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The World of Thermoplastic Polyurethane Hoses and Ducting

by Peter Endres
VACUFLEX GmbH
Germany

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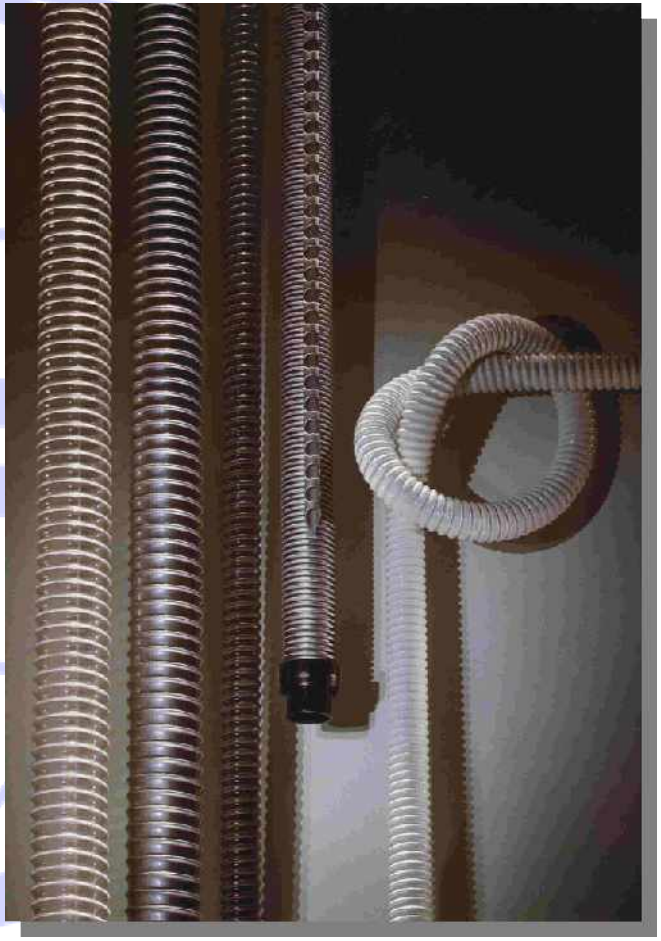
Content:

TPU – Hoses and Ducting

- Characteristics of TPU Raw Material
- Hose Constructions
- Typical Applications for TPU



Thermoplastic Polyurethane

- Characteristics of Material -

What do we know about this material?

Thermoplastic Polyurethane

- Characteristics of Material -

TPU Ester based	TPU Ether based
• One of the best material for abrasive applications • Extremely good tensile strength *(do the pencil test)* • Good temperature resistance: -40°C up to +90°C (+125°C short term) • But: Raw material is much more expensive than many materials, e.g. PVC	
• ~~Abrasion resistance up to 30% better than Ether based TPU~~ not true! • Material is less expensive than Ether based TPU	• Microbe resistance • Hydrolysis resistance • FDA certification
• ***both materials are available in / with:*** • in standard wall thickness: 0,4mm 0,6mm 0,8mm 1,0mm 1,2mm 1,5mm 1,7mm • different shore hardness (standard: Shore 85°A) • flame retardant (optional) – according to DIN 4102 B1 • antistatic or electro conductive (optional)	

Thermoplastic Polyurethane

- Characteristics of Material -

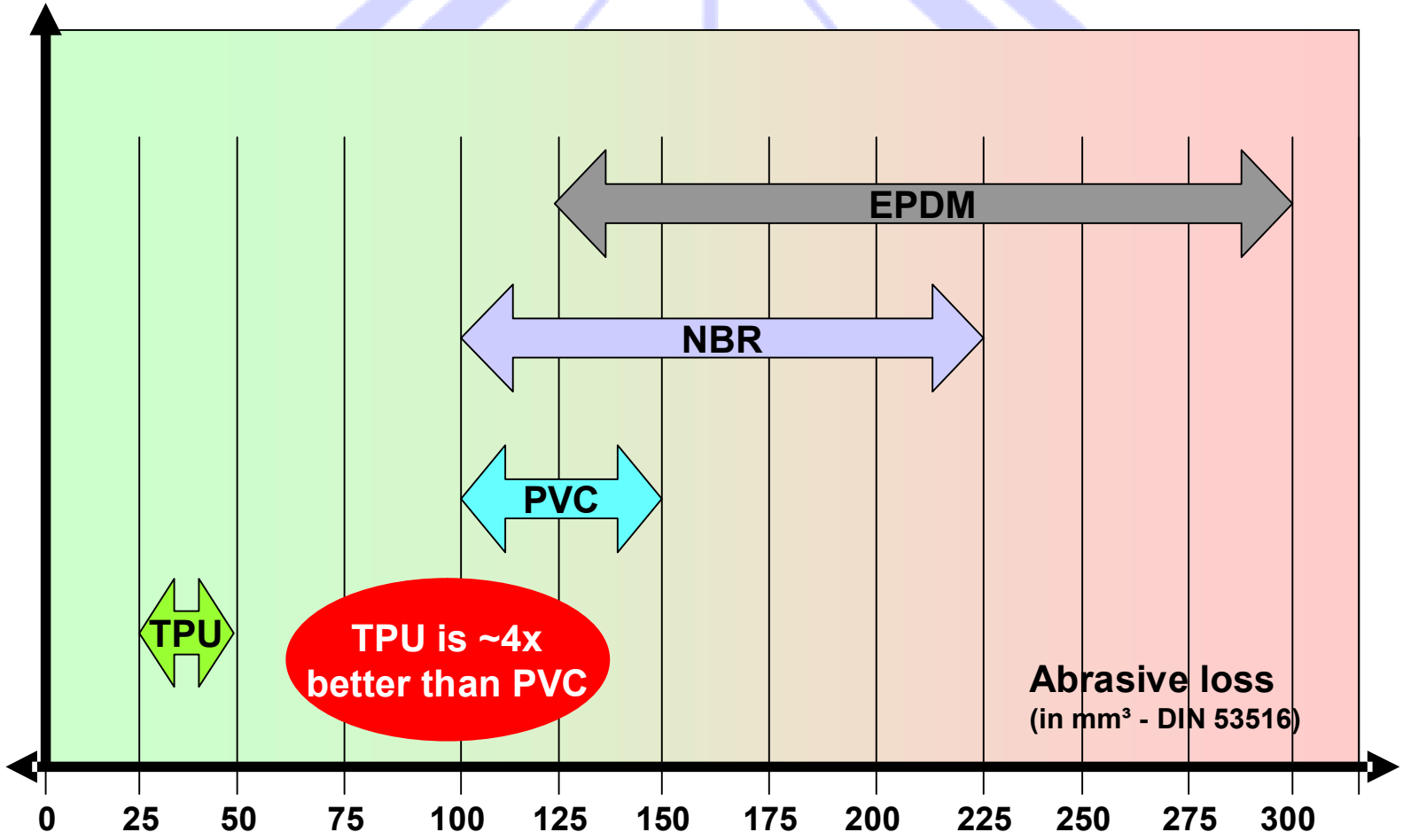
Progress of microbial degradation of polyester-based TPU

Left: reference sample
Middle: mild discolouration
Right: discolouration and distinctly visible cracks

Will not happen with Ether based TPU!

Thermoplastic Polyurethane

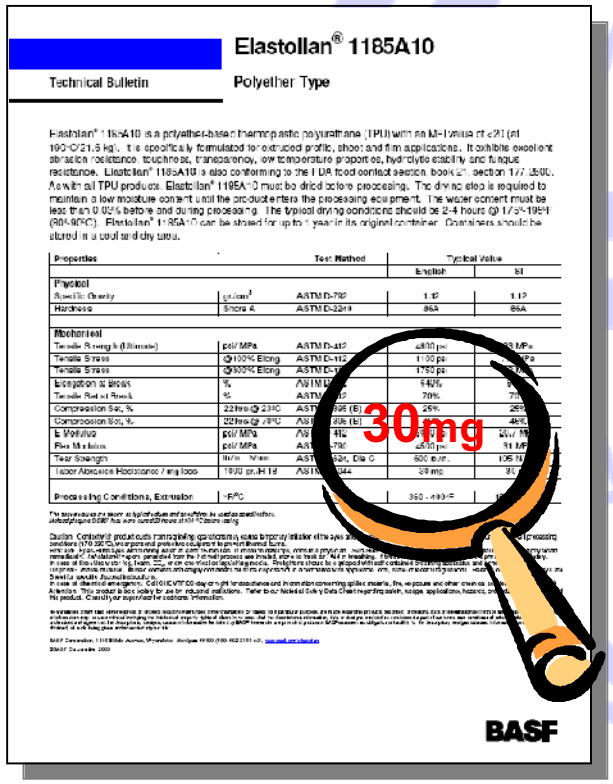
- Characteristics of Material -



Thermoplastic Polyurethane

- The truth in the Abrasion Resistance matters -

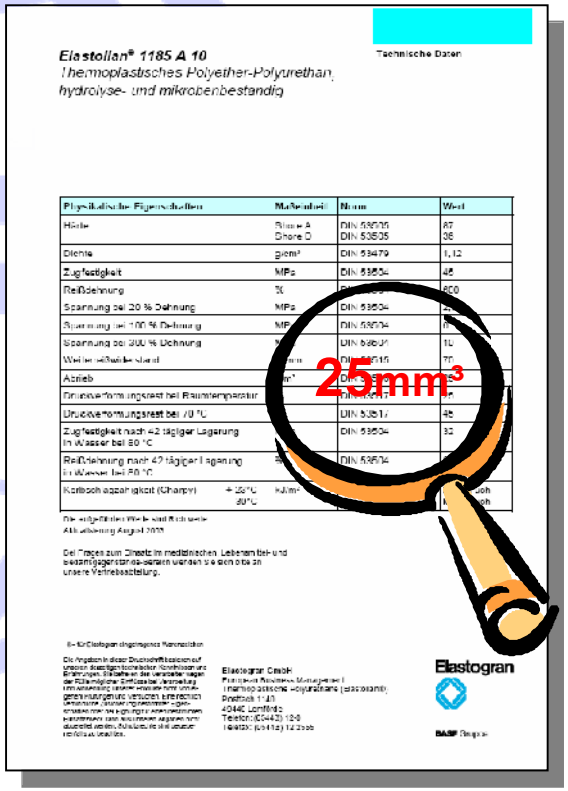
Abrasion Resistance Testing Methods in comparison (DIN 53516 vs. ASTM D-1044):



- Same Material:
  - TPU Ether based
  - Shore 85 A
  - same producer

- Different Testing Methods:
  - DIN
  - ASTM

- Different Results!



Conclusion:
Abrasion results also depend on the testing methods
=> only compare figures which are based on the same testing method

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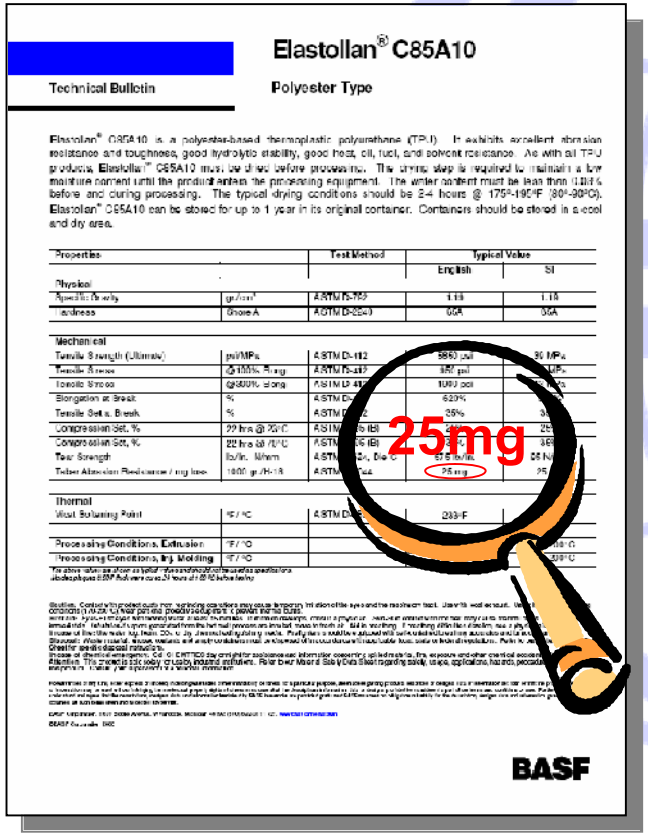
Thermoplastic Polyurethane

- The truth in the Abrasion Resistance matters -

Ether and Ester Abrasion resistance in comparison (according ASTM D-1044):



Ester based Material

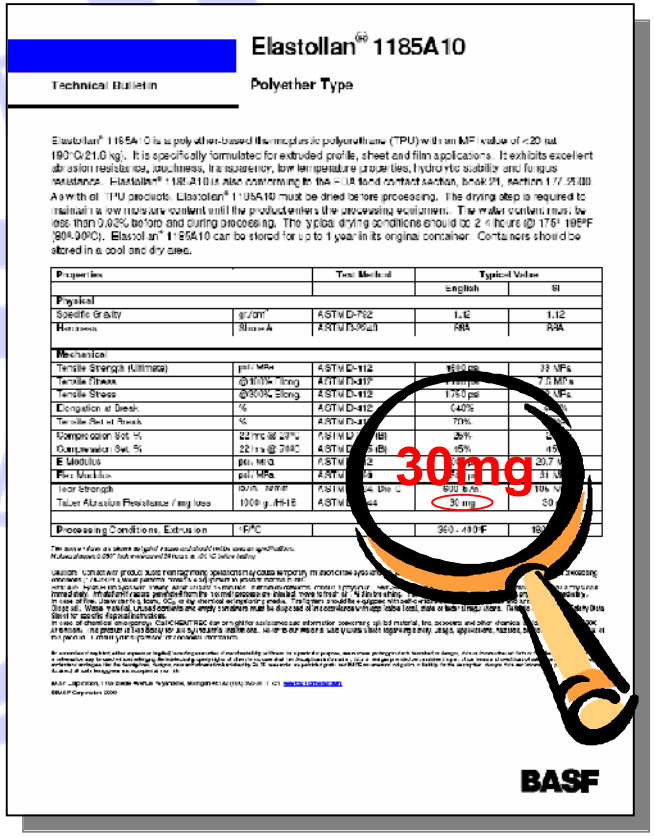
Materials with same
- shore hardness
- same producer

Testing Method
acc. ASTM D-1044

Result: 20% difference

Conclusion:
Ester material seems to be better than Ether based material!

(typical market view)

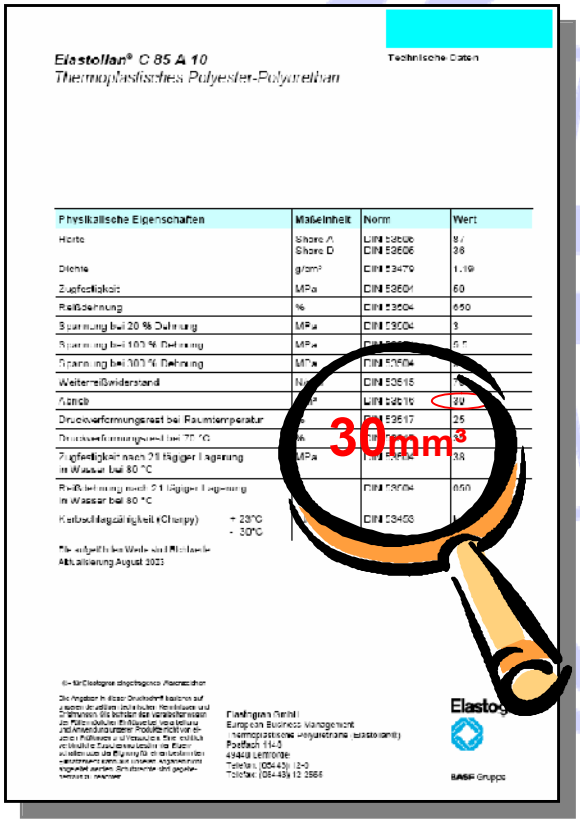


Ether based Material

Thermoplastic Polyurethane

- The truth in the Abrasion Resistance matters -

Ether and Ester Abrasion resistance in comparison (according DIN 53516):



Ester based Material

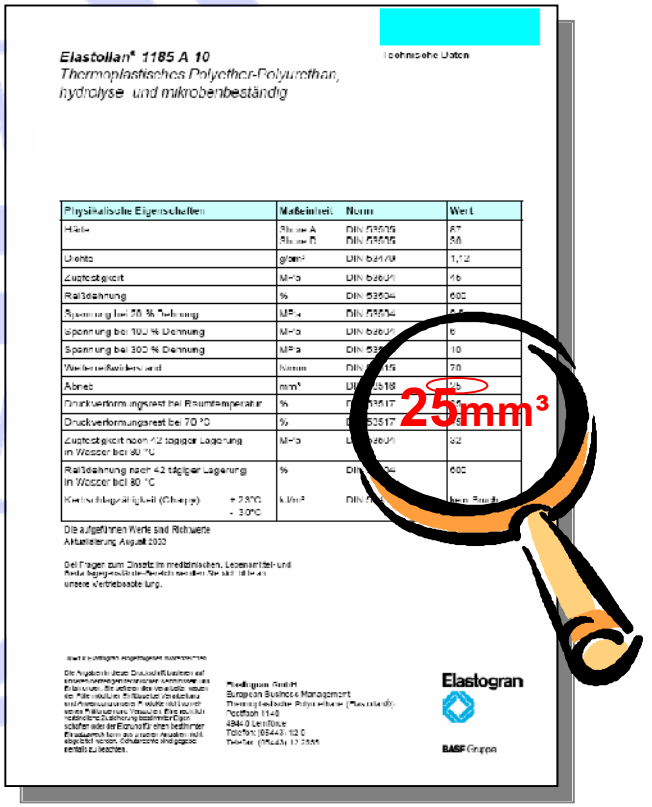
Materials with same
- shore hardness
- same producer

Testing Method
acc. DIN 53516

Result: 20% difference

Conclusion:
Here Ether material is better than Ester material!

(not expected!)



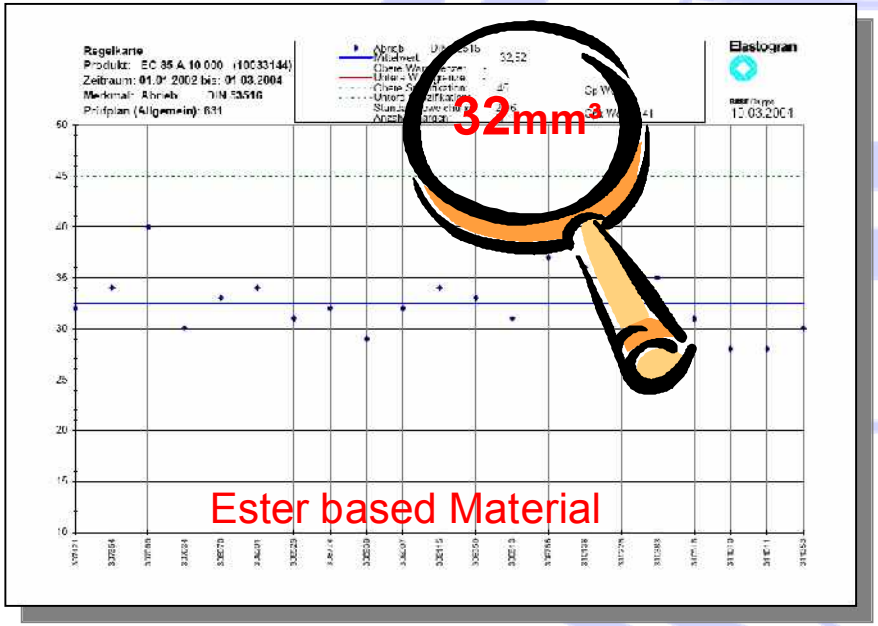
Ether based Material

Thermoplastic Polyurethane

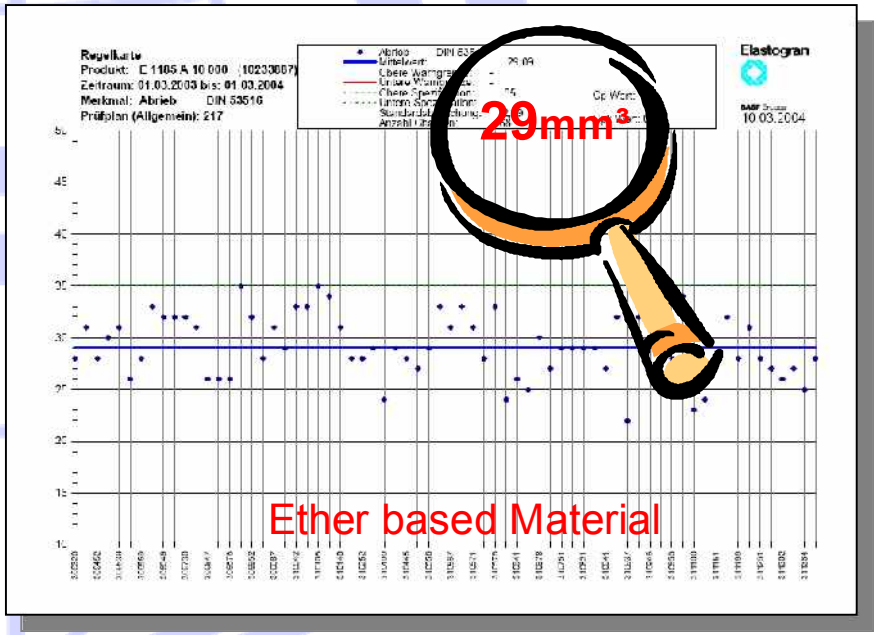
- The truth in the Abrasion Resistance matters -

Production lots regarding Abrasion resistance in comparison (according DIN 53516):

Ester based Material



Ether based Material



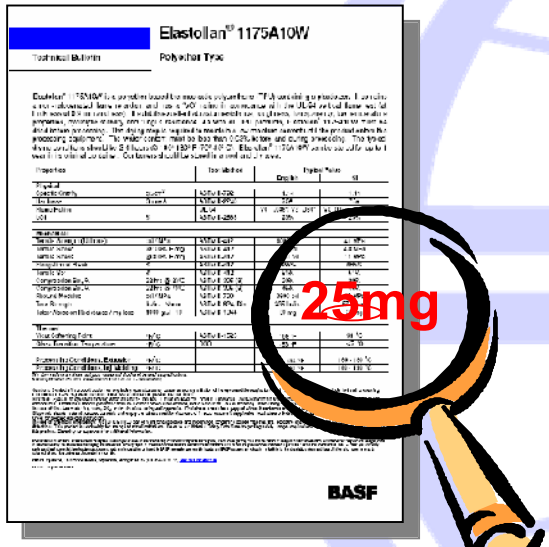
These internal production control cards (done by raw material supplier – internal information) show that there is a high variety of results which differs from production lot to production lot.

Conclusion: in general you can't say Ester is better than Ether or the other way round!

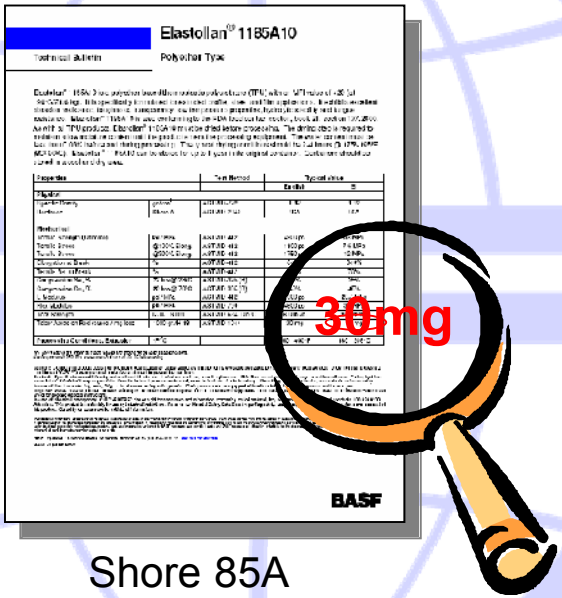
Thermoplastic Polyurethane

- The truth in the Abrasion Resistance matters -

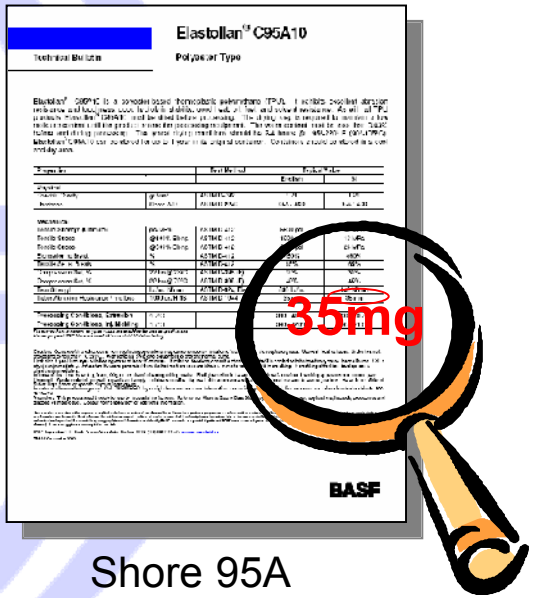
Abrasion resistance regarding the shore hardness in comparison:



Shore 75A



Shore 85A



Shore 95A

But we can say that the abrasion resistance is better the softer the TPU material is

Please note: our standard is Shore 85 A; most of the Italian manufacturs are mainly using Shore 95A (which is cheaper, if same volume of raw material has been ordered)

Thermoplastic Polyurethane

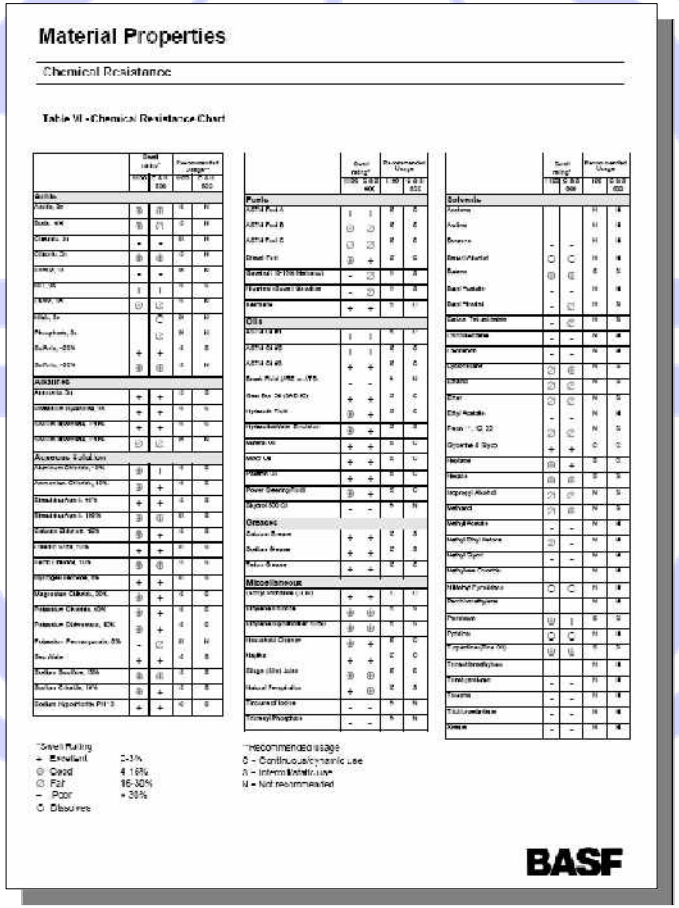
- Chemical Resistance -

Ester based TPU material is better for (C-series):

- Some aqueous solution
- Diesel fuel
- Hydraulic oil
- Hydraulic/Water emulsion
- Power steering fluid
- Household cleaner
- Heptanes
- Petroleum

Not resistant against:
- Microbes
- Hydrolysis

No approval for FDA


Material Properties

Chemical Resistance

Table VI - Chemical Resistance Chart

BASF

Ether based TPU material should be used when (=1100-series):

- risks of infection by microbes and/or

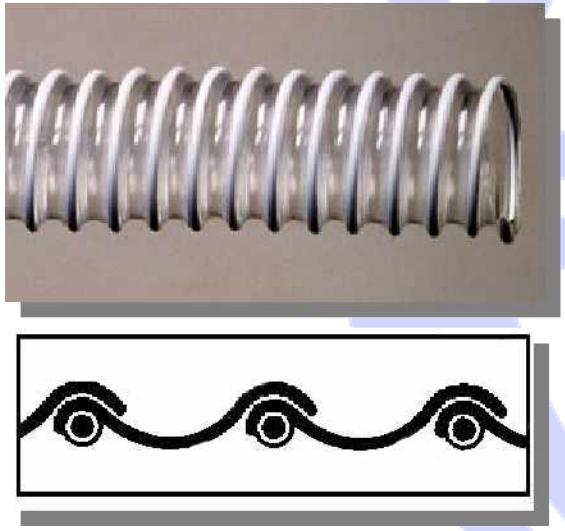
- risks of damages by hydrolysis are expected.

- FDA requirements are given

Thermoplastic Polyurethane

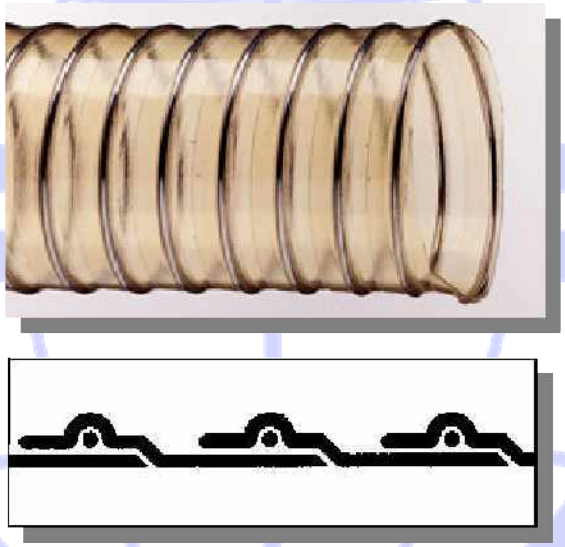
- Characteristics of different Hose Constructions -

Type: K1H-PU



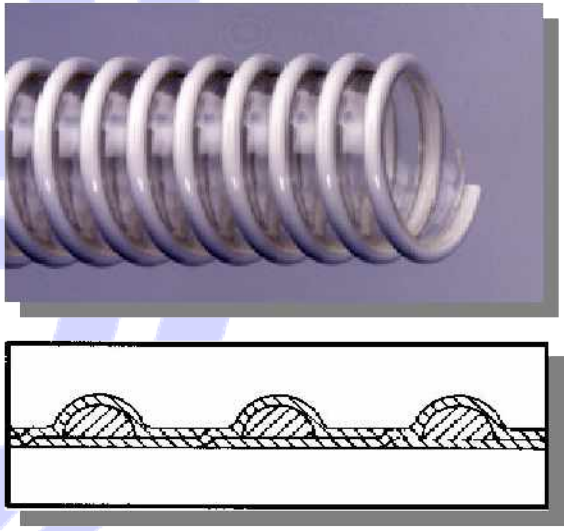
- highly flexible
- double protected for outside abrasion

Type: K1Z-PU



- flexible and smooth
- protected for internal abrasion

Type: Serie 3 PU



- extremely smooth inside
- protected for internal abrasion

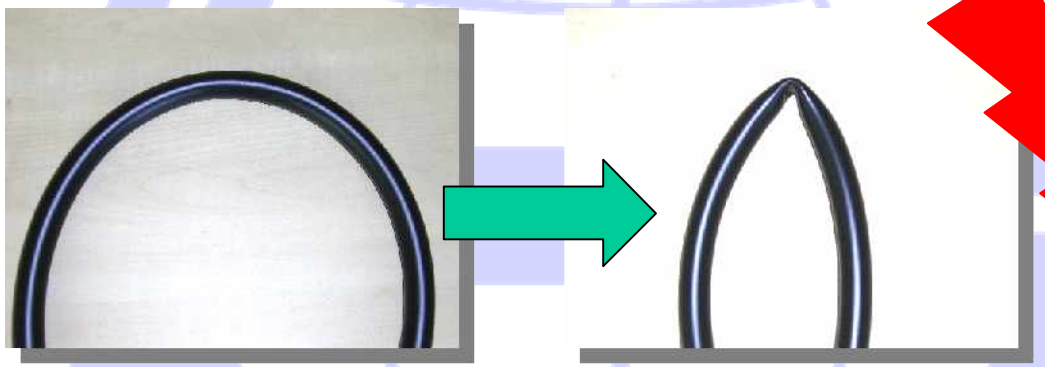
=> each type can be produced in TPU based on Ester or Ether

Thermoplastic Polyurethane

- Characteristics of different Hose Constructions -

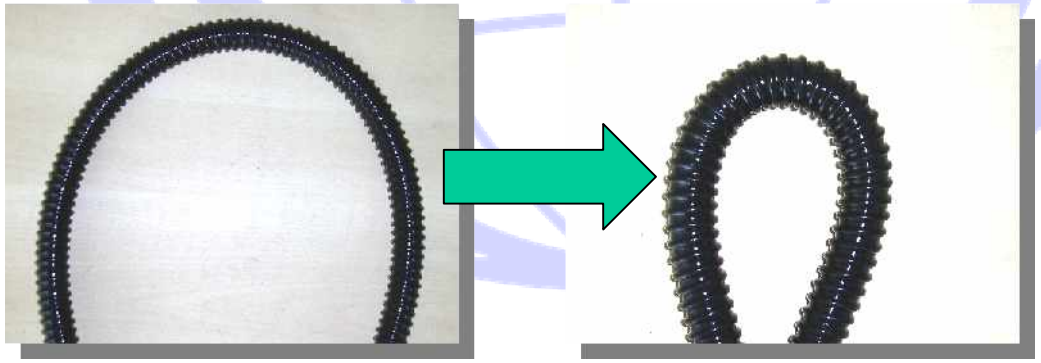
Why Spiral Hoses?

Straight (Plain) Extruded Hose



Risk of Collapsing (Buckling)

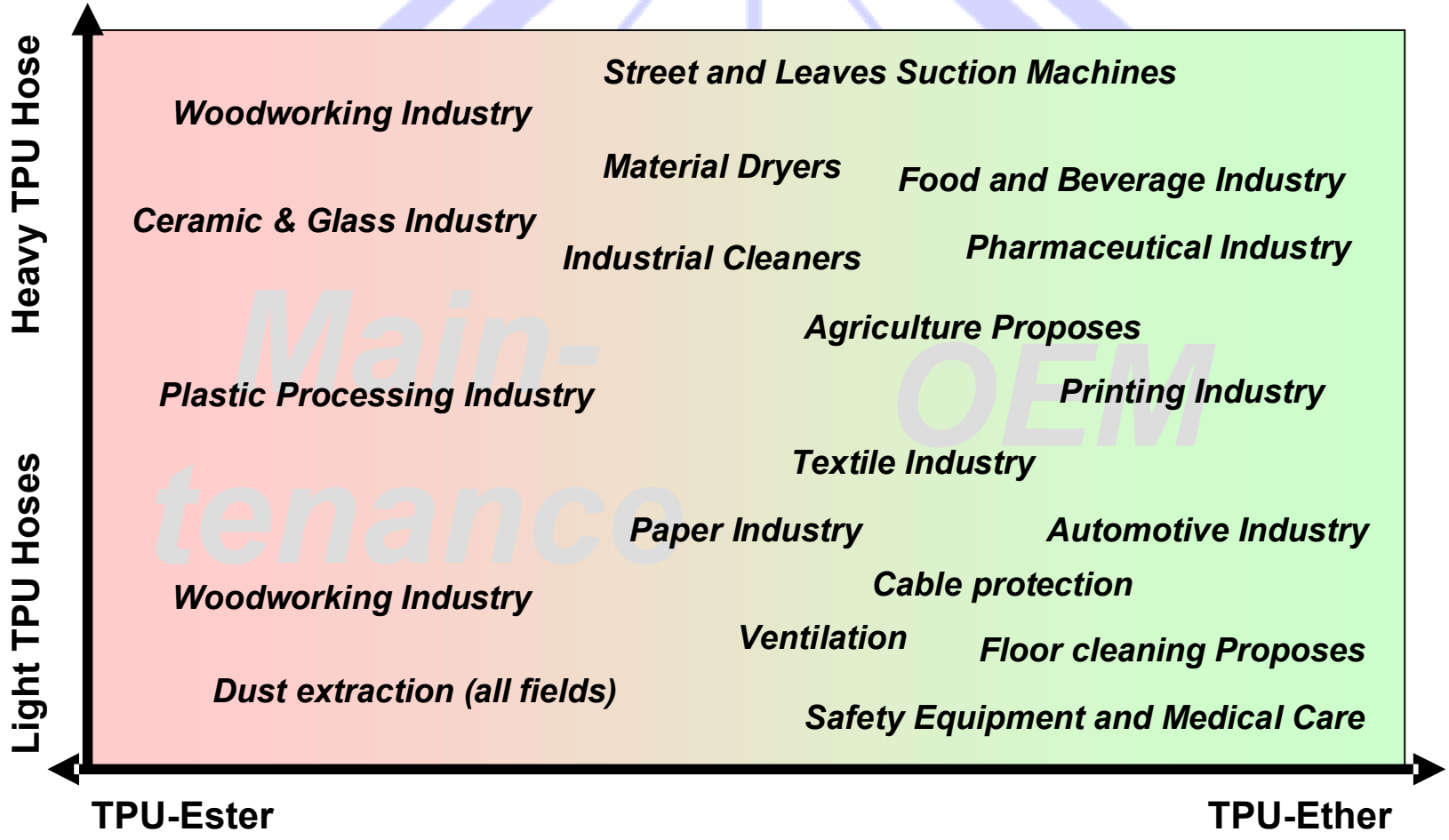
Spiral Hose (hard/soft combination)



No Collapsing also with small bending radius and/or higher temperature

Thermoplastic Polyurethane

- Applications -

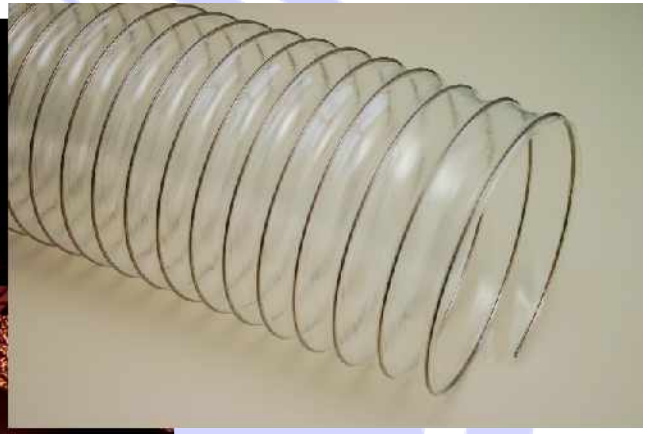


Thermoplastic Polyurethane

- Additional Features -

- Special fix length's (pre-cut)
- Compressed packaging (for 0,4mm hoses in foil or net)
- Customer's name, part no. or other information can be printed on the hose
- Special colors (also translucent color) possible
- White or bronze colored helix
- Special construction (wider or smaller pitch etc.)
- Standard Cuffs (directly over-molded or screwed/glued on)
- Customized Cuffs (over-molded)

Product Developments



High Temperature TPU Hoses

Temp. Resistance
up to +150°C

(but only in TPU Ester available)

Your Link for a Better Solution

VACUFLEX GmbH
Hessenring 8-12
D-64546 Mörfelden
Germany

Tel.: +49 (0) 6015 / 9339-0
Fax: +49 (0) 6105 / 9339-60

Email: info@vacuflex.de
Internet: www.vacuflex.de