

SUCTION AND BLOWER HOSE FOR AIR CONDITIONING / VENTILATION



4.6

MASTER-CLIP PUR

Material

hose wall: pure polyurethane film, free from plasticizers
external helix: galvanized steel

Applications

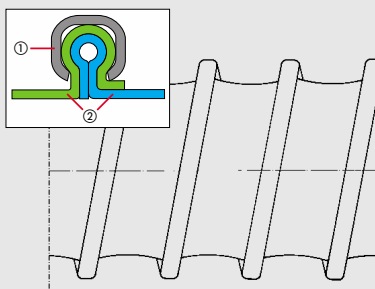
- air conditioning/ventilation
- extraction of abrasive media
- grass collectors and lawn mowers
- low pressure applications

Properties

- highly abrasion-resistant
- good resistance to mechanical damage
- good resistance to oil and gas vapors
- improved vacuum characteristics
- highly resilient
- resistant to ageing
- resistant to low temperatures
- very flexible
- extreme compressibility 1:6
- small bend radius
- external steel helix protects against abrasion
- environmentally sound alternative to PVC
- much higher temperature rating than PVC-hoses
- special clamping method guarantees high tensile strength between hose material and external helix

Construction

- ① external helix
- ② hose wall: pure polyurethane film, wall thickness ca. 0,3 mm



Temperature Range

- -40°F up to +195°F
- intermittent to +260°F

Chem. Resistance

see resistance table section no. 15

Technical Data, custom designs and forms of delivery see back page

 **Masterduct**
Member of the Masterflex-Group

MASTER-CLIP PUR

Dia. (in.)	Positive (in. w.c.)	Negative (in. w.c.)	*Bending radius (in.)	Weight (lbs./ft.)	Product code
1.6	253	60	0.96	0.2684	214-040-101
1.8	249	58	1.08	0.2684	214-045-101
2.0	241	54	1.20	0.2684	214-050-101
2.2	231	52	1.32	0.2684	214-055-101
2.4	221	50	1.44	0.3355	214-060-101
2.6	201	45	1.56	0.3355	214-065-101
2.8	161	44	1.68	0.3355	214-070-101
3.0	141	40	1.80	0.4026	214-075-101
3.2	121	36	1.92	0.4026	214-080-101
3.6	104	32	2.16	0.4026	214-090-101
4.0	92	27	2.40	0.4026	214-100-101
4.4	80	23	2.64	0.4026	214-110-101
4.8	72	21	2.88	0.4697	214-120-101
5.0	68	20	3.00	0.4697	214-125-101
5.2	60	19	3.12	0.4697	214-130-101
5.6	56	18	3.36	0.5368	214-140-101
6.0	54	18	3.60	0.5368	214-150-101
6.4	52	16	3.84	0.6039	214-160-101
6.8	48	14	4.08	0.6039	214-170-101
7.0	44	13	4.20	0.6710	214-175-101
7.2	42	12	4.32	0.6710	214-180-101
8.0	40	10	4.80	0.7381	214-200-101
8.6	36	9	6.04	0.8052	214-215-101
9.0	32	8	6.32	0.8723	214-225-101
10.0	30	6	7.00	0.9394	214-250-101
11.0	28	5	7.72	1.1407	214-275-101
12.0	24	4	8.40	1.2749	214-300-101
12.6	22	4	8.84	1.3420	214-315-101
13.0	21	4	9.12	1.4091	214-325-101
14.0	20	3	9.80	1.5433	214-350-101
15.0	16	3	10.52	1.8117	214-375-101
16.0	12	3	11.20	1.9459	214-400-101
18.0	11	2	14.40	2.3485	214-450-101
20.0	10	2	16.00	2.6169	214-500-101
22.0	10	1	17.60	2.9524	214-550-101
24.0	9	1	19.20	3.2879	214-600-101
28.0	8	1	22.40	3.8918	214-700-101
32.0	6	1	25.60	4.4957	214-800-101
36.0	4	1	28.80	5.0996	214-900-101

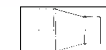
* Referring to the inner side of the elbow of hose.

The above mentioned data refers to an average and ambient temperature of 68°F. Subject to technical changes and color variations. Please refer to technical data sheet when selecting hose.

Installation and connection possibilities (see section no. 11 and 12):



CLIP-GRIP special hose clamp for MASTER-CLIP hoses



hose reducer, symmetrical



hose connector

Delivery forms:

Standard production:

- Dia. 1.6" - 36"
- Color transparent
- Production lengths 20' and 25'

Available on request:

- other colors
- special lengths
- special diameters
- custom design with other pitches and helix sizes
- external helix also in stainless steel or aluminium



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SPECIAL HOSE CLAMP FOR MASTER-CLIP HOSES



CLIP-GRIP

Material

clamp band: galvanized steel
screw casing: galvanized steel
bridge: galvanized steel

Properties

- rust resistant
- easy to install
- extra strength

Applications

- special hose clamps for securing all types of hoses from the MASTER-CLIP series on mobile and stationary units

Construction

- hose clamp with one or more worm drive(s)
- with a hexagon head screw
- with one or more spot-welded bridges



Technical Data, custom designs and forms of delivery see back page

CLIP-GRIP

For MASTER-CLIP hoses (Dia.)	Clamping range (in.)	Product code
1.52" thru 36"	1.52" thru 36"	530-038-100 thru 530-900-100

Note:

CLIP-GRIP worm drive hose clamps are only suitable for securing MASTER-CLIP hoses. We recommend our standard worm drive hose clamps or heavy duty bolted clamps for securing other spiral hoses.

Delivery forms:

Standard production:

- clamping ranges from 1.52" - 36.2"

Available on request:

- in stainless steel
- other clamping ranges
- reinforced clamps with additional bridges



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HOSE CLAMP, BOLT CLAMP



HOSE CLAMP, BOLT CLAMP

Material

clamp band: galvanized steel
screws: galvanized steel

Applications

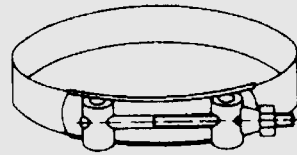
- for attaching medium-weight and heavy spiral hoses onto connecting branches on mobile and stationary units

Properties

- rust resistant
- extra strength
- band width .70" - 1.0"
- band thickness .023" - .063"

Construction

Large strip hose clamp with fastening lug



Technical Data, custom designs and forms of delivery see back page

HOSE CLAMP, BOLT CLAMP

Clamping range (in.)	Width x thickness (in.)	Product code
1.25" thru 20"	.80" x .03" thru 1.00" x .04"	621-032-115 thru 621-500-115

Note:

Heavy duty bolted clamps are suitable for the mounting of medium and heavy weight spiral hose types. For the mounting of lightweight hose qualities we recommend worm drive hose clamps.

Delivery forms:

Standard production:
● clamping ranges from 1.25" - 20"

Available on request:

- in stainless steel
- other clamping ranges



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HOSE CLAMP WITH WORM GEAR DRIVE



11.4

HOSE CLAMP WITH WORM GEAR DRIVE

Material

clamp band: galvanized steel
screw casing: galvanized steel

Properties

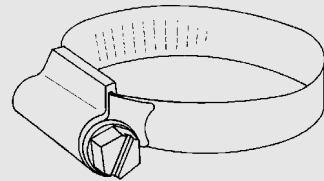
- rust resistant
- extra strength

Applications

- for attaching light spiral hoses onto connecting branches on mobile and stationary units

Construction

one-piece hose band clamps with a hexagon head screw, recessed



Technical Data, custom designs and forms of delivery see back page

HOSE CLAMP WITH WORM GEAR DRIVE

Clamping range (in.)	Product code
1" thru 20"	620-025-100 thru 620-500-100

Delivery forms:

Standard production:
● clamping ranges from 1" - 20"

Available on request:

- in stainless steel
- other clamping ranges

Note:

Worm drive hose clamps are suitable for the mounting of lightweight spiral hose types. For the mounting of heavy weight hose qualities we recommend the heavy duty bolted clamps.



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HOSE REDUCER



11.5

HOSE REDUCER

Material

galvanized steel

Applications

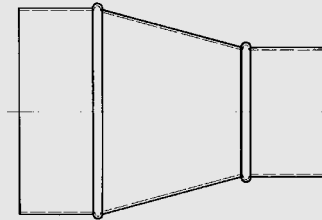
- for extending, connecting and attaching lightweight or medium weight hoses

Properties

- easy to install
- lightweight
- resistant to corrosion

Construction

reducer of rolled sheet steel with beadings on both ends



Technical Data, custom designs and forms of delivery see back page

HOSE REDUCER

(Dia. 1)	(Dia. 2)	S Ga.	L1 (in.)	L2 (in.)	Product code
3" thru 12"	2" thru 10"	24	3.5"	3"	632-080-050 thru 632-300-250

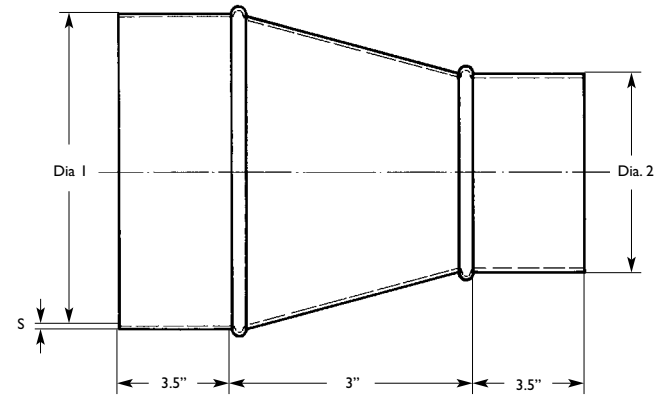
Delivery forms:

Standard production:

- galvanized steel

Available on request:

- special diameters
- stainless steel



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HOSE CONNECTOR



11.6

HOSE CONNECTOR

Material

galvanized steel

Applications

- extending, connecting and attaching lightweight or medium weight hoses

Properties

- easy to install
- lightweight
- resistant to corrosion

Construction

rolled sheet steel with beandings



Technical Data, custom designs and forms of delivery see back page

HOSE CONNECTOR

(Dia.)	Ga.	L (in.)	Product code
2" thru 36"	24	3.5"	630-050-100 thru 630-900-100

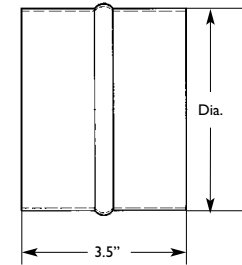
Delivery forms:

Standard production:

- galvanized steel

Available on request:

- special sizes
- stainless steel



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INFORMATION ABOUT MASTERDUCT HOSES 14.1

HOSE CONSTRUCTIONS

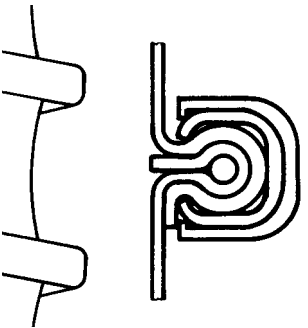
14.1.1

Hoses with an external helix

For example all MASTER-CLIP hoses, the hose-types CARFLEX 350 and CARFLEX 570.

Construction

High-tensile connection between hose material and external helix (CLIP) thanks to special clamping procedure.



Advantages
Universal possibilities of processing and combining hose material without using the manufacturing processes of adhesively bonding, vulcanising, welding or sewing.

- external steel helix protects against abrasion
- excellent flexibility
- small bend radius
- extreme compressibility
- easy installation when using CLIP-GRIP hose clamp
- continuously variable production diameters from 1.5" - 36"

14.1.2

Extruded profile hoses

For example all MASTER-PUR and MASTER-PVC hoses.

Construction

Extruded plastic profile helical, lap-welded with immovable cast spring steel wire.



Advantages

Possibilities of producing hose qualities ranging from light and highly flexible to heavy and highly vacuum-proof.

- even, symmetrical bending thanks to the solid bonding between the plastic and spring steel wire.
- smooth inside, for optimum flow characteristics
- possibility of processing the most varied kind of thermo-plastic plastics
- production diameters from 2.0" - 16.00"

14.1.3

Hoses of sheeting or coated fabric strips with set up support spiral

For example: MASTER PUR STEP- and CAR-FLEX SUPER - hose.

Construction

Sheeting or fabric strips, helical, lap-welded, with a plastic spiral.



Advantages

Variable possibility to produce hoses from different materials, films and fabric thickness.

- highly flexible
- small bend radius
- cost-effective storage
- production diameters from 2.0" - 16.00"

14.1.4

Single and multi-layer spiral hoses of vulcanised fabric strips

For example: the hose types MASTER-NEO 1, MASTER-NEO 2, MASTER-SIL 1, MASTER-SIL 2.

Construction

Vulcanised fabric strips wound and overlapping with internal free or embedded spring steel support spiral and additional external fibre string fixing.



1 - (layer)



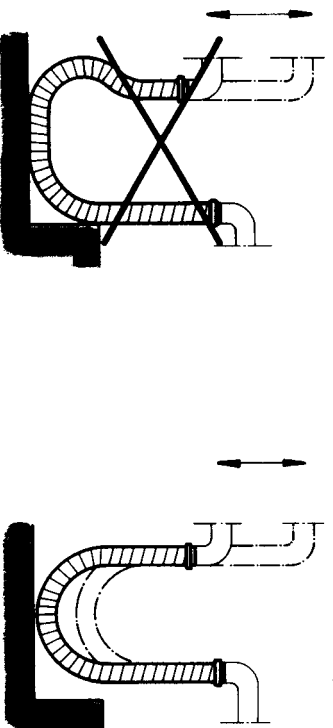
2 - (layers)

- Advantages**
- inner hose wall smooth
 - extremely flexible
 - small bend radius
 - good pressure-resistance
 - production diameters from 0.52" - 12.20"

14.2 POSITIONING OF MASTERDUCT HOSES

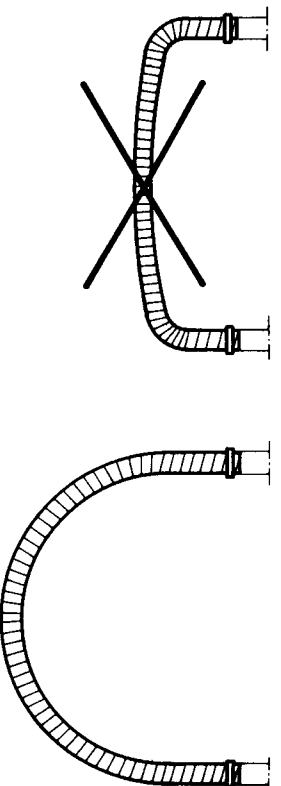
14.2

The length of individual hose types may be changed by the influencing variables of pressure, vacuum, media and ambient temperature. This must be taken into account when laying out flexible hose line in order to prevent mechanical damage occurring.



Arrange flexible hose line as freely-suspended bends in such a manner that they do not come in contact with the wall or other objects or with the ground even during extended stroke.

example 1

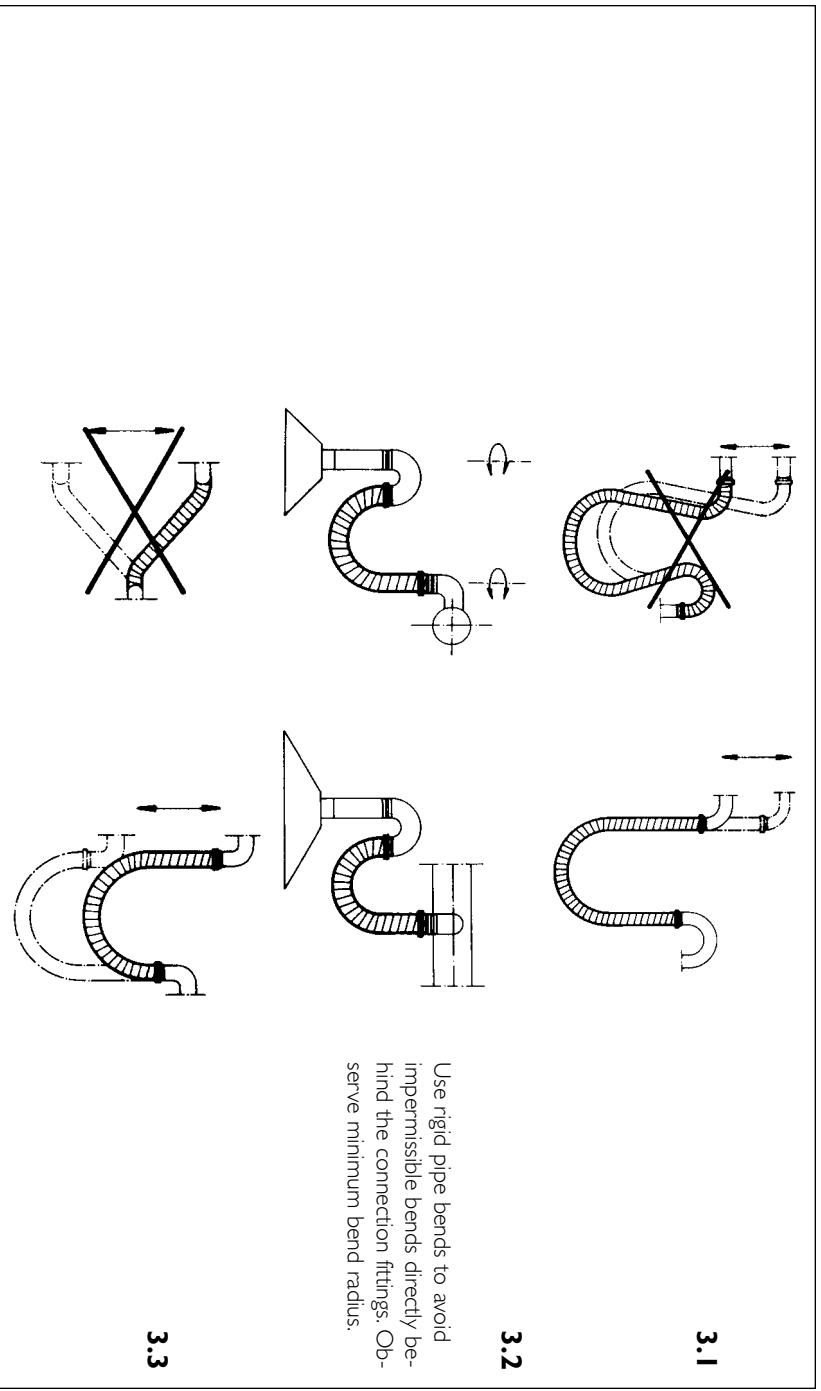


Install flexible hose line at 180° with sufficiently neutral hose ends. Decide on installation interval in accordance with the required bend radius.

example 2

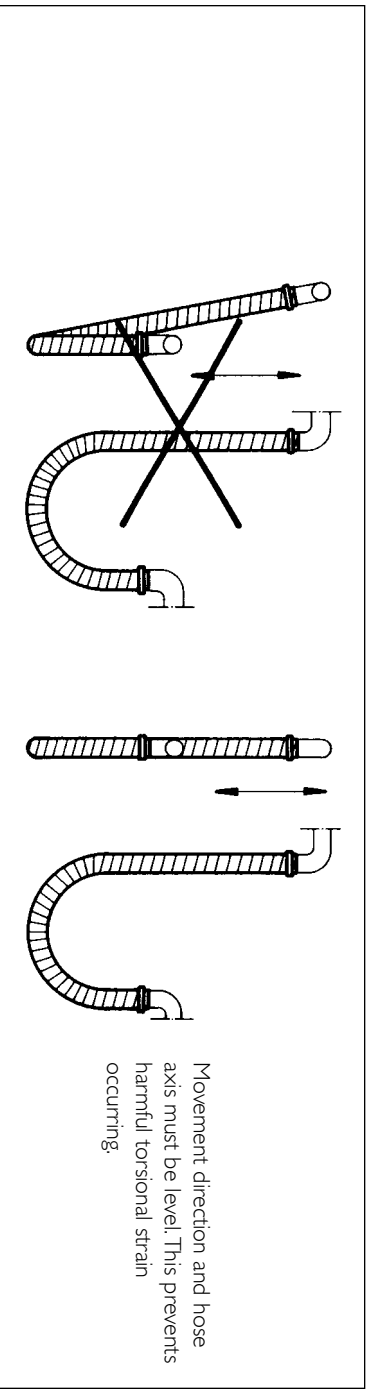
POSITIONING OF MASTERDUCT HOSES 14.2

example 3



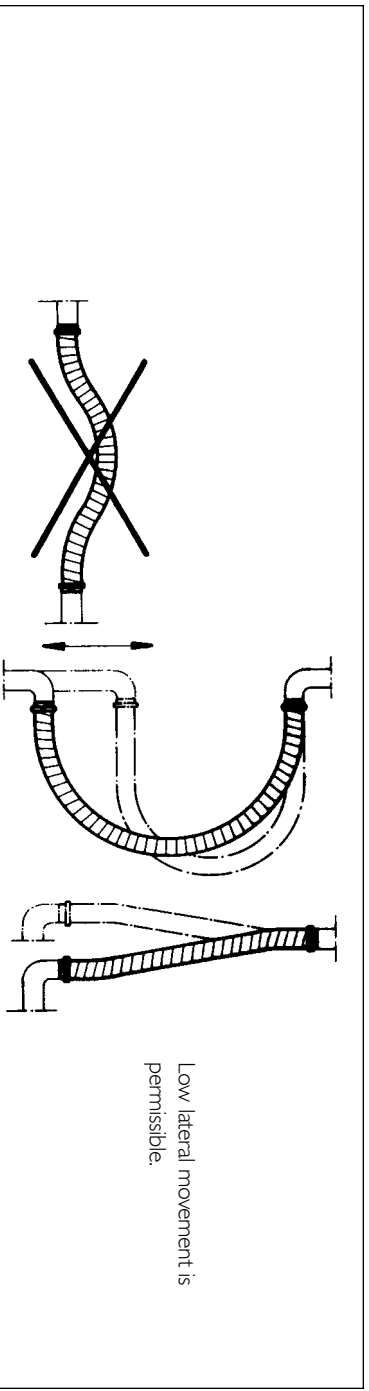
Use rigid pipe bends to avoid impermissible bends directly behind the connection fittings. Observe minimum bend radius.

example 4



Movement direction and hose axis must be level. This prevents harmful torsional strain occurring.

example 5



Low lateral movement is permissible.

1.4.3 INSTRUCTION FOR CUTTING LENGTH MASTERDUCT HOSES

1.4.3.1

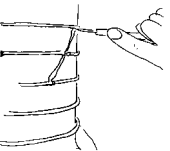
How to cut hoses with an external helix

(all MASTER-CLIP, CARFLEX 350 and CARFLEX 570 hoses)

cut the helix at first with a side cutter



using a sharp knife, cut the hose material through to the both neighbouring helix



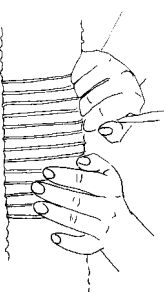
At last cut cleanly the hose material along the helix.



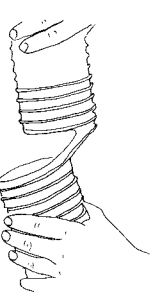
1.4.3.2

How to cut hoses with integrated reinforce-spiral of spring steel wire or plastic

using a sharp knife, cut the hose material through to the reinforce-spiral



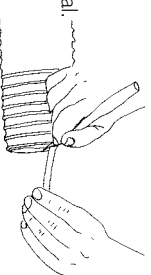
bend the both hose ends to separate the spirals



and cut the reinforce-spiral then with a side cutter



At last cut cleanly the hose material along the reinforce-spiral.



PRESSURE RATING OF MASTERDUCT HOSES 14.4

GENERAL TERMS

All catalog specifications are the result of internal tests and trials on internationally recommended standards and refer to a medium and ambient temperature of +68°F. Deviating temperatures can alter the pressure and vacuum specifications. Due to the construction, the length of individual hose types may be affected by the influencing variables of pressure, vacuum, medium and ambient temperature. This alteration in length must be taken into account by the user during operation. (Also see - positioning of MASTERDUCT hoses 14.2)

OPERATING

PRESSURE

The operating pressure is the maximum permitted overpressure at which a hose may be used.

TEST PRESSURE

The test pressure is up to 50% above the operating pressure depending on the hose construction. At the test pressure the hose may not present any leaks or lasting deformation.

BURSTING PRESSURE

Bursting pressure refers to the pressure at which the hose is destroyed. The bursting pressure serves to establish the operating pressure with due consideration to the normal safety factors.

VACUUM

Testing the vacuum withstand:

In the vacuum tests the hoses were laid in a 90° bend while maintaining the minimum bending radius and subjected to negative pressure until they showed signs of indentation or collapse. The permissible negative pressure in continuous operation is determined with due regard to the normal safety factors.

14.5 PRESSURE LOSSES OF MASTERDUCT HOSES

14.5.1

Pressure losses in hoses when stretched out

The pressure loss is the resistance to air in a hose or pipeline system. When planning a ventilation system, the air resistance which inevitably occurs must be taken into account. To simplify the determination of pressure loss, there are diagrams showing the specific pressure losses in Masterduct-hoses. The figures are average values for hoses which are stretched out straight and where the temperature is 68°F.

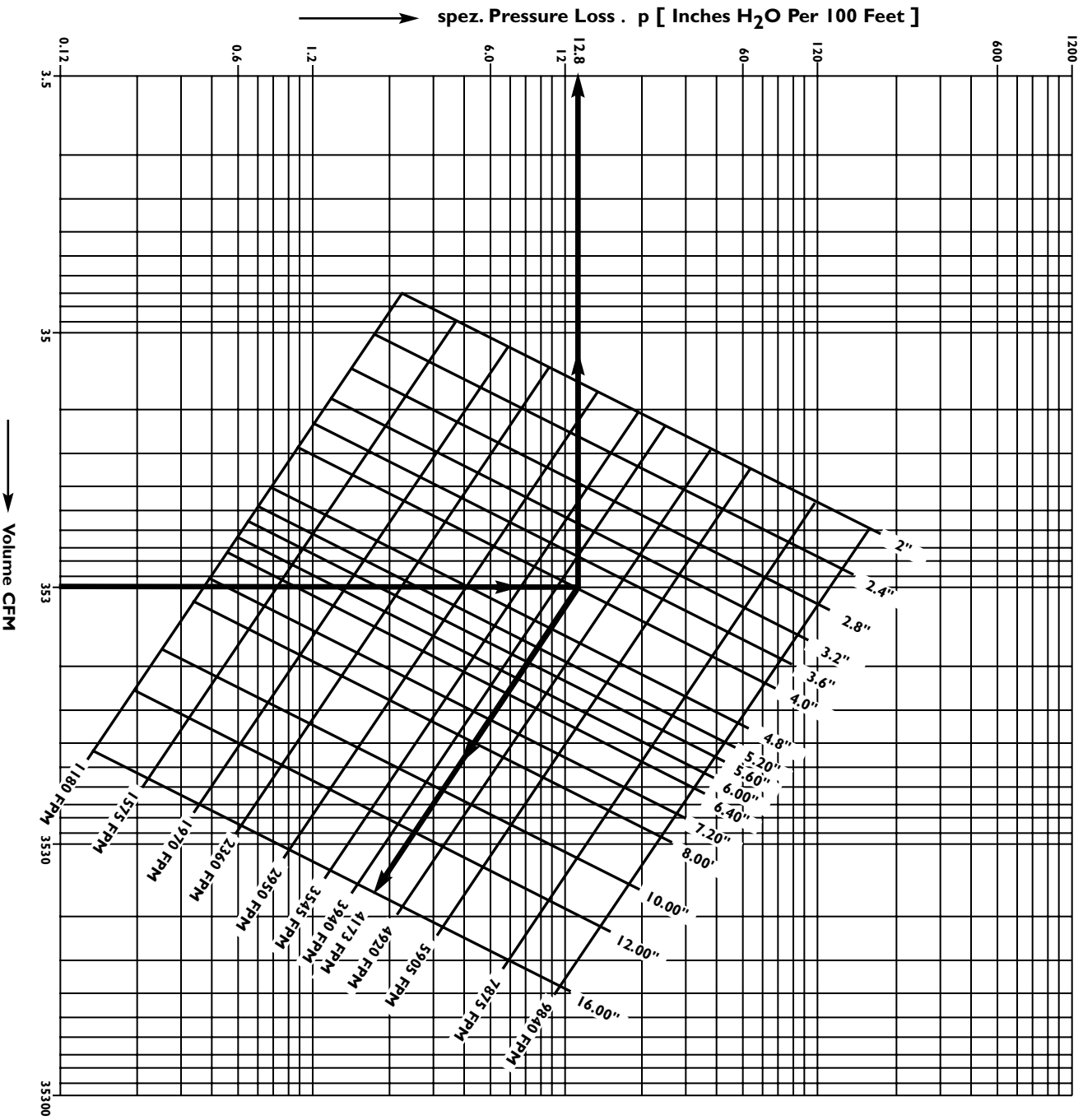


Diagram 1

2.00" - 16.00"

smooth

for following hose types:

- MASTER-PUR L
- MASTER-PUR H
- MASTER-PUR H-EC
- FLAMEX L
- FLAMEX H
- MASTER-PVC L
- MASTER-PVC H
- MASTER-NEO 2
- MASTER-SIL 2

PRESSURE LOSSES OF MASTERDUCT HOSES 14.5

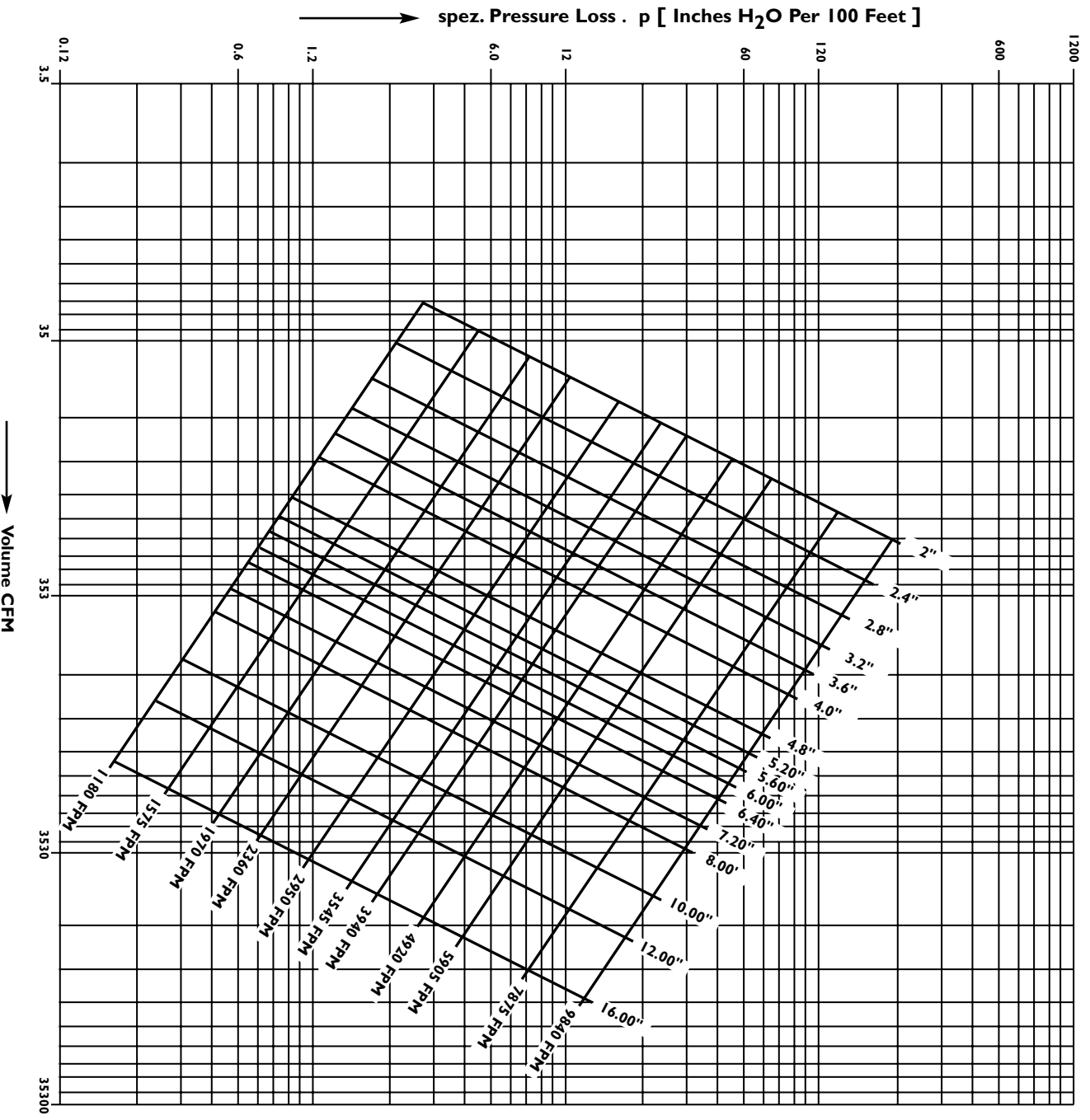
Diagram 2

2.00" - 16.00"

WAVY

for following hose types:

- MASTER-PUR SL
- FLAMEX SL
- MASTER-PVC SL
- MASTER-NEO I
- MASTER-SIL I
- CARFLEX SUPER
- MASTER-PUR STEP



14.5.1 PRESSURE LOSSES OF MASTERDUCT HOSES

Diagram 3

1.52" - 36.00"

for following hose types:

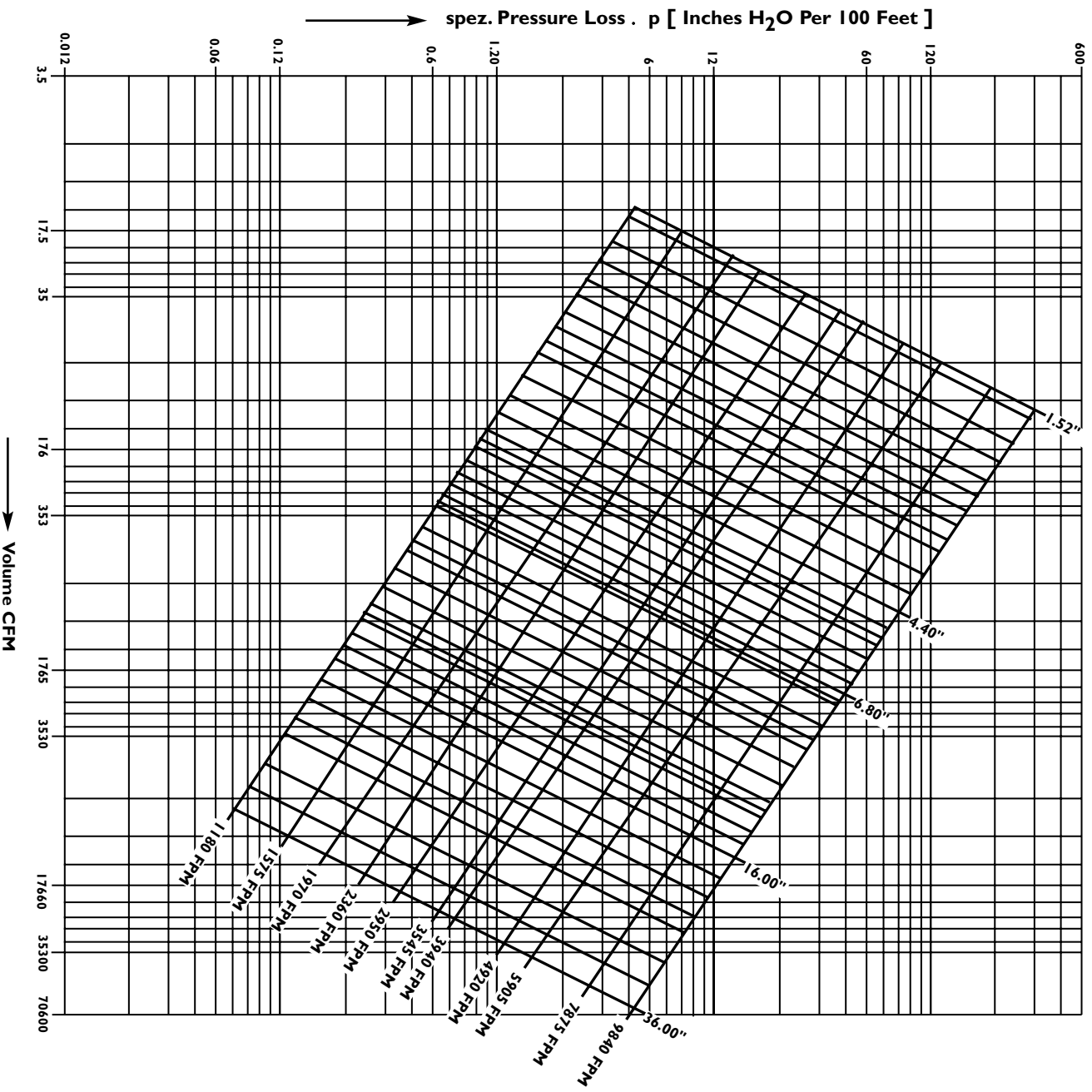
CARFLEX 350

CARFLEX 570

all MASTER-CLIP hoses except

hose constructions

loose lined



14.6.1

General points

Flexible hose lines can be a potential source of danger at pneumatic suction and conveying plants due to the building of electrostatic charges. The possibility of discharging is therefore mandatory in many areas of application to ensure safe operation. Hoses are used to transport solids, e.g. in the form of granular material, chips, dust, sand, cement etc. and also liquid and gaseous media. Electrostatic charges arise wherever solids which are non-conductive or of poor conductivity are brought into contact with other materials and separated again. As a result of the separating process one material has less electrons than the other which leads to one being positively and the other negatively charged. In the area of the common boundary surface the so-called "interfacial potential" is formed which makes spark discharge possible. There are many ways of avoiding such discharge and these are described in more detail in the following.

14.6.2

Regulations

There is a series of directives and regulations on evaluating and avoiding the risk of ignition and deciding on the safety precautions to be taken.

14.6.3

Why electrostatic charge occurs

During the transport of solid, liquid or gaseous media, the "interfacial potential" described in the above is built up due to the friction on the insides of the hose lines. Depending on the degree of charge this leads to sparking, to electric breakdown or sometimes the ignition of flammable materials. In addition to the intensity of the contact (friction) between the medium and the inner sides of the hose, the "permittivity" of the hose and the medium flowing through is decisive for the degree of chargeability. This is considered a gauge of the polarisability. Even conductive materials can become charged if not grounded.

14.6.4

Limit determination and definition

In general the following can become electrostatically charged:

- solids with a surface resistance $> 10^9 \text{ Ohm}$
- liquids with a conductivity of $< 10^{-8} \text{ s/m}$
- all objects of conductive material which are not grounded

In general the following **cannot** become electrostatically charged:

- all solid and liquid matter which fall short of the above critical resistance values
- all conductive materials which are grounded

14.6 DERIVATION OF ELECTRIC CHARGE AT MASTERDUCT-HOSES

14.6.5

Ways of connecting electrostatic charges

The surface resistance of the materials of the hose sides can be reduced to values between $10^3 - 10^4$ Ohm by incorporating conductive additives. These conductive additives form in the plastic a network of conductive particles (volume conductivity) in contact with each other. Another possibility is incorporating antistatic agents. The effect results from the absorption of water from the atmospheric humidity at the surface of the sides of the hose. Surface resistance values of 10^6 Ohm can be attained (surface resistance). Also a risk of danger is not to be expected if the distances between the turns in hoses with metal grounded support spirals do not exceed .75".

14.6.6

Note

The addition of conductive additives or antistatic agents reduces the mechanical material values (e. g. abrasion and ultimate tensile strength) and accordingly reduces service life. The information summarised under points 1-6 are based on internal and external field research and on the regulations in effect at present. They serve as guidelines for using Masterduct hose types in areas of potential danger but no guarantee is given that they are complete. The catalogue details with respect to the surface resistance are based to some extent on official test results, details supplied by our raw-material suppliers and internal measurements. In cases of doubt, we recommend testing the hoses under operating conditions or similar circumstances before final installation.

DESCRIPTION OF THE MATERIAL POLYURETHANE (TPU) 14.7

Description of the material polyurethane (TPU)

MASTERDUCT suction and conveying hoses for abrading solids are made of the high-duty material polyurethane.

Polyurethane essentially made of the reaction of three components:

- 1.) Polyole (long chain diol)
- 2.) Diisocyanate
- 3.) short chain diol

The kind of raw materials, the reaction conditions and the initial materials are responsible for the product characteristics.

The using Polyole determine the characteristics of thermoplastic polyurethane quite essentially. Either polyester-polyole or polyether-polyole are used for polyoles.

14.7.1

Mechanical properties Resistance to further tearing

The term resistance to further tearing refers to the resistance of a nicked test sample to further tearing. The test is carried out on corner samples, each with a cut on one side. This means that it is much more difficult to tear MASTERDUCT hoses, even when damaged, than other thermoplastic hoses (e. g. PVC hoses).

Resistance to abrasion

Abrasion in rubber and elastomers is tested on samples with a particular contact force is brought to bear on a rotating roller covered with a test emery sheet. The entire length of friction amounts to approx. 130 ft. The material consumption due to abrasive wear is measured with due consideration to the thickness of the test sample and the severity of the attack of the test emery sheet. This is indicated as loss of volume in mm³. The standard PUR raw material used by MASTERDUCT has an abrasion of approx. 30 mm³. Comparative values of raw materials used by MASTERDUCT :

- soft PVC approx. 150 mm³
- Santoprene approx. 225 mm³
- PUR-EC approx. 45 mm³

- good resistance to hydrolysis and microbes
- good to very good atmospheric corrosion
- resistance to oil, grease and solvents

Color

The inherent color lies between yellowish and white opaque and also translucent, whereby the wall thickness is a factor here. Dying is possible.

14.7.2

Thermal properties

Like all materials, TPU is subject to temperature-dependent reversible alterations in length. This is indicated by the coefficient of linear thermal expansion α [1/K] as a function of temperature. Shore hardness is also an influencing variable.

It is therefore advisable in many applications to take account of the dependence on temperature when selecting the MASTER PUR hoses. These hoses can be used in temperatures up to 260°F for short periods but a temperature of 195°F should not be exceeded for longer periods. Soft polyether-based types are flexible in temperatures down to -40°F.

14.7 DESCRIPTION OF THE MATERIAL POLYURETHANE (TPU)

14.7.3

Electrical properties

Surface resistance

The polyurethane raw material processed by MASTERDUCT has a surface resistance of 10^{10} Ohm and can therefore be used as electrically-insulating protective hoses.

Discharging electrostatic charge

We refer here to chapter 14.6.

14.7.4

Resistance to media

The suitability of a synthetic material for a particular application often depends on its resistance to chemicals. The reaction of thermoplastic polyurethane to the effects of chemical substances can vary greatly. The resistance of TPU to certain materials, e.g. cooling and lubricating agents, depends on the additives in these agents. The mechanical properties can change when in contact with such materials.

Swelling in polyurethane material is often due to the effects of the media. (See also chapter 14.8

Technical Terms and Definitions).

For TPU resistance to media see our list of resistance properties in chapter 15. For resistance to microbes: see chapter 14.8.

14.7.5

Resistance to

atmospheric corrosion

The resistance of TPU to ozone and ultraviolet radiation is good. See also chapter 14.8 for explanations. The resistance of TPU to high-energy radiation, such as α -, β -, γ -radiation is superior to that of most other plastics. The resistance of these kinds of radiation depends among other things on the dose and dose rate of the radiation, the form and dimensions of the product, and the climate and atmosphere in the location where used. Certain properties such as e.g. resistance to thermoforming and to chemical attack can be positively influenced by purposeful cross-linking as a result of high-energy irradiation with the aid of cross-linking agents.

14.7.6

Fire-resisting

behaviour

Plastics, like all organic materials, are combustible. The standard TPU we use is also inherently classifiable as such. The fire-resisting behaviour of a material is not a material property however and it is influenced by different criteria. The complexity of the influencing variables makes it impossible to give a comprehensive and generally-applicable description of the fire-resisting behaviour of plastics because the risk of burning depends on, e.g. the thickness of the walling and the form, number and lay-out of the combustible objects and other circumstances of use.

For this reason, the behaviour under fire of plastics should not be described in words or phrases which could be misinterpreted, such as "self-extinguishing" or "non-flammable", but best by code numbers or code letters which refer to a specific method of testing. MASTERDUCT hoses made of special PUR materials are flame retardant as per DIN 4102 B1. (German standard)

TECHNICAL TERMS AND DEFINITIONS 14.8

Abrasion

Undesirable alteration of the surface due to the detachment of small particles as a result of mechanical strain. This process in synthetics (and in many other materials) is generally referred to as wear. (Also see chapter 14.7 Description of the material polyurethane.)

Additives

All constituents in synthetic mixtures which are not polymers or their primary products or which are only added in relatively low quantities (e. g. conductive soot, flame proofing agents, UV-stabilising agents etc.).

Aging

The entirety of all irreversible chemical and physical processes occurring in a material over the course of time. Usually leads to a deterioration in performance characteristics. Often caused by: heat, light, high-energy radiation, chemicals, weather, oxygen (ozone).

Bend radius

The bend radius is given in inches. All figures refer to the inside of the hose bend at max. operating pressure.

Elasticity

The ability of a material to reverse alterations in shape or volume caused by outside forces or momentum.

Elastomers

Designation for wide-meshed, cross-linked macromolecular materials which can be extended to at least double of their original length under the influence of a slight force at temperatures of room temperature or higher and can resume their original shape quickly and practically completely once the deforming force has been removed.

Flame proofing agents

Are synthetic additives which reduce the flammability of plastics.

Flexibility

Effectual expenditure of energy to attain the minimum bend radius (the greater the expenditure of force, the less the flexibility).

Gas permeability

See permeability.

Halogens

The elements fluorine (F), chlorine (Cl), bromine (Br) und iodine (I) form the group of halogens.

Hardness

The resistance of one body to the penetration of another. In rubber-type material a needle is pressed with a certain spring tension into the sample. The hardness is measured by the depth of penetration (scale range 0 to 100 in Shore).

Hydrolysis resistance

Hydrolysis = irreversible breaking of the polyester chains in polyester polyurethanes. It occurs after a long period in hot water, saturation steam or a tropical climate (moisture combined with heat). The result of hydrolysis is a decrease in mechanical strength properties. Hardly any hydrolytic decomposition is observed in polyester polyurethanes at room temperatures.

Lamination

Application of a surface coating with particular properties onto foil or plates and the application of foil or sheeting onto fabric web.

Microbial resistance

Polyester-based thermoplastic polyurethanes without additional protection against microbes are at risk of decomposition caused by microbial attack. Moisture combined with heat (e. g. in nutritive surroundings such as grass, foliage, agriculture etc.) can accelerate this process. In such surroundings the microorganisms multiply very rapidly. The enzymes they release split ester compounds and destroy the synthetic part. Attack on individual points is evident first. In contrast to hydrolytic decomposition, which occurs over the entire surface. Polyester-based polyurethanes are to a large extent resistant to decomposition by microbial attack but their mechanical properties are not as good as those of comparable polyester polyurethanes.

14.8 TECHNICAL TERMS AND DEFINITIONS

Permeation

Passage of a gas through a test sample; this occurs in three stages:

1. Dissolution of the gas in the test body
2. Diffusion of the dissolved gas through the test sample
3. Evaporation of the gas from the test body

The permeation co-efficient is a material constant which indicates the volume of gas which passes through a test sample of known surface and thickness at a given partial pressure difference at a particular time. It depends on temperature.

Swelling

Absorption of liquid or gaseous matter in solids without a chemical reaction occurring between them. The results are an increase in volume and weight accompanied by a corresponding decrease in mechanical values. Once the infiltrated matter has been exhausted and swelling has decreased accordingly, the original properties of the product are almost completely restored. Swelling is therefore a reversible process.

Crushing strength

Resistance of suction and delivery hoses to compression caused by outside loads on top of them.

Resistance to further tearing

The resistance of nicked test sample to further tearing. The test is carried out on a corner sample with a cut in one side.

UV radiation

Synthetics can be chemically broken down by the effects of UV radiation depending on the duration and intensity (ageing). The resistance of polyurethanes to UV radiation is good in general but over the course of time the material turns yellow and the surface becomes slightly brittle. The results includes a slight lowering of the mechanical properties. Stabilisation against ageing can be attained with the aid of UV stabilisers and/or through colour pigmentation.

Ozone resistance

Ozone is the combination of three oxygen atoms into one molecule (O₃). It is formed by the action of high-energy ultraviolet radiation on the oxygen in the atmosphere. Due to its composition, ozone is very reactive and reacts easily with organic substances. The resistance of polyurethanes to ozone is good in general.

15.1 RESISTANCE TABLE

Chemical Resistance*	Hose wall resp. coating material	Chemical Resistance*	Hose wall resp. coating material
<p>1 = excellent resistance 2 = good resistance 3 = mediocre resistance x = not resistant</p> <p>Medium</p> <p>Chloroacetic acid: see Homodichloroacetic acid Chloroform: see Homodichlorobenzene Chlorobiphenyl (Cloprene) Chlorobromomethane Chloroalum: see Calcium chloride Chlorobromomethane Chloroethyl: see Ethyl chloride Chloroform (trichloromethane) Chloromethyl: see Friedly chloride Chloroprene Chlorosulphonic acid Chlorotene: see Trichloro-ethane Chromic acid 10% Chromic acid 25% Chromic acid 50% Chromium trioxide: see Chromic acid Circ acid¹⁾ Circ acid, aqueous Cloprene: see Chlorobiphenyl Coal tar (see also hot tar) Coconut grease and oil Compressed air: see Air, oil saturated Copper chloride, aqueous Copper chloride, aqueous Copper nitrate, aqueous Copper sulphate, aqueous (blue vitriol) Corn oil Creosote Cresol: see Cresylic acid Cresylic acid Crude petroleum, strongly aromatic Cupric hydroxide: see Mountain blue Cyankali: see potassium cyanide Cyclohexane (hexahydrobenzene) Cyclohexanol Cyclohexanon Decalin (decalhydrophthalene) Detergent, synthetic, 20 °C Developer liquids (in general) Dextrose: see Glucose Diacetone alcohol Diethyl ether Diethyl ether Diethyl ether: see Ether Diethyl sebacate Diethylamine Diethylene glycol Diethylene glycol Diethylene glycol monoethyl ether (antifrol) Diglycol: see Diethylene glycol Dimethyl ether Dimethyl formamide Dimethyl phthalate Dimethylamine Dimethylamine Diocyl phthalate Diocyl sebacate Diposone Dipropylene glycol Distilled oil:¹⁾ Disulphide of carbon Dodecyl alcohol Drilling oil determine chemical composition Eau de Javelle see Potassium hypochlorite Epidichloroethane, liquid Epsom salt, see Magnesium sulphate Esters: see individual designations Applicable in general Ethanolamine Ethane (gas) Ethanol: see Ethyl alcohol Ether (ethyl ether; diethyl ether) Ethyl acetate Ethyl acrylate Ethyl alcohol (denaturated = spirits) Ethyl benzene</p>	<p>polyurethane silicone hypalon viton Vinyl/PVC polyethylene PTFE neoprene Kapton</p>	<p>1 = excellent resistance 2 = good resistance 3 = mediocre resistance x = not resistant</p> <p>Medium</p> <p>Ethyl bromide Ethyl chloride Ethyl dichloride Ethyl ether: see Ether Ethyl glycol Ethyl glycol acetate Ethyl mercaptan Ethylene diamine Ethylene (gas) (ethylene) Ethylene glycol Ethylene oxide, liquid Fatty acids in general Fermented fruit juice¹⁾ Ferric chloride, aqueous Fluobutyric acid: see Hydrofluoric acid Fluoride of boron acid 65% Fluorine, liquid Fluorobenzene Formaldehyde Formaline (30-40% aqueous formaldehyde solution with 8-12% methyl alcohol additive) Formic acid Frensos and figines: ask for detailed user advisory Fruit juices¹⁾ Fruit pulp¹⁾ Fuming sulphuric acid: see Oleum Furfural alcohol (furfuro) Gallic acid Gasoline, aviation Gasoline, high aromatic Gasoline, low aromatic Gelatins, aqueous Glauber's acetic acid: acetic acid concentrate Glauber's salt: see Sodium sulphate Glucose¹⁾ Glue, animal Glycerine Glycerol: see Ethylene glycol pure Glycerol: determine exact designation, applicable in general Grape juice, unfermented¹⁾ Greases: see Oils and greases Gypsum: see Calcium sulphate Heating oil Heavy gasoline (white spirit, mineral turpentine): see Gasoline Helium Heptane Hexahydrobenzene: see Cyclohexane Hexahydrode Hexaline: see Cyclohexanol Hexane Hexanol = hexyl alcohol Hot, air: see Air Hot, bitumen to °C Hot, tar to °C Hydraulic oils and liquids -mineral oil based -glycol based -phosphate ester based Hydrazine Hydrazine hydrate, aqueous Hydrobromic acid Hydrochloric acid 1.5% Hydrochloric acid 38% (conc.) Hydrocyanic acid: see Prussic acid Hydrofluoric acid 10% Hydrofluoric acid 30% Hydrofluoric acid 75% Hydrofluosilicic acid, aqueous Hydrogen cyanide: see Prussic acid Hydrogen (gas) Hydrogen peroxide 10% Hydrogen peroxide 30% Hydrogen sulphide, dry Hydrogen sulphide moist Iodine tincture (5-10% alcohol iodine solution) Iron sulphate, iron vitriol, aqueous Isobutanol = isobutyl alcohol Isocetane Isooctane = iso octyl alcohol Isopentanol = isopentyl alcohol Isopropyl acetate</p>	<p>polyurethane silicone hypalon viton Vinyl/PVC polyethylene PTFE neoprene Kapton</p>

TERMS AND CONDITIONS OF SALE

I. CONDITIONS

No terms and conditions contained in any order placed with FLEXMASTER U.S.A., INC. (hereinafter "the Company") other than those stated herein shall be binding on the Company unless hereafter agreed in writing, and all orders shall be subject to the terms and conditions contained herein. If the order acknowledgement of the Company deviates from the order placed, the terms in the Company's acknowledgement shall govern unless opposed by the Purchaser within a period of one (1) week. No orders shall be binding on the Company unless acknowledged in writing by an authorized officer or agent of the Company.

II. PRICES

All prices quoted herein will be subject to the prices in effect at time of shipment. Prices are subject to change without notice. The Company will notify the Purchaser of any change in price before acceptance. All quotations for special products, pricing and/or conditions are valid for thirty (30) days unless otherwise specified. For special carton markings (one end) by floors, zones, etc., add 2% with a minimum of \$10,000 per order. For lengths shorter than maximum lengths shown on price sheets, price as catalogued section plus \$1.00 net per joint in reasonable quantities. If only one short length is ordered, it must be priced as a full 25' length.

III. TERMS OF PAYMENT

- (a) FOB factory. Unless otherwise specified, freight allowed on shipments of \$_____ Net one destination Continental U.S.A. payable in U.S. Funds. Minimum invoice charge of \$100,000 Net, Net 30 days, 1% 10th prox., net thirty (30) days.
- (b) A master or blanket purchase order must be issued for the total job, and releases made as required below. A blanket purchase order is not allowed for stock shipments. Minimum release against any master order is 500 feet. Releases under 500 feet will be invoiced according to master discount schedule and freight determined accordingly.
- (c) All orders subject to approval of credit by the Company.

IV. STANDARD WARRANTY

(a) The Company warrants its products, so far as the same is of its own manufacture, against defects in material and workmanship under normal use and service for which the product was designed for a period of ninety (90) days from date of shipment. The Company will warrant components or parts not manufactured by it only to the same extent that respective manufacturers warrant such goods, equipment, and material and their components or parts. Notwithstanding anything herein to the contrary only the manufacturer's warranty will be provided to Customer for goods, equipment, components, or parts not manufactured by the Company. ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE GOODS SOLD UNDER THIS AGREEMENT ARE HEREBY EXCLUDED UNLESS EXPRESSLY SET FORTH HEREUNDER.

(b) Products found to be defective in material or workmanship to the extent provided in Paragraph IV(a) will be replaced or repaired, at the option of the Company, if notice of such defect is provided within the above warranty period as required below. If the original product is replaced, the original product must be returned to the Company. THE COMPANY SHALL NOT BE LIABLE TO CUSTOMER OR ANY OTHER PERSONS FOR LOSS OR DAMAGE DIRECTLY OR INDIRECTLY ARISING OUT OF THE USE OF THE GOODS, FROM BREACH OF WARRANTY OR FROM ANY OTHER CAUSE; THE EXCLUSIVE REMEDY OF CUSTOMER UNDER THIS AGREEMENT BEING THE REPLACEMENT OR, AT THE OPTION OF THE COMPANY, REPAIR OF THE DEFECTIVE GOODS. IT IS THE INTENT OF THE PARTIES THAT SAID REMEDY IS THE SOLE REMEDY AVAILABLE TO CUSTOMER AND NOT CUMULATIVE OF ANY OTHER REMEDIES PROVIDED BY STATUTE OR COMMON LAW. IN THE EVENT OF A BREACH OR REPUDIATION OF THIS AGREEMENT BY THE COMPANY OR A DEFECT OR FAILURE OF THE GOODS, CUSTOMER SHALL NOT BE ENTITLED TO ANY SPECIAL OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO DAMAGES DUE TO DOWNTIME OF GOODS, RENTAL CHARGES WHILE GOODS AND/OR RELATED EQUIPMENT ARE OUT OF COMMISSION, AND INSTALLATION COSTS. Every claim made for defective products or for any other cause shall be deemed waived by Customer unless made in writing to the Company within ten (10) days of the date the defect or other cause arose.

This warranty does not obligate the Company to bear the cost of labor or transportation charges in connection with the replacement or repair of defective parts without written approval by an officer of the Company prior to the time repairs are made. The obligation under this warranty may be limited to the repair or replacement of parts f.o.b. its factory provided that, upon inspec-

tion at such point, they shall be determined by the Company to have been defective in material or workmanship.

THE REVISION OR ALTERATION OF THE GOODS BY OTHERS INCLUDING THE PURCHASER, ITS EMPLOYEES, AGENTS, OR REPRESENTATIVES WILL NEGATE ANY WARRANTY PROVIDED IN CONNECTION HERewith.

(c) Acceptance of the product from a common or contract carrier constitutes a waiver of any claim against the Company for delay or damages in transit.

V. SHIPMENT

- (a) Shipment quoted as being effective as of a particular proposal date will be confirmed upon receipt of order, subject to availability of materials and production space. The Company shall not be held responsible for any delay or failure to deliver due to causes beyond the Company's control such as labor disputes, strikes, riots, war, accident, carrier delays, fire damage to, or destruction in whole or in part, of the equipment or manufacturing facility; lack or inability to obtain raw materials, labor, fuel, parts, or supplies; or storm, fire, flood, or any act of God, or other causes beyond the Company's control.
- (b) Should significant manufacturing changes or additions be made by the Purchaser after production has begun, shipping commitments may be extended at the Company's discretion.
- (c) The place of delivery of the goods sold hereunder is the Company's place of business unless otherwise agreed in writing signed by both parties.
- (d) In the event that Purchaser rejects any of the goods sold by this Agreement, Purchaser must notify the Company of the rejection in writing within forty-eight (48) hours of delivery, and Purchaser agrees not to resell or dispose of the rejected goods in any manner and will hold the equipment without charge to the Company until the time that the Company may reasonably arrange for transportation. Should Purchaser sell the goods, the sale shall be deemed an unequivocal acceptance of the goods.
- (e) Purchaser should obtain prior written approval for any shipment to be returned to the Company by contacting the Company which will assign a returned goods authorization number. All shipments must be returned freight prepaid, or the shipments will be refused. Freight charges will be credited to the Purchaser for any returned goods found to be nonconforming. A minimum restocking charge of 25% of the sales value of the item returned will be applied to each returned item, unless the product is nonconforming. All special products manufactured by the Company are not subject to cancellation or return.
- (f) All materials are packed for domestic shipments. For special requirements or export packaging requirements, the Company must be contacted for additional information and pricing.

VI. CANCELLATION

This Contract cannot be canceled without the mutual agreement between the Purchaser and the Company. If such cancellation is agreed upon, Purchaser agrees to pay immediately all cancellation charges. Any order canceled by Purchaser after acceptance by the Company will be subject to a cancellation charge up to an amount equal to 25% of the sales value of the item canceled. All special products manufactured by the Company are not subject to cancellation or return.

VII. TAXES

The Purchaser shall pay to the Company, in addition to the purchase price, the amount of Sales, Use, Privilege, Occupation, Excise or other taxes, Federal, State, local or foreign, which the Company is required to pay in connection with sale of goods. This obligation is in addition to any such taxes which the Purchaser is required to pay in connection with the sale of goods to Purchaser. Prices quoted to Purchaser are exclusive of all such taxes.

VIII. EXCLUSIVE REMEDIES OF PURCHASER

The exclusive remedies of Purchaser are (1) the return of any nonconforming goods to the Company and the reimbursement of the purchase price from the Company or (2) the repair and replacement of nonconforming goods or parts, at the Company's option. Said remedies are the sole remedies available to the Purchaser and are not cumulative of any other remedies provided by law. Under no circumstances shall the Company be liable for incidental or consequential damages.

IX. PRODUCT REQUIREMENTS

Product data listed represents current information available and is subject to change without notice. Technical data concerning dimension, weights, and performance figures along with illustrations, and drawings are only authoritative within the context of usual technical tolerances unless expressly confirmed in writing. The Company reserves the right to introduce technical alterations at any time with no obligation to expressly point out any changes. Any particular product requirement of Purchaser should be communicated to the Company in writing and must be acknowledged in writing by the Company in order to bind on the Company.

X. PLACE OF PERFORMANCE AND JURISDICTION

The Company performs all of its duties under its contracts in the State of Texas, and all payments are due and payable in Houston, Harris County, Texas.