HYPERLINE FX HOSE DESCRIPTION

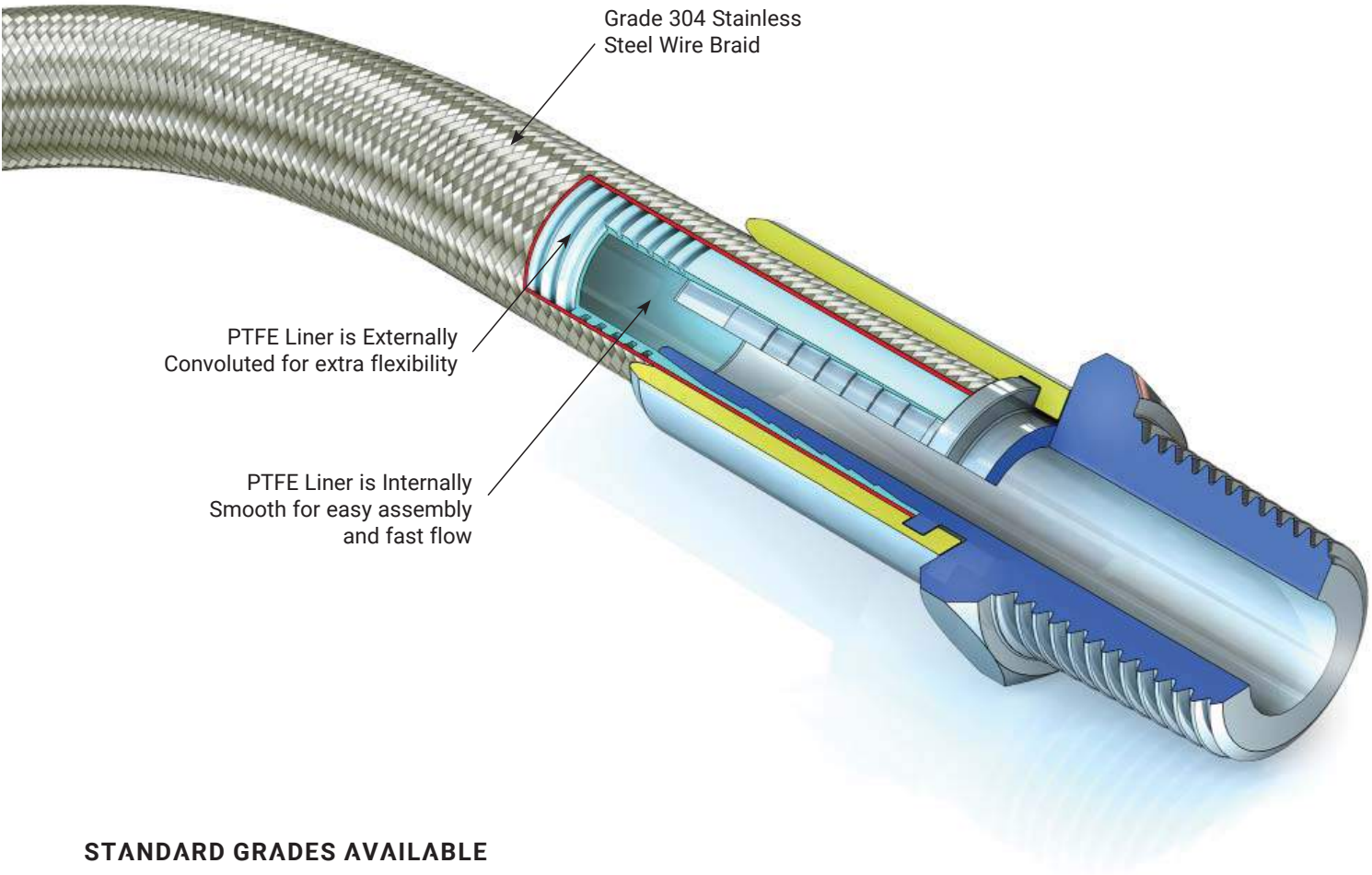
There is a fundamental problem with larger sizes of standard, smooth bore PTFE hose products - as the hose size increases above 1/4", so smooth bore PTFE lined hose become significantly less flexible, and more easily kinked.

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

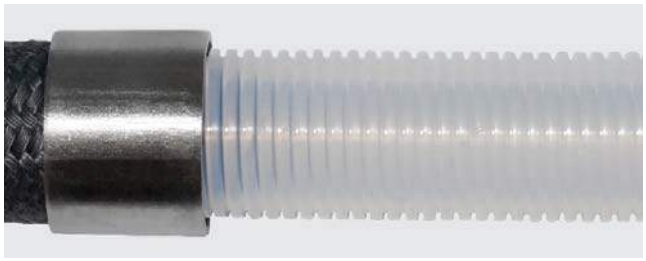
Hyperline FX, TO - Natural PTFE Tube Only, No Braid.
Hyperline FX, AS, TO - Antistatic Black PTFE Tube Only, No Braid.

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

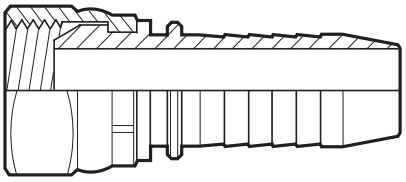
SUPPLY OPTIONS

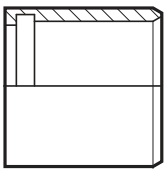
Hyperline FX hose can either be supplied as made up and crimped hose assemblies, or as loose hose for customers to assemble themselves, using ferrules supplied by Aflex Hose, and standard hydraulic end fittings, which can also be supplied by Aflex Hose if required.

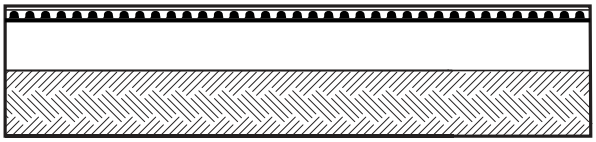
EASIER ASSEMBLY

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.

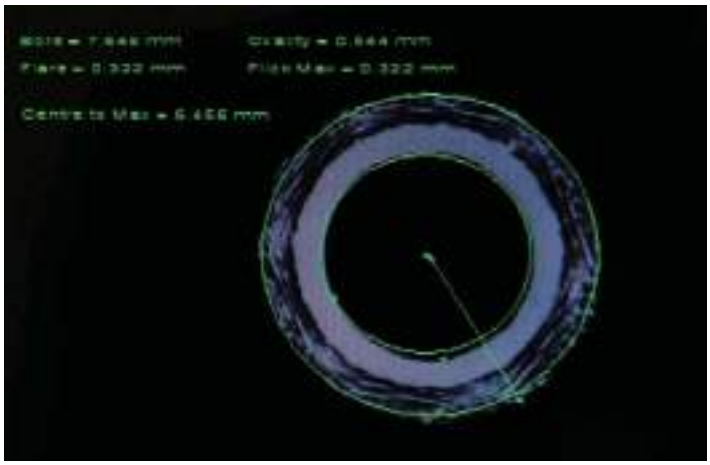
Aflex Hose have developed an automatic hose cutting machine which is able to cut stainless steel braided hose lengths perfectly, without squashing or braid flare out.

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 & LENGTH CALCULATIONS
- FOR BEND RADIUS

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.

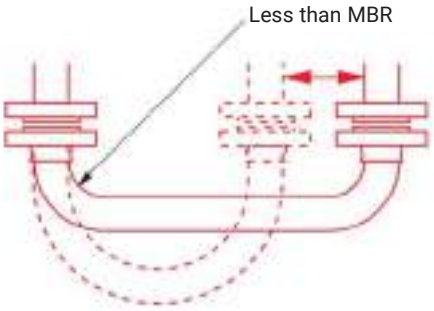
Whether static or dynamic, the First Rule concerning the configuration of the hose is that the bend radius of the hose must never be less than the Minimum Bend Radius (MBR) for the hose as listed in the relevant hose brochure.

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.

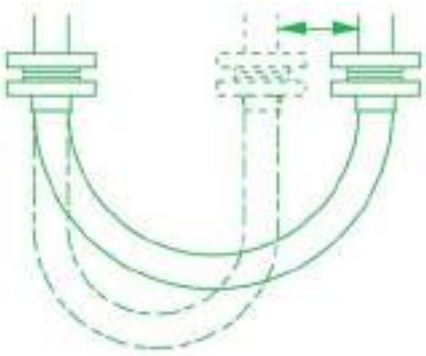
The Second Rule, therefore, if possible, is to design the configuration to ensure that any flexing in the hose takes place away from the end fittings.

(DYNAMIC) CONFIGURATION

INCORRECT - Hose too short

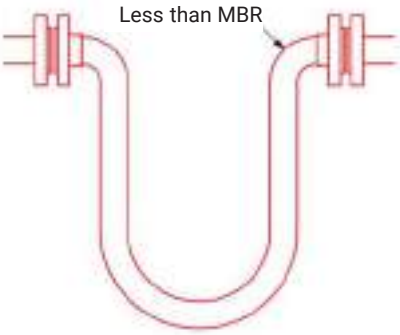


CORRECT - No flex at End Fittings

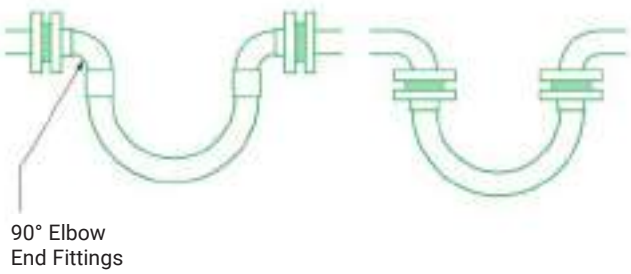


(STATIC) CONFIGURATION

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



CORRECT - No flex at end fittings

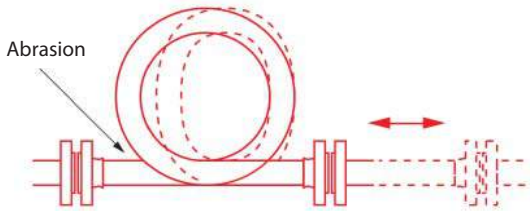


HOSE CONFIGURATION & LENGTH CALCULATIONS
- FOR ABRASION & TORQUE

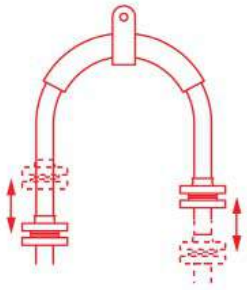
The Third Rule is that the hose configuration should always be designed, and supported where necessary, to avoid any possibility of external abrasion.

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.

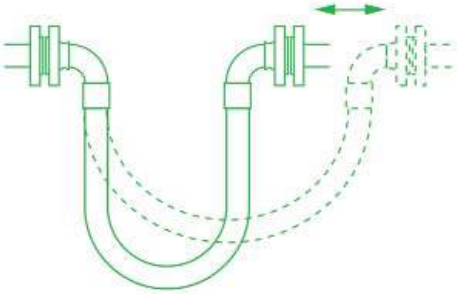
INCORRECT - Abrasion against hose



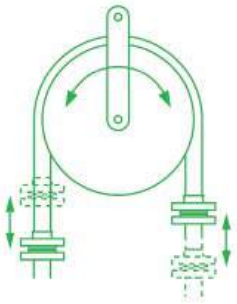
INCORRECT - Abrasion inside support



CORRECT - No hose abrasion



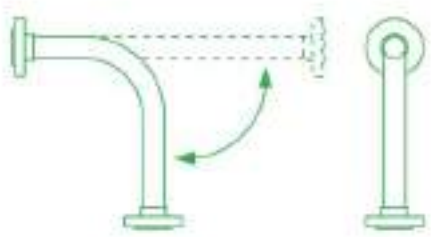
CORRECT - No abrasion over support



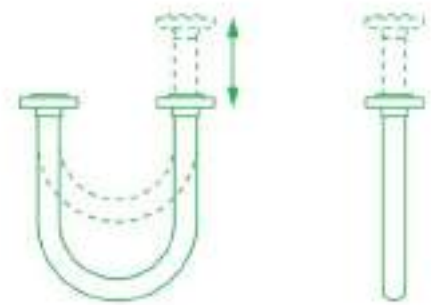
The Fourth Rule is that the hose must not be subjected to torque, either during connection, or as a result of the flexing cycle.

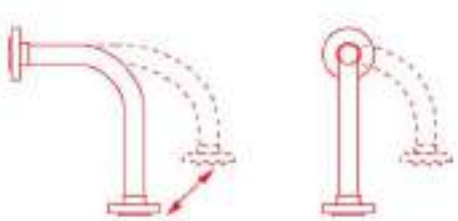
Torque (twist) in the hose can be applied during connection if the hose is accidentally twisted, or if the second end being connected is a screwed connection, and the hose is subjected to torque during final tightening.

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

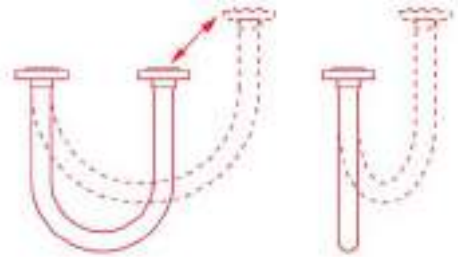


CORRECT - Flexing movement takes place in 2 dimensions





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.