel method combines the long-length advantage of non-mandrel hose with the close inside diameter tolerances and high pressure ratings of rigid mandrel hose. This is achieved by building the hose on a long length mandrel made of flexible plastic or rubber.

**Typical Size Range:** 1-1/2" ID and smaller

**Typical Uses:** High pressure, air, water, LPG

**Advantages:** Long lengths, close tolerances on I.D., higher pressure ratings than non-mandrel produced hose

**Disadvantages:** Higher cost than non-mandrel hose; not available in ID sizes as large as rigid mandrel hose

*(Continued)*

## Basic Hose Constructions (Continued)



### Wrapped Ply – Machine Built

The wrapped ply construction is the oldest method of making hose, applying all hose components (tube, reinforcement and cover) in spiral strips on a rigid mandrel. After a tube is in place on the mandrel, layers or plies of bias cut fabric reinforcement are wrapped around the tube. The cover is applied and the hose is wrapped in nylon tape prior to curing. This process is capable of producing a hose for suction service when a helix wire(s) is incorporated.

**Size Range:** 1/2" through 30" ID

**Typical Uses:** Air; suction and discharge service for chemicals, dry materials, oil and water, conduit

**Advantages:** Good inside diameter tolerances, many special constructions available without large minimum production runs, special ends available, wide size range

**Disadvantages:** Higher cost compared to non-mandrel and flex mandrel; pressure and length limitations



### Wrapped Ply – Hand Built

Wrapped ply hose may be hand built when the diameter is too large for the building machine or where special built-in ends are desired. The plies are laid on by an operator rather than an automated machine process, allowing hand-forming of built-in ends.

**Size Range:** 1/2" through 60" ID

**Typical Uses:** Oil suction and discharge, sand suction, acid suction and discharge

**Advantages:** Special ends can be built into the hose; wide size range; special constructions available in small quantities

**Disadvantages:** Relatively expensive due to high labor content

## Age Control of Hose (Shelf Life)

The Parker warranty takes precedence over guidelines established by other industry organizations regarding the recommended shelf life of industrial hose. To achieve maximum shelf life, employ proper storage and handling practices and techniques, such as:

- Storage in the original shipping container such as a box, coil, or reel. Hose stored on a reel or in a coil should have its plastic wrapping kept intact.
- Storage in temperatures of 100°F (38°C) or less.
- Avoidance of ozone (electrical discharges or fields), water, extreme humidity, corrosive chemicals and ultraviolet radiation (direct sunlight).
- Use on a first-in, first-out (FIFO) basis determined by the manufacturing date on the hose.

For further information pertaining to age control of hose, contact Parker or refer to the current ARPM Hose Handbook, IP-2.

## Electrical Properties of Rubber Hose

### Electrical Conductivity

Industrial hoses generally fall into three categories: conductive, nonconductive, or somewhere in-between. Because of its unique properties, it is possible for rubber to be nonconductive at low voltage and conductive at high voltage. When using a hose in an application that has electrical resistance requirements (low electrical resistance for conductive applications or high electrical resistance for nonconductive applications), always select a hose that is specifically designed to meet the specific need. Since conductivity or nonconductivity is not a consideration for many applications, electrical resistance ratings do not exist for many hoses.

### Conductive Hose

Static electricity is generated by the flow of material (even some liquids) through a hose. As the material flows, molecules collide and generate friction, which creates minute amounts of electrical charge (excess electrons). The charge accumulates potential energy at the delivery end of the hose (coupling/nozzle). The amount of charge increases with material volume and linear velocity, coarseness of the material, and length of the hose. If not properly grounded, the accumulated charge (potential energy) will seek its own ground. The charge will be attracted to external materials in proximity (such as a steel storage container); if not properly grounded, the electrons may arc (jump) to the external material, igniting volatile materials in the hose, or in proximity to the hose.

Electrically conductive wires and conductive rubber components are used in hose to prevent static electricity build-up and discharge as a spark. Electrical engineers differ in opinion on the effects of static electricity and the means of dissipating it. In handling gasoline and other petroleum-based liquids, recognized national associations and companies have conflicting opinions on the need for conductive hoses. Until a consensus is reached among all associations, laboratories and users, and a standard practice is established, it is essential that the user determine the need for static bonded hose based on (a) the intended use of the hose, (b) instructions from the company's safety division, (c) the insurer, and (d) the laws of the localities and states in which the hose will be used.

Some types of hose include a helical or static wire(s). This wire can be used for electrical continuity provided that proper contact is made and maintained between it and the hose couplings.


### Nonconductive Hose

Nonconductive hose constructions are those that resist the flow of electrical current. In some specific applications, especially around high voltage electrical lines, it is imperative for safety that the hose be nonconductive. Unless the hose is designed particularly to be nonconductive and is so branded, do not conclude that it is nonconductive. Many black rubber compounds are inherently and inadvertently conductive. Nonconductive hose is usually made to a qualifying standard that requires it to be tested to verify the desired electrical properties. The hose is frequently (but not necessarily) non-black in color and clearly branded to indicate it is designed for nonconductive applications.

**NOTE 1:** Parker industrial hose generally uses the non-conductivity standard originally developed by Alcoa Aluminum: A minimum resistance of one megaohm per inch at 1,000 volts D.C.

**NOTE 2:** SAE has a separate standard for nonconductivity for high pressure hydraulic applications. Part of the standard requires that nonconductive hose feature an orange cover.

**NOTE 3:** Nonconductive hoses contain little/no conductive rubber compounds, static wires, helical wires, or wire reinforcement. Therefore, a nonconductive hose would not be recommended for an application requiring an "anti-static/static dissipating/conductive" hose.

 **WARNING!** Unless a hose is described as, or specifically and clearly branded to be conducting or nonconducting, assume that the electrical properties are uncontrolled.

## Force to Bend / Minimum Bend Radius

The amount of force required to bend a hose and the minimum bend radius are important factors in hose design and selection. The minimum bend radius is defined as the radius to which the hose can be bent in service without damaging or appreciably shortening the life of the product, and is measured to the inside of the curvature of the bend. The bend radius for a given application must be equal to or greater than the rated minimum bend radius. Bending the hose to a smaller bend radius than minimum may kink the hose and result in premature failure.

Perhaps more important in determining flexibility, the force-to-bend is defined as the amount of force required to induce bending around a specified radius. The less force that is required, the easier the product is to maneuver in the field. Different hose constructions may require significantly different forces to attain the same minimum bend radius. Generally, the preferred hose is the more flexible hose, provided all other properties are essentially equivalent.

## Oil and Fuel Resistance

Rubber compounds are available in different formulations, blends and grades. Compounds are selected by hose design engineers based on the intended application of the hose. For instance, a hose recommended for multipurpose applications that may include hydraulic or

lubrication oil service generally contains a lower grade of tube compound. Conversely, a hose recommended for a more rigorous application, such as highly refined fuel service, contains a higher grade of compound, often within the same compound family.

Rubber hose is used to convey petroleum products both in the crude and refined stages. The aromatic content of refined gasoline is often adjusted to control the octane rating. The presence of aromatic hydrocarbons in this fuel generally has a greater effect on rubber components than do aliphatic hydrocarbons. Aromatic materials in contact with rubber tend to soften it and reduce its physical properties. For long-lasting service, the purchaser of fuel hose should inform the hose manufacturer of the aromatic content of the fuel to be handled so that the proper tube compound can be recommended for the specific application.

The effect of oil on rubber depends on a number of factors that include the type of rubber compound, the composition of the oil, the temperature and duration of exposure. Rubber compounds can be classified to their degree of oil resistance based on their physical properties after exposure to a standard test fluid. In this ARPM classification, the rubber samples are immersed in IRM 903 oil at 212°F (100°C) for seventy hours. (See ASTM Method D-471 for a detailed description of the oil and the testing procedure.) As a guide to users of hose in contact with oil, the oil resistance classes and a corresponding description are listed on the next page.

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### General Formula for Minimum Hose Length (given hose bend radius and degree of bend required)

$$\frac{\text{Angle of Bend}}{360^\circ} \times 2 \pi r = \text{Minimum length of hose to make bend.}$$

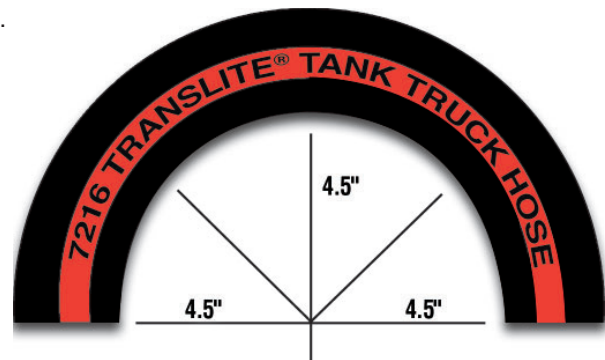
$r =$  Given bend radius of hose.

**Example:** To make a 90° bend with 2" I.D. hose.  
Given  $r = 4.5$  inches.

$$\frac{90}{360^\circ} \times 2 \times 3.14 \times 4.5$$

$$.25 \times 2 \times 3.14 \times 4.5 = 7" \text{ (minimum length of hose to make bend without damage to hose)}$$

The bend radius for a given application must be equal to or greater than the rated minimum bend radius. Bending the hose to a smaller bend radius than minimum may kink the hose and result in premature failure.



The minimum bend radius is measured to the inside of the curvature.

### General Formula for Minimum Hose Length (allowing relief from couplings)

$$\text{Overall Length (OAL)} = (2 \times \text{Length of Coupling}) + (2 \times \text{Hose OD}) + (\text{Angle}/360) \times 2 \pi r$$

## Physical Properties After Exposure to Oil

Class	Volume Change Maximum	Tensile Strength Retained
<b>Class A (High Oil Resistance)</b>	+25%	80%
<b>Class B (Medium/High Oil Resistance)</b>	+65%	50%
<b>Class C (Medium Oil Resistance)</b>	+100%	40%

The above ARPM guideline does not imply compatibility with all oil based fluids. There are many grades of rubber compounds that meet ARPM Class A oil resistance requirements. Some compound grades will be fine for multipurpose applications, while higher grades would be required for more rigorous applications.

Oil resistant hoses for multipurpose service tend to be more economical than hoses specifically designed and recommended for highly refined fuel service. These multipurpose hoses, even if they feature an ARPM Class A tube, are not necessarily recommended for use with highly refined fuels. Furthermore, many chemical resistance charts represent data developed from testing of a typical grade of compound used for that family of fluids. For example, “nitrile” may show compatibility with gasoline, but the nitrile that was tested is likely the nitrile used in gasoline dispenser hose, as opposed to the nitrile commonly used in multipurpose hose.

When selecting a hose for highly refined fuels such as aviation fuel, biodiesel, diesel, ethanol, gasoline or kerosene, be guided by the hose manufacturer’s recommendation to use a hose designed and manufactured for that specific application and/or fluid. Contact Parker for further information.

## Suction and Vacuum

Hose is constructed with high adhesion between the tube and the carcass to prevent tube separation. Most hose is used for pressure service; however, some applications require the hose to resist collapse in suction and vacuum service. Such hose is subjected to crushing forces because the atmospheric pressure outside the hose is greater than the internal pressure. The hose can collapse and restrict the flow unless the hose is constructed to resist these pressure differentials. The most common method of preventing hose collapse is to build a helical member(s) (wire or thermoplastic) into the hose body. The size and spacing of the helix depends on the size of the hose and the pressure differential. In applications approaching a perfect vacuum, most of the plies of reinforcement are applied over the helix.

Suction hose must be specifically designed for the service for which it is used. Each element—tube, reinforcement, size, spacing, and location of the helix—must be carefully considered. While suction hose is generally used to convey liquids, vacuum hose carries air under a partial vacuum. Vacuum hose is reinforced to resist collapse and maintain its shape under rough handling and/or mechanical abuse. It does not require the heavy construction of suction hose because the dry materials generally conveyed are much lighter in weight than liquids and the vacuum is usually less than for normal suction service.

# Coupling Thread Compatibility

Industrial hose couplings have threads which are usually one of the various “pipe” threads. All pipe threads are commonly referred to by the generic name of Iron Pipe Thread or IPT. There are several different types of IPT threads and you must know specifically what they are to ensure compatibility with mating threads.

## IPT Thread Compatibility Chart

Description	Seal	Thread (Female)	Compatible Threads (Male)
American Standard Tapered Pipe Thread	Thread Seal (with Sealing Compound)	NPT	NPT NPTF
American Standard Tapered Dryseal Pipe Thread	Thread Seal (Dryseal)*	NPTF	NPTF NPT
American Standard Straight Pipe Thread for mechanical joints (includes 2 female types, depending on sealing method, and one male type compatible with both females)	Washer or Mechanical Ground Joint	NPSM	NPSM NPT NPTF
American Standard Straight Pipe Threads for hose couplings and nipples	Washer	NPSH	NPSH NPT NPTF

\*When NPTF Threads are used more than once, they require sealing compound after the first use.

In addition, there are various other thread types that may be found on industrial hose couplings. These types are generally not compatible with any other thread types:

Type	Description	Seal
<b>GHT</b>	Garden Hose Thread	Washer seal
<b>API</b>	American Petroleum Institute Thread	Thread seal
<b>JIC (37°)</b>	Joint Industry Council	Mechanical seal
<b>SAE (45°)</b>	Society of Automotive Engineers	Mechanical seal
<b>NF</b>	Welding Hose Threads-Left Hand and Right Hand	Mechanical seal
<b>CHT</b>	Chemical Hose Thread (for booster hoses)	Gasket seal