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Installation Tips

polyflex Hose —
Determination of Length of Hose for Over-the-Sheave Applications

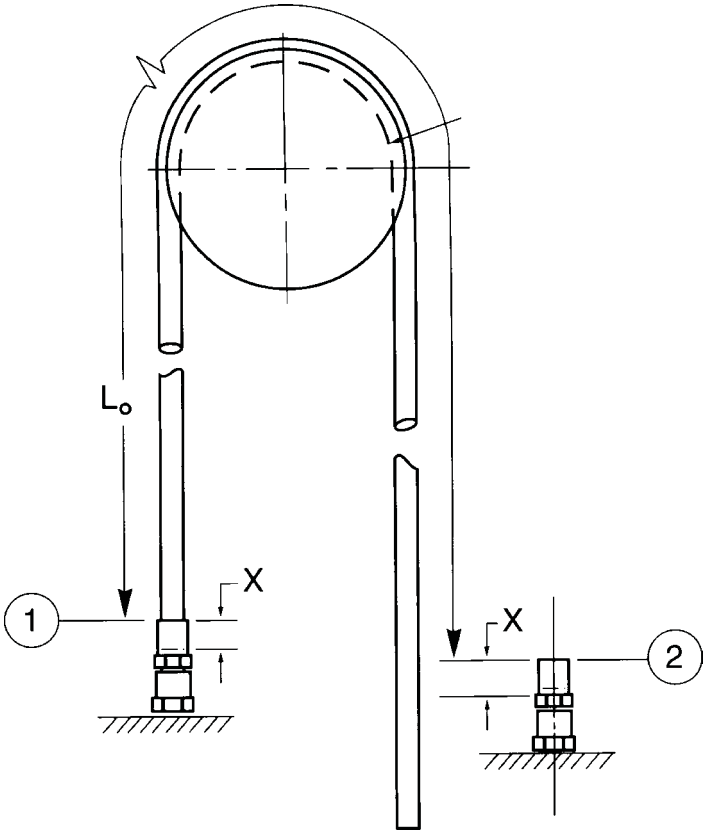
The exact cutoff length for an optimum over-the-sheave assembly depends on the particular mechanical arrangement of the machine. A method for finding an approximate starting point is as follows:

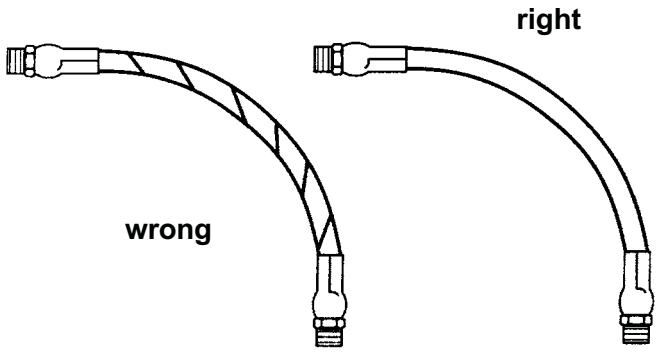
1. Assemble hose with one coupling as shown in diagram.

2. Measure hose length from point 1 to point 2 **with hose taut**. (L_O = length)

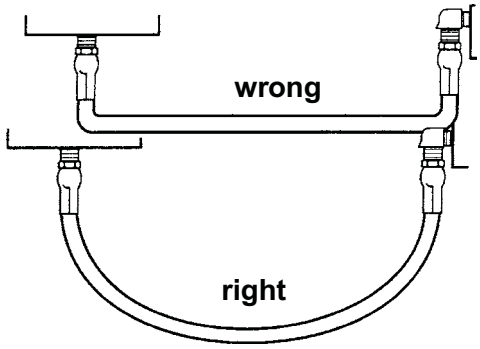
3. Calculate hose cutoff or free length L_F:
   $L_F = 0.985\ L_O + 2x$
   Where L_F includes coupling insert allowance on both ends. The coupling insert allowance (x) may be found from the coupling dimension tabulations in the fittings sections section of this fitting section or from direct measurement on the coupling. A 1.5% stretch allowance is provided in this formula.

4. Couple the remaining hose end and assemble on the machine.

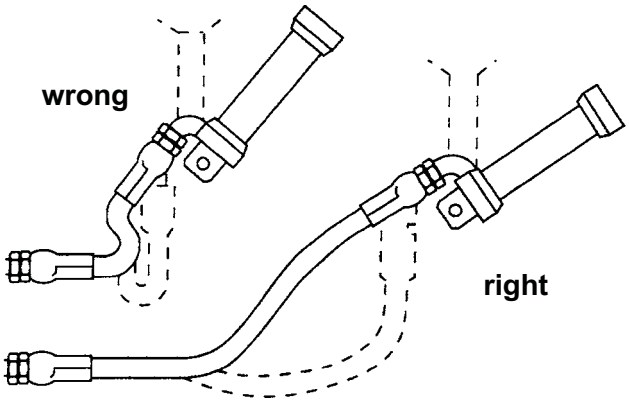




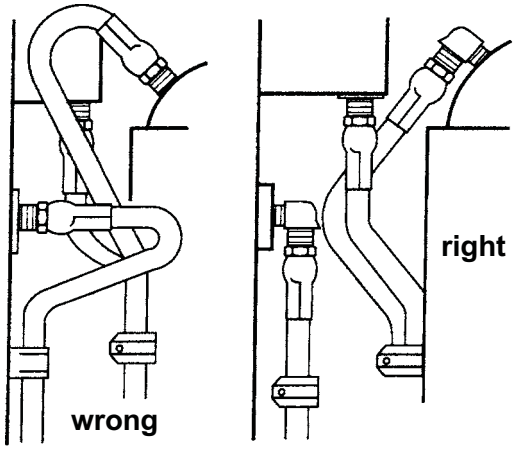
Hose is weakened when installed in twisted position. Also, pressure pulses in twisted hose tends to fatigue wire and loosen fitting connections. Design so that machine motion produces bending rather than torsion.



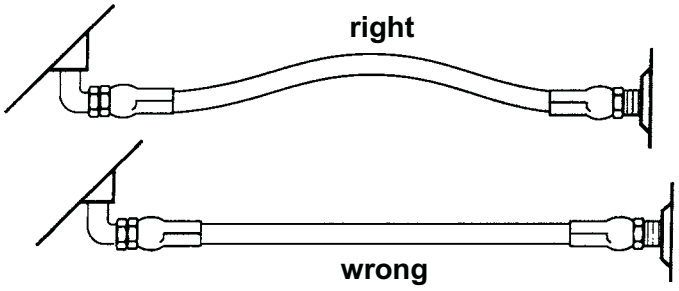
Hose should exit coupling in a straight position rather than side loaded. Ample bend radius should be provided to avoid collapsing of hose and flow restriction. Exceeding minimum bend radius will greatly reduce hose assembly life.



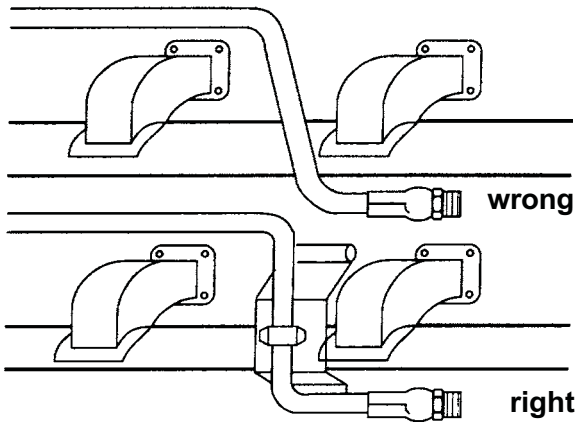
When hose assembly is installed in a flexing application, remember that metal hose fittings are not part of the flexible portion. Allow ample free length for flexing.



Use elbows or other adapters as necessary to eliminate excess hose length and to ensure neater installation for easier maintenance.



Pressure can change hose length as much as ±3%. Provide slack in line to compensate for hose length changes.



Avoid installing hose line close to exhaust manifold or any other hot section. If possible, isolate hose with fireproof boot or other protective means.

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Recommended Practice for Selection, Installation, and Maintenance of *polyflex* Hose and Hose Assemblies

Hose and hose assemblies have a finite life span and many things reduce this time. This recommended practice should be read by designers and users of hose to assist them in the proper selection of hose. These guidelines, while not all inclusive, will assist the user in maintaining hydraulic and pneumatic systems.

READ THE PARKER SAFETY GUIDE CONTAINED IN THIS CATALOG IN ITS ENTIRETY.

PART ONE – How to Select Hose

- **Pressure** – Maximum operating pressure of the hose must be greater than or equal to the system pressure. Pressure surges or system "spikes" in excess of the maximum operating pressure will shorten hose life and must be avoided.
- **Temperature** – Ambient and fluid temperatures must not exceed the hose/fittings rated design temperature. Attempt to route hose or shield hose from high temperature sources.
- **Size** – Adequately size hose and fittings to avoid damaging hose with excessive turbulence, or heat build-up, while maintaining proper flow and pressure. (Refer to fluid velocity nomogram.)
- **Fluid compatibility** – Refer to Chemical Compatibility Guide in this catalog for use of fluids with various materials. If unsure of an application, contact the factory. Additional care must be taken with gaseous applications. (See Safety Guide at end of catalog.)
- **Environment** – Conditions such as ozone, UV light, harsh chemicals, salt water, and other airborne contaminants can degrade hose and shorten its life.
- **Length** – Hose length changes with pressure. This, along with equipment movement, must be considered in the system design.
- **Proper couplings** – Always follow manufacturers specifications and do not mix components of different manufacturers.
- **Mechanical loads** – Conditions such as tensile and side loads, vibration, excessive flexing, and twist will reduce hose life. Use swivel fittings and adapters to avoid hose twisting. Test the hose if the application is potentially problematic or unusual.
- **Electrical conductivity** – Determine if the hose must be non-conductive to prevent electrical current flow or conductive to dissipate static electricity. Choose hose and fittings accordingly. (See Safety Guide for Electrical Conductivity issues.)

PART TWO – Installation and Maintenance

- **Inspect components** – Check hose for cover cracks, blisters, cleanliness, kinks, cracks or core tube obstructions or other defects. Examine fittings for poor threads, obstructions, cracks, rust. Do not use hose or fittings if these problems exist.
- **Assemble per instructions contained in this catalog.**
- **Do not exceed specified minimum bend radius** – Use stress relievers to prevent sharp bends at the hose and fitting juncture. These can be spring guards or other stress relieving members.
- **Ensure that hose bends rather than twists with equipment motion.**
- **Use a torque wrench or the flats from finger tight method to properly install port connections.**
- **After installation, eliminate air entrapped in system, pressurize to maximum operating pressure, and check for leaks and proper system function.**
- **After installation, periodically (frequency depends on severity of application and potential risk) inspect the system for the following:**
  1. Blistered, degraded, or loose hose covers.
  2. Stiff, cracked, or charred hose.
  3. Cuts or abrasion of hose. Look for exposed reinforcement.
  4. Leaks in hose or fittings.
  5. Damaged or corroded fittings.
  6. Excessive build up of dirt, grease, oils, etc.
  7. Defective or broken clamping devices, shields.
  8. Kinks in hoses.

  Upon discovery of any of these items, replace it, repair it, but **DO NOT IGNORE IT**!
- Retest the system after all maintenance procedures.
- Establish replacement schedules based on previous service life, or when failures could result in damage, personal injury, excessive or unacceptable downtime.

Dash Sizes

Dash sizes are commonly used to designate hose I. D., plastic tubing and metal tubing O. D. and coupling size. Dash size systems in common use:

Nominal Hose I. D. or Tubing O. D.		Dash Number for all ***polyflex*** Hose	Dash Number for TFE Hose	Nominal DIN Size
Inches	**Millimeters**			
3/32	2.0	-012		
1/8	3.2	-2	–	–
3/16	4.8	-3	-4	5
1/4	6.3	-4	-5	6
5/16	7.9	-5	-6	8
3/8	9.5	-6	–	10
13/32	10.3	-6.5	-8	–
1/2	12.7	-8	-10	12
5/8	15.9	-10	-12	16
3/4	19.1	-12	–	20
7/8	22.2	-14	-16	–
1	25.4	-16	–	25
1-1/8	28.6	–	-20	–
1-1/4	31.8	-20	–	32
1-3/8	34.9	–	-24	–
1-1/2	38.1	-24	–	40
1-13/16	46.0	–	-32	–
2	50.8	-32	–	50

Selection of Hose Diameter from Flow Rate and Velocity

The Fluid Velocity Nomogram gives the velocity of a liquid or gas as a function of flow rate and inside diameter of the fluid line. The commonly recommended maximum velocities for hydraulic oil systems at 200°F or less are indicated for guidance.

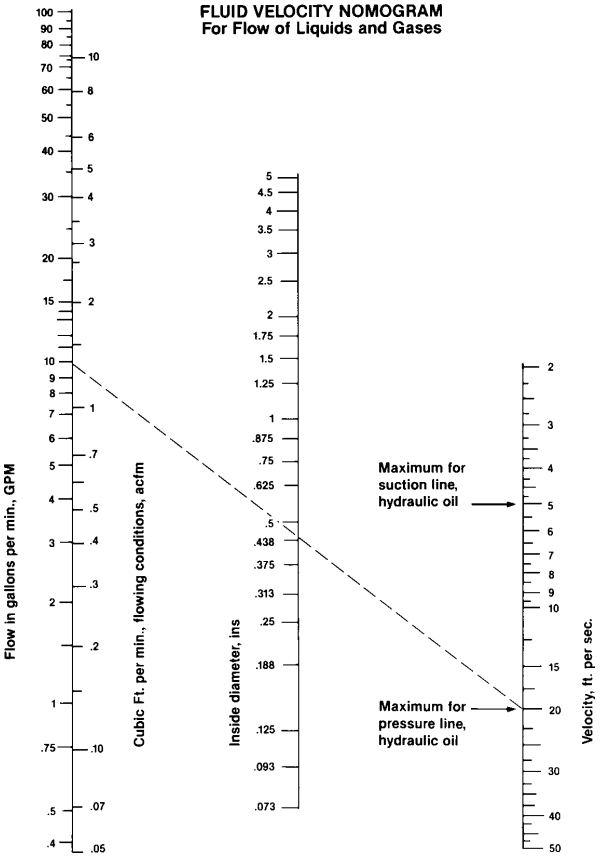
Example: At 10 gpm, what is the minimum size within the recommended velocity range for a hydraulic pressure line?

The dashed line drawn from the 10 gpm mark on the left hand line to the maximum velocity of 20 fps intersects the middle line at .438 " (7/16" I. D. hose or tubing).
For a hose application, use 1/2" I. D., the nearest common standard size.

This chart is based on the following formulas: $v_{fps} = \frac{.321Q}{\frac{\pi d^2}{4}}$, Q = gal per min
d = hose or tube I. D. (inch)

cu. ft./min. = .1337 Q

The cu. ft. per min. value is the actual volume flow rate under flowing conditions.
For air, standard cfm of free air = 7.81 actual cfm when the inlet air is at 100 psig, 68°F.



Determination of Pressure Drop in the Line

Velocity: $v = .409\frac{Q}{d^2} = .0509\frac{W}{\rho d^2} = \frac{q}{.785d^2}$

Reynold's Number: $Re = 124\frac{dv\rho}{\mu} = 6.31\frac{W}{d\mu} = 378\frac{q\rho}{d\mu}$

Pressure Drop, Isothermal, Incompressible Flow (Liquids):

$\Delta P = .001\,294\frac{fL\,\rho\,v^2}{d} = .000\,00336\frac{fLW^2}{\rho d^5} = .0121\frac{fL\,q^2}{d^5}$

Pressure Drop, Isothermal, Compressible, Long Lines (Gases and Vapors):

$$\frac{\Delta P}{P1} = 1 - \sqrt{1 - \frac{fL\rho\,1\,v_1^2}{12\,g\,d\,P_1}}$$

Symbols and Units for Listed Formulas

d = inside diameter of hose, inches

f = friction coefficient, dimensionless

g = gravitational constant, 32.2 ft./sec.^{2}

P1 = input pressure, psi

ΔP = pressure difference, psi

q = rate of flow at flowing condition, cu. ft./min.

Q = rate of flow, gals./min.

Re = Reynolds number, dimensionless

v = flow velocity, ft./sec.

W = rate of flow, lbs./hr.

ρ = weight density of fluid, lbs./cu. ft.

μ = absolute (dynamic) viscosity, centipoises

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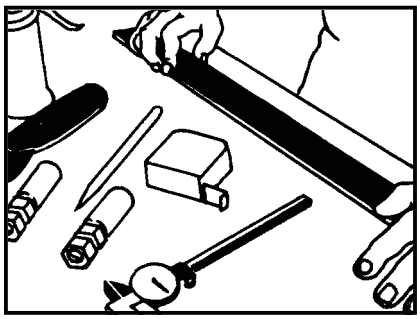
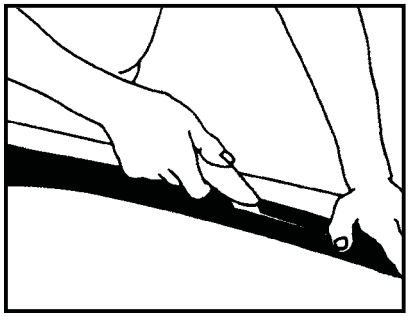
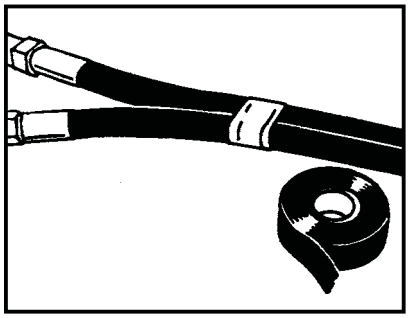
Twin Line and Multi-Line Separation Instructions



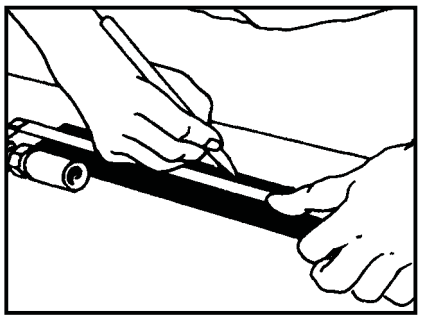
1. **Position twinned or multi-line hose assembly so that it lies flat on work surface without tendency to twist or turn.**



4. **Press the multi-line hose assembly firmly and flat against the work surface with your free hand so that it does not move. Using a Stanley trimming knife model No. l0-5l5 or equivalent, draw the knife toward you with constant light to moderate pressure, and a smooth stroke. Three or four strokes will be necessary to separate the hoses.**



6. At the option of the assembler as dictated by the installation, **it is suggested that a nylon lashing strap or tape be applied at the termination of the separated length to provide protection against tearing of the web or hose covers.**

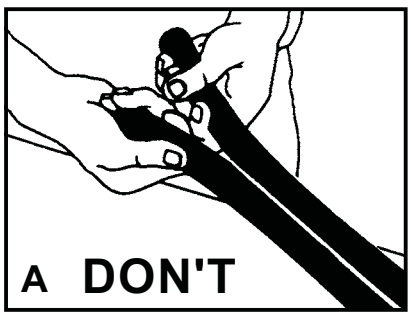


2. **Measure and mark the length that the hoses are to be separated. Note:** if length of separation is specified from the threaded or swivel nut end of coupling, deduct the cutoff allowance dimension for the specific style of coupling used. The cutoff allowance is obtainable from the hose fitting tables found in the hose fitting tables or can be calculated by subtracting the insertion depth of the shell from the overall coupling length.

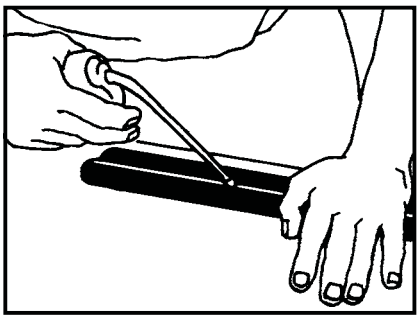
NOTE:

• It is important that the knife blade be perpendicular to the hose during this procedure so that the blade cuts only the center line of the web. EXTREME CARE MUST BE TAKEN TO AVOID CUTTING THROUGH THE COVER OF THE HOSES AND THEREBY EXPOSING THE FIBER REINFORCEMENT. If this occurs, the hose assembly must be discarded. (*see photo A.*)

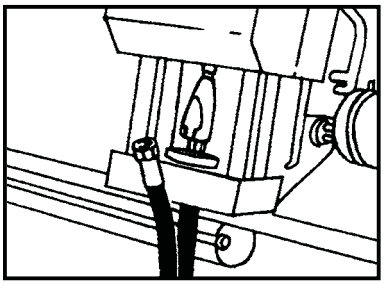
If the separation length is greater than that which can be accomplished with one continuous, smooth stroke, then the procedure should be repeated over shorter distances always cutting toward the free end of the hoses.



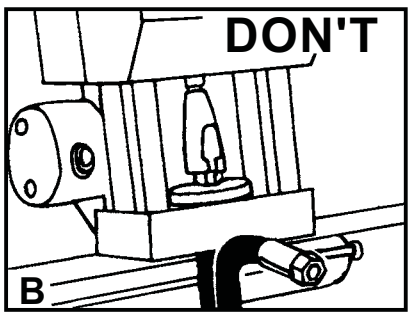
EXTREME CARE MUST BE TAKEN TO AVOID CUTTING THROUGH THE COVER OF THE HOSES AND THEREBY EXPOSING THE REINFORCEMENT.
If this occurs, the hose assembly must be discarded.



3. **Lightly lubricate the web area between the hoses. Distribute the lubricant uniformly along the web of the assembly to be separated.** Parker Hoze-Oil or any lightweight oil will suffice. (SAE 10 or 20) The function of the oil is to reduce the friction of the knife blade so that it naturally seeks the center of the valley formed by the hoses. This eliminates the need for the operator to steer the knife.



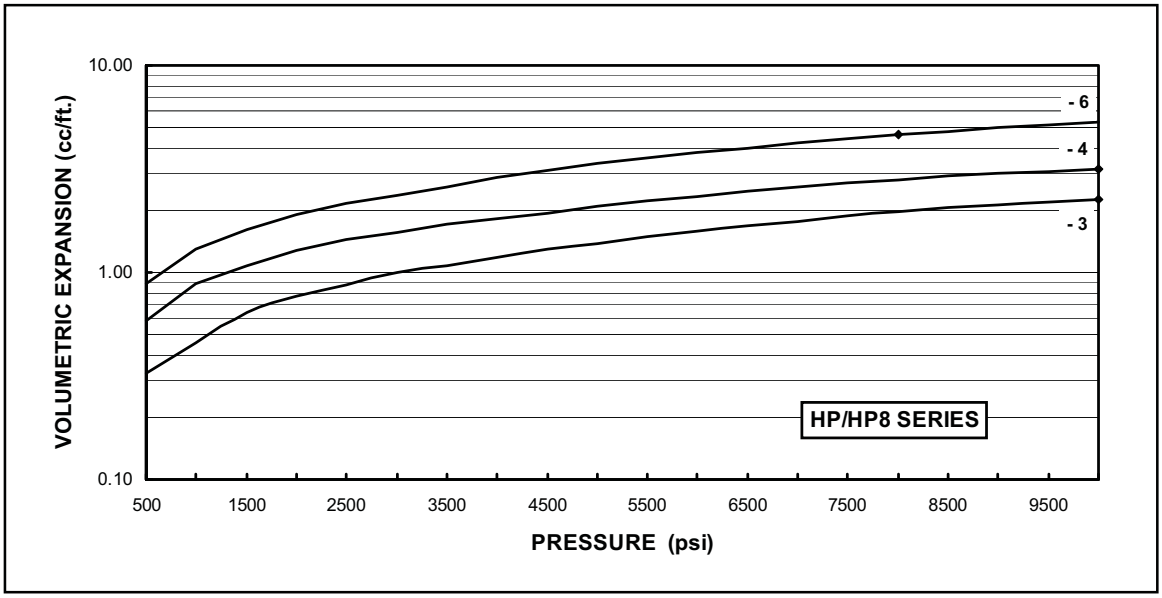
5. **It is suggested that the separation length be sufficiently long** so that the swaging or crimping operation can be accomplished without risk of kinking the hoses or tearing the web which could result in exposure of the braided reinforcement. (*see photo B*)



The separation length must allow for the swaging or crimping operation without damaging the hose.

Volumetric Expansion Data For HP/HP8 Thermoplastic Hose

(▲ indicates hose working pressure)



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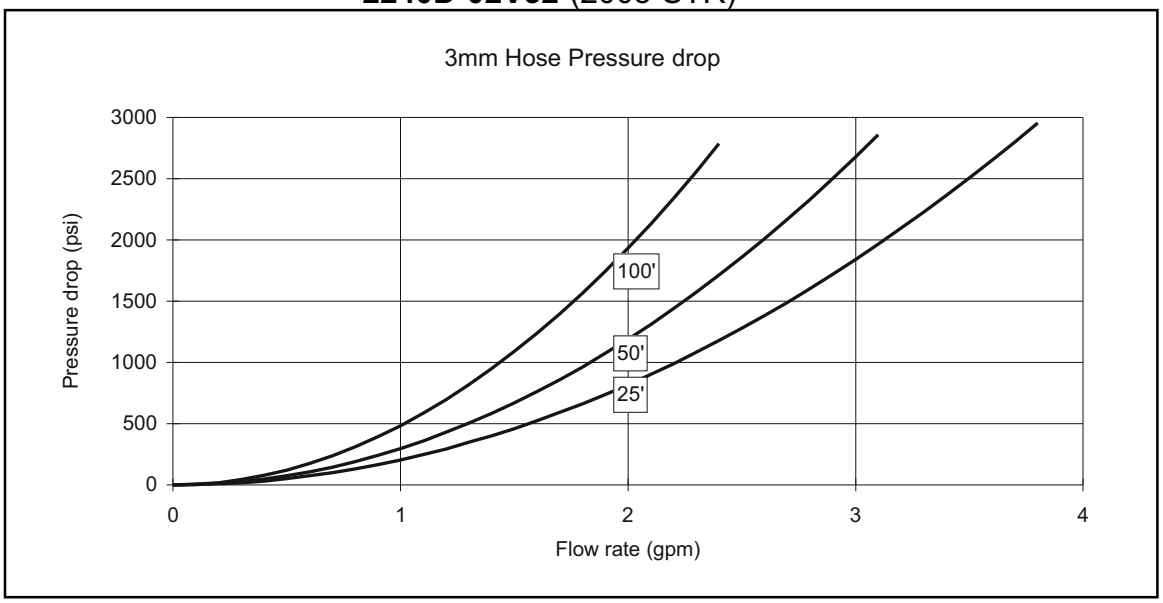
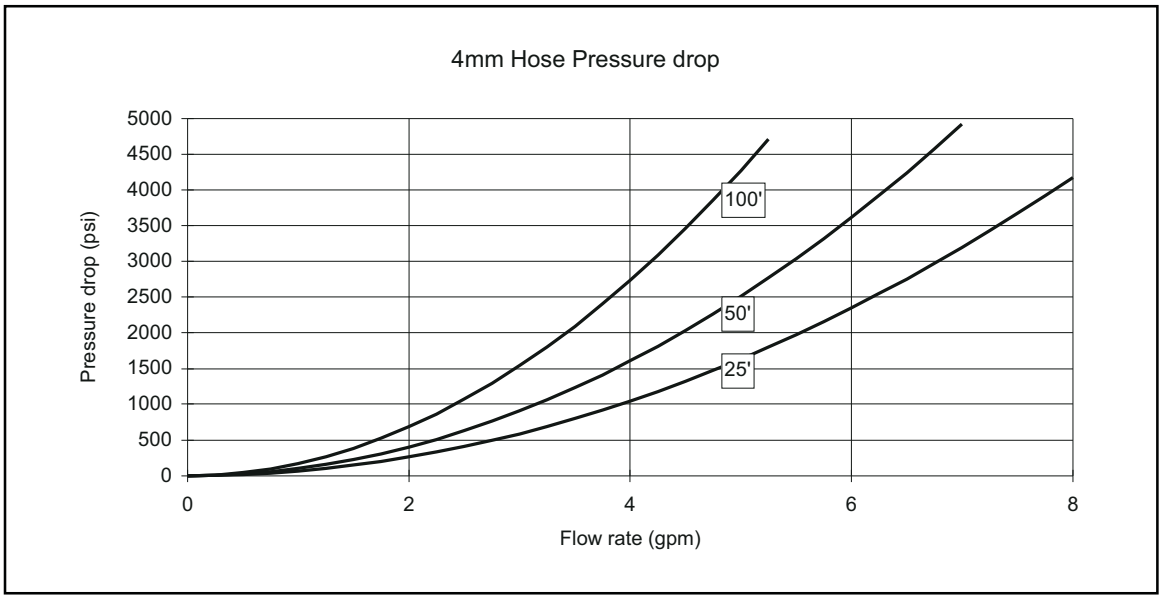
For Hose Types:

2040N-02V00 (1003 K)
2020N-02V30 (1003 MK)
2240D-02V32 (2003 STR)



For Hose Types:

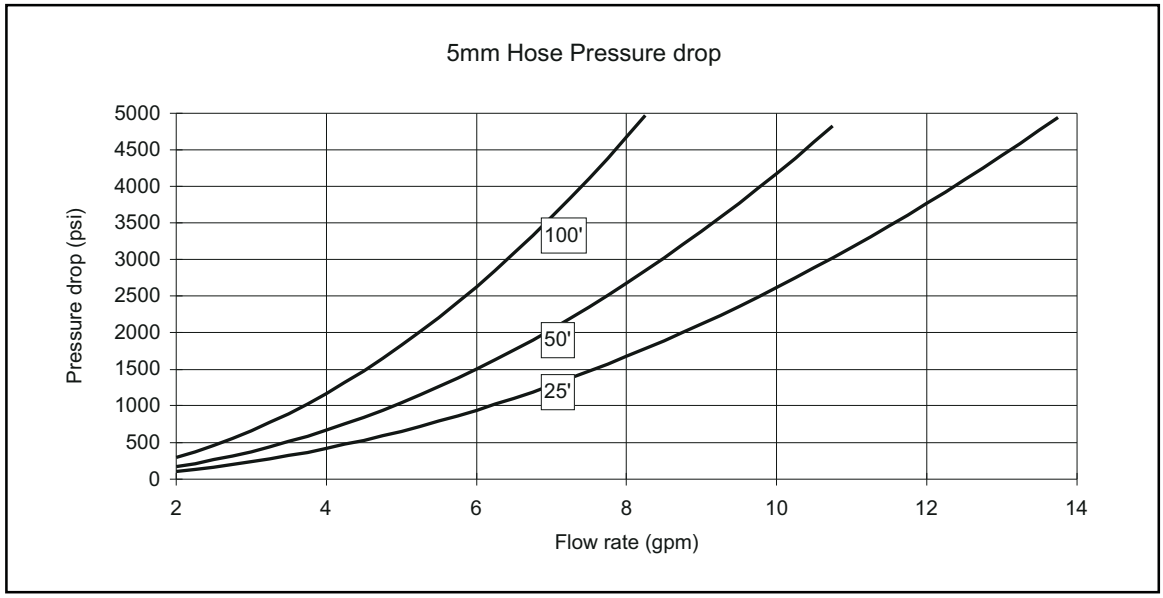
2240D-025V34 (2004 STR)
2243D-025V70 (2004 STV)
2244N-025V00 (2104 ST)
2440D-025V37 (4004 ST)
2640D-025V32 (6004 ST)
2740D-025V30 (6104 ST)



Results obtained from actual pressure drop tests, pumping water through hose assemblies with normal end fittings.

For Hose Types:

2240D-03V32 (2005 STS)
2245D-03V32 (2005 STR)
2243D-03V70 (2005 STV)
2440D-03V37 (4005ST)
2640D-03V32 (6005 ST)
2740D-03V30 (6105 ST)



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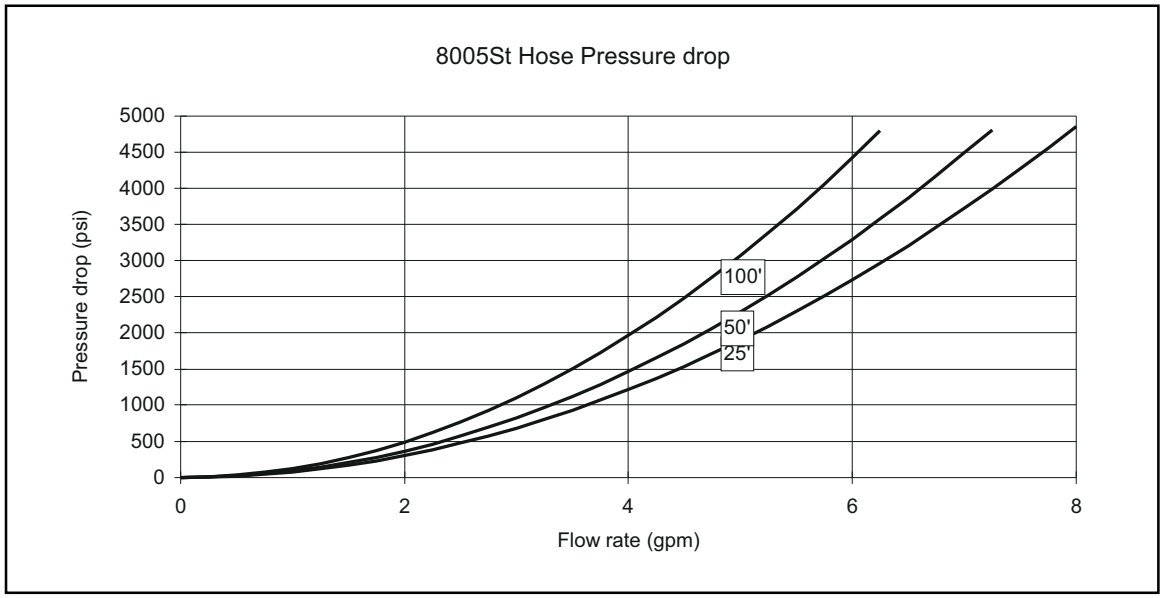
For Hose:

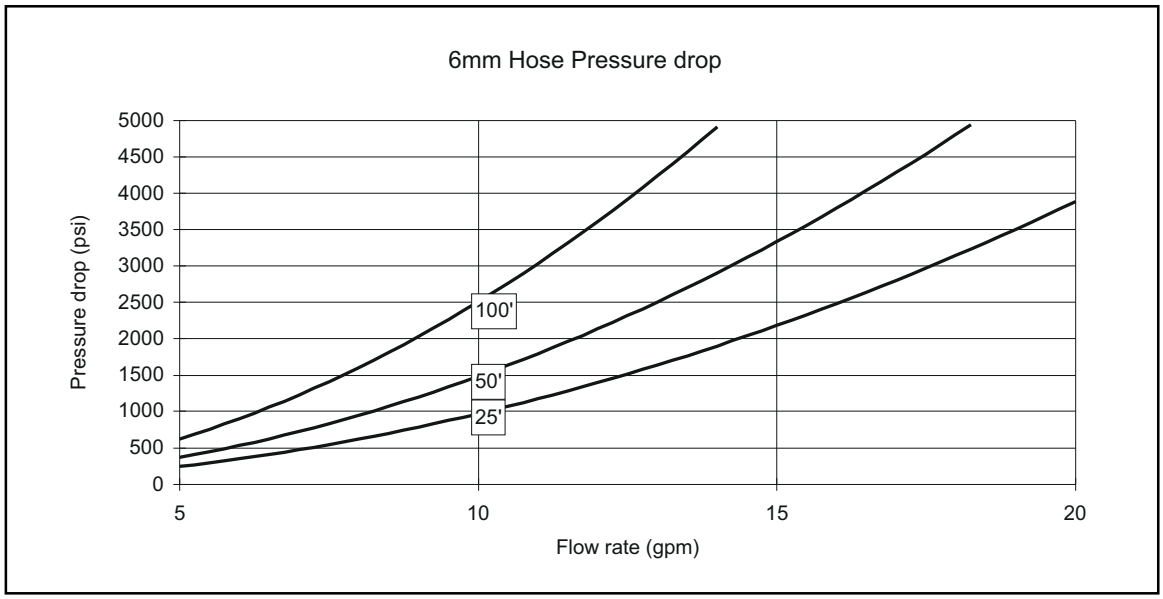
2840D-03V34 (8005 ST)



Results obtained from actual pressure drop tests, pumping water through hose assemblies with normal end fittings.

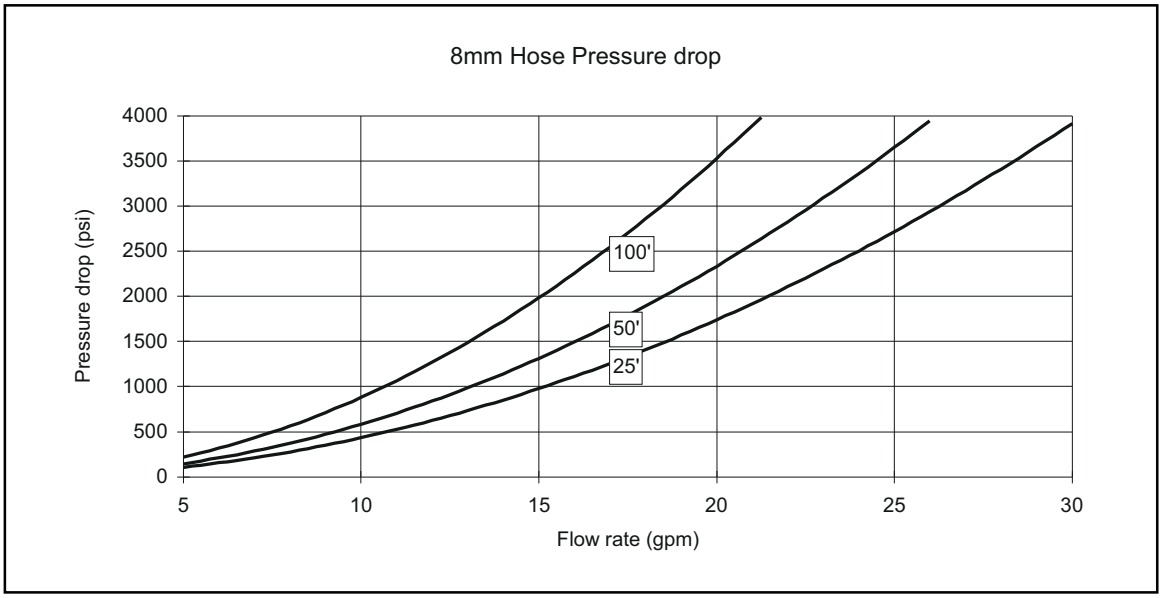
For Hose Types:

2245N-04V00 (2006 ST)
2380N-04V33 (2006 STA)
390N-04V00 (2206 ST)
2440N-04V37 (4006ST)
2440M-04V30 (ChemJec)
2380N-04V00 (2106 ST)
2380M-04V00 (ChemJec)
2240D-04V32 (2006 STS)
2X90N-04V14 (Red Snake)



For Hose Types:

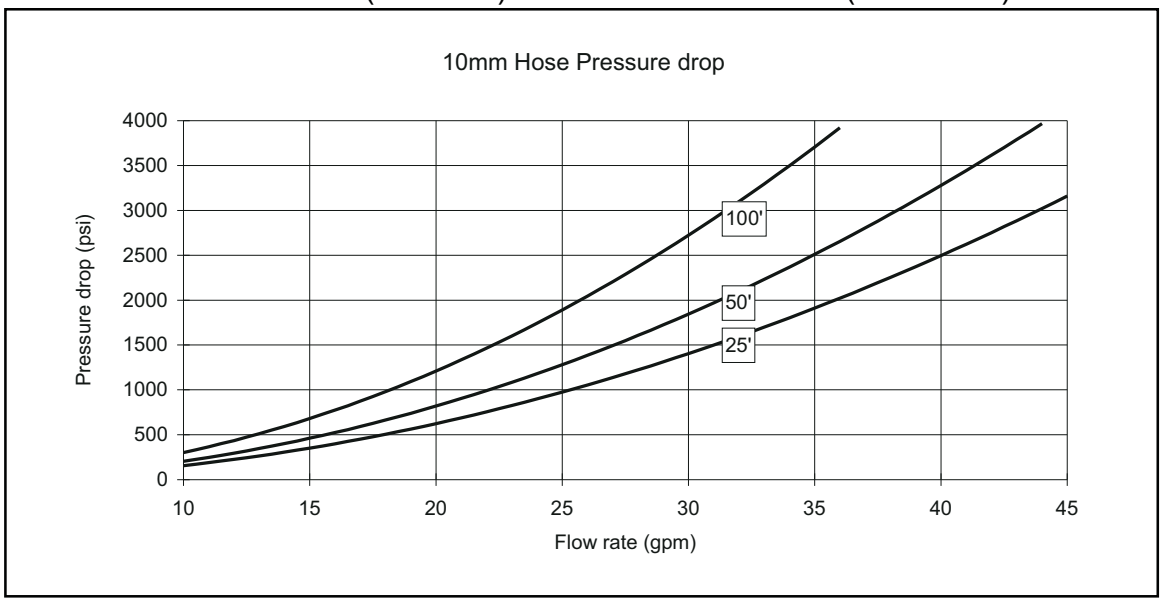
2240N-05V32 (2008 STS)
2380F-05V07 (FEP)
2380M-05V30 (ChemJec)
2440M-05V30 (ChemJec)
2440D-05V37 (4008 ST)
2640D-05V32 (6008 ST)
2740D-05V32 (6108 ST)
2840D-05V32 (8108 ST)



Results obtained from actual pressure drop tests, pumping water through hose assemblies with normal end fittings.

For Hose Types:

2245N-06V30 (2010 ST)
2390N-06V13 (2210 ST)
2X90N-06V14 (Red Snake)
2440N-06V91 (4110 STN)



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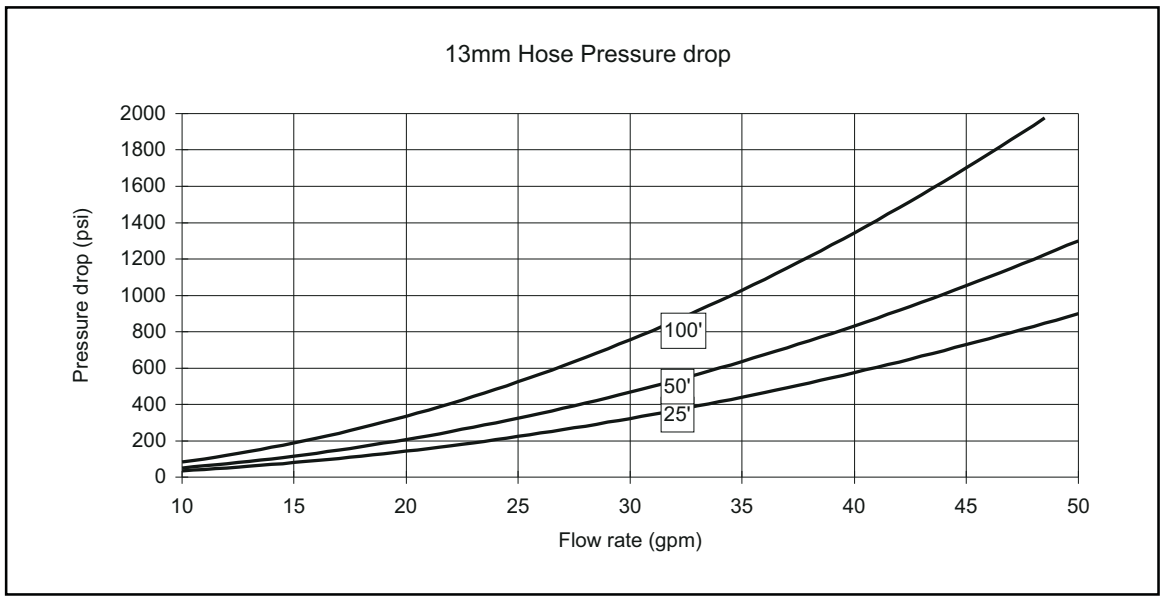
For Hose Types:

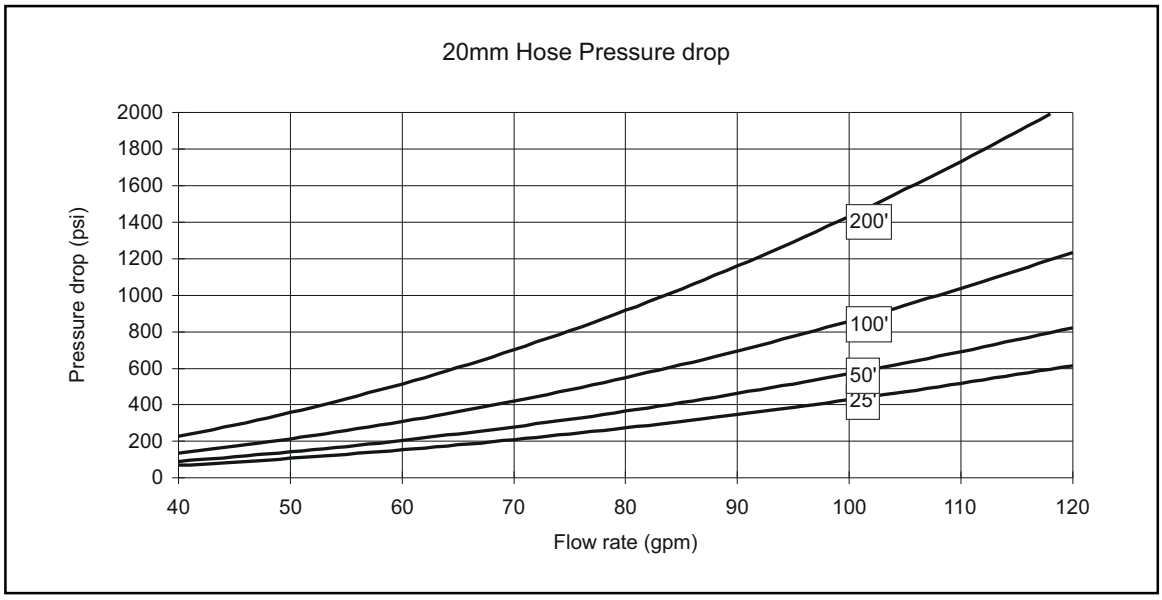
2245N-08V30 (2013 ST)
2244N-08V10 (2113 ST)
2390N-08V13 (2213 ST)
2X90N-08V14 (Red Snake)
2380F-08V07
2440N-08V30 (4113 ST)
2640N-08V32 (6013 ST)
2840D-08V30 (8013 ST)



Results obtained from actual pressure drop tests, pumping water through hose assemblies with normal end fittings.

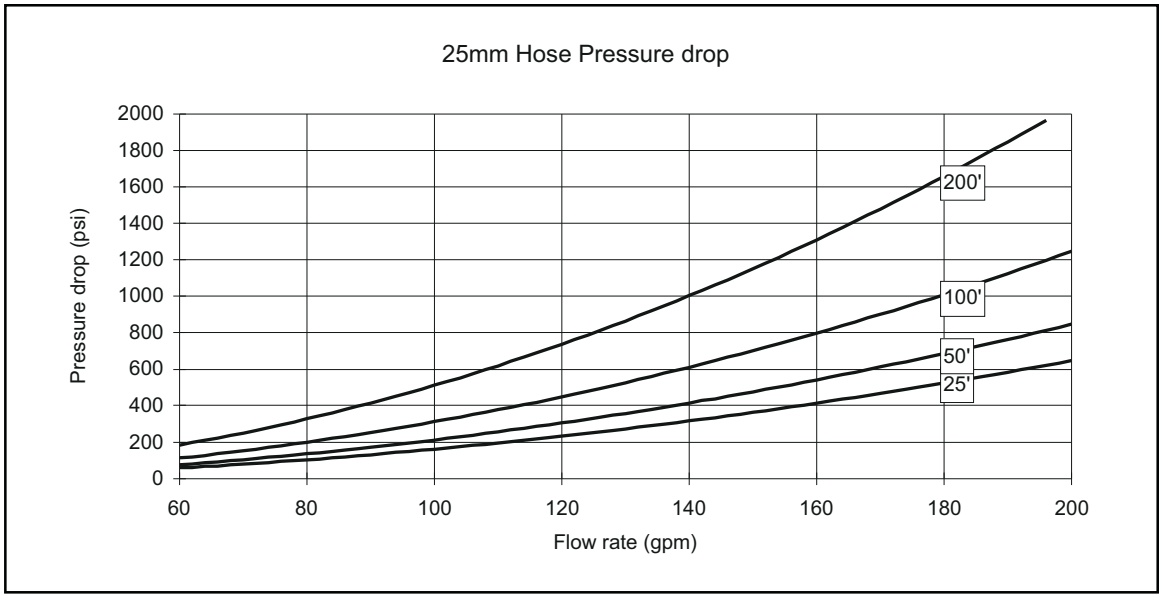
For Hose Types:

2380F-12V07 (FEP)
2390N-12V03 (2220 ST)
2640N-12V32 (6020 ST)
2245N-12V30 (2025 ST)
2440N-12V37 (4120 ST)
2X90N-12V34 (Red Snake)



For Hose Types:

2245N-16V30 (2025 ST)
2390N-16V13 (2225 ST)
2440N-16V37 (4125ST)



Results obtained from actual pressure drop tests, pumping water through hose assemblies with normal end fittings.

Agency and Specifications	Approved ***polyflex*** Products
Hydraulic Service: SAE 100R10	 2244N/2380N
DIN (Deutsches Institur Für Normung): DIN 20022 Part 1 (Performance Requirements) DIN 20022 Part 2	 2040N 2040H, 2245N/2244N
Electrical Non-Conductivity: SAE J517, Pitman E-00094	 HP8
DNV: Cert. No. P-8934, P-8936, P-10271, P-10410 Cert. No. P-9785	 HP, HP8 2040N, 2380N

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Abrasion

Abrasion occurs in numerous forms; two of the more common are the typical rubbing or chafing, with the second being very high frequency, low amplitude friction. This type of abrasion results from pump pressure pulses otherwise known as pump ripple. It can also be caused by equipment vibration or resonance. Abrasion may occur when two hose lines cross or when a hose line rubs or bears against a fixed point. Abrasion resistance is also a function of temperature and attack of the cover material by aggressive chemicals.

Spring guards or other protective sleeving can also ward off premature hose failure resulting from abrasion. Spring guards also distribute bending force often associated with excessive side loading or even kinking at the skirt of the coupling.

Ambient Temperature

Exceedingly high or low ambient temperatures will affect the materials from which the hose is constructed and will negatively influence hose life. When at all possible, the hose should be routed in such a manner as to protect it from heat sources. In extreme cold applications, the equipment should be designed with remote relief valves to allow circulation and warming of the oil before hose articulation is attempted. The hose liner (core tube) of choice for extremely high or low temperature is Teflon®. Teflon® is serviceable at temperatures as low as -100°F and as high as +450°. Consult the specific hose operating parameters for more information.

Bend Radius

The minimum bend radii listed in this catalog are valid at rated working pressures and indicated service temperatures. Service life of a hose may be shortened if the minimum radius is exceeded or if the hose is flexed continuously in use.

Burst Pressure and Working Pressure

The specified burst pressure for each hose style and dash size are for unaged hoses tested at normal laboratory temperature in accordance with SAE J343 specification for normal service and technically ideal installations. The maximum recommended working pressure is 1/4 of the minimum rated burst pressure, except as otherwise specifically stated in those product specifications. For more severe service, a higher rated working pressure hose may have to be selected.

Hose Installation Tips

Establish hose size (I. D.) and style based upon flow rate (GPM), pressure drop, and chemical compatibility with fluid medium. Other significant factors to be considered in hose selection and installation are discussed briefly as follows:

Operating Temperature

The temperature range for satisfactory service (maximum hose life) depends to a great extent upon the fluid being conveyed. Use of a hose above maximum specified temperature ratings will shorten hose life due, but not limited, to oxidation, chemical degradation and loss of compression within the coupling.

Pressure Effects

Pressure surges and system shocks (spikes) are common in hydraulic systems. The normal 4:1 safety factor should reflect these transient pressures. Where these surges and shocks are considered severe or hazardous, the safety factor should be increased.

When hose is under pressure, it may change in length by as much as ±3%. Installation should compensate for shortening by providing an appropriate amount of slack and for lengthening by allowing space for this growth to be absorbed.

Routing and Clamping

Whenever possible, and maximum efforts should be made to do so, hose should be routed to flex in a single plane. Routing hoses in flexure through compound bends results in torsions. When this is unavoidable, the torsion should be distributed over the maximum hose length possible. Wire reinforced hoses suffer the most rapid and severe loss of service life when applied in torsion. Extremely tight and improperly located clamps focus this torsion over short distances.

Analysis of the hose function is required before the proper clamping techniques can be selected. In some applications, hoses must be contained to stay out of harm's way and at the same time be free to come and go with equipment articulation. Other applications may require restrictive clamping, in which case a protective material should be used around the hose to provide the grasp without deformation of the hose by the clamp. These techniques also apply to the use of the popular method of clamping and clustering hoses with plastic tie straps.

Parker swivel adaptors feature 360° swiveling action that especially suits them for use in applications where hose moves, bends or twists. Swivel adapters connected to hose assemblies relieve twisting, prevent excessive flexing of hose, eliminate need for long radius bends, and cushion intraline shock caused by peak system pressure pulses.

High Pressure Adapters

It is critical that the adapter material be properly suited to the fluid media. Widely varying conditions frequently necessitate high pressure adapters constructed of materials other than conventional 316 stainless steel. Since many variables affect the corrosion resistance of metallic materials, it is Parker Hannifin's policy not to recommend materials based on corrosion resistance for specific fluid applications. The published recommended working pressure represent the capability of the subject fitting. Nevertheless, in some instances, the hose, hose fitting or other connector assembled to the adapter may dictate the maximum working pressure. The end-user should read and understand the Parker Safety Guide (Bulletin 4400-B.1) and follow its suggested practices and warnings.

$$\text{Permeability Coefficient} = \frac{V}{A \times T \times p}$$

Where: V is the volume of gas, in cm^3, which diffuses through a 1mm thickness.
A is the area across which the gas diffuses, in m^2.
T is the diffusion time, in days.
p is the pressure difference across the plastic, in bar.

Permeability Coefficients per DIN 53380

Material	Gas				
	N_2	O_2	CO_2	H_2	He
PTFE	50	150	1500	—	3500
PVDF	3	2	10	—	60
PA-6 XE 3289	1	4	10	100*	60*
PA-6 A 28 NZ	0.5	2	5	50*	30*
PA-12 L 2124	—	30	180	210	160
PA-12 P40 TL	—	—	105	—	—
PA-12 L 25W40	8	35	150	1000*	500*
PA-12 L 2140	—	12	71	—	130
PA-11 P 40 TL	—	—	55	130	—
PA-11 POTL	2	20	65	65	—
POM H 2320	5	10	130	35	40
POM 150 SA	2	4	20	—	—
PEE 4055	150	—	3000	—	1400
PEE 5556	120	—	1600	—	900
PEE 7246	—	—	—	—	300

* Calculated value. Diffusion constants based on normal room temperature. Actual behavior mat vary considerably because of variations in processing the plastic.

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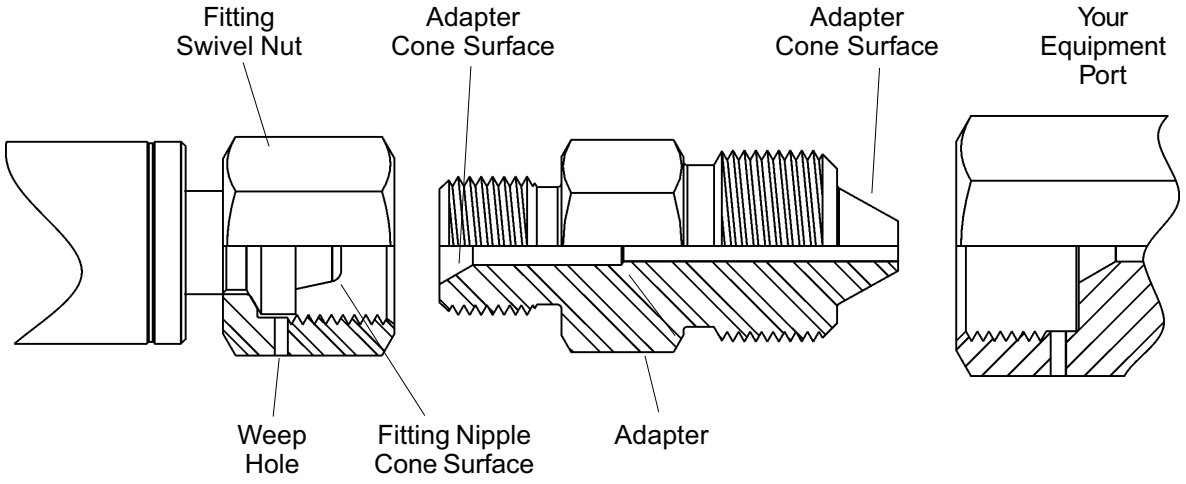
Connection	Thread Sizes	Tightening Torque (ft. Lb)
High Pressure		
1/4"	9/16" - 18thd	25
3/8"	3/4" - 16thd	50
9/16"	1-1/8" - 12thd	75
Medium Pressure		
1/4"	7/16" - 20thd	20
3/8"	9/16" - 18thd	30
9/16"	13/16" - 16thd	85
3/4"	3/4" NPSM	90
1"	1-3/8" - 12thd	125
Type "M" Swivel		
A9	9/16" - 18thd	25-30
A12	3/4" - 16thd	40-50
A14	7/8" - 14thd	50-60
A16	1" - 12thd	75-85
A21	1-5/16 - 12thd	100-120



Leakage at Swivel Nut-to-Adapter Joint
(Seen by leak at weep hole in swivel nut)

1. Reduce system pressure to zero
2. Unscrew swivel nut and check cone surfaces of adapter and hose insert.
3. If hose insert is damaged, return hose to ***polyflex*** for repair and retest.
4. If cone surfaces look good after cleaning, re-tighten swivel nut. Do not exceed 150% of recommended torque.

Leakage at Type "M" Adapter-to-Port
(Seen by leak at weep hole in pressure port,or leak at threads for NPT adapters.)

1. Reduce system pressure to zero.
2. Slacken Hose Swivel Nut.
3. Tighten Adaptor into Port.
4. Re-tighten Swivel Nut.

Never use the swivel nut to tighten the adapter into the port.

Metric Conversion Chart

	English to Metric			Metric to English		
	To Convert From	**To**	**Multiply**	**To Convert From**	**To**	**Multiply**
Area	sq. in. (in^2)	sq. mm (mm^2)	645.16	sq. mm (mm^2)	sq. in. (in^2)	0.00155
	sq. in. (in^2)	sq. cm (cm^2)	6.4516			
	sq. ft. (ft^2)	sq. meters (m^2)	0.0929			
Density	pounds/cubic foot (lb/ft^3)	Kilograms/cubic meter (kg/m^3)	16.02	Kilograms/cubic meter (kg/m^3)	pounds/cubic foot (lb/ft^3)	0.0624
Energy	British Thermal Units (Btu) (1 J = Ws = 0.2388 cal)	joules (J)	1055	joules (J)	British Thermal Units (Btu)	0.000947
Force	pounds - force (lbf) (1N = 0.102 kgf)	newtons (N)	4.448	newtons (N)	pounds - force (lbf)	0.2248
Length	inches (in)	millimeters (mm)	25.4	millimeters (mm)	inches (in)	0.03937
	feet (ft)	meters (m)	0.3048	meters (m)	feet (ft)	3.281
	miles (mi)	kilometers (km)	1.609	kilometers (km)	miles (mi)	0.621
Mass (Weight)	ounces (oz.)	grams (g)	28.35	grams (g)	ounces (oz.)	0.035
	pounds - mass (lb)	kilograms (kg)	0.4536	kilograms (kg)	pounds - mass (lb)	2.205
	short tons (2000 lb) (tn)	metric tons (1000 kg)	0.9072	metric tons (1000 kg)	short tons (2000 lb) (tn)	1.102
Power	horsepower (550 ft. lb/s) (hp)	kilowatts (kW)	0.7457	kilowatts (kW)	horsepower (550 ft. lb/s) (hp)	1.341
Pressure	pounds/square inch (psi)	kilograms (f)/square cm ($kg(f)/cm^2$)	0.0703	kilograms (f)/square cm ($kg(f)/cm^2$)	pounds/square inch (psi)	14.22
	pounds/square inch (psi)	kilopascals (kPa)	6.8948	kilopascals (kPa)	pounds/square inch (psi)	0.145
	pounds/square inch (psi)	bars (100 kPa)	0.06895	bars (100 kPa)	pounds/square inch (psi)	14.503
Stress	pounds/square inch (psi) ($1N/mm^2$ = 1MPa)	megapascals (MPa)	0.006895	megapascals (MPa)	pounds/square inch (psi)	145.039
Temperature	degrees Fahrenheit (°F)	degrees Celsius (°C)	5/9 (after subtracting 32)	degrees Celsius (°C)	degrees Fahrenheit (°F)	9/5 (then add 32)
Torque or Bending Moment	pounds-force-foot (lb-ft)	Newtons-meter (Nm)	1.3567	Newtons-meter (Nm)	pounds-force-foot (lb-ft)	0.737
	pounds-force-inch (lb-in)	Newtons-meter (Nm)	0.113	Newtons-meter (Nm)	pounds-force-inch (lb-in)	8.85
Velocity	feet/seconds (ft/s)	meters/second (m/S)	0.3048	meters/second (m/S)	feet/seconds (ft/s)	3.2808
Viscosity	dynamic (centipoise)	Pascal-second (Pas)	0.001	Pascal-second (Pas)	dynamic (centipoise)	1000
	kenematic-$foot^2$/sec (ft^2/s)	$meter^2$/sec (m^2/s)	0.0929	$meter^2$/sec (m^2/s)	kenematic-$foot^2$/sec (ft^2/s)	10.7643
Volume	cubic inch (in^3)	cubic centimeter (cm^3) (milliliter)	16.3871	cubic centimeter (cm^3) (milliliter)	cubic inch (in^3)	0.061
	quarts (qt)	liters (1000 cm^3)	0.9464	liters (1000 cm^3)	quarts (qt)	1.057
	gallons (gal)	liters	3.7854	liters	gallons (gal)	0.2642

F

Ratings Code:

G – Good to excellent. Little or no swelling, tensile or surface changes. Preferred choice.

L – Marginal or conditional. Noticeable effects but not necessarily indicating lack of serviceability. Further testing suggested for specific application. Very long-term effects such as stiffening or potential for crazing should be evaluated.

P – Poor or unsatisfactory. Not recommended without extensive and realistic testing.

— – Indicates that this was not tested.

– For Teflon. Indicates good chemical resistance but potential for excessive permeation.

Polyester Elastomer "H" Core Tube	Polyamide "N" Core Tube	Polyoxy-methylene "POM" Core Tube	Fluorinated-ethylene "F" Core Tube	Proprietary Fluoropolymer "M" Core Tube	Polyurethane "U" Hose Covers	Polyamide "N" Hose Covers
2040H	2020N	2240D	2380F	2380M	2040N	2020N
2370H	2040N	2243D		2440M	2244N	2240D
	2244N	2245D		2640M	2245N	2243D
	2245N	2440D			2380F	2245D
	2380N	2640D			2380N	2245N-8
	2390N	2740D			2390N	2245N-12
	2440N	2840D			2440N-32V10	2245N-16
	2640N				2640N-24V80	2380N-04V33
	2X90N				2640N-32V80	2440D
					2X90N	2440N
						2640D
						2640N
						2740D
						2840D

Notes on the Chemical Resistance Table

(1) The fluid resistance tables are simplified rating tabulations based on immersion tests at 24° C. Higher temperatures tend to reduce ratings. **Since final selection depends on pressure, fluid and ambient temperature and other factors not known to Parker Hannifin , no performance guarantee is expressed or implied.** The indications do not imply any compliance with standards and regulations and do not refer to possible changes of colour, taste or smell. For food and drinking water specially approved materials have to be used. For fluids not listed or for advice on particular applications, please consult Parker Hannifin, Polyflex in Stafford, TX.

(2) Hose applications for these fluids must take into account legal and insurance regulations. The chemical resistance indicated does not express or imply approval by certain institutions.

(3) Satisfactory at some concentrations and temperatures, unsatisfactory at others.

(4) For gas applications, the cover should be pin-pricked and the pressure must not be released quickly. Special safety guard accessories are to be used to prevent damage or personal injury in the event of failure..

(5) Chemical resistance does not imply low permeation rates. Please consult Parker Hannifin for a recommendation for your specific requirements.

(6) The indication of chemical resistance does not imply any special food compatibility; it refers only to the chemical resistance of the material.

(7) Chemical resistance does not imply acceptability for use in airless paintspray applications. These applications require a special, electrically conductive hose.

Chemical	H	N	U	POM	FEP
Acetaldehyde	G	L	L	—	G
Acetic Acid Glacial	L	L	L	—	L
Acetone	L	G	P	L	G
Acetylene	2	2	2	—	2
Air (4)	G	G	G	G	G
Ammonium Chloride	G	P	G	—	L
Ammonium Hydroxide	L	G	P	—	G
Anhydrous Ammonia	P	P	P	—	8
Aniline	P	P	P	—	G
Animal Oils (6)	G	G	G	—	—
Aromatic Hydrocarbons	L	G	L	—	—
Asphalt	G	G	G	—	L
Baygon (insecticide)	L	G	P	—	—
Beer	G	G	G	—	G
Benzene	L	G	L	—	G
Brake Fluid (DOT #3)	—	G	P	L	—
Butane (2) (4)	G	G	L	—	#
Butter (6)	G	G	G	—	—
Calcium Chloride	G	3	G	—	G
Carbon Dioxide (4)	G	G	G	—	#
Carbon Monoxide (4)	G	3	G	—	#
Carbon Tetrachloride	L	G	P	—	G
Castor Oil	G	L	L	—	—
Chlordane (Insecticide)	L	G	P	—	—
Chlorinated Hydrocarbon Base Fluids	L	G	L	—	—
Chlorinated Petroleum Oil	G	G	L	—	—
Chlorinated Solvents	P	3	P	—	#
Chlorine, Gaseous, Dry	P	P	P	—	—
Chloroform	P	P	P	—	G
Chromic Acid	P	3	P	—	L
Citric Acid Solutions	G	G	L	—	G
Crude Petroleum Oil	G	G	G	G	—
Cyclohexane (2)	G	G	G	—	G
Cygon (Insecticide)	L	G	P	—	—
Diazion (insecticide)	L	G	P	—	
Diesel Fuel (2)	G	G	G	G	—
Diester Oils	L	G	P	—	—
Enamels	G	G	G	—	—
Ethanol (6)	G	G	L	G	—
Ethers	L	G	P	P	G
Ethylene Glycol	G	G	L	G	G
Ethylene Oxide	G	G	L	—	#
Fatty Acids	G	G	3	—	G
Formaldehyde	L	L	P	—	G
Formic Acid J	P	P	P	—	G

F

Chemical	H	N	U	POM	FEP
Freon 12 (5)	P	G	L	—	#
Freon 22 (5)	P	G	L	—	#
Fruit Juices	G	G	G	—	—
Fuel Oil (2)	G	G	L	G	G
Gas (Oil) (2)	G	G	G	—	—
Gas (Natural) (4)	—	—	—	—	2
Gasoline (2)	G	G	3	—	G
Glue	3	3	3	—	3
Glycerin	G	G	L	—	G
Glycols (to 135°F)	G	G	L	G	G
Grease (petroleum base)	G	G	G	G	—
Heptachlor (insecticide)	L	G	P	—	—
Hexane (2)	G	G	G	—	G
Houghto Safe-600 Series	—				
(hydraulic fluid)	G	G	L	—	—
Houghto Safe-1000 Series	—				
(phosphate esters)	L	G	P	—	—
Hydraulic Fluid (petroleum base)	G	G	G	G	L
Hydraulic Fluid (phosphate ester base)	L	G	L	—	—
Hydraulic Fluid (water glycol base)	G	G	G	—	—
Hydraulic Oil (petroleum base)	G	G	G	G	L
Hydrochloric Acid	P	L	P	—	G
Hydrofluoric Acid	P	P	P	—	G
Hydrogen, Gaseous (2) (4) (5)	G	G	G	—	#
Hydrolube	—				
(hydraulic fluid/water glycol base)	G	G	L	—	—
IRUS 902	—				
(hydraulic fluid/water-oil emulsion)	G	G	G	—	—
Isocyanates (2)	L	L	L	—	—
IsoOctane (2)	G	G	G	—	G
Isopropyl Alcohol	G	G	L	—	G
Kerosene (2)	G	G	L	—	G
Ketones	L	G	P	—	G
Lacquer Solvents	L	G	P	—	L
Lactic Acid	P	G	P	—	G
Lime (calcium oxide)	G	G	G	—	G
Lindol	—				
(hydraulic fluid\phosphate esters)	L	G	P	—	—
Linseed Oil	G	G	G	G	G
LP - Gas	2	2	2	—	2
Lubricating Oils (diester base)	L	G	P	—	—
Lubricating Oils (petroleum base)	G	G	G	G	G
Magnesium Hydroxide	L	G	L	—	G
Magnesium Salts	—	G	G	—	—
Malathion (insecticide)	L	G	P	—	

Chemical	H	N	U	POM	FEP
Mercury	G	G	G	—	G
Meropa Oil (sulphur base)	G	G	—	—	—
Methane	2	2	2	—	2
Methanol	G	G	P	—	—
Methoxychlor (insecticide)	L	G	P	—	—
Methyl Alcohol (6)	G	G	P	G	G
Methylene Chloride	—	—	—	—	G
Methyl Ethyl Ketone (MEK)	L	G	P	L	G
Methyl Ethyl Ketone Peroxide (MEKP)	—	L	P	—	—
Methyl Isobutyl Ketone (MIBK)	L	G	P	—	G
Methylene Chloride	P	L	P	P	
Milk (6)	G	G	G	—	G
Mineral Oil	G	G	G	G	G
Mineral Spirits	P	—	L	—	—
Motor Oils	G	G	G	—	G
Naphtha	L	G	P	G	G
Natural Gas (4)	2	2	2	—	2
Nitric Acid	P	P	P	—	L
Nitrobenzene	P	G	P	—	G
Nitrogen, Gaseous (4) (5)	G	G	G	—	G
Nitrous Oxide	—	L	—	—	#
Oil (SAE)	G	G	G	G	—
Oil of Turpentine	G	G	P	—	—
Oleic Acid	G	G	G	—	G
OS 45 Type 3 Hydraulic Fluid (silicate esters)	L	G	L	—	—
Oxygen, Gaseous (4) (5) (6)	G	G	G	—	G
Ozone	L	P	L	—	G
Paint (Oil Base) (7)	G	G	G	—	—
Paint Solvents (oil base)	L	G	L	—	—
Pentane (2)	G	G	L	—	G
Perchloric Acid	P	P	P	—	L
Perchloroethylene	P	P	P	L	—
Petroleum Ether	—	2	2	—	2
Petroleum Oils	G	G	G	—	—
Phenols	P	P	P	—	—
Phosphate Esters (above 135°F)	P	G	P	—	—
Phosphate Esters (to 135°F)	G	G	P	—	—
Polyol Esters	L	G	P	—	—
Potassium Hydroxide, 50%	P	P	P	—	G
Propane (4) (5)	2	2	2	—	2
Propylene Glycol	—	—	G	—	G
Pydraul 312C, 625 (to 135°F)	P	G	P	—	—
Pydraul F-9, 150, 160 (to 135°F)	G	G	P	—	—
Quintolubric 822 Fluid	—	G	G	—	—

Chemical	H	N	U	POM	FEP
Salt Water	3	3	3	—	G
Sevin (insecticides in water)	G	G	G	—	—
Silicone Greases	G	G	G	—	—
Silicone Oils	G	G	G	—	—
Skydrol 500 & 7000	L	G	P	—	G
Soap Solutions	G	G	G	—	G
Soda Water	G	G	G	—	—
Sodium Borate	G	G	G	—	G
Sodium Carbonate	3	3	3	—	3
Sodium Chloride Solutions	G	G	G	—	G
Sodium Hydroxide, 50%	L	P	P	—	G
Sodium Hypochlorite	L	P	P	—	G
Steam	P	P	P	—	G
Stoddard Solvent	P	G	P	—	G
Straight Synthetic Oils					
(phosphate esters)	L	G	P	—	—
Sulfur	G	G	G	—	G
Sulfur Dioxide	P	L	L	—	G
Sulfur Hexafluoride Gas (4) (5)	G	G	G	—	—
Sulphuric Acid	P	P	P	—	—
Toluol, Toluene	L	G	L	G	G
Toluol	L	G	L	—	—
Transmission Fluid	G	G	G	L	—
Trichloroethylene	P	L	P	—	G
Trisodium Phosphate Solutions	L	G	P	—	G
Turpentine	G	G	L	—	G
Ucon					
(hydraulic fluid-water glycol base)	G	G	L	—	—
Varnish	G	G	G	G	—
Vinegar (6)	L	G	L	—	G
Water (to 135°F) (6)	G	G	G	G	G
Water (above 135°F) (6)	P	G	P	—	L
Water Glycols (to 135°F)	G	G	L	—	—
Water Glycols (above 135°F)	P	G	P	—	—
Water in oil Emulsions (to 135°F)	G	G	L	G	—
Water in oil Emulsions (above 135°F)	P	G	P	—	—
Whiskey, Wines (6)	G	G	L	—	G
Wood Oils	G	G	L	G	—
Xylene	L	G	P	G	G
Zinc Chloride	G	G	G	—	G

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

Parker Publication No. 4400-B.1
Revised: November, 2007

WARNING: Failure or improper selection or improper use of hose, tubing, fittings, assemblies 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.
- Electrocution 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.
- 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. Only Hose from Parker's Stratoflex Products Division is approved for in-flight aerospace applications.

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. All assemblies made with Hose are called "Hose Assemblies". All products commonly called "fittings", "couplings" or "adapters" are called "Fittings". All related accessories (including crimping and swaging machines and tooling) are called "Related Accessories". 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. SAE J1273 (www.sae.org) and ISO 17165-2 (www.ansi.org) also provide recommended practices for hydraulic Hose Assemblies.

1.2 Fail-Safe: Hose, Hose 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 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 and Fitting products. Do not select or use Parker Hose 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 and Fittings, Parker does not represent or warrant that any particular Hose 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.
- 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, for telephone numbers of the appropriate technical service department.

2.0 HOSE 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 and Fittings for these or any other applications in which electrical conductivity or nonconductivity is a factor.

The electrical conductivity or nonconductivity of Hose and Fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials 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 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, 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 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.
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 4.2-1999; CSA 12.52-M99, "Hoses for Natural Gas Vehicles and Dispensing Systems" (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 at a maximum temperature of 180°F (82°C). Parker CNG Hose should not be used in confined spaces or unventilated areas or areas exceeding 180°F (82°C). Final assemblies must be tested for leaks. CNG Hose Assemblies should be tested on a monthly basis for conductivity per ANSI/IAS NGV 4.2-1999; CSA 12.52-M99.
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 selection must be made so that the published maximum working pressure of the Hose and Fittings are equal to or greater than the maximum system pressure. The maximum working pressure of a Hose Assembly is the lower of the respective published maximum working pressures of the Hose and the Fittings used. Surge pressures or peak transient pressures in the system must be below the published maximum working pressure for the Hose. 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. Temperatures below and above the recommended limit can degrade Hose to a point where a failure may occur and release fluid. 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 Assembly selection must assure compatibility of the Hose tube, cover, reinforcement, and Fittings 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 that is chemically compatible with a particular fluid must be assembled using Fittings and adapters containing likewise compatible seals.

2.6 Permeation: Permeation (that is, seepage through the Hose) will occur from inside the Hose to outside when Hose is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, 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 if this permeation could be hazardous. The system designer must take into account all legal, government, insurance, or any other special regulations which govern the use of fuels and refrigerants. Never use a Hose even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the Hose Assembly.
Permeation of moisture from outside the Hose to inside the Hose will also occur in Hose 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.

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 if possible, should be installed in a manner that allows for ease of inspection and future replacement. Rubber Hose because of its relative short life, should not be used in residential and commercial buildings for HVAC (heating, ventilating and air conditioning) applications.

2.9 Environment: Care must be taken to insure that the Hose and Fittings are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.

2.10 Mechanical Loads: External forces can significantly reduce Hose life or cause failure. Mechanical loads which must be considered include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type Fittings or adapters may be required to insure no twist is put into the Hose. Unusual applications may require special testing prior to Hose selection.

2.11 Physical Damage: Care must be taken to protect Hose from wear, snagging, kinking, bending smaller that 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.

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 establishing a proper Hose length, motion absorption, Hose length changes due to pressure, and Hose and machine tolerances and movement must be considered.

2.14 Specifications and Standards: When selecting Hose and Fittings, government, industry, and Parker specifications and recommendations must be reviewed and followed as applicable.

2.15 Hose Cleanliness: Hose components may vary in cleanliness levels. Care must be taken to insure that the Hose 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 require use of the same type of Hose as used with petroleum base fluids. Some such fluids require a special Hose, while a few fluids will not work with any Hose at all. See instructions 2.5 and 1.5. The wrong Hose may fail after a very short service. In addition, all liquids but pure water may burn fiercely under certain conditions, and even pure water leakage may be hazardous.

2.17 Radiant Heat: Hose can be heated to destruction without contact by such nearby items as hot manifolds or molten metal. The same heat source may then initiate a fire. This can occur despite the presence of cool air around the Hose.

2.18 Welding or Brazing: When using a torch or arc welder in close proximity to hydraulic lines, the hydraulic lines should be removed or shielded with appropriate fire resistant materials. Flame or weld spatter could burn through the Hose and possibly ignite escaping fluid resulting in a catastrophic failure. Heating of plated parts, including Hose Fittings and adapters, above 450°F (232°C) such as during welding, brazing or soldering may emit deadly gases.

2.19 Atomic Radiation: Atomic radiation affects all materials used in Hose assemblies. Since the long-term effects may be unknown, do not expose Hose assemblies to atomic radiation.

2.20 Aerospace Applications: The only Hose 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 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.

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 515:1989 (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".