AFLEX HOSE

HYPERLINE FX

PTFE Lined Smoothbore Flexible Hose

TEMPERATURE RESISTANT

CHEMICAL RESISTANT

VERY FLEXIBLE

SMOOTHBORE

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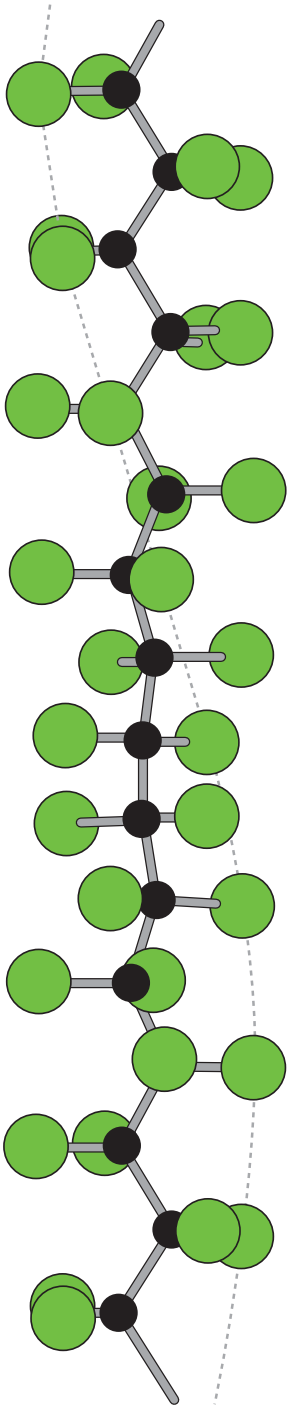
PTFE - THE OPTIMUM CHOICE FOR HOSE LININGS

Section from a PTFE Molecule, 16 Angstrom Units long



= **Fluorine Atom**

= **Carbon Atom**

PTFE, or Polytetrafluoroethylene, comprises of long-chain molecules of carbon atoms, each linked to two fluorine atoms.

The fluorine atoms provide a helical spiral which surrounds the carbon chain and protects it.

It is this structure which creates the unique properties for which PTFE is well-known.

- **Excellent Chemical Resistance**

  PTFE is renowned as the most chemically resistant material known. Only a very few, very unusual substances and conditions can affect it, like Fluorine gas at high temperature and pressure and liquid, boiling sodium metal.

  PTFE lined hoses can therefore be used for a wider variety of chemicals than any other hose type, making it the ideal choice for very corrosive chemical applications and multi-product applications.

- **Non-Stick Surface**

  The use of PTFE as a surface for cookware products has demonstrated to the world how easily cleanable PTFE surfaces are.

  This means that PTFE lined hoses can be purged 100% clean more quickly, easily and reliably than any other type of hose.

- **Excellent Temperature Range**

  The cookware application also demonstrates another of PTFE's many attributes - temperature resistance. PTFE itself can be used as a hose liner at temperatures from -150˚C up to +260˚C, dependent upon the hose design and the application conditions.

  This is the widest temperature range of any rubber or plastic hose lining material.

- **Hose Design**

  The only issue with PTFE as a hose lining material is the best way it can be integrated in to the hose design. This is where Aflex Hose have a proven record of success over the last 40 years.

HYPERLINE FX HOSE DESCRIPTION

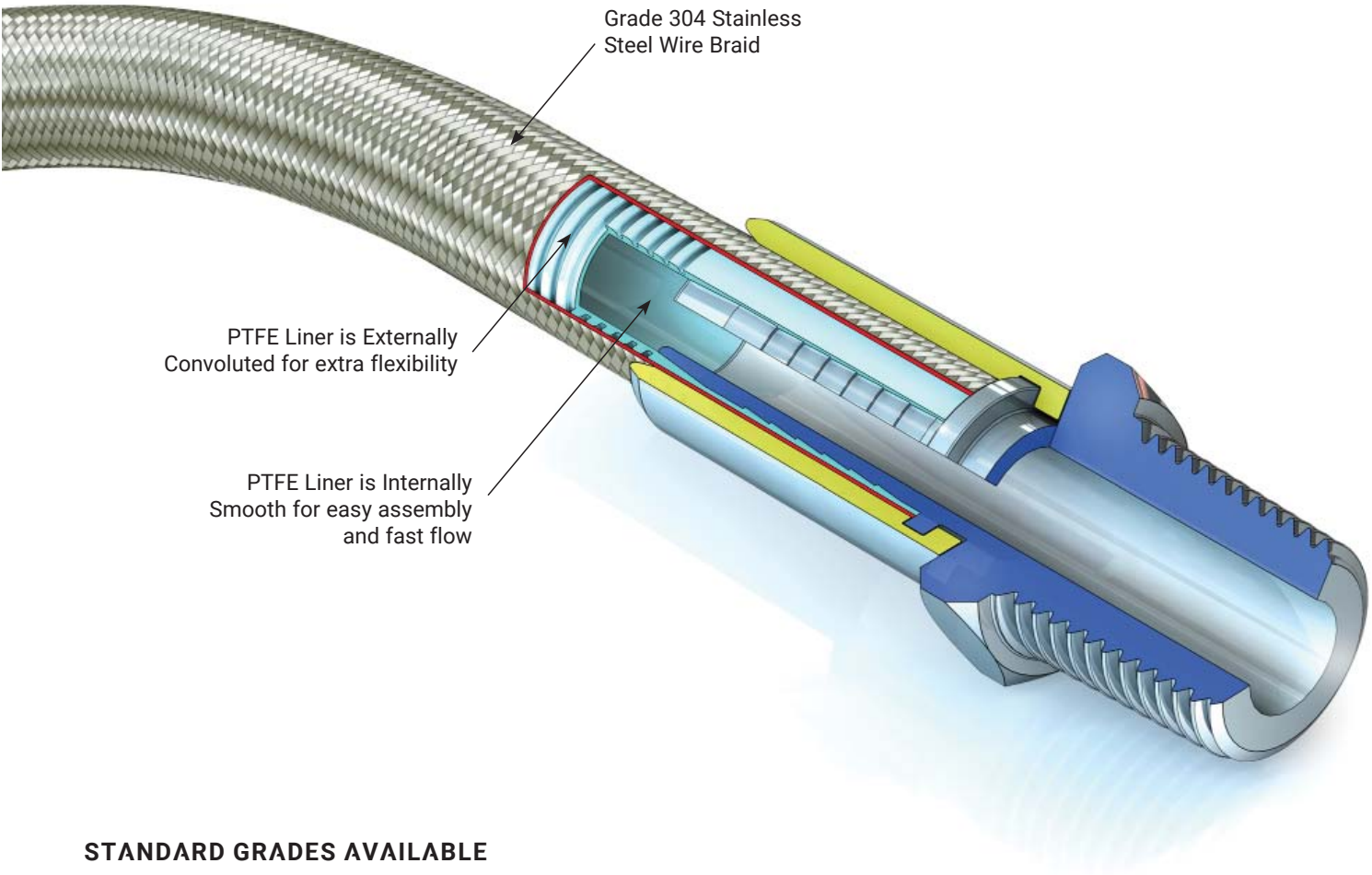
There is a fundamental problem with larger sizes of standard, smooth bore PTFE hose products - as the hose size increases above 1/4", so smooth bore PTFE lined hose become significantly less flexible, and more easily kinked.

One solution is to use a conventional convoluted PTFE lined hose, but the internal convolutions make the hose difficult to assemble, and reduces fluid flow rates due to turbulent flow.

Hyperline FX is a new and revolutionary solution to all these problems, providing a unique and patented hose liner design which is flexible in the larger bore sizes, yet which retains a smooth bore.

The advantage of a smooth bore as compared with a convoluted bore is that it is easy clean, and does not create "turbulent flow", which drastically reduces fluid flow rates.

HYPERLINE FX, SS HOSE ASSEMBLY WITH A HYDRAULIC FIXED MALE END FITTING CRIMPED ON TO THE HOSE



STANDARD GRADES AVAILABLE

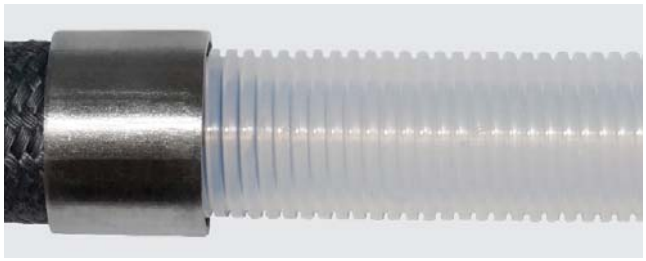
Hyperline FX, TO - Natural PTFE Tube Only, No Braid.
Hyperline FX, AS, TO - Antistatic Black PTFE Tube Only, No Braid.

Hyperline FX, SS - Natural PTFE Tube external AISI 304 Stainless Steel Wire Braid.
Hyperline FX, AS, SS - Antistatic Black PTFE Tube, external AISI 304 Stainless Steel Wire Braid.

Hyperline FX, AM - Natural PTFE Tube, Black Aramid Fibre Braid.
Hyperline FX, AS, AM - Antistatic Black PTFE Tube, Black Aramid Fibre Braid.

HYPERLINE FX HOSE GRADES

Natural PTFE Tube Lining



Hyperline FX Natural PTFE Tube is for use in all applications where fluids or gases are being conveyed which do not generate a risk of static charge development (see “AS”).

Tube Only (no braid)

TO grade hose (available in both GP and AS) is a lightweight hose, used in applications where working pressures are low and where there is no need for the physical protection offered by an external braid.

Stainless Steel Wire Braid (SS Grades)

The braid supports the PTFE liner tube against internal pressure and protects against mechanical abuse. Often used in applications involving high temperatures and working pressures. High tensile 304 stainless steel wire is used to give maximum pressure resistance and external protection to the hose.

Aramid Fibre Braid (AM Grades)

The aramid fibre is “Tecnora”, a higher specification fibre than Kevlar, with excellent temperature, tensile and abrasion resistant properties.

For applications requiring minimum weight for maximum pressure reinforcement.

Antistatic PTFE Linings (AS Grade)

When electrically resistive fluids like solvents and fuels, or multiphase mixtures are passed through natural PTFE hose at high flow rates, a static charge build up occurs on the inner wall of the PTFE liner. This can discharge to the nearest conductor (e.g. SS braid) that creates a pin-hole in the PTFE liner resulting in a leak-path.

Antistatic PTFE includes a small quantity of a special high purity carbon black, which ensures safe static charge dissipation in accordance with International Standards.

Antistatic Hose Assemblies

When “AS” (Antistatic) grade hose is specified the hose or hose assembly supplied will be tested in accordance with EN ISO 8031 to meet the Antistatic requirements of EN 16643. This requires, for an antistatic liner or antistatic cover, that the resistance between an appropriately placed foam electrode and a metallic end fitting will be between 10^3 to 10^8 ohms per assembly. For hose assemblies which meet these requirements an appropriate Grade “Ω” marking is applied in accordance with EN 16643 if requested.

Note: When in service, at least one end fitting must be connected to earth, to permit dissipation of the static charge from the end fitting.

EC - ELECTRICAL CONTINUITY
(Also known as ‘Electrically Bonded’ & 'M' grade)

All Hyperline FX hose assemblies are electrically continuous, except AM (Aramid Fibre) and TO (Tube Only) grade hose assemblies. Electrical Continuity requires that the hose assembly supplied is electrically continuous, or conductive, between metal end fittings at each end of the hose (whether GP or AS grade).

The requirements for this are specified in the German Document BRG 132 and EN 16643, when tested in accordance with EN ISO 8031, which requires that the resistance between end fittings shall be <100 Ohms per assembly. For hose assemblies that meet this requirement a Grade “M” marking is applied in accordance with EN 16643.

HYPERLINE FX HOSE: SPECIFICATIONS AND PROPERTIES

SPECIFICATIONS FOR HYPERLINE FX HOSE GRADES

Specifications listed below are for non-AS Grades. For AS Grades the specifications are all the same, except that "AS" is added to the Grade Reference, and the Part Number reads "-110-" in place of "-100-".

Nominal Hose Size	*Actual Hose Bore Size		Hose Grade	Outside Diameter of Tube or Braid		Minimum Bend Radius		Maximum Working Pressure (MWP)		Weight per Unit Length		Hose Part Number
in	mm	in		mm	in	mm	in	Bar	Psi	Kg/mtr	Lbs/Ft	
1/4	6.8	0.270	TO SS AM	9.0 9.6 9.6	0.354 0.378 0.378	38 19 38	1 1/2 3/4 1 1/2	4 88 62	60 1280 900	.041 .092 .056	.027 .062 .038	92-100-04 92-100-04-01-02 92-100-04-01-55-01
5/16	7.9	0.312	TO SS AM	10.0 10.6 11.3	0.394 0.420 0.445	38 19 38	1 1/2 3/4 1 1/2	4 84 59	60 1220 850	.056 .126 .075	.037 .084 .050	92-100-05 92-100-05-01-02 92-100-05-01-55-01
3/8	10.0	0.394	TO SS AM	12.5 13.5 13.5	0.492 0.534 0.534	50 25 50	2 1 2	4 80 56	60 1160 810	.070 .160 .100	.047 .107 .067	92-100-06 92-100-06-01-02 92-100-06-01-55-01
1/2	13.6	0.536	TO SS AM	16.2 17.5 17.5	0.640 0.690 0.690	76 38 76	3 1 1/2 3	4 60 42	58 870 600	.110 .225 .140	.074 .151 .094	92-100-08 92-100-08-01-02 92-100-08-01-55-01
5/8	16.7	0.658	TO SS AM	20.0 21.1 21.1	0.787 0.831 0.831	100 50 100	4 2 4	3 50 35	44 730 510	.161 .336 .204	.108 .226 .137	92-100-10 92-100-10-01-02 92-100-10-01-55-01
3/4	19.8	0.780	TO SS AM	23.2 24.2 24.2	0.913 0.953 0.953	126 63 126	5 2 1/2 5	3 42 29	44 610 430	.179 .383 .236	.120 .257 .158	92-100-12 92-100-12-01-02 92-100-12-01-55-01
1	26.0	1.023	TO SS AM	30.3 31.7 31.7	1.193 1.250 1.250	150 75 150	6 3 6	2 40 28	29 580 400	.268 .540 .354	.180 .362 .237	92-100-16 92-100-16-01-02 92-100-16-01-55-01

***Hydraulic Bore Size** - *The actual bore sizes of Hyperline FX hose are slightly larger than the nominal size, to allow the insertion and assembly of standard Hydraulic Fittings, using ferrules supplied by Aflex Hose (see page 9).*

PROPERTIES

Temperatures and Pressures

Hyperline FX, SS Grades - The MWP listed above should be reduced by 1% for each 1˚C above 160˚C (1% for each 1.8˚F above 320˚F) up to a maximum of 260˚C (500˚F).

Hyperline FX, AM Grades - The MWP listed above should be reduced by 1% for each 1˚C above 130˚C (1% for each 1.8˚F above 266˚F) up to a maximum of 180˚C (356˚F).

Maximum Working Pressures (MWP) listed are calculated on the basis of a 3:1 safety factor relative to the burst pressure, so Burst Pressure = 3 x MWP. If MWP is required based on a 4:1 safety factor (e.g. EN 16643 requirement), multiply the listed value by 0.75.

Vacuum Resistance

Hyperline FX, SS Grades are vacuum resistant to -0.9bar up to 150˚C (300˚F).

Excellent Flow Rates

Compared with conventional convoluted hose designs, Hyperline FX has excellent flow rates due to the smooth bore, which prevents the turbulent fluid flow which occurs in convoluted hose products.

Reduced Diffusion Rates

Hyperline FX is much more resistant to diffusion of liquids or gases than other PTFE hose products, due to its highly compressed, non-porous PTFE matrix. Hyperline FX has been successfully tested to SAE J1737 for resistance to automotive fuel diffusion.

Non-Stick Internal Surface

Hyperline FX hose has a smooth bore, non-stick liner which is effectively "self-cleaning", and which resists material build-up inside the hose which may cause bore constriction.

LOOSE HOSE LENGTHS

Loose hose is supplied in random lengths up to a maximum of 18 metres (60 feet) long.

ASSEMBLED HOSE LENGTHS

Hyperline FX hose assemblies are made up to the specific lengths required. The hose length is taken as the length from the sealing face at one end of the hose to the same at the other end. The length tolerance is normally +2% / -0%. Closer tolerances are available to special order.

HYPERLINE FX
EN 16643 HOSE ASSEMBLY ELECTRICAL PROPERTY GRADES

The hose assembly electrical property grades and electrical resistance limits are defined within EN 16643 and tested in accordance with BS EN ISO 8031. Aflex Hose electrically conductive (**EC**) assemblies are defined in EN 16643 as *electrically bonded* and given the symbol **M**. M-grade assemblies exhibit a maximum electrical resistance of 100Ω between end fittings. Aflex Hose anti-static (**AS**) PTFE liners and rubber covers are termed *static dissipative* within EN 16643 and given the symbol **Ω** followed by letters that specify either the liner, cover or both; **L**=liner, **C**=cover, **CL**= cover & liner. Ω-grade covers or liners exhibit an electrical resistance of 10^3-10^8 **Ω**.

The table below identifies each EN 16643 electrical grade for a hose assembly along with a brief description and example assembly configuration.

EN16643 Electrical Grade For Hose Assembly	EN16643 Description	Example Hose Assembly
Grade M	Electrically bonded without static-dissipative lining or cover	HFX GP SS Sarlink Ends Fixed male
M/Ω-L	Electrically bonded and static-dissipative lining	HFX AS SS Sarlink Ends Fixed male
M/Ω-C	Electrically bonded and static-dissipative cover	HFX GP SS EPDM (AS) Ends Fixed male
M/Ω-CL	Electrically bonded and static-dissipative cover and lining	HFX AS SS EPDM (AS) Ends Fixed male
I	Electrically insulated (no electrical bonding AND no static-dissipative layers)	HFX GP AM Ends Fixed male
Ω-L	Static dissipative lining without electrical bonding	HFX AS AM Ends Fixed male
Ω-C	Static dissipative cover without electrical bonding	HFX GP AM EPDM(AS) Ends Fixed male
Ω-CL	Static dissipative cover and lining without electrical bonding	HFX AS AM EPDM(AS) Ends Fixed male

HYPERLINE FX HOSE COVER OPTIONS AND APPLICATIONS

ALTERNATIVE DESIGN OPTIONS - HOSE COVERS

For certain applications, it is an advantage to have a flexible plastic or rubber outer cover extruded on to the hose. The cover provides protection for the braid, as well as being easy to clean, and can be printed with a continuous text line.

Covered hose is, however, only available to special order, so price and availability are very dependent upon quantities required.

Options are:

Flexible PVC :
from -10˚C (+14˚F) to +60˚C (+140˚F) max. In transparent or a wide variety of solid or translucent colours.

Nylon 11 :
from -40˚C (-40˚F) to +120˚C (+248˚F) max. In natural, semi-transparent or black.

Sarlink, Hytrel, Polyurethane :
from -40˚C (-40˚F) to +125˚C (+257˚F) max. Others may also be available.

EPDM Rubber :
from -40˚C (-40˚F) to +140˚C (284˚F) max. In Blue or (antistatic) Black.

Silicone Rubber :
from -73˚C (-100˚F) to +204˚C (400˚F) max. Peroxide cured, in natural (semi-transparent) or white.

Other rubbers may also be available.

APPLICATIONS FOR HYPERLINE HOSE

Automotive and Motorsport :
Replacing conventional PTFE hoses in ESP systems, fuel systems, braking systems and oil lines.

Refrigeration :
Refrigerant feed lines to freezer plates, where the high resistance to permeation, together with the flexibility and chemical resistance, are primary advantages.

Steam and Gas Lines :
Where the smooth bore ensures non-turbulent gas flow, leading to noise free operation at higher flow rates, and longer service life.

Industrial applications :
In general where the ease of assembly to end fittings together with the higher flow rates, chemical and temperature resistance and resistance to permeation make Hyperline FX the optimum choice.

HYPERLINE FX HOSE ASSEMBLY SUPPLY OPTIONS

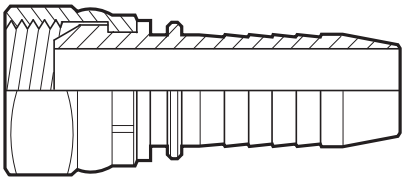
SUPPLY OPTIONS

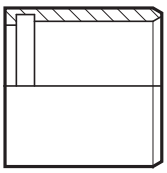
Hyperline FX hose can either be supplied as made up and crimped hose assemblies, or as loose hose for customers to assemble themselves, using ferrules supplied by Aflex Hose, and standard hydraulic end fittings, which can also be supplied by Aflex Hose if required.

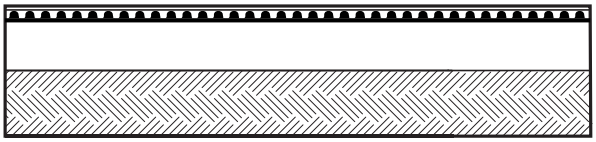
EASIER ASSEMBLY

Hyperline FX is very flexible, and is designed to replace conventional flexible tape wrapped convoluted or autoconvoluted PTFE hoses in application where **faster, cleaner fluid flow or ease of assembly** is paramount. SS or MS ferrules and crimp diameters can be supplied to suit any conventional hydraulic hose tail end fittings.

Problems associated with assembling fittings to convoluted hoses, such as leakages, the need for special or sleeved spigots, the need to de-convolute etc. disappear - Hyperline FX is literally as easy to assemble as any smooth bore hose.







ASSEMBLY INSTRUCTIONS

1. Cut the hose to the desired length using a cut off machine with a high tensile steel blade, allowing for the length of the end fittings.
2. Push the ferrule onto the hose (chamfered end first) and insert the fitting and push into the hose until it meets the collar on the fitting. Align the ferrule over the collar.
3. Place the assembly into the swaging machine and swage down the ferrule to the recommended swage dimension as given in Aflex Document AS-42. Check using a vernier or micrometer.

To find AS-42 and the current swage diameters, consult the Aflex Hose I-Bay system. To obtain the I-Bay address, please contact Aflex Hose.

FERRULES TO SUIT

Hose Size	Ferrule Part Number*
1/4	01-170-04-04-(*03 or 04)
3/8	01-170-06-06-(*03 or 04)
1/2	01-170-08-08-(*03 or 04)
5/8	01-170-10-10-(*03 or 04)
3/4	01-170-12-12-(*03 or 04)
1	01-170-16-16-(*03 or 04)

**Note: Ferrule Part Numbers end in -03 for Stainless Steel (Grade 303 or 304), and -04 for Mild Steel (Zinc Plated).*

PRESSURE TESTING INSTRUCTIONS

All self-assembled hose assemblies must be pressure tested to 1.5 x MWP before end use.

HYPERLINE FX HOSE AUTO-CUT HOSE LENGTHS

Self assembly customers who manufacture large numbers of hose assemblies require perfectly cut hose ends, to facilitate easy, quick assembly of end fittings.

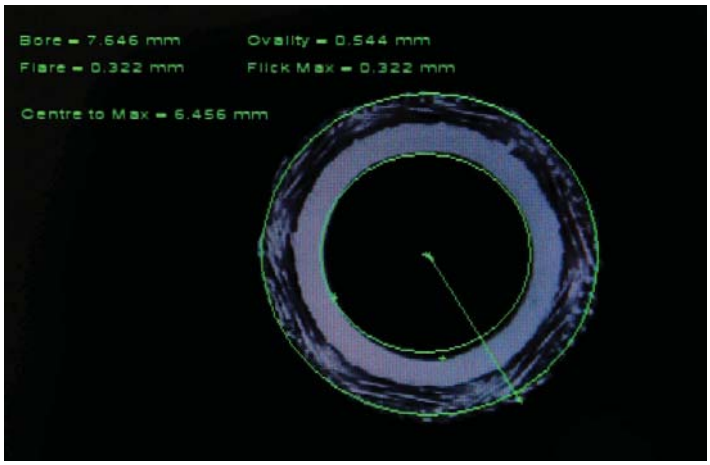
Aflex Hose have developed an automatic hose cutting machine which is able to cut stainless steel braided hose lengths perfectly, without squashing or braid flare out.

This system is applicable to (uncovered) stainless steel braided grades of Smoothbore and Hyperline FX hose, in sizes up to 1" bore, in minimum cut lengths of 60mm (2³/₈"), no maximum length.

In addition, Aflex have developed a fully automated inspection system which checks the cut ends for diameters, ovality and protruding cut wire ends.

This inspection system is only applicable to regularly supplied large quantities of cut lengths and is limited to cut lengths which are less than 0.4 metres (16 inches) in length.

Automated washing equipment is available for short cut lengths, capable of achieving the required tolerance levels for particle size and count.



HYPERLINE FX HOSE SPECIAL USAGE CONDITIONS

PTFE Hose-Use with Alkali Metals, Halogens and Halogen containing Chemicals

PTFE hose liners react chemically with Fluorine, Chlorine Trifluoride and molten Alkali Metals.

When PTFE lined hose is used to carry Chlorine or Bromine, either as gasses or fluids, they will diffuse into and through the PTFE liner wall thickness. Trace quantities will then combine with atmospheric moisture to corrode any braid/rubber outer coverings.

Heavily halogenated chemicals, like Hydrogen Fluoride, Hydrogen Chloride, Phosgene (Carbonyl Chloride) Carbon Tetrachloride and other organic chemicals with a high halogen content can also be absorbed and transmitted through the PTFE liner tube.

Other “Penetrating” Fluids and Gases

Sulphur Trioxide, Methyl Methacrylate, Caprolactam and Glacial Acetic Acid are some other chemicals which can be absorbed and transmitted through the PTFE liner tube wall.

Generally, however, as a hydrophobic (non-wetting) material, PTFE is very resistant to the absorption of chemicals. In some cases, PTFE has superior resistance to diffusion, for example to the diffusion of automotive fuels, in comparison with all other plastics and rubbers.

Gas/Fluid Cycling

There are some applications where the fluid passing through the hose turns into a gas, then back into a fluid, then into a gas etc, in a cyclic sequence.

This is normally associated with changes in temperature and/or pressure. For complex reasons these conditions are extremely damaging to the hose liner, whatever material it is made from.

For example, hoses are sometimes used to pass steam, water, steam etc into rubber moulding presses, in order to heat the mould, then rapidly cool it before reheating in the next cycle. Hoses of all types fail rapidly in such an application and PTFE lined hoses are no exception.

Please contact Aflex Hose for further information if these conditions apply.

Connecting Assemblies for Use in Applications

The lengths of hose assemblies and their configuration in use when connected into the application must always be in accordance with the Hose Configuration information at the end of this product literature.

When being connected for use in applications, the end fittings on hose assemblies must be connected to correct mating parts in the correct way, using the correct tools, spanners, clamps, nuts and bolts etc. The connections must be sufficiently tightened to ensure that the joint is leak free but not be over tightened as this can damage the sealing surfaces.

In applications involving the transfer through the hose of expensive or dangerous fluids or gases, the hoses and connections must be pressure tested in situ before being put in to service. This should be done with some harmless media to 1½ times the maximum working pressure of the hose assembly, as stated in the product literature.

If in doubt please contact Aflex Hose for advice.

Special Applications

Aflex Hose PTFE lined hose products are not rated as suitable for use in the following, special applications:

All Radioactive Applications involving high energy radiation, including Gamma radiation (degrades PTFE)

All Medical Implantation Applications.

All Aerospace Applications.

Hyperline FX and
Quality Assurance, Certification and Approvals

BS EN ISO 9001:2008

Aflex products are all manufactured in accordance with BS EN ISO 9001: 2008 Quality Management Systems independently assessed and registered by The British Standards Institution (BSI).

EN16643

Hyperline FX meets the requirements of EN16643 (SC), which include the electrical and electrostatic requirements of hose assemblies

TS16949

Aflex Hose Ltd manufactures PTFE flexible hose for the automotive industry in accordance with TS16949 and is assessed and certified by The British Standards Institution (BSI).

ISO 14001

Aflex Hose Ltd have been successfully assessed to the requirements of ISO 14001, by the British Standards Institution (BSI). By gaining this accreditation Aflex Hose Ltd are demonstrating our commitment to reducing our impact on the environment

FDA

The Materials used to manufacture the natural PTFE Tube liner conforms to FDA 21 CFR 177.1550, and the antistatic PTFE liner conforms to FDA 21 CFR 178.3297.

Automotive Fuel Hose - SAE J1737

Tested and approved for automotive fuel hose use in accordance with SAE J1737.

CE Marking (Europe only)

Aflex has been assessed by The British Standards Institution (BSI) and found to comply with the Pressure Equipment Directive 2014/68/EU Conformity Assessment Module D1, approved to CE Mark applicable hose products, accompanied by a Hose Usage Data Sheet, and a Declaration of Conformity.

Attestations of Conformity to ATEX Directive 2014/34/EU (Potentially Explosive Atmospheres)

Available for hose assemblies for components used in Gas Zones 1 & 2 and Dust Zones 21 & 22, when applicable.

Material Certification to EN10204

Available for all the hose or hose assembly components.

Certificates of Conformity to BS EN ISO/IEC 17050

Are available for all products.

HOSE CONFIGURATION REQUIREMENTS

Hose Assemblies are usually connected at both ends in service. They may then either remain in a fixed, or static configuration or in a flexing, or dynamic configuration.

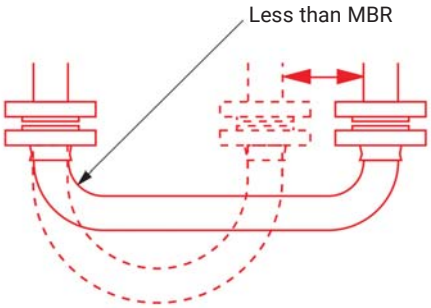
Whether static or dynamic, the First Rule concerning the configuration of the hose is that the bend radius of the hose must never be less than the Minimum Bend Radius (MBR) for the hose as listed in the relevant hose brochure.

The most common situation when this is likely to occur is when the hose is flexed at the end fitting, with stress being applied to the hose at an angle to the axis of the end fitting. Typically, this happens either because the length of the hose is too short, or because the weight of the hose plus contents creates a stress at an angle to the end fitting.

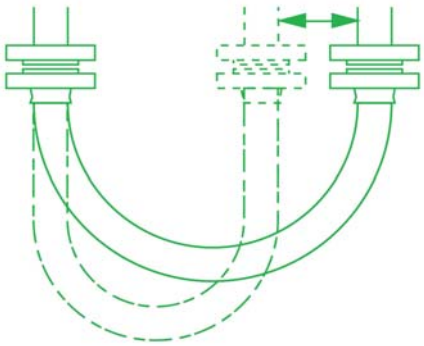
The Second Rule, therefore, if possible, is to design the configuration to ensure that any flexing in the hose takes place away from the end fittings.

(DYNAMIC) CONFIGURATION

INCORRECT - Hose too short

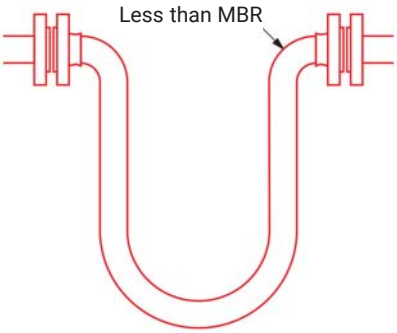


CORRECT - No flex at End Fittings

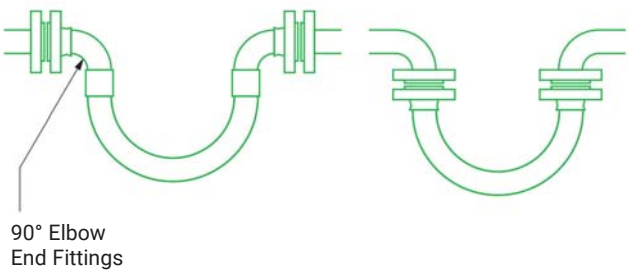


(STATIC) CONFIGURATION

INCORRECT - Weight of hose is at 90° to Axis of End Fittings



CORRECT - No flex at end fittings

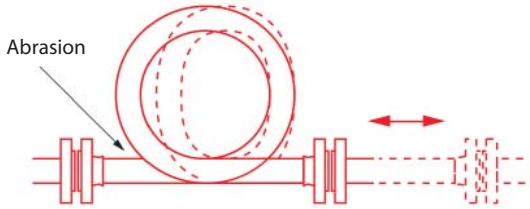


HOSE CONFIGURATION & LENGTH CALCULATIONS
- FOR ABRASION & TORQUE

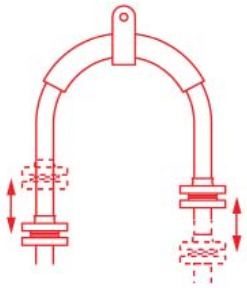
The Third Rule is that the hose configuration should always be designed, and supported where necessary, to avoid any possibility of external abrasion.

In some cases, the length, configuration and angle of the hose can be designed to avoid abrasion. In others, static or moving support frames or support wheels are required.

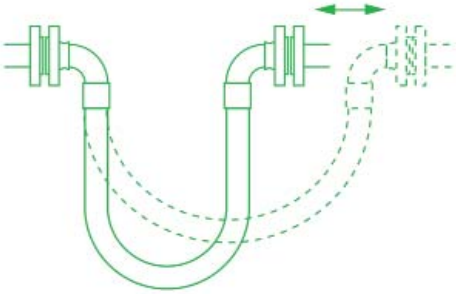
INCORRECT - Abrasion against hose



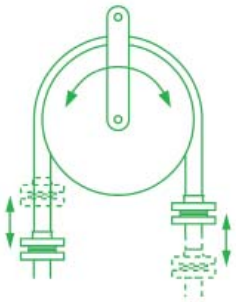
INCORRECT - Abrasion inside support



CORRECT - No hose abrasion



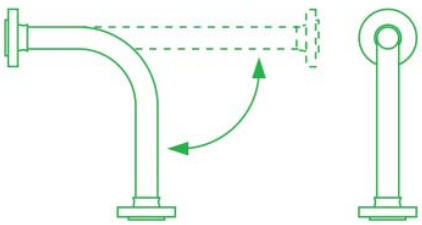
CORRECT - No abrasion over support



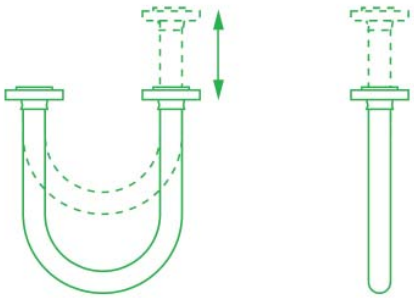
The Fourth Rule is that the hose must not be subjected to torque, either during connection, or as a result of the flexing cycle.

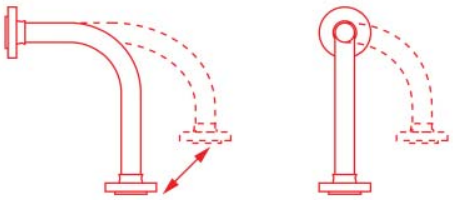
Torque (twist) in the hose can be applied during connection if the hose is accidentally twisted, or if the second end being connected is a screwed connection, and the hose is subjected to torque during final tightening.

In a flexing application, if any flexing cycle of the hose occurs in 3 dimensions instead of 2, then torque will also occur:

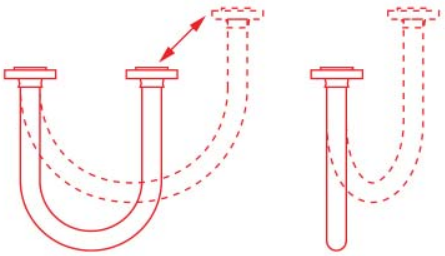


CORRECT - Flexing movement takes place in 2 dimensions





INCORRECT - Flexing movement takes place in 3 dimensions so torque is applied



CALCULATING THE HOSE LENGTH

The formula for calculating the bent section of the hose length around a radius is derived from the basic formula that the circumference of a circle = 2πR, where R = the radius of the circle, and π = a constant, = 3.142.

So, if the hose goes around a 90˚ bend, which is ¹/₄ of a full circumference, and the radius of the bend is R, then the length of the hose around the bend is = ¹/₄ x 2πR. Or half way round, in a U-shape, = ¹/₂ x 2πR.

Note :

In calculating the length of a hose assembly, the (non-flexible) length of the end fittings must be added in, also the length of any straight sections of hose, as in the following example:

Example :

To calculate the length for a 2" bore size hose with flange end fittings, to be fitted in a 90˚ configuration with one leg 400mm long, the other 600mm long.

Length of Bent Section (yellow) = ¹/₄ x 2πR (334)

= ¹/₄ x 2 x 3.142 x 334 = 525mm

Length of top, Straight Section, including the top end fitting length

= 600 - 334 = 266mm

Length of bottom end fitting = 66mm

Total length of Hose Assembly = 525 + 266 + 66 = 857mm

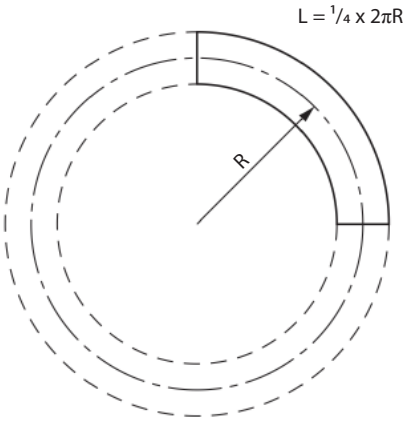
Things to consider

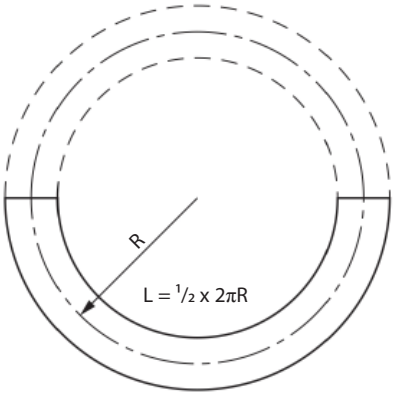
a. A hose will normally take the longest radius available to it to go around a corner, not the MBR! Also - always remember to include the non-flexible end fitting lengths.

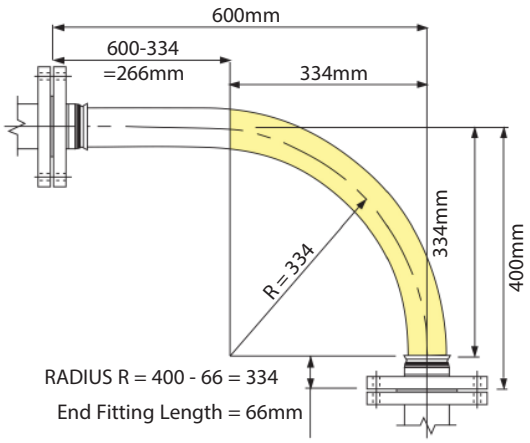
b. In dynamic applications, remember to always calculate the lengths for the most extended configuration during the flexing cycle, not the least extended.

c. If the configuration is simply too complex for calculation, then obtain a length of flexible tubing of some kind, mark on paper, or a wall, or floor, or both where the connection points will be relative to each other, scaled down if necessary, then manually run the flexible tubing between them with full radii round bends. Measure the extended length, then scale up if necessary to determine the approximate length of the hose.

   If in doubt, consult Aflex Hose.







CONDITIONS OF SALE

DEFINITIONS

"**Business Days**" shall mean a day (other than Saturday or Sunday or public holiday) when the banks in London are open for business.

"**Conditions**" shall mean these terms and conditions for the sale of Goods or the supply of Services or both made by the Seller and the Customer.

"**Contract**" shall mean a binding contract for the sale of Goods and/or Services or both made by the Seller and the Customer.

"**Customer**" shall mean the individual or entity that is purchasing Goods and/or Services hereunder.

"**Factored Products**" shall mean products which are supplied by Seller, but are not manufactured by Seller, and are purchased by Seller from another supplier or manufacturer.

"**Full Product Brochure**" shall mean the brochure for each of Sellers specific Product available at **http://www.aflex-hose.com/products-and-markets/**.

"**Goods**" shall mean either the Products and/or the Factored Products.

"**Losses**" shall mean a) any direct and/or indirect, special or consequential loss or damage; b) loss of data or other equipment or property; or c) economic loss or damage; or d) incurring of liability for loss of damage of any nature whatsoever suffered by third parties (including in each case incidental and punitive damage); or e) any loss of actual; or anticipated profit, interest, revenue, anticipated savings or business damage to goodwill.

"**Products**" shall mean those products which are manufactured by Seller and are described on the Seller's website.

"**Seller**" shall mean Aflex Hose Limited.

"**Services**" means the services (if any) agreed to be supplied by the Seller to the Customer as detailed in the Order acknowledgment.

1. GENERAL

(a) These Conditions shall govern all Contracts between Seller and the Customer to the exclusion of all other terms and conditions including any terms or conditions which the Customer may purport to impose, apply or introduce under any document, communication, order or similar.

(b) A Customer shall place its order for the Goods or Services (or both) by completing the Seller's standard purchase order form (the "**Purchase Order**"). Each Purchase Order shall be deemed to be an offer by the Customer to buy the Goods or Services (or both) of the Seller that are identified in the Purchase Order subject to these Conditions exclusively. The Purchase Order shall only be deemed to be accepted when the Seller issues to the Customer an order acknowledgment form which indicates acceptance of the Customer's offer on these Conditions ("**Order Acknowledgment**"). A Contract between the Seller and the Customer shall come into existence at the time and on the date when the Seller delivers the relevant Goods and/or Services (or both) to the Customer.

(c) Delivery will be at Customers cost from Seller's facilities Brighouse, West Yorkshire, England.

(d) Title in the Goods shall remain at all times with Seller until full payment in clear funds has been received.

(e) Risk of loss or damage in the Goods shall pass to the Customer upon delivery to the Customer or third party carrier.

(f) Delivery dates specified by Seller are only Seller's best estimates and Seller's only responsibility will be to use reasonable commercial efforts to meet all specified delivery dates. Unless otherwise agreed in writing, time is not of the essence.

2. CUSTOMER RESPONSIBILITIES AND OBLIGATIONS

(a) It is the Customer's strict responsibility and sole liability to review all of the usage conditions and usage limitations given for the Seller's Products. The usage conditions and limitations are as referred to in these Conditions and are as further specified in the relevant Full Product Brochure. It will be the Customer's sole responsibility to consult with and to familiarise itself with the latest, up to date Product information and Full Product Brochure at the time of ordering, which are only available and downloadable from the Sellers website at **http://www.aflex-hose.com/products-and-markets/** or on request, in writing from Seller. The Customer hereby represents and warrants that it has read and understood the applicable Full Product Brochure and the usage conditions and the usage limitations set forth therein, and has ensured their compliance with the [intended end use] application conditions.

(b) If the Customer subsequently sells or assigns any Products to any other person or entity, the Customer shall ensure that the final end user of the Products is supplied with these Conditions of Sale, the applicable Full Product Brochures, the Seller website address, together with notification of the requirement to review the usage conditions and limitations. The Customer shall include the terms and conditions set forth herein in its Conditions of Sale to any third party. The Customer hereby agrees and acknowledges that Seller shall have no responsibility nor liability whatsoever for any claims arising in whole or in part out of the Customer selling or assigning the Products to a third party that does not use the Products in accordance with Sellers usage requirements and limitations ("**Non-Conforming Use Claims**"). The Customer shall indemnify and hold Seller, its officers, directors, employees, affiliates and representatives fully harmless from any and all claims in respect of any Losses whatsoever howsoever arising out of or related to or associated with Non-Conforming Use Claims.

(c) The Customer agrees and acknowledges that for any intended Product application in which special conditions apply which are not defined, or not defined sufficiently in the Product Brochure, the Customer shall write to Seller requesting written advice relating to any usage limitations resulting from special conditions. The Customer shall be fully liable and responsible for ensuring the design suitability and safety of the Products in their intended applications, giving particular consideration to any special condition relating to, but not restricted to the chemical and electrostatic compatibility of the fluids or gases passing through, the possibility of diffusion of fluid or gases through the PTFE hose lining, the possibility of external corrosive conditions, the types and likelihood of excessive mechanical abuse, such as abrasion (internal or external), crushing, excessive flexing or vibrations, etc. and any excessive temperature and/or pressure "pulsing" conditions, or any other condition which may cause premature hose failure. The Customer shall consider, and take account of the degree of risk involved in any potential Product failure, including the provision of adequate protection in the event of any risk to any persons. In applications where any type of Product failure would lead to financial losses if the Product is not replaced immediately, the Customer agrees and acknowledges that it shall be the Customer's responsibility to order and hold in stock spare Product(s) accordingly. The Customer shall advise Seller in writing at the time of placing the enquiry and on any Purchase Order if there are any special requirements for the Product, including special cleaning, or drying, or extra testing requirements which are in addition to normal industrial standards. Mere notice of such additional requirements to Seller however, does not relieve the Customer of its responsibility and liability for ensuring adequate measures are taken or are in place for such applications nor does the mere notification burden nor transfer to Seller any Customers' liability that the Customer has for such intended application.

3. FACTORED PRODUCTS

(a) The Customer accepts that Seller is not an expert in the technical features which apply to Factored Products and/or their use in application. Seller's only obligation will be to pass on to the Customer all the written information which they have regarding the Factored Product, but the Customer shall be responsible for ensuring that this and any other necessary Factored Product information is obtained and is reviewed and will decide solely if such data is sufficient to ensure that the Factored Product is fit for purpose in the intended usage application. If any application requirements apply which are not fully covered by the information which the Customer can obtain, then the Customer undertakes not to use or supply the Factored Product for use in that application. The Customer is also responsible for ensuring that the Factored Product will not be subjected to levels of usual or accidental physical abuse in service which would cause the Factored Product to fail. The Customer agrees and acknowledges that Seller, its officers, directors, employees, affiliates and representatives shall not be held liable for any claims or obligations arising out of the Customer's failure to fulfil any or all of its responsibilities set forth in this clause 3. a)., and hereby agrees to indemnify and hold Seller its officers, directors, employees, affiliates and representatives fully harmless from any and all claims that may arise in regard to Factored Products.

(b) If the Customer has any doubts concerning these or any other usage conditions and limitation or safety parameters, the Customer shall consult Seller at the number and address in the Notice Provisions below and request a written response to any queries.

4. HOSE SERVICE LIFE - WARRANTY

(a) The Product shall be as described in the Full Product Brochure. It shall comply with the specification materially in all respects. In respect of Factored Products please refer to its manufacturer's statement.

(b) It is not possible for Seller to warranty a minimum service life for any of its Products (for Factored Product's warranty provisions, please refer to manufacturer's standard policy) which can be applicable for every type of application. As such, Customer acknowledges that, except as provided below in Sections 4. c), 4. d) and 4. e)., Seller is not warranting a minimum service life of any of the Seller's Products. For avoidance of doubt Seller cannot and does not give any warranty in respect of the Factored Products, but will pass on to the Customer any (unexpired) warranty that is given by the manufacturer of the Factored Products.

(c) Save as provided for in 4. e)., below service life predictions or warranties of the Products, in respect of certain applications can only be given in cases where all the relevant information concerning the application is given in writing to Seller and Seller subsequently confirms in writing the service life prediction/warranty prior to the order being placed.

(d) If such a written undertaking is not sought and given, Seller shall not be held liable for any of its Product's (or Factored Product) failure which the Customer considers to be premature, except for defects which are due to faulty materials or manufacturing and which occur within 24 months or 12 months, as applicable, of supply as provided for under 4.e) below.

(e) Seller warrants its Products to be free from faulty materials or manufacturing defects from the date of delivery, for 24 months; provided, however, that

all Hose Assemblies which are "ETH" (Electrical Trace Heated) Grade or are Factored Products are only warranted for 12 months. The sole liability of Seller and the Customer's sole remedy for breach of warranty is as set out in clauses 5. a) and/or 5. b) below as applicable.

(f) SAVE AS PROVIDED FOR IN CLAUSE 4 c) (IF APPLICABLE) and/or 4 e) ABOVE, SELLER MAKES NO WARRANTY OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED OTHER THAN AS SPECIFICALLY STATED HEREIN, AND THERE ARE NO WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE OBLIGATIONS AND WARRANTIES SPECIFICALLY STATED HEREIN.

5. PRODUCT FAILURE

(a) In the event of a Product failure during the applicable warranty period set forth in Section 4 c) (if applicable) and/or 4. e), the Customer shall provide Seller with written notification within forty-eight (48) hours of discovering the fault. Seller requires that the relevant Product(s) not be cut up or tampered with, but should be decontaminated and returned to Seller, together with a decontamination certificate, for examination and analysis of the fault. The Customer should also provide full details in writing of the application conditions under which the hose failed, including Pressure, Vacuum, Temperature, Flexing and any cycling of any of these, also the fluids, gases and any cleaning products passed through the hose, and the total time that the hose has been in service also the original order number and the Serial Number for the hose. The Customer may send its own witness to the examination if required. Seller will provide a Non-Conformance Report to the Customer. The Customer shall bear the cost of returning the Seller Products that have failed; provided, however, as set forth in 5. b) or 5. c)., below, Seller shall reimburse the Customer for any shipping costs if it is determined that the failure is covered by the warranty set forth in Section 4. e).

(b) In the event of a Factored Product failure, the Customer shall advise Seller with written notification within 48 hours of discovering the fault. The failed Factored Product shall not be tampered with or de-constructed in any way, but shall be decontaminated as required to render it fully safe and free from harmful substances and held awaiting advice concerning its disposition from Seller. Full details concerning the application, the time in use in the application and a full description of the type of failure shall be supplied to Seller, who shall pass this information on to the supplier or manufacturer of the Factored Product for advice concerning the appropriate course of action. The Customer will then be advised accordingly.

(c) If Seller determines that faulty materials or a manufacturing defect in the Product (and/or Factored Product after consulting with the manufacturer) is responsible for the product failure, the maximum liability shall be the invoice value of the failed product itself, or the invoice value of the whole customer order as determined by Seller in its sole discretion, along with any reasonable costs for removal and replacement of the product, and costs for packing and dispatching the failed product back to Seller.

6. UNTESTED HOSE SUPPLIES FOR SELF-ASSEMBLY BY CUSTOMERS ("SAC")

(a) Seller does supply "loose" hose, without end fittings attached to a SAC, who will then cut the hose to length and attach end fittings to make up Hose Assemblies for their own use, or for sale to their own customers.

(b) Unless the SAC requests, and Seller confirms that the 'loose' hose is to be pressure tested before supply, such Hydrostatic testing of the hose and the end fitting attachment will not normally be offered by Seller. The SAC agrees and acknowledges that it will be solely responsible for carrying out such hydrostatic pressure testing of one hundred percent (100%) of such assemblies. The Maximum Working Pressure (MWP) of the hose assembly is specified in the relevant Full Product Brochure. The safety factor is also noted within the Full Product Brochure.

(c) When pressure testing braided hoses with a plastic or rubber outer cover, the cover will mask any signs of leakage for a time. The SAC agrees and acknowledges that after the hydrostatic pressure test, it is further required to test each covered hose assembly with an internal helium gas pressure of 30 Bar (450 psi) for hose sizes up to 1" and 15 Bar (225 psi) for hose sizes above 1", with the hose assembly immersed in water to enable leak detection by gas bubbles, for a minimum test period of 5 minutes.

(d) The SAC agrees and acknowledges that it alone shall determine and approve the Design Suitability of the hose assembly for its intended use before supply and that, except as set forth in 6. B), it shall indemnify and hold Seller fully harmless from any and all Claims and Losses, whether direct or indirect arising from Design Suitability for a SAC. This includes proceeding in accordance with 2. a) and 2. d) above.

(e) Seller's liability is limited to its Products which are assembled by approved SAC if all the hose and fitting components were supplied by Seller or approved for use by Seller in writing, and they were assembled and tested in accordance with Seller's current Manufacturing and Testing Instructions, available to approved SAC in an I-Bay on the Seller website.

7. UNTESTED HOSE ASSEMBLIES

Seller is sometimes requested by Customers to attach non-standard end fittings to hose assemblies which the Customer supplies, and in some cases it is not possible to connect these fittings to the Seller pressure test system. In such cases a "concession not to test" is obtained from the Customer, and a label is attached to the hose assembly, warning that it requires pressure testing before use. The Customer agrees and acknowledges that Seller shall have no liability whatsoever if the Customer does not comply with the warning that requires pressure testing before use, and agrees to fully indemnify and hold Seller fully harmless from any and all claims arising from this situation.

8. FORCE MAJEURE

Seller shall not be liable for any delay in delivery, failure to deliver or default in performing in accordance with any Customer's order if the delay or default is due to: (a) fires, floods, strikes, or other labour disputes, accidents to Seller's production facilities, acts of sabotage, riots, natural disasters, difficulties procuring materials, shortages of raw materials, interference by civil or military authorities, whether legal or de facto, governmental restrictions, including but not limited to failure to obtain export licenses, delays in transportation or lack of transportation facilities, restrictions imposed by federal, state or other governmental legislation or, rules or regulations thereof, including a force majeure event occurring in respect to one of Seller's suppliers; or (b) any other cause beyond Seller's control.

9. LIMITATIONS OF LIABILITY & EXCLUDED APPLICATIONS

(a) Seller's Products and/or Factored Products have not been designed nor tested for use in aerospace, medical implantation or radioactive fields ("**Excluded Applications**"), and as such their use is therefore strictly prohibited. Customer agrees and acknowledges that it is aware of the limitations set forth in this clause 9. a)., and hereby acknowledges and agrees that Seller shall have no liability whatsoever in the event Customer decides to unilaterally violate such prohibition by using Seller Products and/or Factored Products for such Excluded Applications. Customer hereby further agrees to indemnify Seller, its officers, directors, employees, affiliates and representatives for any and all Claims and Losses arising out of Customer's use of the Seller's Products and/or Factored Products in such Excluded Applications.

(b) Seller will not accept liability for any failures of the Seller Products and/or Factored Products which are caused by Customer's failure to perform and/or discharge their Responsibilities fully as specified in these Conditions.

(c) SAVE FOR: i) DEATH OR PERSONAL INJURY CAUSED BY AN ACT OR OMISSION TO ACT OF SELLER; OR ii) FOR AN ACT OF FRAUD/FRAUDULENT STATEMENT AND TO THE MAXIMUM EXTENT PERMITTED BY LAW AND NOTWITHSTANDING ANYTHING TO THE CONTRARY HEREIN, IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY, OR PUNITIVE DAMAGES OR LOSSESS, LOSS OF PROFITS OR REVENUE, LOSS OF PROCESS PRODUCTS, DAMAGE TO EQUIPMENT, DOWNTIME COSTS, OR LOSS OF USE EVEN IF INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. TO THE EXTENT PERMITTED BY APPLICABLE LAW, THESE EXCLUSIONS AND LIMITATIONS WILL APPLY REGARDLESS OF WHETHER LIABILITY ARISES FROM failure of the product(s), BREACH OF CONTRACT, FAILURE TO DELIVER ON TIME, WARRANTY, TORT (INCLUDING, BUT NOT LIMITED TO, NEGLIGENCE), BY OPERATION OF LAW, OR OTHERWISE.

10. COMPLETION OF BULK HOSE ORDERS

Due to the nature of the production of PTFE hose, Seller reserves the right to call an order complete in the following situations. If a product is a standard Seller product (as listed in Seller's product brochures) a figure of +10% of original order quantity can be supplied. If the product is a non-standard product and outside the Seller's standard product range the figure of +/- 10% of the original order quantity can be supplied. Goods supplied within these parameters would render the order complete.

11. NOTICE PROVISIONS

Any written notice required to be provided to Seller shall be sent to the following address: Seller Limited, Spring Bank Industrial Estate, Watson Mill Lane, Sowerby Bridge, Halifax, West Yorkshire, HX6 3BW.

12. EXCLUSION OF CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS

The United Nations Convention on Contracts for the International Sale of Goods shall not apply to these Conditions of Sale and any and all other Customer documents.

13. GOVERNING LAW; JURISDICTION

(a) These Conditions of Sale and all rights, duties and obligations hereunder, including any and all other Customer agreements and orders shall be governed by and subject to English Law.

(b) The Customer acknowledges and agrees that any disputes arising out of or related in any way to this Agreement, including a breach of this Agreement, shall be brought exclusively in the courts of England, United Kingdom. Furthermore, Customer knowingly, voluntarily and irrevocably (a) consents to the exclusive jurisdiction of these courts, (b) waives any immunity or objection, including any objection to personal jurisdiction or the laying of venue or based on the grounds of forum non conveniens, which it may have from or to the bringing of the dispute in such jurisdiction, (c) waives any personal service of any summons, complaint or other process that may be made by any other means permitted by England, United Kingdom, (d) waives any right to trial by jury, (e) agrees that any such dispute will be decided by court trial without a jury, (f) understands that it is giving up valuable legal rights under this 13. B), including the right to trial by jury, and that it voluntarily and knowingly waives those rights.

bsi. ISO 9001 Quality Management FM 643412 | ISO 14001 Environmental Management EMS 657211 | TS 16949 Automotive Quality Management TS 643414

NAHAD MEMBER THE ASSOCIATION FOR HOSE AND ACCESSORIES DISTRIBUTION

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