



POLYMER MANAGEMENT IN DIFFERENT INDUSTRIES

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Forsmark

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RISE Research Institutes of Sweden

**Biovetenskap och Material
Kemi och Material**



Outline

- Background
- Examples of some product certificates and mark systems.
- Certification – how does it work
- How do you set up a material specification
 - Type testing what should be included, methods etc.
 - Regular control and testing
- Examples fingerprinting to secure the same material over time.



Polymer material management in industries other than NPP:s

Examples from:

- Construction
- Relining
- Automotive
- Sports – Floorball

Why marking systems and certificates?

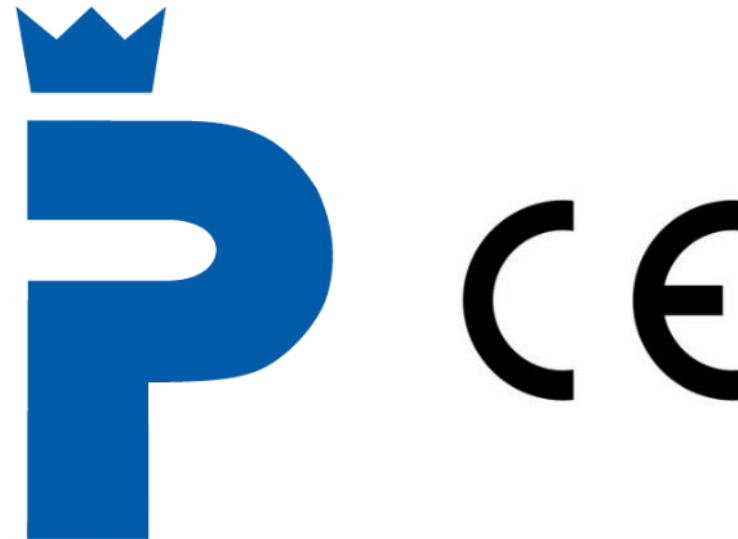
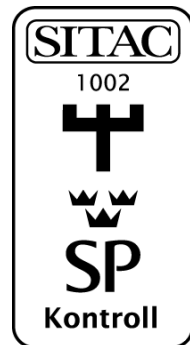
Better safe than sorry!



Leading certifying body in Sweden

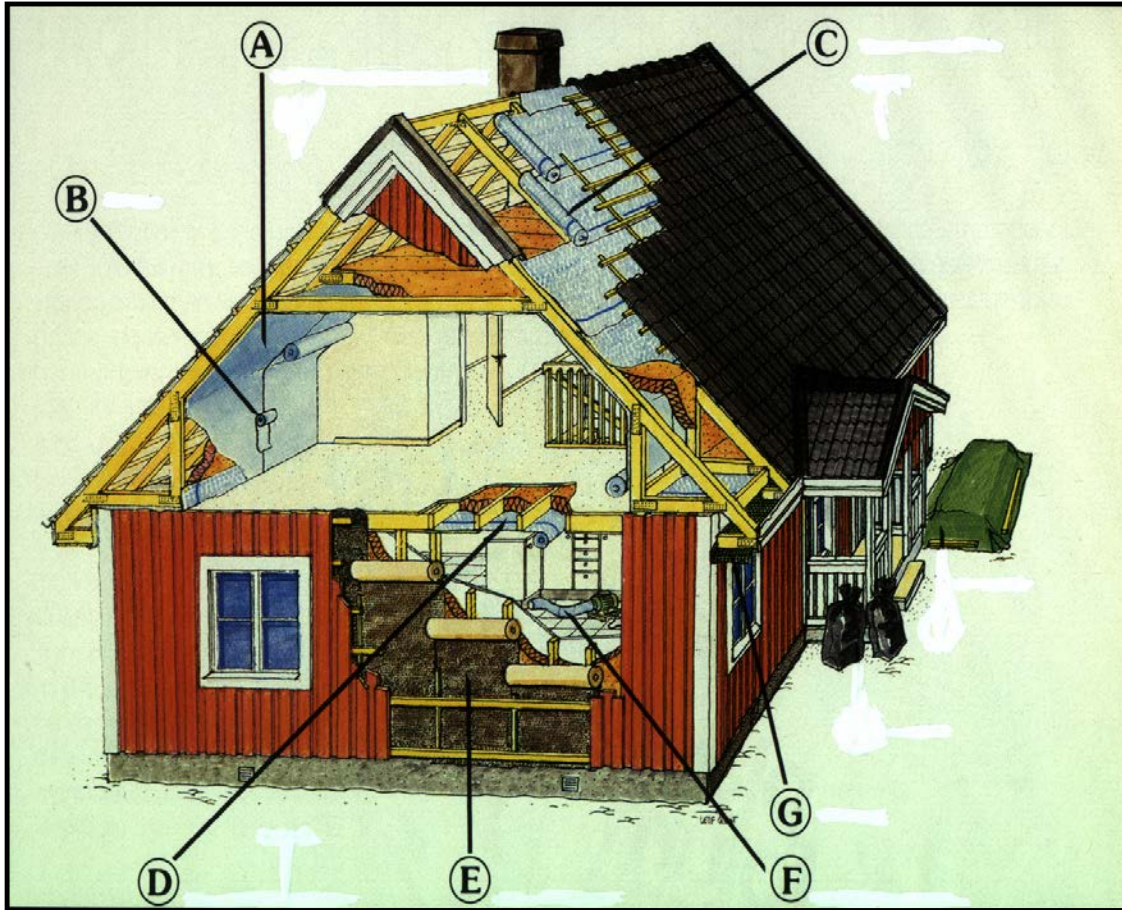
RISE is the largest certifying body in Sweden and issues certification in accordance with a long list of standards that cover management systems, products and individuals.

- The aim of certification is to build trust.
- Expertise and impartiality are the cornerstones of RISE.
- The P-mark (SP's own mark of quality) shows that a products complies with legal and authority requirements, as well as stricter requirements demanded by the market.
- The CE-mark is becoming increasingly important. This focuses on safety, a standardised way to report product properties. There are no quality requirements.



Background Construction

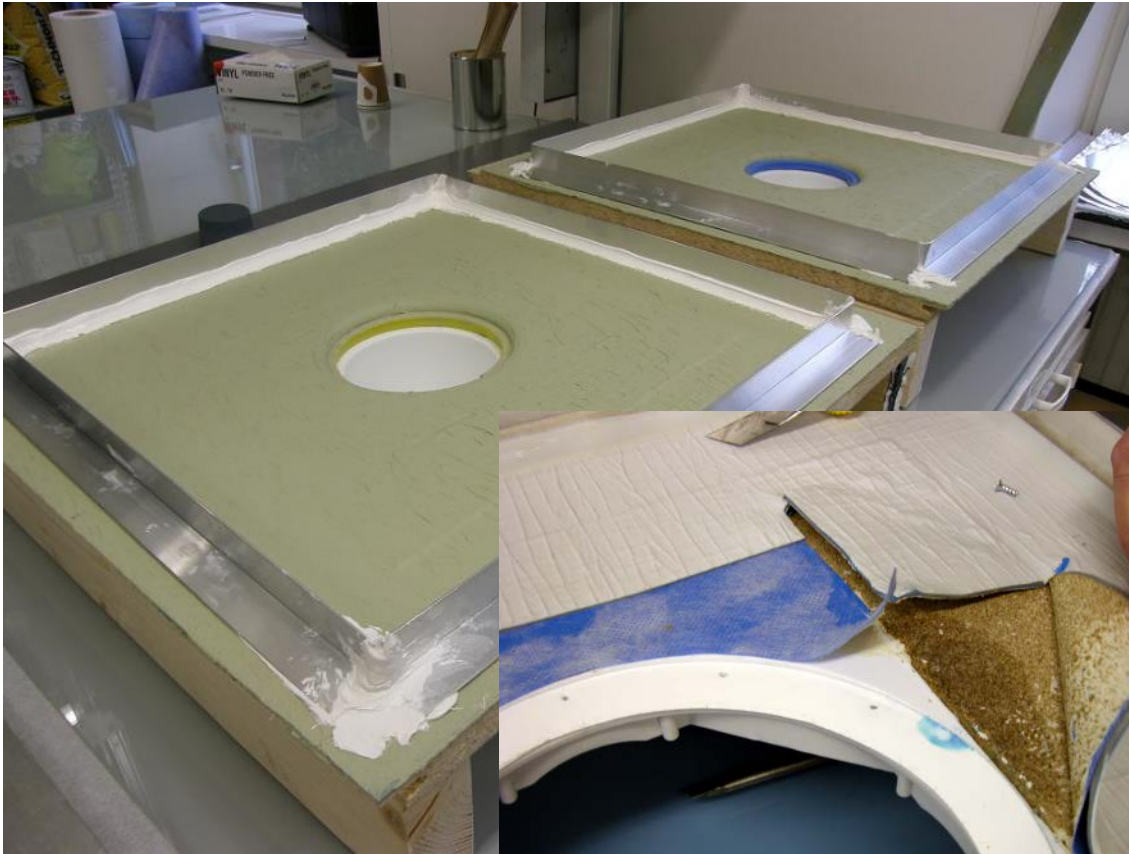
Modern houses consist of quite a lot of polymer materials,



Totally degraded vapour barrier in residential houses built from 1968-71. At a renovation 1981 the polymer films found inside the walls were totally degraded.



Example: Construction Industry



- Bathrooms – high risk for water leakage
- Brick tiles are not water proof!
- Behind the nice bathroom floor you find waterproofing membranes!
- Only type testing according to CE mark (voluntary, required by tilers federation)

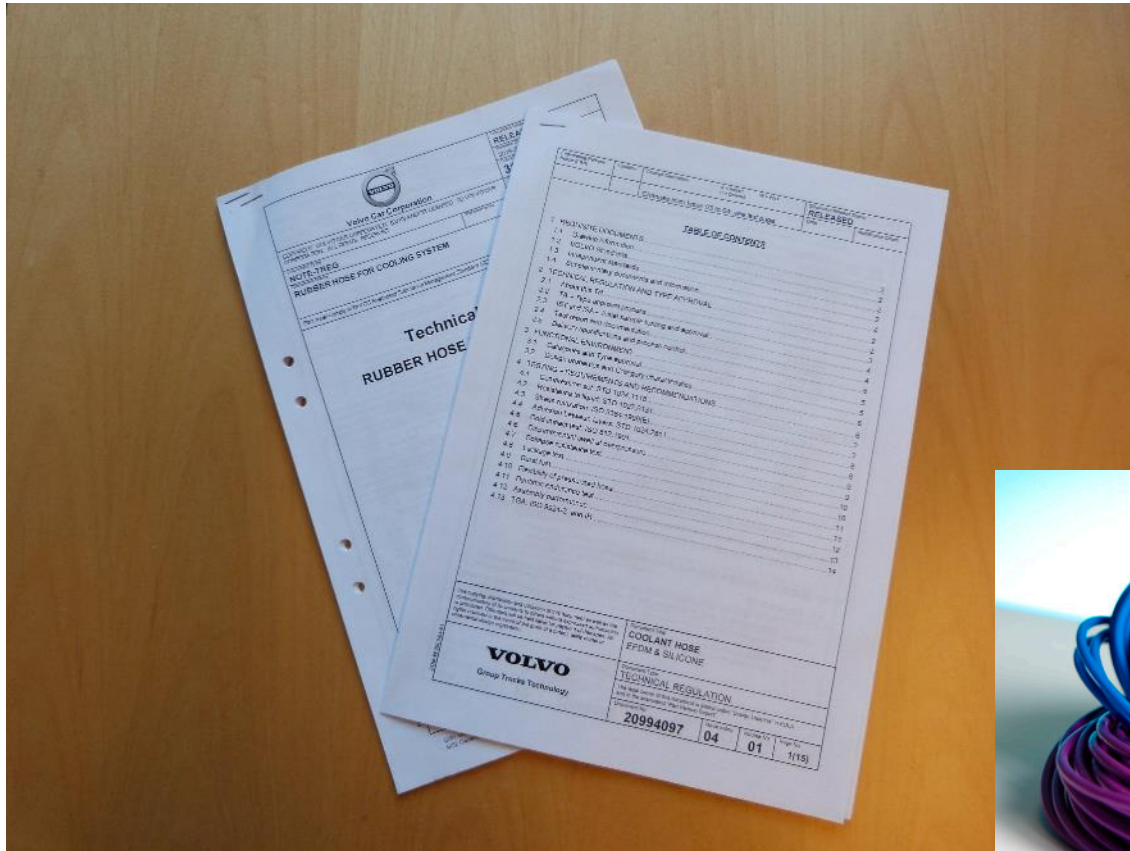


Floorball equipment

- During the 1990:ies Floorball was a rapidly growing sport in Sweden.
- The equipment was of rather low quality, safety problems.
- Swedish Floorball federation contacted former SP for advice and guidance to develop a certification system
- Result: SPCR 011
- Now IFF (International Floorball Federation) is the commissioner of the tests
- Two parts:
 - Type testing - manufactureres
 - Market control - IFF



Automotive industry

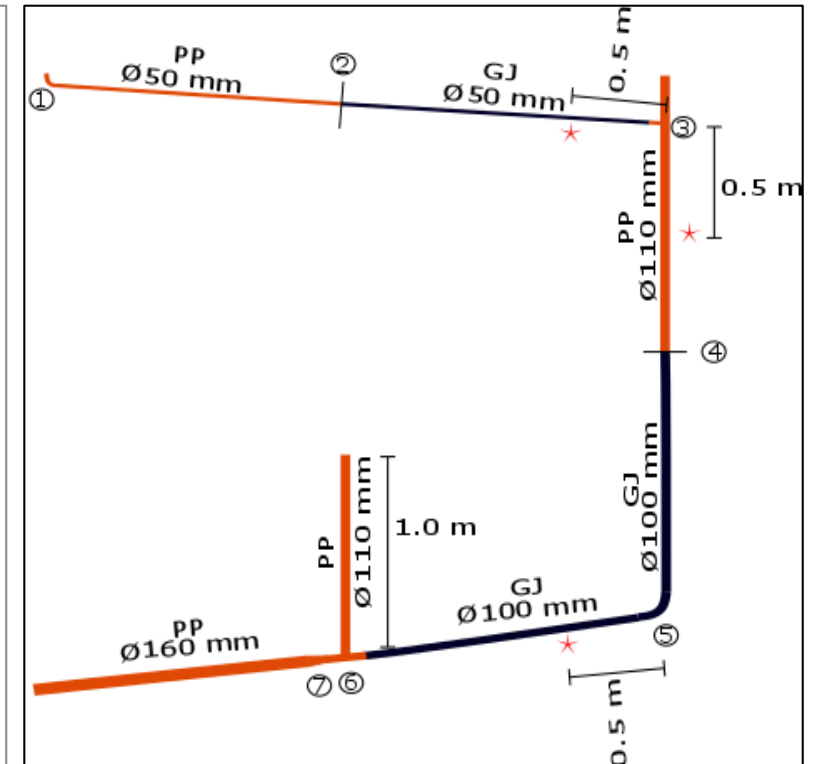
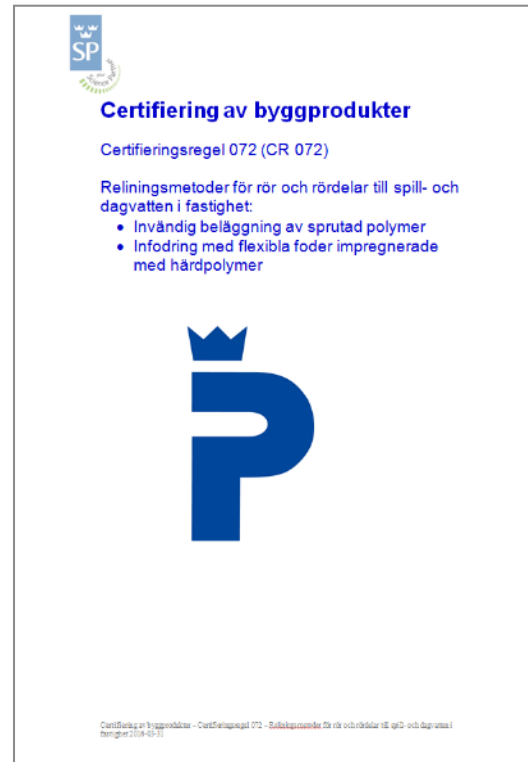


- Automotive companies usually have their own test standards and approvals for components.
- Usually the suppliers have to fulfil a number of tests to be an approved supplier.
- Often approved laboratories are required by the automotive company.
- Usually type testing only.




What do CR072 Relining methods for pipes and pipe parts for waste water in a building contain?

- CR072 contain 3 parts:
 - Monitoring, testing and control
 - Testing of material
 - Testing of finalised product
- System owner and entrepreneur
 - Every relining entrepreneur shall perform a type testing. A pipe is relined and tested.
 - If a relining company can buy a P-marked product the material must not be tested again.
- Only the company with their name on the certificate has a certified product.



Test schedule – Relining

- The branch of relining wanted to prove quality and reliability to their customers.
- Visit at work site every year, to control routines and verify product.
 - Control routines for installation and verification. Are they implemented and are they followed?
 - Control of mark system.
- Material properties, type testing
 - Accelerated ageing (corresponding to 50 år), Three point bending test, FTIR. Performed every 5th year
 - Three point bending and FTIR performed every year for comparison and securing that the product properties do not change.
- Testing of the material function every 5th
 - Tightness test with temperatur fatigue.
 - Ring stiffness.
- **All the tests above are needed to achieve a certificate!**




Certifiering av byggprodukter

Certifieringsregel 072 (CR 072)

Reliningmetoder för rör och rördelar till spill- och dagvatten i fastighet:

- Invändig beläggning av sprutad polymer
- Infodring med flexibla foder impregnerade med hårdpolymer



Certifiering av byggprodukter – Certifieringsregel 072 – Reliningmetoder för spillvattnesystem i byggnader 2016-05-24

Example product standard (CEN, EU)

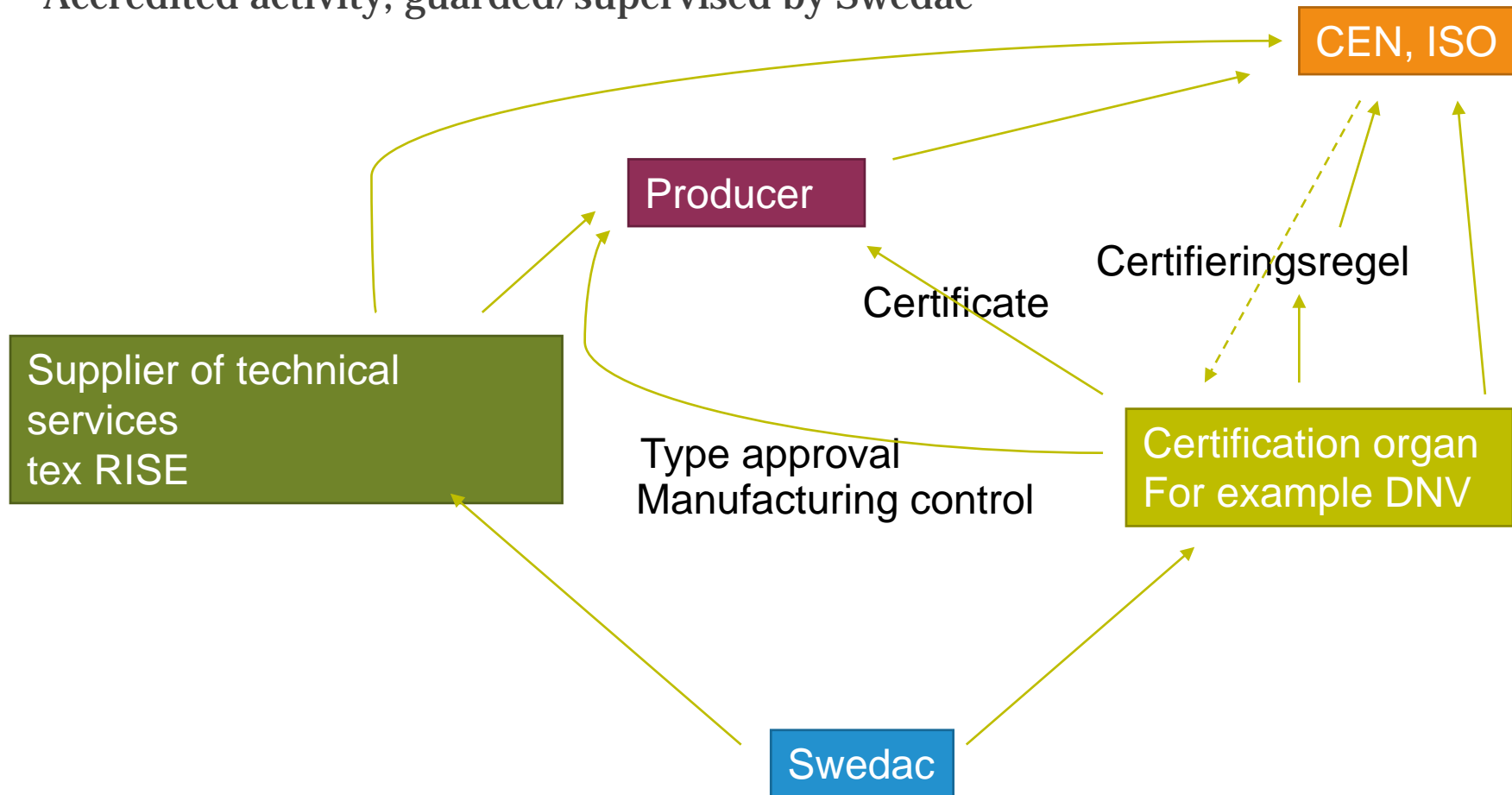
- Most often non specified material
- Pleaded for by authorities
- Contain requirements and limitations based on a method standard
- Exemple: SS-EN 17033 - Plastics– Biodegradable mulch films for use in agriculture and horticulture – Requirements and test methods



Certification

Third Party control of a product (or service) in order to increase the market value for i.e. plastic material: food grade, medical grade

Accredited activity, guarded/supervised by Swedac



CE	CE-logotypen
0970	Identifikationsnumret på det organ som har utfärdat intyget (godkännandeorganet)
Albini & Fontanot S.p.A. Via P. Paolo Pasolini, 6 47853 Cerasolo Ausa (RN) - Italy Manufacturing plant located in Villa Verucchio (RN) - Italy	Tillverkarens namn och säte Produktionsanläggningens adress
13	Första året som märkningen anbringats
0970-CPD-0079/CE/FPC13	Certifieringsnummer (tillverkningskontroll i fabrik)
ETA 13/0299	ETA-nummer (Europeiskt tekniskt godkännande)
Prefabricated metal spiral stair kits	Trappmodell
"AF26"	Trappans benämning
ETAG 008-01	Referensstandard (riktlinjer för europeiskt tekniskt godkännande)



How to write a material specification

- Start from technical requirements
- Let the supplier suggest a material
- Specify long term properties and other things you cannot easily control.
 - Durability (example: 15 years in sunlight/UV-light)
 - Specific chemical resistance (example spill motor oils during 10 years)
 - Durability towards surrounding materials (concrete, metals, wood...)
 - Fire properties
 - Service temperature (from -30°C to $+45^{\circ}\text{C}$)
- Prioritize. What is most important for your product. All plastics have drawbacks..



Product requirement - example

P-marked
vapor barrier



"fingerprint"

Provning för P-märke	Metod	Krav
Ångtäthet (Z_{Uv} , Z_p , s_d)	EN 1931	Ekvivalenta krav: $\geq 1,5 \cdot 10^6$ s/m $\geq 2,0 \cdot 10^{11}$ m ² sPa/kg ≥ 40 m (s_d -värde)
Rivhållfasthet (nail shank)	EN 12310-1	≥ 60 N
Draghållfasthet och brotttöjning	ISO 527 ¹	TPV ± 20 %
Slagstyrka	ASTM D 1709 metod B	≥ 250 g
Alkalibeständighet	SP-metod 0414	≥ 50 % av ursp töjn (ISO 527 ¹) Ångtäthet (EN 1931) efter åldring utförs vid TP samt vid övervakande kontroll ³
UV-beständighet	ISO 4892-2 ²	≥ 80 % av ursp töjn (ISO 527 ¹)
Låsning av receptur	Beroende av material	TPV
Längd	EN 1848-2	$\geq DV -2,0$ %
Bredd	EN 1848-2	$\geq DV -2,0$ %
Tjocklek	EN 1849-2 medel enskilda	$\geq DV -5,0$ % $\geq DV -15$ %
Ytvikt	EN 1849-2	$\geq DV -5,0$ %
Synliga skador	EN 1850-2	Inga skador



Type testing – Life time prediction should be included in type testing

- What properties can be accelerated and not?
- UV Yes and no
- Oxidation Yes
- Fysikalisk åldring No
- Ozon Yes and no
- Biologisk nedbrytning No
- Radiation Nja



Fingerprint of materials – Why?

Raw material business is "dynamic"

- Product development
- Agency for different materials are changing owners
- "Re-structuring" of the product portfolio
- Change of additive suppliers
- Chemical substances are banned

Do you really get the material you order?

The trade name may be the same but the composition may have changed.

The screenshot shows the ECHA (European Chemicals Agency) website. The header includes the ECHA logo, navigation links (About Us, Contact), and a search bar. The main content area is titled "Candidate List of substances of very high concern for Authorisation" and includes a note about its publication in accordance with Article 59(10) of the REACH Regulation. Below this, there are "Notes" and "Further Information" sections. The "Notes" section contains three bullet points: "Authentic version", "Numerical identifiers", and "Other numerical identifiers". The "Further Information" section contains two bullet points: "More information about Candidate list of Substances of Very High Concern for Authorisation" and "Data on Candidate List substances in articles". Below the notes, there is a "Filter the list" link. At the bottom, there is a table with 7 columns: Substance name, EC No., CAS No., Date of inclusion, Reason for inclusion, Decision, and IUCLID dataset. The table lists four substances: Benzene-1,2,4-tricarboxylic acid 1,2 anhydride, Benzo[ghi]perylene, Decamethylcyclopentasiloxane, and Dicyclohexyl phthalate.

Substance name	EC No.	CAS No.	Date of inclusion	Reason for inclusion	Decision	IUCLID dataset
Benzene-1,2,4-tricarboxylic acid 1,2 anhydride trimellitic anhydride; TMA	209-008-0	552-30-7	27/06/2018	Respiratory sensitising properties (Article 57(f) - human health)	ED/61/2018 EU/2018/594	
Benzo[ghi]perylene	205-883-8	191-24-2	27/06/2018	PBT (Article 57d) vPvB (Article 57e)	ED 61/2018	
Decamethylcyclopentasiloxane DS	208-764-9	541-02-6	27/06/2018	PBT (Article 57d) vPvB (Article 57e)	ED 61/2018	
Dicyclohexyl phthalate DCHP	201-545-9	84-61-7	27/06/2018	Toxic for reproduction (Article 57c) Endocrine disrupting properties (Article 57(f) - human health)	EU/2018/636 ED/61/2018	

Finger print techniques

- Thermal properties
 - DSC – Melting, crystallinity, glass transition and indirectly antioxidant concentration (in cas of phenoloc antioxdants.
 - TGA – Composition, filler and plasticizers oils only quantitative.
- Chemical analyses
 - XRF – X-ray fluorescence, elemental analysis
 - GC-MS – Identification of chemeical substances, samples are prepared by macerating or pyrolysis.
 - FTIR
- Mechanical tests
 - Compression set, Stress Relaxation (sealings)
 - Tear resistance (membranes)
 - Tensile testing



Summary: Toolbox to manage good material quality

- Type testing/material qualification
- Qualification of laboratories for type testing (ackredited laboratory)
- Periodical manufacturing control
- Periodical control of product
- Fingerprint as a support for product control
- Market control if the products are available on the market.



THANK YOU FOR LISTENING

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