Smoothbore

PTFE Lined Flexible Hose, High Pressure Hose and End Fittings

- Temperature Resistant

- Chemical Resistant

- Self Cleaning
PTFE - The Optimum Choice
For Hose Linings

PTFE, or Polytetrafluoroethylene, comprises 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 into the hose design. This is where Alflex Hose have a proven record of success over the last 30 years.
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Standard Smoothbore Hose Grades

Construction

**Hose Liner:** Seamless extruded PTFE tube. The extrusion, heat treatment and quality control programmes are designed to produce the best quality PTFE tube possible, ensuring minimum porosity and maximum flexibility.

**Hose Braid:** Braided from AISI grade 304 stainless steel wire, bright hard drawn to a minimum 1700 N/mm² tensile strength. The braiding process is closely controlled to ensure even tensions and the correct braid angle, to give minimum expansion/contraction under pressure.

GRADES AVAILABLE, and APPLICATIONS

There are 3 standard grades available, with a Single SS wire braid (SB) or a Double wire braid (DB).

Single Braid is suitable for applications in general. Double Braid is required for higher pressures and increased kink resistance.

Grade SW, SB - Standard Wall, Single Braid (or DB, Double Braid)
For general purpose use, including high and low pressure steam, chemicals, paints, inks, adhesives, brake fluids, fuels, oils, detergents, refrigerants and foodstuffs.

PTFE lined hose is the optimum hose product wherever excellent chemical resistance, temperature resistance and/or internal “non-stick” cleanability are primary requirements of the application.

Grade HW, SB - Heavy Wall, Single Braid (or DB, Double Braid)
For heavy duty use, also for use with gases up to 100 Bar pressure, and for hot/cold cycling applications.

Grade MW, SB - Medium Wall, Single Braid, also called Hyperline SB (or DB, Double Braid)
The Hyperline name is applied to Aflex PTFE hose products which have an oversize bore, to enable assembly with standard Hydraulic End Fittings. In most cases, these sizes are the same as the conventional “dash” hose size range, as indicated in the specifications.

SPECIFICATIONS and SIZE RANGES

SW, HW & MW Single Braid (SB) Hose - Page 5
SW, HW & MW Double Braid (DB) Hose - Page 6

Alternative PTFE Tube Liners Page 8
The standard grades described above are not suitable for applications using high pressure gas or electrostatic charging fluids.

The alternative PTFE tube liners described on page 9 are required to satisfy such applications.

Plastic or Rubber Hose Covers - Page 9
For external abrasion resistance, ease of cleaning, colour identification or for printing, plastic or rubber covers may be applied as described on page 9.
# Specifications for Standard Single Braid Hose and Hose Properties

## SPECIFICATIONS and SIZE RANGE
For Single Stainless Steel wire braid hose, for Standard Grade and AS Grade

### STANDARD WALL, SINGLE BRAID (SW, SB) 

<table>
<thead>
<tr>
<th>Bore Size (Nominal)</th>
<th>Bore Size (Actual)</th>
<th>PTFE Tube Wall Thickness</th>
<th>Braid Outside Diameter</th>
<th>Minimum Bend Radius</th>
<th>Maximum Working Pressure</th>
<th>Weight per Unit Length</th>
<th>*Part Number</th>
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### HEAVY WALL, SINGLE BRAID (HW, SB) 

<table>
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<tr>
<th>Bore Size (Nominal)</th>
<th>Bore Size (Actual)</th>
<th>PTFE Tube Wall Thickness</th>
<th>Braid Outside Diameter</th>
<th>Minimum Bend Radius</th>
<th>Maximum Working Pressure</th>
<th>Weight per Unit Length</th>
<th>*Part Number</th>
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<td>69 1004</td>
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</tbody>
</table>

*The Hyperline SB Range meet or exceeds SAE 100R14 standard.

### MEDIUM WALL SINGLE BRAID (MW, SB), also referred to as HYPERLINE SB

**For Anti-Static Grade, add 10 to the 3-digit part number e.g. 70-100- becomes 70-110**

### Note:
Many of the sizes of hose and fittings listed above are available as ex-stock items and are priced accordingly. However, some of the less popular items are not always in stock, and may therefore incur a minimum order charge or a set-up charge for smaller quantities. Aflex Hose will advise when the enquiry is made.

### Temperature & Pressure
- Temperature affects the Maximum Working Pressure (MWP) as listed above, so for temperatures above 130°C reduce the MWP by 0.75% for each 1°C above 130°C. Example: at 180°C, reduce the MWP by (180 - 130) x 0.75 = 37.5%.
- Pressure Ratings above 100 Bar (1500 psi) only apply for the transfer of non-penetrating fluids. If gases or penetrating fluids are used in the application, or used during pressure testing at pressures above 100 Bar, HP grade hose is required.
- 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, multiply the listed value by 0.75.
## Specifications for Standard Double Braid Hose

**SPECIFICATIONS and SIZE RANGE** - For Double Stainless Steel wire braid hose (DB Grade) and Antistatic (AS, DB) Grade.

The Smoothbore Range meet or exceeds SAE 100R14 standard.

### STANDARD WALL, DOUBLE BRAID (SW, DB)

<table>
<thead>
<tr>
<th>Bore Size (Nominal)</th>
<th>Bore Size (Actual)</th>
<th>PTFE Tube Wall Thickness</th>
<th>Braid Outside Diameter</th>
<th>Minimum Bend Radius</th>
<th>Maximum Working Pressure</th>
<th>Weight per Unit Length</th>
<th>Part Number</th>
</tr>
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<tbody>
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### HEAVY WALL, DOUBLE BRAID (HW, DB)

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<th>Bore Size (Actual)</th>
<th>PTFE Tube Wall Thickness</th>
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<th>Minimum Bend Radius</th>
<th>Maximum Working Pressure</th>
<th>Weight per Unit Length</th>
<th>Part Number</th>
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### MEDIUM WALL, DOUBLE BRAID (MW, DB) also referred to as HYPERLINE SB, DB)

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<tr>
<th>Bore Size (Nominal)</th>
<th>Bore Size (Actual)</th>
<th>Dash Size Reference (If any)</th>
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<th>Braid Outside Diameter</th>
<th>Minimum Bend Radius</th>
<th>Maximum Working Pressure</th>
<th>Weight per Unit Length</th>
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*For Anti-Static Grade, add 10 to the 3-digit part number e.g. 70-100 becomes 70-110.

For High Pressure Gas Grade, add 20, eg 70-200- becomes 70-220.

**Note:** A few of the sizes of hose and fittings listed above are available as ex-stock items and are priced accordingly. However, most of the items are not stocked, and will therefore incur a minimum order charge or a set-up charge for small quantities.

**Temperature & Pressure**

- Temperature affects the Maximum Working Pressure (MWP) as listed above, so for temperatures above 130°C reduce the MWP by 0.75% for each 1°C above 130°C. Example: at 180°C, reduce the MWP by (180 - 130) x 0.75 = 37.5%.

- Pressure Ratings above 100 Bar (1500 psi) only apply for the transfer of non-penetrating fluids. If gases or penetrating fluids are used in the application, or during pressure testing at pressures above 100 Bar, HPG grade hose is required.

- 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, multiply the listed value by 0.75.
High Pressure Smoothbore Hose Grades

Construction

**Hose Liner:** Seamless extruded PTFE tube. The extrusion, heat treatment and quality control programmes are designed to produce the best quality PTFE tube possible, ensuring minimum porosity and maximum flexibility.

**Hose Braids:** 2 braid materials are utilised:

- **Aramid Fibre Braid** - a black aramid fibre named “Tecnora”, which is a high technology fibre, with tensile, abrasion and temperature properties significantly better than the older Aramid products like Kevlar.

- **Stainless Steel Braid** - Braided from AISI grade 304 stainless steel wire, bright hard drawn to a minimum 1700 N/mm² tensile strength. The braiding process is closely controlled to ensure even tensions and the correct braid angle, to give minimum expansion/contraction under pressure.

There are many different applications for PTFE lined smoothbore hose which is subjected to high pressures in service, and each application has its own individual set of requirements.

Aflex Hose are able to provide different specifications of high pressure hose which are custom designed for particular applications or testing procedures where pressures exceed 100 Bar (1500 psi) for gases, or the listed maximum pressures for fluids.

Designs include (but are not limited to) the following:

- **Tecnora (Aramid Fibre) Braid + Stainless Steel Wire Overbraid Hose**

- **High Pack Stainless Steel Wire Braid Hose**

The custom design will include the size, wall thickness and quality of the PTFE tube and the precise design of the Braid, all optimised for the particular application.

Please consult Aflex Hose for further advice.
Alternative PTFE Tube Liners
High Pressure Gas (HPG) and Antistatic (AS)

High Pressure Gas (HPG Grade) PTFE Tube Liners (Available to Special Order Only)

For applications where gases are used in the hose at high pressures, or testing procedures above 100 bar (1500 psi) it is necessary to specify an HPG grade PTFE liner tube. HPG grade is also required when high pressures are applied to “penetrating” fluids.

HPG grade tubing is achieved by subjecting the PTFE tube to certain special processes, commonly known as “post sintering”, which increases the resistance of the material to penetration and porosity development by gases in service.

HPG Specification

This specification requires that when compressed air or nitrogen is applied to a sample length at a pressure of 275 Bar (4000 psi) for 1 minute, then the pressure rapidly broken then re-applied for a total of 10 cycles, the the sample must not show signs of excessive diffusion when finally gas tested under water.

Because pure gases do not generate static charges, HPG liners are rarely required to be antistatic, but on such rare occasions, a special “inner layer” AS grade is used as described at the bottom of this page.

Note: All sizes and types of Smoothbore Hose PTFE tube liners can be supplied to HPG quality. In practice, however, HPG hoses are nearly always HW (Heavy Wall) grade, in bore sizes from 6mm (¼") up to 10mm (⅜").

Anti-Static (AS Grade) PTFE Tube Liners (Available to Special Order Only)

Purpose

An AS Grade PTFE tube liner is an essential requirement in applications where there is a risk of an electrostatic charge build-up on the inside surface of the PTFE tube which may then discharge through the tube wall. Media passing through which create such a risk are fluids which have a Conductance of less than 10⁻⁸ S/m (Siemens per Metre), or 10⁴ pS/m such as fuels, solvents, freons, some oils, some WFI (ultra-pure “Water for Injection”) and non-polar organics which are being transferred at a medium to high flow velocity (more than 2 mtrs/sec.)

All twin or multi phase media, and any non-mixing media, such as powder in air, or water droplets in steam, in gases or in oil, also colloidal fluids constitute a particular hazard for static charge generation, and always require grade AS.

Design & Approval

Aflex Hose AS Grade PTFE tube liners are manufactured from FDA 21 CFR 177.1550 approved PTFE, and less than 2.5% of “high purity” Carbon Black material to FDA requirement 21 CFR 178.3297. The carbon is encapsulated by the PTFE, and in normal, non-abrasive applications will not come loose to contaminate any fluid passing through. Leachables and Extractables testing has confirmed that no loose carbon was found.

HPG/AS Grade Liner

The carbon is mixed into the PTFE for the whole wall thickness of the tube, EXCEPT for rare applications where both HPG and AS are required. For such HPG/AS grade tubes, only an inner layer of the wall thickness is AS grade PTFE, with the outer layer in natural PTFE (see drawing).
Plastic or Rubber Hose Covers

ALTERNATIVE PTFE HOSE COVER DESIGN OPTIONS

Purpose

For many applications, it is required that Smoothbore PTFE hose of all sizes, grades and braids should have an outer cover of a flexible plastic, or rubber.

This is usually required to protect the braid, or to colour the hose, or to allow printing on to the hose.

Plastic Covers - available to special order

PVC - flexible PVC covers are the most popular, either transparent, or a wide range of solid or semi-transparent colours.

A particular application is for -3 size single braid, clear PVC covered hose, used as a brake hose for motorbikes, motorsport and special vehicles.

PVC covers are designated as “PVC” followed by the colour if a solid colour is required or “Trans” then the colour if a semi-transparent colour is required. PVC cover will be 0.025” (0.63mm) as standard, alternative cover thickness is available on request.

For example - “-3 HW, SB, PVC Blue” would call for a -3 heavy wall, single braid hose with a solid, blue PVC cover.

Nylon II (Nyl), Hytrel (Hyt), Sarlink (Sar) and other types of flexible thermoplastics are also widely used.

Text can be continuously printed along the hose length, usually in black.

Rubber Covers - available to Special Order

Aflex Hose also have rubber extrusion facilities, and can continuously extrude rubber covers on to all grades of hose.

EPDM rubber in blue (RC Blue) or black(antistatic) (RC Black), or platinum cured Silicone rubber in transparent (SI) or white (SI White) are available to special order. Other colours and types of rubber may also be available. Consult Aflex Hose for details. Standard thickness of EPDM/Silicone covers are 0.040” (1mm). Other thicknesses are available on request. EPDM covers are only available in sizes from ¼” (-5).

“PRICKING” of Hose Covers

When covered hose is used in gas applications, it is always necessary to “prick” the cover at intervals, to allow the release of any diffused gas. Rubber covered hose is always pricked, but plastic covered hose is not, so pricking must be specially requested for all gas applications requiring plastic covered hose.

Colour References

If a particular grade of one colour is required, a RAL Number or a colour reference sample is required.

Note: Coloured covers are to special order, and require a Set-Up Charge, so small quantities are usually not economic.

Limitations in Use - The application of a plastic or rubber cover limits the usage conditions of the hose, particularly the operating temperature ranges, as given below.

Flexible PVC from -10°C (+14°F) to +60°C (+140°F)
Nylon II from -40°C (-40°F) to +120°C (+248°F)
EPDM Rubber from -40°C (-40°F) to +140°C (+284°F)
Silicone Rubber from -73°C (-100°F) to +204°C (+400°F)
Smoothbore Hose End Fittings - PTFE Tail and Hydraulic Tail

PTFE TAIL END FITTINGS FOR SW AND HW GRADES

Aflex Hose keep in stock a wide range of "PTFE-tail" design standard end fittings, ferrules and adaptors in both zinc plated carbon steel and 316L stainless steel.

These are specified, with the relevant Aflex Hose Part Number, on Page 11.

PTFE-Tail End Fittings can only be applied to the Standard Smoothbore, Standard Wall (SW) and Heavy Wall (HW) Hose Grades.

HYDRAULIC-TAIL END FITTINGS FOR MW GRADE

These can only be used with the Standard Smoothbore, Medium Wall (MW) Hose Grade.

Hydraulic Tail end fittings are usually sourced from local Hydraulic Suppliers, but can be supplied by Aflex Hose if required.

Ferrules for MW, SB and MW Hose can be supplied by Aflex Hose, as below.

Ferrule Sizes and Part Numbers

<table>
<thead>
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<th>MW, SB Hose</th>
<th>Zinc Plated Carbon Steel</th>
<th>Stainless Steel</th>
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<tr>
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<td>1 BB</td>
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# List of PTFE Tail End Fittings for Standard Smoothbore Hose Grades

## Fitting Sizes, Types and Part Numbers

<table>
<thead>
<tr>
<th>Hose Size and Grade</th>
<th>Fitting Material</th>
<th>Fixed Males</th>
<th>Fixed Female NPT</th>
<th>Cone Seat Female Union BSPP</th>
<th>Cone Seat Male-to-Male Adaptors</th>
<th>37° JIC Female Unions</th>
<th>JIC-to-NPT Male/Male Adaptors</th>
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<td>150-32-32-04</td>
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</table>

* 1" Ferrules for HW, SB hose are 01-150-16-16-02 (and 04).

**Example:** Part Numbers for a 1/2" NPT Fixed Male in SS is 06-110-08-08-01.

**Note:** The last 2 digits of the Part Number indicates the material: 01 = 316 SS, 02 = 304 SS, 04 = Zinc Plated Carbon Steel.
How To Order Smoothbore Hose, Hose End Fittings or Hose Assemblies

SMOOTHBORE HOSE (Supplied loose - without end fittings attached)
The hose size and grade requires specification as shown in this brochure.

Either the combination of initials is used to specify the grade:
Example “¼” VH1, HPG, AS, RC (Blue)” specifies a ¼” nominal bore hose to the very high pressure grade specification, which has a tube liner which is both High Pressure Gas quality, and Antistatic, and the hose has an outer cover of blue EPDM rubber.

Or the Part Number of the hose as listed in this brochure can be used, together with any additional requirements for Example “Part No 70-310-03-01-02, PVC Trans Blue” specifies -3 Medium Wall Hose, with an HPG quality PTFE Liner tube (-310), and a semi transparent blue PVC cover.

Bulk hose is normally supplied in random production lengths, in loose coils or on wooden reels dependent upon quantity.

Specific lengths, or minimum lengths can be specified, but will require an extra charge.

SMOOTHBORE HOSE CUT TO LENGTH (with non-flared ends)
Aflex Hose are also able to supply Smoothbore Hose in ready-to-assemble pre-cut lengths, with the braid wire at the ends annealed and cut so the cut ends to not flare out. This makes it easier to slide ferrules on to the hose ends during assembly.

This can be applied to all sizes up to 1” bore Smoothbore, Single Braid hose for minimum quantities of 500+ lengths. Minimum cut length 60mm (23/8”), lengths cut to an accuracy of 1.5mm (1/16”).

* The actual bore size of hose required by customers is sometimes hard to define if the hose was previously purchased from another supplier, especially in the case of “dash” size (e.g. -10) hose size references. In such circumstance Customers are requested to consult the Aflex Hose size specifications, also to state the actual bore size of the hose they require (not the nominal bore size according to another supplier). Alternatively, a short sample of the hose required can be sent to Aflex for examination.

HOSE END FITTINGS (Supplied loose)
The end fittings and ferrules supplied require specification as shown in this brochure. Each end fitting supplied requires a ferrule which fits the type of hose to be used, as listed with Part Numbers on pages 10 & 11.

Either a written description of the size, type and material of the end fitting or ferrule is required, for example: “-3/8” Cone Seat Female Union Fitting in Stainless Steel”.

Or The Part Number of the component, for example: “Part No. 01-120-08-08-02” specifies a 1/2” Stainless Steel Ferrule, suitable for a 1/2” bore single braid hose.

Note: Special Crimp Tools are required for ferrules on a PTFE-Tail Fitting, available from Aflex Hose.

HOSE ASSEMBLIES
The hose size and grade, and the hose end fitting for each end of the hose assembly require specification as stated above. (The ferrules do not require specification).

The overall length of the Hose Assembly is required, between the sealing faces of the end fittings. The length tolerance for Smoothbore hose assemblies is minus 0%, plus 1 1/2% up to 1 metre long, and minus 0%, plus 2 1/2% for over 1 metre long.

HYDROSTATIC PRESSURE TESTING (To 1.5 times the listed maximum working pressure)
Hose supplied loose is not pressure tested, and the assembling Customer is responsible for pressure testing hose assemblies prior to use.

Smoothbore Hose Assemblies supplied by Aflex are all pressure tested for quantities up to 10 off, but only 10% of the quantity are normally pressure tested if more than 10 off are ordered.
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.
Smoothbore Hose and
Quality Assurance, Certification and Approvals,
and Hose Testing

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 National Quality Assurance Limited (NQA).

TS16949
Aflex Hose Ltd manufactures PTFE flexible hose for the automotive industry in accordance with TS16949:2009 and is assessed and certified by National Quality Assurance Limited (NQA).

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.

3-A Sanitary Standards
The PTFE used in the liner is manufactured solely from materials which meet the requirements of the 3-A Sanitary Standards.

Automotive Fuel Hose - SAE J1737
Approved for automotive fuel hose use in accordance with SAE J1737.

CE Marking (Europe only)
Aflex has been assessed by Zurich Engineering and found to comply with the Pressure Equipment Directive 97/23/EC (European Community) 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 94/9/EC (Potentially Explosive Atmospheres)
Available for hose and 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.

SAE 100R14 Standard
The Smoothbore range meet or exceeds this standard.
Correct 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

Less than MBR

CORRECT - No flex at end fittings

(Static) Configuration

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

Less than MBR

CORRECT - No flex at end fittings

OR

90° Elbow end fittings
Correct 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.

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:

Both Corroflon and Bioflex hose have good resistance to a small level of torque, much better resistance that rubber or SS hose types, but it is still the best practice to take whatever steps are necessary to eliminate torque. If in doubt, consult Aflex Hose.
**Hose Configurations & Length Calculations**
- for Length Calculation

**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 = \(2\pi R\), where \(R\) = the radius of the circle, and \(\pi = 3.142\).

So, if the hose goes around a 90° bend, which is \(\frac{1}{4}\) of a full circumference, and the radius of the bend is \(R\), then the length of the hose around the bend is \(\frac{1}{4} \times 2\pi R\). Or half way round, in a U-shape, = \(\frac{1}{2} \times 2\pi R\).

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) = \(\frac{1}{4} \times 2\pi R \times 334\)  
= \(\frac{1}{4} \times 2 \times 3.142 \times 334 = 525\)mm

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 MBRI! 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.