mandals

SINCE 1775

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Mandals AS has existed for more than 230 years. In 1775 Norway was under Danish rule, and in order to establish the company the founders had to ask the king of Denmark for approval. Since then there have been many changes in social, cultural and market conditions, both nationally and internationally, in addition to changes in ownership and product range. Mandals has adjusted to and restructured itself according to all of this, the business has been going strong and the company has experienced a constant development.

The foundation of the company was based on the many sailing vessels needing ropes. Rope production was the only business area until 1922 when fire hoses became a supplementary product. In the 1930's a weaving loom was needed in the hose production, and the development of Mandals' circular weaving loom started.

Product development has always been highlighted at Mandals, and the company turned out to be pioneer of the lay flat hose. Mandals started early with the "extrusion through the weave" technology which is still vital to the company. Only nitrile rubber had been used in this technology, but in the 1980's Mandals also started to develop hoses extruded with thermoplastic polyurethane (TPU). This is a complicated process, but Mandals has managed to develop also that business area year by year, and has a wide range of both nitrile and TPU based hoses.

PRODUCTS

Quality is strongly underlined at Mandals, proved by our ISO 9001 certification. Mandals is a world leading producer of circular weaving looms and today we can offer three world class models; the well known HM 604, the newer
3-shuttled HM 3000 and the brand new HM 1500.
The HM 1500 is also called "Miniloom" as this is a specialized machine for sizes up to and including 2½ inch.

The miniloom is also physically smaller and more silent than the other looms. The loom knowledge is essential and gives major benefits in the lay flat hose development.

We have a wide range of lay flat hose products for use in a number of areas, the main areas being the following:

- Fire fighting
- Compressed air
- Irrigation
- Potable/drinking water
- Slurry, waste water & mine dewatering
- Heavy duty transfer
- Dewatering
- Pipe rehabilitation
- Well rising

Nitrile rubber extruded hoses are available with a diameter of up to 6 inches and thermoplastic polyurethane (TPU) extruded hoses with a diameter of up to 12 inches. Generally, the abrasion resistance of nitrile rubber is approximately 3 times higher than that of PVC, and the abrasion resistance of polyurethane is 4-5 times higher than that of nitrile rubber. In addition to the extruded hoses, we also produce uncovered textile hoses.

MANDALS TODAY

Since the change in ownership back in 2004 we have focused on increasing our capacity and enhancing our presence in the market world wide by establishing more partnerships and distribution channels, while at the same time maintaining a strong relationship with our customers. In addition we have allocated more resources and manpower into improving our products and mainly in developing new hoses for old and new applications.

We see a trend where our knowledge and skills as one of the leading lay flat hose suppliers world wide are more and more needed, making Mandals a sought after partner in turn-key applications and systems.

Going forward we will continue our ambition to be a preferred partner in these fields, so please do not hesitate to contact us. We also recommend you to visit www.mandals.com where you will always find up-to-date information.

Øyvind Berntsen
Managing Director


Mantex


Flexitex


Aquaman


Guardman


Guardman


Dragman

MANUFACTURING A WORLD CLASS LAY FLAT HOSE

Twisting of yarn
Mandals uses premium quality filament yarns. When arriving at our factory, the yarn is tested to ensure that it meets our specifications. We then twist the required number of threads a precalculated number of times to achieve a yarn with known strength. This is secured by using advanced equipment in our twisting department.

HM 1500 - Miniloom

Weaving of a circular jacket
The jacket is the reinforcement, and thus a very vital part of the hose. We use the pretwisted filament yarns for weft and warp in the circular weaving loom. The circular woven jacket is produced with known strength both axial and longitudinal. We pre-calculate both tensile strength and burst pressure, and run tests to secure the right quality. The weave is designed to split lengthwise when the hose is pressurized to burst pressure level. This type of construction is used to avoid accidents from a snapping end. Mandals' circular weaving loom is used when weaving the jacket. Our long experience in loom production gives us the optimal know-how for designing the circular woven jacket.

Extrusion of the hose
The "extrusion through the weave" production method gives a very strong bonding between cover and woven jacket as well as firmly encapsulating the woven polyester. Mandals uses both nitrile rubber and thermoplastic polyurethane (TPU) when extruding. The chosen material depends on the use of the hose. Typically a rubber hose is more flexible, but when it comes to abrasion resistance a TPU hose is much stronger. The raw materials are also important. We buy some nitrile rubber ready for extrusion, but we also buy raw nitrile rubber which we mix with a number of additives to ensure the correct blend for hose extrusion. Likewise we purchase premium TPU from world leading manufacturers.

Vulcanization, leak testing and control.
It is essential to vulcanize a nitrile rubber hose.
We also point out that all hoses are leak tested and controlled before they are shipped to customers. These operations are carried out in "the long bench" which makes it possible for Mandals to supply lengths of 200 meters for all dimensions. For some hoses we can also supply lengths longer than 200 meters.

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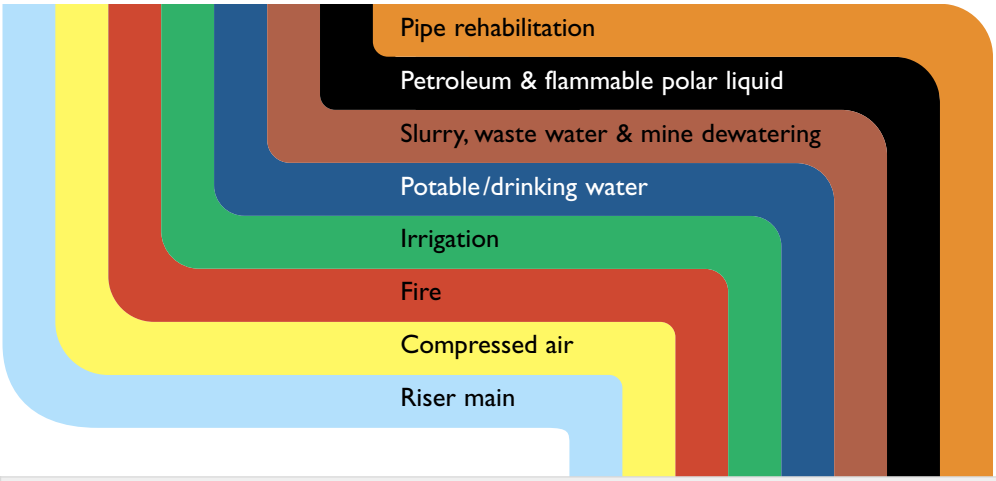


Pipe rehabilitation

Mandals Phoenix Lining of Polyethylene (PE) and Hytrel (HY) is ideal for pipe rehabilitation.

Mandals Phoenix Lining is an extremely flexible polymer coated hose, designed for relining and renovation of all kinds of leaking transfer pipes. This includes pipes for drinking water, methane gas, sewer or industrial chemicals.

Advantages of Phoenix renovation system

- Very cost efficient compared to changing the entire pipe.
- Renovation of long pipe sections, length depending on diameter.
- No excavation needed to connect service lines. Can be opened from the inside by remote controlled robot drilling.
- Connecting service lines can be done in a traditional way.
- Minimal obstruction of traffic.
- Minimum reduction of pipe cross section area.
- Increased flow capacity because of less pipe wall roughness.
- Resistant to vibrations and settings underground.
- Resistant to leaks even at high internal pressure.
- Easy to pass even sharp bends (low R/D ratio).
- Totally maintenance free.

The outer polymer layer of 1,2 mm is extruded on a strong circular polyester weave, ensuring the achievement of two crucial parameters:
1) A uniform polymer distribution around the lining circle.
2) Excellent adhesion of polymer to the textile weave.

The lining itself is installed into the host pipe by reversion, using either compressed air or water as a pressure medium. Prior to the installation, the lining is coated inside by a liquid epoxy resin, which is permanently attaching the reverted lining to the inner pipe wall. The installation of Mandals Phoenix Lining requires special installation equipment and highly skilled crew, and is carried out by specialized contracting companies. If needed we can put you in contact with such companies.

The strong polyester yarn in the weave provide the longitudinal and circumferential strength, whilst the outer polymer layer ensures impermeability and chemical resistance to the conveyed fluid.

Two standard polymers are available:

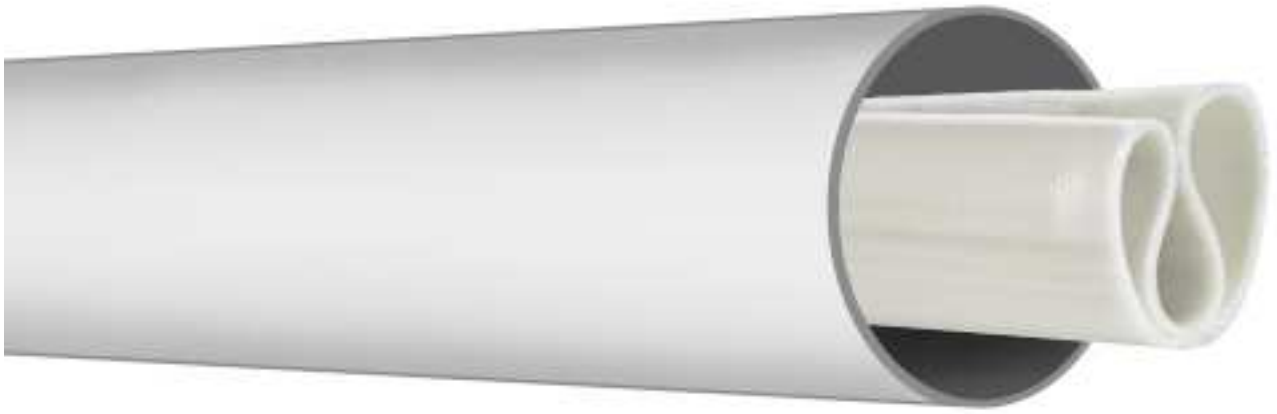
- Polyethylene (PE) lining is suitable for drinking water renovation, sewer lines and other water based fluids.
- Hytrel (HY) lining is suitable for renovation of gas pipes (natural gas) at low or medium pressure.

Mandals Phoenix Lining covers a nominal internal pipe diameter range from DN100 up to DN300. Five standard dimensions are available, but also special non-standard dimensions can be delivered on request. Section lengths up to 1000 meters per bobbin.

Mandals Phoenix Lining - standard dimensions

Nominal Pipe Internal Diameter		Wall Thickness		Weight PE lining		Weight HY lining		Burst Pressure	
inch	mm	inch	mm	lbs/ft	kg/m	lbs/ft	kg/m	psi	bar
4	100	0,07	1,70	0,32	0,48	0,32	0,48	174	12
6	150	0,07	1,85	0,47	0,70	0,54	0,81	145	10
8	200	0,08	1,95	0,77	1,15	0,81	1,20	145	10
10	250	0,08	2,00	0,91	1,35	1,02	1,52	145	10
12	300	0,09	2,15	1,18	1,75	1,31	1,95	145	10

Pipe rehabilitation



Mandals Tube In is dragged through the pipe in a "U-shape" and then pressurized to adapt to the pipe.

Mandals Tube In is a strong circular woven hose extruded with a flexible polyethylene material (PE) which is developed for renovation of leaking drinking water mains. The weave is made from high tenacity filament polyester yarn and is covered inside and outside by the "extrusion through the weave" production method, giving an outstanding adhesion level to the PE-material as well as being firmly encapsulated. The hose is packed in a "U-shape", which in combination with high flexibility allow easy installation into the host pipe by pulling, even through sharp bends. No steaming is needed to inflate the hose afterwards.

By recoupling and just setting the installed hose under normal water pressure, it opens up and expands towards the inner host pipe wall.

Special end couplings are available on request. Prior to installation all that is needed is a regular cleaning procedure of the host pipe by Polypig or other pipe cleaning equipment.

Mandals Tube In is a semi-structural, stand-alone hose which will ensure continual water supply even if the host pipe should break.

The easy installation and short down period of the water supply make the Tube In a unique renovation system for drinking water mains.

Standard length is 200 meters. Longer lengths can be made on request.

Mandals Tube In

Nominal Pipe Internal Diameter		Hose Internal Diameter	Wall Thickness		Weight		Burst Pressure		Max. Working Pressure		Tensile Strength*	
inch	mm	mm	inch	mm	lbs/ft	kg/m	psi	bar	psi	bar	lbs	kg
3	**80**	72,0 +2,0	0,12	3,0	0,50	0,75	696	48	261	24	13 890	6 300
4	**100**	90,0 +2,5	0,13	3,2	0,75	1,11	551	38	232	19	17 850	8 100
5	**125**	113,0 +3,0	0,13	3,3	1,00	1,48	464	32	232	16	21 170	9 600
6	**150**	136,0 +3,0	0,13	3,3	1,10	1,65	464	32	232	16	26 240	11 900
8	**200**	189,0 +3,0	0,15	3,8	1,85	2,75	464	32	232	16	65 270	29 600
10	**250**	228,0 +4,0	0,16	4,0	2,60	3,90	464	32	232	16	81 140	36 800
12	**300**	271,0 +5,0	0,17	4,3	3,20	4,75	464	32	232	16	98 780	44 800

** Total theoretical longitudinal strength.*

mandals Ultraman

SINCE 1775

Mandals Ultraman is an extremely hardwearing, multi purpose industrial hose for use in abrasive environments.

Mandals Ultraman is made from extruded thermoplastic polyether based polyurethane (TPU) with excellent wear & tear properties. The reinforcement is made from circular woven filament polyester yarn. The "extrusion through the weave" production method gives a very strong bonding between cover and lining as well as firmly encapsulating the woven polyester.

The hose has high resistance against commonly used chemicals and has excellent resistance to UV radiation, hydrolysis and fungus degradation. The abrasion resistance of the TPU is one of the highest available, making the hose ideal for use in rugged terrain or in applications where the strength and abrasion resistance either for the cover or lining is essential.

The circular woven filament polyester reinforcement ensures very high tensile strength combined with maximum 2 % extension in length at recommended working pressure. This prevents "snaking" of the hose when pressurized. Similarly, the interlocking weave gives unequalled high pressure ratings.

Mandals Ultraman can operate in a temperature range from -50°C to +75°C. It can withstand intermittent use up to +80°C.

Standard lengths up to 200 meters. Longer lengths on request for diameter smaller than 6 inches.

Mandals Ultraman

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
2	**51,0** +2,0	0,10	2,6	0,34	0,51	1015	70	11 800	5 400
2½	**65,0** +2,0	0,10	2,6	0,43	0,64	725	50	14 400	6 500
3	**76,0** +2,0	0,11	2,8	0,50	0,75	700	48	17 400	7 900
3½	**90,0** +2,0	0,11	2,9	0,64	0,95	580	40	20 000	9 100
4	**102,0** +2,5	0,12	3,0	0,74	1,10	525	36	22 000	10 100
4 ½	**114,0** +2,5	0,12	3,0	0,87	1,30	495	34	23 800	10 800
5	**127,0** +2,5	0,12	3,0	0,99	1,48	435	30	26 400	12 000
6	**152,0** +3,0	0,12	3,0	1,11	1,65	460	32	32 800	14 900
8	**203,0** +3,0	0,12	3,0	1,48	2,20	377	26	41 600	18 900
10	**254,0** +4,0	0,13	3,2	1,91	2,85	305	21	52 100	23 700
12	**305,0** + 5,0	0,13	3,3	2,35	3,50	220	15	84 000	38 200

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.
** Total theoretical longitudinal strength.*

mandals Superman HVT

Mandals Superman is a High Volume Transfer (HVT) hose

Mandals Superman HVT is made from thermoplastic polyether based polyurethane (TPU) extruded through a circular woven jacket made from high tenacity filament polyester yarn. The hose has been developed for higher than normal working pressures for transfer of large volumes of liquid while at the same time being lightweight and easy to deploy.

The excellent abrasion resistance prevents the hose from being damaged when used in rugged terrain. Other types of outer cover would be worn off quickly due to the pulsations of the flow combined with the weight of the filled hose. The heavily reinforced weave ensures minimum extension in length and minimum "snaking" of deployed hose.

Mandals Superman HVT can operate in an ambient temperature range from -50°C to +75°C. It can withstand intermittent use up to +80°C.

Standard lengths up to 200 meters.

Mandals Superman HVT

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
8	**203,0** +3,0	0,16	4,2	1,85	2,75	600	42	81 400	37 000
12	**305,0** +5,0	0,18	4,5	3,36	5,00	410	30	123 200	56 000

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.
** Total theoretical longitudinal strength.*

Mineman

Mandals Mineman is a large diameter dewatering hose for use in open pit mines.

Mandals Mineman is made from extruded thermoplastic polyether based polyurethane (TPU) with excellent wear & tear properties. The reinforcement is made from circular woven filament polyester yarn. The "extrusion through the weave" production method gives a very strong bonding between cover and lining as well as firmly encapsulating the woven polyester.

The hose has high resistance against commonly used chemicals and has excellent resistance to UV radiation, hydrolysis and fungus degradation. The abrasion resistance of the TPU is one of the highest available, making the hose ideal for use in the extremely abrasive environment in open pit mines. The outer cover has been designed with extra thickness in order to increase abrasion resistance. This extends the lifespan of the hose. The circular woven filament polyester reinforcement ensures very high tensile strength and facilitates towing with tractors without risk of damage. The interlocking weave prevents the hose from lengthwise extension when pulled or pressurized. This avoids delamination of cover or lining from the woven reinforcement and minimizes "snaking" and twisting.

Mandals Mineman can operate in a temperature range from -50°C to +75°C. It can withstand intermittent use up to +80°C.

Standard lengths up to 200 meters.

Mandals Mineman

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
6	**152,0** +3,0	0,15	3,9	1,41	2,10	460	32	32 800	14 900
8	**203,0** +3,0	0,16	4,2	2,00	3,00	377	26	41 500	18 900

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.
** Total theoretical longitudinal strength.*

mandals Dragman

Mandals Dragman is a lightweight, very abrasion resistant hose for umbilical slurry drag systems.

Mandals Dragman has been designed for the latest environmentally friendly umbilical drag systems. Such systems are used for distribution of slurry and manure as fertilizer in the fields of agriculture.

These systems require hoses to be connected between slurry reservoirs (lagoons) and tow tractors in the field to be fertilized. The tow tractor pulls the draghose while the hose feeds the injection tool bar that deposits the manure in the plowed furrows. Transfer hoses (Mandals Flexitex / Mandals Superman HVT) are used in the distance between the lagoon and the edge of the field, but the last one or two lengths connecting the transfer hose with the tow tractor are dragged in the field and put under continuous severe stress. Mandals Dragman has been designed with this extreme tensile stress and abrasion in mind. The TPU cover has abrasion resistance 4 - 5 times that of commonly used rubber. The tensile strength has been substantially increased to withstand the pull forces. Mandals Dragman represents the latest in environmentally friendly and safe manure distribution.

Standard lengths up to 200 meters. Longer lenghts on request for diameter smaller than 6 inches.

Please note!
Never tow one part of the hose across another.

Mandals Dragman

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
3	**76,0** +2,0	0,14	3,5	0,64	0,95	700	48	17 400	7 900
3½	**90,0** +2,0	0,14	3,5	0,74	1,10	580	40	26 400	12 000
4	**102,0** +2,5	0,14	3,5	0,89	1,33	550	38	28 800	13 100
4½	**114,0** +2,5	0,14	3,5	1,00	1,50	510	35	35 000	15 900
5	**127,0** +2,5	0,14	3,5	1,11	1,65	460	32	38 900	17 700
6	**152,0** +3,0	0,14	3,5	1,34	2,00	460	32	54 600	24 800

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.
** Total theoretical longitudinal strength.*

mandals Wellman

SINCE 1775

Potable/drinking water

Riser main

Mandals Wellman is used as riser main in wells and has drinking water approval.

Mandals Wellman is made from extruded thermoplastic polyether based polyurethane (TPU) with excellent wear & tear properties. The reinforcement is made from circular woven filament polyester yarn. The "extrusion through the weave" production method gives a very strong bonding between cover and lining as well as firmly encapsulating the woven polyester.

The hose has the following certifications:
- WRAS approved to BS 6920, UK
- KTW-DVGW approval, Germany
- W270 approval, Germany
- NSF 61 listing, USA

Mandals Wellman is an important part of a system where also the coupling is central.
The hose is mainly used in a borehole with a submersible pump mounted at the end of the hose.

This is possible due to the high tensile strength of the hose. The use of such pumps is the reason why there is an incorporated strap at the outside of the hose, so that the electrical cables for the pump can be strapped to the hose.

Mandals Wellman can operate in a temperature range from -50°C to +75°C. It can withstand intermittent use up to + 80°C.

Maximum length extension under recommended operation is 2 % and maximum diameter swell under recommended operation is 15 %.

Standard lengths up to 200 meters. Longer lengths can be made on request.

Mandals Wellman

Inner Diameter		Wall Thickness		Weight*		Burst Pressure		Max. Well Depth		Max. continuous end load**	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	ft	m	lbs	kg
1 1/4	32+1,5	0,07	1,8	0,51	0,23	870	60	820	250	1 550	700
2	51+2,0	0,10	2,6	1,15	0,52	870	60	820	250	3 750	1 700
3	76+2,0	0,12	3,1	2,01	0,91	870	60	820	250	6 600	3 000
4	102+2,5	0,14	3,5	2,76	1,25	870	60	820	250	12 100	5 500
5	127+2,5	0,15	3,7	4,14	1,88	870	60	820	250	15 900	7 200
6	152+3,0	0,16	4,0	5,07	2,30	870	60	820	250	19 850	9 000

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure does not exceed 30 bar / 435 psi at the submerged pump head.
** Dry hose without any attachments.*
*** Including weight of water, pump, power cable, coupling, attachments etc.*

The use of Mandals Wellman

The hose is part of a total system.

The coupling at the bottom is designed by Mandals and is therefore optimized for this use. The construction makes it easy to use and ensures that the hose is coupled properly.

Mandals can supply the couplings together with the hose.

Our long experience and knowledge have been central when constructing the Wellman hose.

- The weave is constructed to meet the necessary demands for such hoses – and it does!
- The loops make sure that the electrical cables can be easily strapped to the hose.
- And; the hose is approved for potable water!

The submersible pump is also an important part of the system, but this part is not sold by Mandals. We can advice if you need information in this area.

Advantages / important issues regarding use of the Wellman system:

- Easy to handle. The hose is far easier and more flexible to handle than pipes made by steel, fibreglass or poly/PVC pipes. This benefit also counts when it comes to packing, transport etc.
- Simple installation and retrieval.
- Low risk of damage at the equipment such as cables and the submersible pump.
- Very good hydraulic characteristics. Some diameter swell is good for the capacity; gives less friction and more flow.
- No corrosion.
- Simple maintenance.

mandals Aquaman

SINCE 1775

Mandals Aquaman is an extremely hardwearing hose for transfer of drinking water or other liquids intended for human consumption.

Mandals Aquaman is made from extruded thermoplastic polyether based polyurethane (TPU) with excellent wear & tear properties. The reinforcement is made from circular woven filament polyester yarn. The "extrusion through the weave" production method gives a very strong bonding between cover and lining as well as firmly encapsulating the woven polyester.

The hose has the following certifications:
- WRAS approved to BS 6920, UK
- KTW-DVGW approval, Germany
- W270 approval, Germany
- NSF 61 listing, USA

The hose has high resistance against commonly used chemicals. The excellent abrasion resistance of the TPU material enables the use of very thin, lightweight hoses with large diameters to be quickly and easily deployed in disaster areas without risk of damage to the hoses. The circular weaving of the filament polyester yarn ensures interlocking of the reinforcing yarns and increases both tensile strength and pressure rating. The interlocking weave ensures that the extension in length does not exceed 2 % when pulled or pressurized. This keeps "snaking" of the hose at a minimum.

Mandals Aquaman can operate in a temperature range from -50°C to +75°C. It can withstand intermittent use up to +80°C.

Standard lengths up to 200 meters. Longer lengths on request for diameter smaller than 6 inches.

Mandals Aquaman

Inner Diameter		Wall Thickness		Weight		Burst Pressure		
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	
1	**25,4** +1,3	0,06	1,6	0,11	0,16	725	50	
1 1/2	**38,0** +1,6	0,07	1,8	0,19	0,28	650	45	
1 3/4	**45,0** +1,8	0,08	2,0	0,22	0,33	650	45	
2	**51,0** +2,0	0,08	2,0	0,25	0,38	650	45	
2 1/2	**65,0** +2,0	0,09	2,2	0,33	0,50	600	42	
3	**76,0** +2,0	0,11	2,4	0,47	0,70	600	42	
3 1/2	**90,0** +2,0	0,11	2,8	0,62	0,93	580	40	
4	**102,0** +2,5	0,11	2,9	0,70	1,05	520	36	
4 1/2	**114,0** +2,5	0,11	2,9	0,79	1,18	500	34	
5	**127,0** +2,5	0,11	2,9	0,94	1,40	435	30	
6	**152,0** +3,0	0,12	3,0	1,11	1,65	460	32	
8	**203,0** +3,0	0,12	3,0	1,48	2,20	380	26	*42 bar on request*
10	**254,0** +4,0	0,13	3,2	1,91	2,85	290	20	
12	**305,0** +5,0	0,13	3,3	2,35	3,50	220	15	*30 bar on request*

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.

mandals Proman

Mandals Proman is a flexible, hardwearing tubular sheath for mechanical protection of ship hawsers, ropes, cables and wires.

Mandals Proman is constructed as a sheath. We use polyester yarns for the woven inner reinforcement, and a 1,0 mm layer of thermoplastic polyurethane (TPU) as an outside cover. The extrusion process ensures excellent bonding between the TPU cover and the circular woven polyester. The lack of an inner liner ensures low friction when the Proman is pulled on the rope or hawser to be protected.

Mandals Proman has excellent abrasion, chemical, oil and UV resistance.

The combination of low internal friction, high flexibility and long durability makes Mandals Proman the first choice in tubular protective sheathing.

Mandals Proman can be delivered in continuous lengths.

Mandals Proman

Inner Diameter		Wall Thickness		Weight	
inch	mm	inch	mm	lbs/ft	kg/m
2	**51,0** +4,0	0,06	1,6	0,20	0,300
2½	**65,0** +4,0	0,06	1,6	0,21	0,320
3	**75,0** +4,0	0,06	1,6	0,25	0,370
3½	**90,0** +4,0	0,06	1,6	0,29	0,430
4	**102,0** +4,0	0,07	1,7	0,33	0,500
4½	**114,0** +4,0	0,07	1,7	0,40	0,600
5	**127,0** +4,0	0,07	1,7	0,47	0,700
6	**152,0** +4,0	0,07	1,7	0,60	0,900

Mantex HP

Mandals Mantex High Pressure (HP) is a double jacket compressed air hose.

This double jacket hose is developed for more demanding use of compressed air.

Mandals Mantex HP is made from two layers of circular woven high tenacity filament polyester yarn. The hose has both inner and outer cover of oil resistant thermoplastic polyurethane, which gives very high abrasion and puncture resistance combined with high burst pressure.

The hose can be supplied with different kinds of couplings/screw connections, assembled at Mandals.

Standard lengths: 20 and 40 meters.

Operating temperature range from -50°C to +100°C.

Mandals Mantex HP

Inner Diameter		Weight		Burst Pressure	
inch	mm	lbs/ft	kg/m	psi	bar
2	**51,0** +2,0	0,48	0,72	2 175	150

To obtain safe use the Maximum Working Pressure should not exceed 37 bar / 540 psi.

Mandals Mantex is a single jacket compressed air hose.

Mandals Mantex is lightweight, but rugged and hardwearing. The hose is mainly used for compressed air and has for more than 20 years been distributed by among others Atlas Copco.

Mandals Mantex is made from a blend of nitrile rubber and PVC, with added UV barrier to prevent damage from UV radiation.

The rubber blend is extruded through a circular woven jacket made from high tenacity filament polyester yarn.Thanks to the jacket being circular woven and not just spun, the hose does not stretch when pulled and has a very high pressure rating versus wall thickness. The low weight combined with a high pressure rating make the hose popular and easy to use.
The hose can safely be used in ambient temperatures from -30°C to +75°C.

Standard lengths: 30 and 60 meters. Lengths up to 200 meters on request.

Mandals Mantex

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
3/4	**20,0** +1,6	0, 09	2,3	0,14	0,21	1 500	100	4 200	1 900
1	**25,4** +1,6	0,10	2,5	0,18	0,28	1 500	100	5 100	2 300
2	**51,0** +2,0	0,10	2,5	0,35	0,53	870	60	10 350	4 700
2 (90 bar)	**51,0** +2,0	0,11	2,9	0,44	0,65	1 300	90	17 400	7 900
2 1/2	**65,0** +2,0	0,11	2,9	0,50	0,75	725	50	14 750	6 700
3	**76,0** +2,0	0,12	3,1	0,63	0,95	725	50	17 800	8 100

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure and/or Working Tensile Stress do not exceed 1/3 of the above listed values.
** Total theoretical longitudinal strength.*

mandals Flexitex Standard

Mandals Flexitex Standard is a very lightweight, easy to handle yet hardwearing hose.

Mandals Flexitex Standard is intended for use as a feeder hose for smaller irrigation and slurry units in the agricultural sector. The hose is also used as a lightweight allround hose for water-based and non-polar liquids in construction and general industry. It is ideal as a "back-up" hose for industrial firefighting teams.

Mandals Flexitex Standard is made from a blend of nitrile rubber and PVC, with added UV barrier to prevent damage from UV radiation. The rubber blend is extruded through a circular woven reinforcement made from filament polyester yarn. This production method gives a very strong bonding between cover and lining as well as firmly encapsulating the reinforcing polyester.
The hose has high resistance against commonly used chemicals. Because of the interlocking circular weave, the hose does not stretch when pulled. For the same reason, it has a very high pressure rating to wall thickness ratio.

It can operate from -30°C to +75°C.
Intermittent use up to +80°C.

The hose can be delivered in lengths up to 200 meters.

Mandals Flexitex Standard

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
1 1/2	**38,0** +1,6	0,09	2,2	0,20	0,30	800	55	6 400	2 900
2	**51,0** +2,0	0,09	2,2	0,25	0,38	650	45	8 400	3 800
2 1/2	**65,0** +2,0	0,09	2,2	0,35	0,53	650	45	9 250	4 200
3	**76,0** +2,0	0,10	2,6	0,47	0,70	580	40	11 450	5 200
3 1/2	**90,0** +2,0	0,11	2,8	0,67	1,00	580	40	17 600	8 000
4	**102,0** +2,5	0,11	2,7	0,70	1,05	500	35	19 400	8 800
6	**150,0** +3,0	0,12	3,0	1,14	1,70	525	36	35 400	16 100

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.
** Total theoretical longitudinal strength.*

mandals Flexitex Extra/Köper

Mandals Flexitex Extra and Flexitex Köper are lightweight, easy to handle yet hardwearing hoses.

Mandals Flexitex Extra/Köper are intended for use as feeder hoses for larger irrigation and slurry units in the agricultural sector, and as transfer hoses for non-flammable liquids in the construction and general industry.

Mandals Flexitex Extra/Köper are made from a blend of nitrile rubber and PVC, with added UV barrier to prevent damage from UV radiation.

The rubber blend is extruded through a circular woven reinforcement made from filament polyester yarn. This production method gives a very strong bonding between cover and lining as well as firmly encapsulating the reinforcing polyester.

Mandals Flexitex Extra/Köper have high resistance against commonly used chemicals. Because of the interlocking circular weave, the hoses do not stretch when pulled. For the same reason, they have a very high pressure rating to wall thickness ratio.

They can operate from -30°C to +75°C.
Intermittent use up to +80°C.

The hoses can be delivered in lengths up to 200 meters.

Mandals Flexitex Extra/Köper

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
3	**76,0** +2,0	0,12	3,1	0,64	0,95	725	50	17 800	8 100
3½	**90,0** +2,5	0,13	3,3	0,77	1,15	580	40	20 000	9 100
4	**102,0** +2,5	0,13	3,3	0,90	1,35	550	38	22 450	10 200
4½	**114,0** +3,0	0,13	3,3	0,94	1,40	500	35	24 650	11 200
5	**127,0** +3,0	0,13	3,3	1,14	1,70	435	30	26 850	12 200
6	**154,0** +3,0	0,15	3,8	1,48	2,20	600	42**	36 500	16 600

Maximum recommended Working Pressure: 50 % of the listed values - for temporary use. To obtain maximum lifetime of the hose, it is recommended that the Working Pressure or the Working Tensile Stress do not exceed 1/3 of the listed values.
** Total theoretical longitudinal strength.*
*** Higher Burst Pressure on request.*

Antistatica

Mandals Antistatica is an electrically conductive hose for transfer of fuels and other flammable liquids.

Mandals Antistatica is used for transfer of fuels and other flammable liquids. The hose can also be used in the construction and general industry.

Mandals Antistatica is made from a blend of nitrile rubber and PVC, with added UV barrier to prevent damage from UV radiation. The nitrile rubber blend has additives making the hose itself electrically conductive, ensuring a volume resistivity of max. 10^6 Ohm · cm.

This method of achieving conductivity removes the risk of breaking conductive wires commonly used in rubber hoses for this purpose.

The rubber blend is extruded through a circular woven reinforcement made from filament polyester yarn. This production method gives a very strong bonding between cover and lining as well as firmly encapsulating the reinforcing polyester. The hose has high resistance against commonly used chemicals.

Because of the interlocking circular weave, the hose does not stretch when pulled. For the same reason, it has a very high pressure rating to wall thickness ratio.

It can operate from -30°C to +75°C.
Intermittent use up to +80°C.

Mandals Antistatica

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Tensile Strength*	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	lbs	kg
3/4	**20,0** +1,6	0,09	2,3	0,14	0,21	1500	100	4 200	1 900
1	**25,4** +1,6	0,10	2,5	0,18	0,28	1500	100	5 100	2 300
1 1/2	**38,0** +1,6	0,09	2,2	0,20	0,30	800	55	6 400	2 900
2	**51,0** +2,0	0,09	2,2	0,25	0,38	650	45	8 350	3 800
2 1/2	**65,0** +2,0	0,09	2,2	0,35	0,53	650	45	9 200	4 200
3	**76,0** +2,0	0,12	3,1	0,64	0,95	725	50	17 800	8 100
4	**102,0** +2,5	0,13	3,3	0,90	1,35	550	38	22 450	10 200
5	**127,0** +3,0	0,13	3,3	1,14	1,70	435	30	26 850	12 200
6	**150,0** +3,0	0,12	3,0	1,14	1,70	525	36	35 400	16 100

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure and/or Working Tensile Stress do not exceed 1/3 of the above listed values.
** Total theoretical longitudinal strength.*

Mandals Guardman is a high quality fire hose made from a blend of nitrile rubber and PVC.

Mandals Guardman is a fully extruded hose where the rubber blend has been extruded through the circular woven polyester jacket, ensuring exceptionally good bonding and no delamination.

After extrusion, the hose is vulcanized and hydro tested. The hose is designed to absorb the pressure increase by swelling rather than stretching. This means increased diameter under pressure and reduced friction loss.

The special rubber blend renders Mandals Guardman light and pliable with no adverse effects on operability all the way from +70°C down to -30°C. Intermittent use up to +100°C. The rubber blend has added UV barrier to prevent damage to the rubber from UV radiation. It can tolerate most low aromatic oil products as well as commonly used chemicals.

Mandals Guardman has been chosen by the most demanding of customers over the years. Offshore oil rigs and installations in the Norwegian North Sea sector have standardized on this fire hose. So has international shipping - a proof of quality in the most demanding of markets. Mandals Guardman has been approved by a large number of national authorities and has obtained the maritime certification.

Mandals Guardman is tested in accordance with:
- NS 4016 - 4018
- SS 2840
- DIN 14811
- NEN 2242
- BS 6391 type 3

Standard lengths:
In meters: 15 - 20 - 25 - 30 - 60
In feet: 50 - 75 - 100 - 200

Lengths up to 200 meters on request.

Mandals Guardman

Inner Diameter		Wall Thickness		Weight		Burst Pressure	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar
1	**25,4** +1,6	0,10	2,5	0,18	0,28	1500	100
1 1/2	**38,0** +1,6	0,09	2,2	0,20	0,30	800	55
4	**2,0** +1,6	0,09	2,2	0,20	0,31	725	50
1 3/4	**45,0** +1,6	0,09	2,2	0,24	0,36	725	50
2	**51,0** +2,0	0,09	2,2	0,25	0,38	650	45
2 1/2	**65,0** +2,0	0,09	2,2	0,35	0,53	650	45
3	**76,0** +2,0	0,10	2,6	0,47	0,70	580	40
3 1/2	**90,0** +2,0	0,11	2,8	0,67	1,00	580	40
4	**102,0** +2,5	0,11	2,7	0,70	1,05	500	35
6	**150,0** +3,0	0,12	3,0	1,14	1,70	525	36

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure does not exceed 1/3 of the above listed values.

mandals SINCE 1775 Mertex

Mandals Mertex is an uncovered, fully synthetic polyester fire hose with a TPU inner lining.

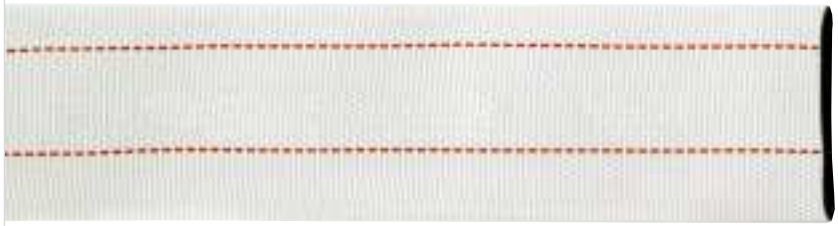
Mandals Mertex is a circular woven hose with an extruded inner lining of thermoplastic polyurethane (TPU). The hose is very lightweight yet rugged with good mechanical properties. Mandals Mertex has excellent performance under all climatic conditions from -50°C to +75°C. Intermittent use up to +80°C. Mandals Mertex is manufactured in accordance with BS 6391 type 1. The hose has obtained the maritime ⎈ certification. The hose can be delivered in continuous lengths.

Mandals Mertex

Inner Diameter		Weight		Burst Pressure	
inch	mm	lbs/ft	kg/m	psi	bar
1 1/2	**38,1** +1,6	0,13	0,190	870	60
2	**51,5** +2,0	0,18	0,270	800	55
2 1/2	**64,5** +2,0	0,23	0,350	725	50

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure does not exceed 1/3 of the above listed values.

mandals SINCE 1775 Martex



Mandals Martex is an uncovered, fully synthetic polyester fire hose with an EPDM inner lining.

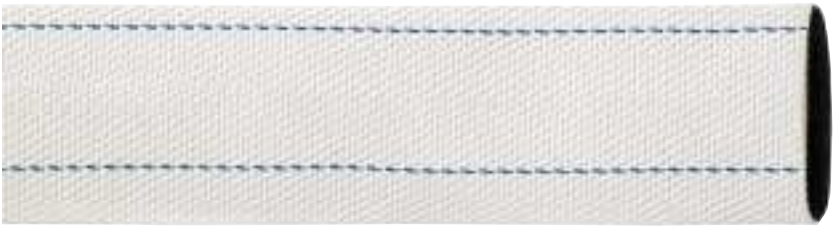
Mandals Martex is an uncovered fully synthetic fire hose made from circular woven polyester with an inner lining made from EPDM rubber. The circular woven polyester is robust and does not rot when wet for extended periods. The hose is very lightweight and ideal for use where hoses have to be manhandled over longer distances. Mandals Martex is excellent under all climatic conditions and can be used in a temperature range from -40°C to +90°C. Mandals Martex is produced and tested in accordance with NS 4016 – 4018 and BS 6391 type 1. The hose has been approved by a number of national authorities and has obtained the maritime ⎈ certification. The hose can be delivered in continuous lengths.

Mandals Martex

Inner Diameter		Weight		Burst Pressure	
inch	mm	lbs/ft	kg/m	psi	bar
1 1/2	**38,0** +1,6	0,14	0,210	1 015	70
1 3/4	**45,0** +1,6	0,17	0,250	940	65
2	**51,0** +2,0	0,19	0,290	725	50
2 1/2	**65,0** +2,0	0,25	0,380	725	50

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure does not exceed 1/3 of the above listed values.

mandals Getex



Mandals Getex is an extremely lightweight uncovered, fully synthetic polyester fire hose with an EPDM inner lining.

Mandals Getex is an uncovered fully synthetic fire hose made from circular woven polyester with an inner lining made from EPDM rubber. The hose has good chemical resistance against common chemicals.

Mandals Getex remains flexible and easy to handle under most climatic & temperature conditions. It can be safely used from -40°C to +90°C. The hose can be delivered in continuous lengths.

Mandals Getex

Inner Diameter		Weight		Burst Pressure	
inch	mm	lbs/ft	kg/m	psi	bar
1	**25,4** +1,6	0,08	0,120	1 015	70
1 1/2	**38,0** +1,6	0,12	0,180	870	60
2	**51,0** +2,0	0,18	0,270	725	50
2 1/2	**65,0** +2,0	0,21	0,320	650	45
3	**76,0** +2,0	0,27	0,400	650	45
4	**102,0** +2,0	0,43	0,650	510	350

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure does not exceed 1/3 of the above listed values.

mandals Formtex

Mandals Formtex is a semi-rigid, extremely lightweigth, smooth fire hose.

Mandals Formtex meets the demand for extra light and easy-to-handle hoses used in for instance hose reel cabinets and fire trucks. The weight is only 1/3 of conventional rigid rubber/pvc hoses used for this application. The polyester outer cover ensures that the friction to floors or other surfaces is kept at a minimum.

The circular woven design combines high pressure rating and strength with very easy handling. The lining is made from EPDM rubber with good chemical and ozone resistance. Formtex can be delivered in continuous lengths up to 600 meters.

Mandals Formtex is approved according to EN 694.

Mandals Formtex

Inner Diameter		Wall Thickness		Weight		Burst Pressure		Bending Diameter	
inch	mm	inch	mm	lbs/ft	kg/m	psi	bar	inch	mm
3/4	**19,0** +1,6	0,10	2,5	0,10	0,15	2 320	160	4,72	120
1	**25,0** +1,6	0,10	2,5	0,15	0,23	2 175	150	5,51	140
1 1/4	**32,0** +1,6	0,10	2,5	0,17	0,25	1 740	120	5,90	150
1 1/2	**38,0** +1,6	0,10	2,5	0,22	0,33	1 600	110	9,84	250

To obtain maximum lifetime for the hose, it is recommended that actual Working Pressure does not exceed 1/3 of the above listed values.

Couplings & Accessories

Mantex HP hose

Mandals can supply the most commonly used fire hose couplings in Europe. Similarly, we carry stock of compressed air claw couplings for the industrial sector in addition to certain couplings for the agricultural sector.

We can wire whip the couplings for fire hoses or assemble claw couplings, Bauer, Cam-lock, Storz etc. for our hoses. We also carry out the pressure testing and will issue certificates on request.

For our Mandals Wellman we carry the complete stock of couplings needed for your installation.

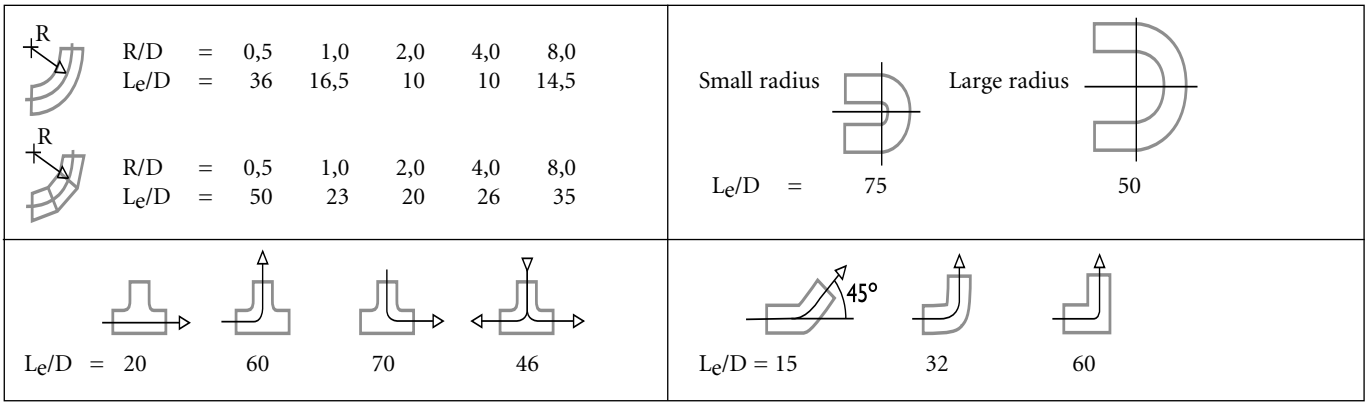
For special projects we can assemble couplings up to 12”/305 mm, and will carry out special requests such as adding burst- or reflective sleeves to the hose.

Some couplings are made according to our specifications, whereas the major part is sourced through the leading suppliers in Europe. Please feel free to ask for quotations on any type of couplings, even those not mentioned here.

Assembly of Storz coupling to Guardman hose

Pressure drop in hoses

The flexible lay flat hose will swell in diameter when pressureized, causing a lower pressure drop than compared to a rigid hose. The data is based on internal hose diameter, and the actual pressure drop is therefore some lower. Variables such as fittings and bends increase the frictional losses and an estimate of their effect may be determined by adding an "equivalent length" to the hose length. Values of the equivalent length (L_e) may be determined using the internal diameter (D) of the hose in the following relationship:



Pressure drop (Bar/100m) water at 20°C through hose

Flow rate Q [l/min]	Hose Internal Diameter, D											
	1" 25mm	1 1/2" 38mm	2" 51mm	2 1/2" 65mm	3" 76mm	3 1/2" 90mm	4" 102mm	5" 127mm	6" 152mm	8" 203mm	10" 254mm	12" 305mm
50	1,15	0,14										
100	4,61	0,56	0,12									
150	10,37	1,26	0,27	0,08								
200		2,23	0,48	0,13	0,06							
300		5,03	1,08	0,30	0,13	0,06						
400		8,94	1,92	0,54	0,24	0,10	0,05	0,05				
500			3,00	0,84	0,37	0,15	0,08	0,08				
1 000				3,37	1,49	0,62	0,32	0,10	0,04			
2 000					5,97	2,47	1,28	0,41	0,16	0,04		
3 000						5,55	2,89	0,92	0,36	0,08		
4 000							5,14	1,64	0,64	0,14		
5 000								2,56	1,00	0,22		
8 000								6,56	2,57	0,57	0,18	
10 000									4,02	0,89	0,28	0,11
15 000										2,01	0,63	0,24
20 000											1,11	0,43

Note: (1) Pressure drop is directly proportional to the length of hose.
(2) Pressure drop is dependent on inlet pressure (i.e. actual diameter, D) and Flow Rate given by proportional factor (Q^2/D^5).

Pressure drop of air through rubber hose

Hose int. Dia.	Flow rate Q [l/min] of free air											
	500	1 000	1 250	2 000	2 750	3 500	4 250	15 000	20 000	30 000	50 000	90 000
3/4" 20mm		2,15	3,50	8,95	17,25	27,45						
1" 25mm				2,00	4,65	7,55	11,00					
1 1/2" 38mm					0,45	0,75	1,35					
2" 51mm								3,85	6,80	15,30	42,30	
2 1/2" 65mm								1,60	2,70	5,65	16,30	52,70
3" 76mm										2,15	5,20	16,75

To obtain frictional pressure loss in (Bar/100m) devide above values by the Ratio of Compression listed here:

(Bar) W.P	4,0	5,0	6,0	7,0	8,0	9,0	10,0
Ratio of Compression	3,90	4,90	5,90	6,90	7,85	8,85	9,85

Chemical Resistance

E	recommended; little or no effect on hose compound, suitable for continuous service.
G	recommended; minor effect on hose compound, may be suitable for continuous service, suitable for intermittent service.
C	conditional or questionable; moderate to severe effect on hose compound, may be suitable for limited applications.
X	not recommended.
I	no data available.

	EPDM	Nitrile	Urethan
acetaldehyde 50%	G	X	X
acetic acid. Glacial	G	C	X
acetic acid 30%	G	G	X
acetic anhydride	C	C	X
acetone	G	X	X
acetyl chloride	X	X	X
acetylene	G	E	X
adipic acid	G	E	I
aluminum acetate	G	G	X
aluminum chloride	G	E	C
aluminum fluoride	G	E	C
aluminum hydoxide	I	I	I
aluminum nitrate	G	E	C
aluminum sulfate	G	E	X
ammonia anhydrous	Use anhydrous ammonia hose only		
ammonia gas (cold)	G	E	C
ammonia gas (hot)	C	X	X
ammonium carbonate	G	X	X
ammonium chloride	G	E	E
ammonium hydroxide	G	G	X
ammonium nitrate	G	E	X
ammonium nitrite	G	E	I
ammonium phosphate	G	E	I
ammonium sulfate	G	E	E
amly acetate	X	X	X
amyl alcohol	G	G	X
aniline	G	X	X
aniline dyes	G	X	X
aniline hydrochloride	C	G	X
animal fats	C	E	E
arsenic acid	G	E	C
arsenic trichloride	X	E	I
asphalt	I	G	G
barium chloride	G	E	E
barium sulfate	G	E	E
barium sulfide	G	E	E
beer	G	E	G
benzene	X	X	C
benzoic acid	X	C	I
benzyl alcohol	G	X	X
benzyl benzoate	C	X	I
benzyl chloride	X	X	X
boric acid	G	E	E
brine	G	E	G
bromine-anhydrous	X	X	X
bromine trifluoride	X	X	X
bromine water	G	X	X
bromotoluene	X	X	I
bunker oil	X	E	G
butadiene	X	X	X
butane	X	E	E
butter	G	E	E
butyl acetate	X	X	X
butyl alcohol	C	E	X
butyl aldehyde	C	X	I
butyl amine	G	C	X
butyl benzoate	C	X	I
butyl cellosolve	G	C	X
butyl stearate	X	G	I
calcium acetate	G	G	X
calcium bisulfite	X	X	E
calcium carbonate	E	E	I
calcium chloride	G	E	E
calcium hydroxide	G	E	E
calcium hypochlorite	G	G	X
calcium nitrate	G	E	E
calcium sulfide	G	E	E
carbitol	C	G	X
carbolic acid (phenol)	C	X	C
carbon bisulfite	X	C	I
carbon dioxide	C	E	E
carbonic acid	G	G	E
carbon monoxide	G	E	E
carbon tetrachloride	X	C	X
carbon tetrafluoride	I	I	E
castor oil	C	E	E
caustic soda (sodium hydroxide)	G	G	C
cellosolve	C	X	I
cellosolve acetate	C	X	X
chlorine (dry)	X	X	X
chlorine (wet)	X	X	X
chlorine dioxide	X	X	X
chloroacetone	G	X	X
chloroacetic acid	G	X	X
chlorobenzene	X	X	X
chlorobutadiene	X	X	X
chloroform	X	X	X
chlorotoluenen	X	X	X
chrome plating solutions	C	X	I
chromic acid	G	X	X
citric acid	G	E	G
cobalt	G	E	I
coconut oil	X	E	G
cod liver oil	G	E	E
coke oven gas	X	X	X
copper acetate	G	G	X
copper chloride	G	E	E
copper cyanide	G	E	E
copper sulfate	G	E	E
corn oil	X	E	E
cottonseed oil	C	E	E
creosote (coal tar)	X	E	X
cresol	X	X	X
cresylic acid	X	X	X
cumene	X	X	I
cyclohexane	X	E	G
cyclohexanol	X	C	I
cyclohexanone	G	X	X
p-cymene	X	X	I
decalin	X	X	I
denatured alcohol	G	E	X
detergent solution	G	E	C
(non-hydrocarbon) diacetone	G	X	X
diacetone alcohol	G	X	X
dibenzyl ether	C	X	G
dibutyl amine	G	X	X
dibutyl ether	X	X	G
dibutyl phthalate	C	X	C
dibutyl sebecate	C	X	X
dichlorobezene	X	X	X
dichloroethylene	X	X	X
dichloro-isopropyl ether	X	X	G
diesel oil	X	E	C
diethylamine	G	G	C
diethylamine bezene	X	X	X
diethyl ether	X	X	G
diethylene glycol	G	E	X
diethyl sebecate	C	G	I
diisobutylene	G	G	I
diisopropyl bezene	X	X	I
diisopropyl ketone	G	X	X
dimethyl formamide	G	G	I
dimethyl phthalate	G	X	I
dinitrotoluene	X	X	I
dioctyl phthalate	C	C	I
dioctyl sebecate	C	X	I
dipentene	X	G	I
diphenyl - (phenylbezene)	X	X	I
dowtherm oil	X	X	C
dry cleaning fluids	X	C	X
ethane	X	E	C
ethanolamine	G	G	C
ethyl acetate	G	X	X
ethyl acetoacetate	G	X	X
ethyl alcohol (ethanol)	G	E	X
ethyl benzene	X	X	X
ethyl benzoate	G	X	X
ethyl cellulose	C	G	G
ethyl chloride	X	E	C
ethyl ether	X	C	C
ethyl formate	C	X	I
ethyl pentochloro-benzene	X	X	C
ethyl silicate	G	E	I
ethylene	C	E	I
ethylene chloride	X	X	X
ethylene chlorohydrin	C	X	X
ethylene diamine	G	E	X
ethylene dichloride	X	X	X
ethylene glycol	G	E	C
ethylene tricholoride	X	X	X
fatty acids	X	G	E
ferric chloride	G	E	E
ferric nitrate	G	E	E
ferric sulfate	G	E	E
fish oil	X	E	I
fluoroboric acid	G	E	I
fluorobenzene	X	X	I
fluorolube	G	E	I
flurosilicic acid	C	E	I
formaldehyde	G	C	X

	EPDM	Nitrile	Urethan
formic acid	G	G	X
freon, all types	Use freon hoses only		
fuel oil	X	E	G
furfural	G	X	C
gallic acid	G	G	X
gasoline	X	E	G
gelatin	G	E	C
glucose	G	E	C
glycerine	G	E	E
glycols	G	E	C
green sulfate liquor	G	G	E
hexane	X	E	G
hexyl alcohol	X	E	X
hydraulic oil (petroleum)	X	E	E
hydrobromic acid	G	X	X
hydrochloric acid 37%	G	C	X
hydrocyanic acid	G	G	I
hydrocyanic acid-(conc.) cold	G	X	X
hydrofluoric acid-anhydrous	G	X	X
hydrofluosilic acid	C	E	I
hydrogen gas	G	E	E
hydrogen peroxide 10%	I	I	I
hydrogen peroxide >10%	I	I	I
iodine	X	X	I
isobutyl alcohol	G	G	X
isooctane	X	E	G
isopropyl acetate	C	X	X
isopropyl alcohol	G	G	C
isopropyl chloride	X	X	X
isopropyl ether	X	G	G
kerosene	X	E	G
lacquer solvents	X	X	X
lactic acid (cold)	G	E	I
lard	C	E	E
lavender oil	X	G	X
lead acetate	G	G	X
lead nitrate	G	E	I
lead sulfamate	G	G	I
linseed oil	X	E	G
liquefied petroleum gas	X	E	E
lubricating oils - (petroleum)	X	E	G
lye	G	G	X
lye solutions	E	I	I
magnesium chloride	G	E	E
magnesium hydroxide	G	G	X
magnesium sulfate	G	E	E
maleic acid	G	X	I
maleic anhydride	C	X	I
malic acid	G	E	I
merculy	G	E	G
mesityl oxide	C	X	X
methane	X	E	C
methyl acetate	G	X	X
methyl alcohol (methanol)	G	E	X
methyl bromide	X	X	X
methyl butyl ketone (propyl acetone)	G	X	X
methyl cellosolve	C	G	X
methyl chloride	X	X	X
methyl ethyl ketone - (mek)	C	X	X
methyl isobutyl ketone	C	X	X
methyl oleate	C	X	I
methylene bromide	X	X	I
methylene chloride	X	X	I
milk	G	E	X
mineral oil	X	E	E
monochlorobenzene	X	X	X
monoethanolamine	G	X	I
monomethylether	X	E	I
monovinyl acetylene	G	E	I
naphtha	X	G	C
naphthalene	X	X	G
napthenic acid	X	G	I
natural gas	X	E	G
nickel acetate	G	G	X
nickel chloride	G	E	C
nickel sulfate	G	E	C
nitric acid-conc.	G	X	X
nitric acid-dilute	G	X	C
nitrobenzene	G	X	X
nitroethane	C	X	X
nitromethane	C	X	I
nitrogen	G	E	E
nitrous oxide	I	E	I
octachlorotoluene	X	X	X
octyl alcohol	X	G	X
oleic acid	X	C	G
oleum	G	G	C
olive oil	C	E	E
o-dichlorobenzene	X	X	I
oxalic acid	G	G	I
oxygen	G	G	E
ozone	G	X	E
palmitic acid	C	E	E
peanut oil	X	E	G
perchloric acid	C	X	X
perchloroethylene	X	G	X
petroleum	X	E	G
phenol (carbolic acid)	G	X	C
phenylbezene	X	X	I
phenyl hydrazine	C	X	I
phorone	X	X	I
phosphoric acid-20%	G	G	E
phosphoric acid-80%	G	X	I
phosphoric thrichloride	G	X	I
picric acid	G	G	G
pine oil	X	E	I
polyvinyl acetate emulsion	G	I	I
potassium acetate	G	G	X
potassium chloride	G	E	E
potassium cupro cyanide	E	E	E
potassium cyanide	G	E	E
potassium dichromate	G	E	G
potassium hydroxide	G	G	X
potassium nitrate	G	E	E
potassium sulfate	G	E	E
propane	X	E	C
propyl acetate	C	X	I
propyl alcohol (propanol)	G	E	X
propyl nitrate	G	X	I
propylene	X	X	X
pyranol (transformer oil)	X	X	G
pyridine	G	X	G
salammoniac	G	E	E
salicylic acid	G	G	I
salt water	G	E	E
sewage	G	E	X
silicone greases	G	E	E
silicone oils	G	E	E
silver nitrate	G	G	E
skydrol 500 & 7000	G	X	X
soap solutions	G	E	C
soap ash	G	E	E
sodium acetate	G	G	X
sodium bicarbonate	G	E	E
sodium bisulfite	G	E	E
sodium borate	G	E	E
sodium chloride (brine)	G	E	E
sodium cyanide	G	E	E
sodium hydroxide	G	G	X
sodium hypochlorite	C	G	X
sodium metaphosphate	G	E	I
sodium nitrate	G	G	E
sodium perborate	G	G	I
sodium peroxide	G	G	X
sodium phosphate	G	E	E
sodium silicate	G	E	E
sodium sulfate	G	E	E
sodium thiosulfate	G	G	E
soybean oil	X	E	G
stannic chloride	G	E	I
stearic acid	G	G	E
styrene	X	X	C
sucrose solution	G	E	X
sulfur	G	X	I
sulfur chloride	X	C	I
sulfur dioxide-dry	E	X	I
sulfur dioxide-liquid	G	X	I
sulfur dioxide-wet	E	X	I
sulfuric trioxide	C	X	I
sulfuric acid 10%	G	C	C
sulfuric acid 10-75%	G	X	X
sulfurous acid	G	G	X
tannic acid	G	E	E
tar bituminous	X	G	I
tartaric acid	C	E	E
terpioneol	X	G	G
tertiary butyl alcohol	C	G	X
tetrachloroethylene	X	X	X
tetraethyl lead	X	G	I
totulene	X	X	X
toluol	X	X	I
transformer oil	X	E	E
transmission fluid A	X	E	E
trichloroethane	X	X	X
trichloroacetic acid	C	G	I
trichloroethylene	X	X	X
tricresyl phosphate	X	X	C
triethanol amine	G	G	X
trinitrotoluene	X	X	I
turbine oil	X	G	E
turpentine	X	E	X
vegetable oils	X	E	G
vinegar	G	G	X
vinyl chloride	X	X	X
water	G	E	G
whiskey, wine	G	E	G
white oil	X	E	E
wood oil	X	E	C
xylene	X	X	X
zinc chloride	G	E	E
zinc sulfate	G	E	I

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