Angst+Pfister Group

Material resistance

EHEDG World Congress

Christian Geubert // 12/13 Oct 2022

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Seals in the process industry

Hygienic design

- Easy to clean
- Dead-space free
- Smooth surfaces

- Maximize the contact pressure of the seal to the food side

- Fool-proof design

- Mechanical stop and
- Mechancial guidance

- Prevention of pumping effects

Regulatory demands

- Europe
  - 1935/2004
  - 2023/2006
  - 10/2011
- USA
  - CFR 177.2600 (FDA)
  - 3A
- China
  - GB 4806.n
  - GB 9685
- Other countries
  - Mercosur
  - JP
- Additional (Atex, TSEfree,…)

Material resistance

- Chemical resistance
  - Starting materials and resulting products
  - Cleaning and sterilizing agents
  - Water and steam („normal“ and „cleaner“)
  - Resistant against migration of flavors, whether natural or artificial
- Mechanical resistance
  - Against abrasional products like soy, chocolate, nuts, seeds, and fruits like straw-berries and blue berries

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Test condition for CIP medias

	P3 HOROLITH V	P3 OXONIA ACTIVE	MIP SC	ANSEP CIP
Product type	Inorganic acid based descaler	Peracetic acid and hydrogen peroxide based foam disinfectant	High alkaline sodium hydroxide-based product	Alkaline with chlorine-based disinfectant
Dilution %	50	50	50	50
pH of recommended Diluent by Ecolab	**1.0 – 2.0**	**3 – 3.4**	**12.4 – 13.4**	**12.3 – 12.5**
Temperature	+65°C	RT	+65°C	+65°C

Measurements / Assessments	Norms
Hardness [IRHD - M]	ISO 48-2:2018 micro-IRHD (2 mm)
Density [g/cm^3]	ISO 2781:2018
Tensile Strength [N/mm^2]	ASTM D1414
Elongation at break [%]	
E-Module at 100% elongation [N/mm^2]	
Volume change [%]	DIN ISO 1817:2015
Mass change [%]	

Hard testing environment

- Dilution is with 50% more than 10 times higher than under process conditions, to really stress the material and to guarantee the performance of the compounds.

CIP Media

Test conditions

- 3 O-rings from each compound submerged in the Ecolab solutions continuously for 3d, 7d and 14d at defined temperatures (+65°C or RT)

Results from storage tests in commonly used acids and solvents in CIP

Material	HOROLITH V	OXONIA ACTIVE	MIP SCA	ASEPTO FL-D	Cleaning Tabs – Acidic Medium	Cleaning Tabs – Basic Medium
CIP FKM 75.501-04	🟢	🟢	🟢	🟢	🟢	🟢
EPDM 70.10-02	🟠	🟢	🟢	🟢	🟡	🟡
EPDM 1	🔴	🟢	🟢	🟢	🟠	🟠
EPDM 2	🔴	🟢	🟢	🟢	🟠	🟠
EPDM 3	🔴	🟡	🟠	🟠	🟠	🟠

🟢 Excellent compatibility
< 5% change of properties

🟡 Good compatibility
5 - 10% change of properties

🟠 Poor compatibility
> 10% change of properties

🔴 No rating possible

PERTEC® CIP FKM shows extremely high performance with very aggressive solvents and acids and achieves by far the best test results in keeping the mechanical properties.

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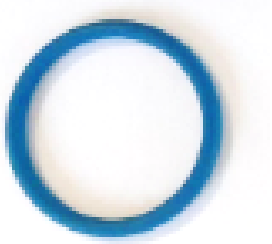
Results after test in HOROLITH V after 14 days



CIP FKM 75.501-04, no deformation or cracks

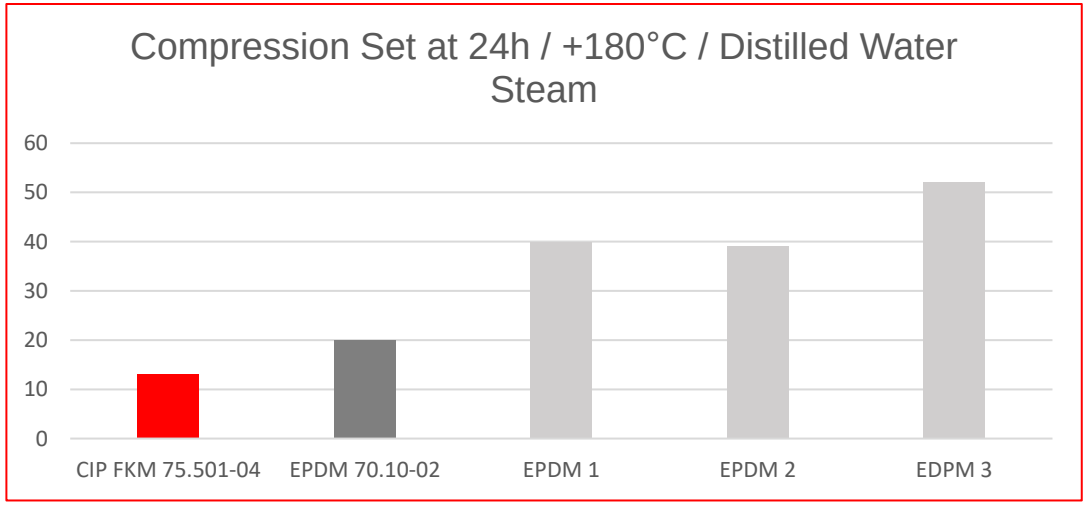
EPDM 70.10-02, slight deformation but no cracks

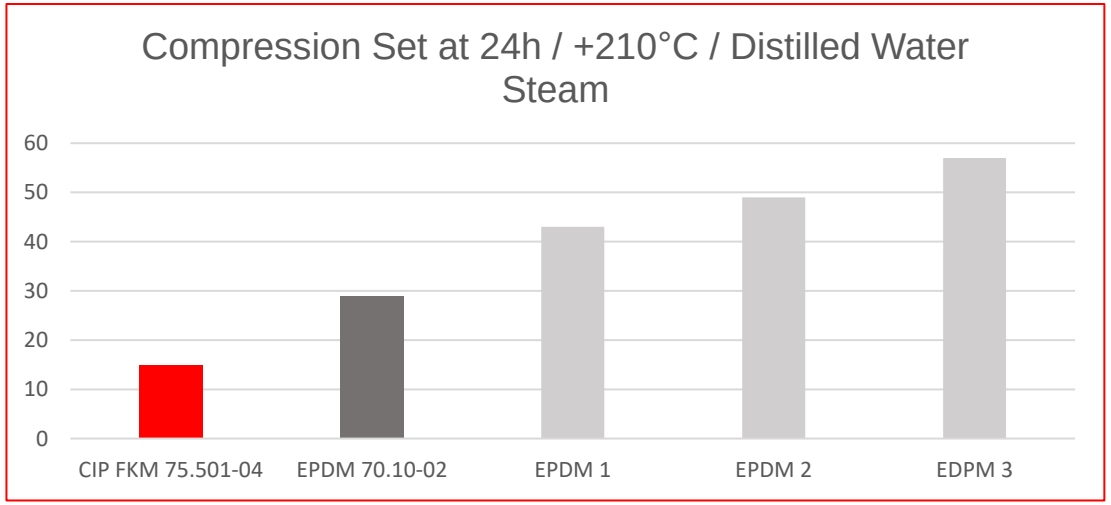
EPDM 1, strong deformation and cracks

With the **extremely tough test conditions**, we wanted to **stress** the **various materials** beyond their limits (over 10 times higher media concentration).

Fortunately, the O-ring made of the material **CIP FKM 75.501-04** was the **only one** that still **showed** itself in **perfect performance**.

Compression Set Test in hot steam SIP





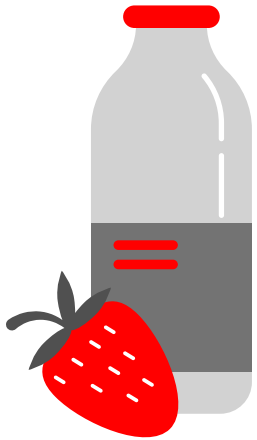
- Low compression set is evidence for long life cycles.
- Even polymers from the same family (EPDM) show big differences under this harsh test conditions.

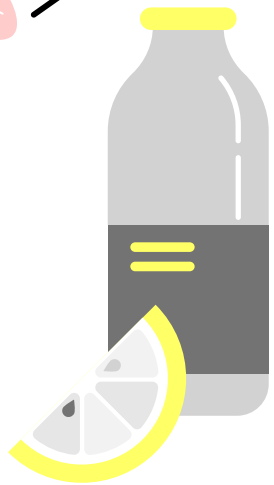
Carryover of Aroma

Filling Process
- Aromatic substance like strawberry drink meets seal
- Diffusion into seal

CIP / SIP Process
- Strawberry aroma dissolved from the seal
- Residual aroma stays in the seal

New Filling Process
- Remaining aromatic substances can migrate into the next lime drink.





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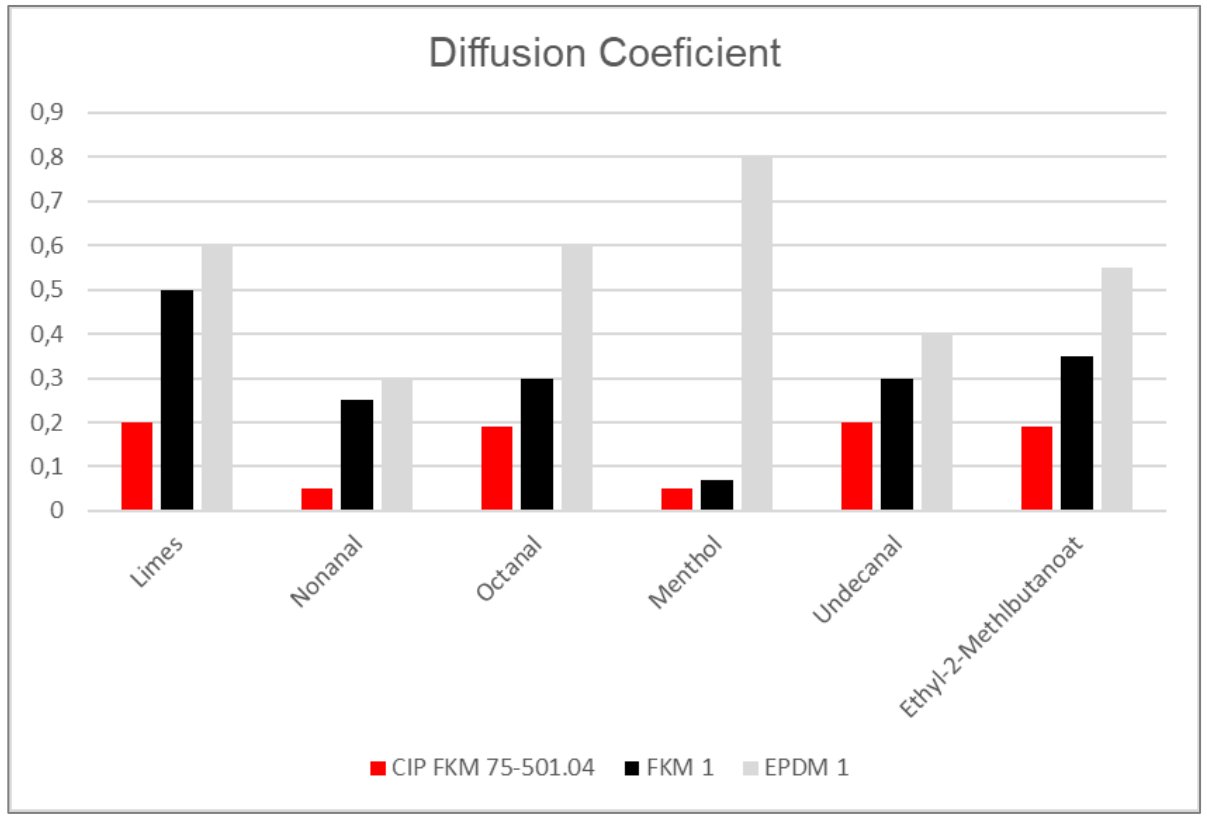
Comparison of aroma diffusion



- High diffusion value means high flavor uptake and thus release of the tested flavoring substances of the produced foodstuff.
- To prevent aroma diffusion, FFKM or FKM are the best choice. But even within the same compound family big differences appear.
- VMQ and EPDM show poor behavior regarding aroma diffusion.
- Finally important are the kind of food products which are produced on the line.

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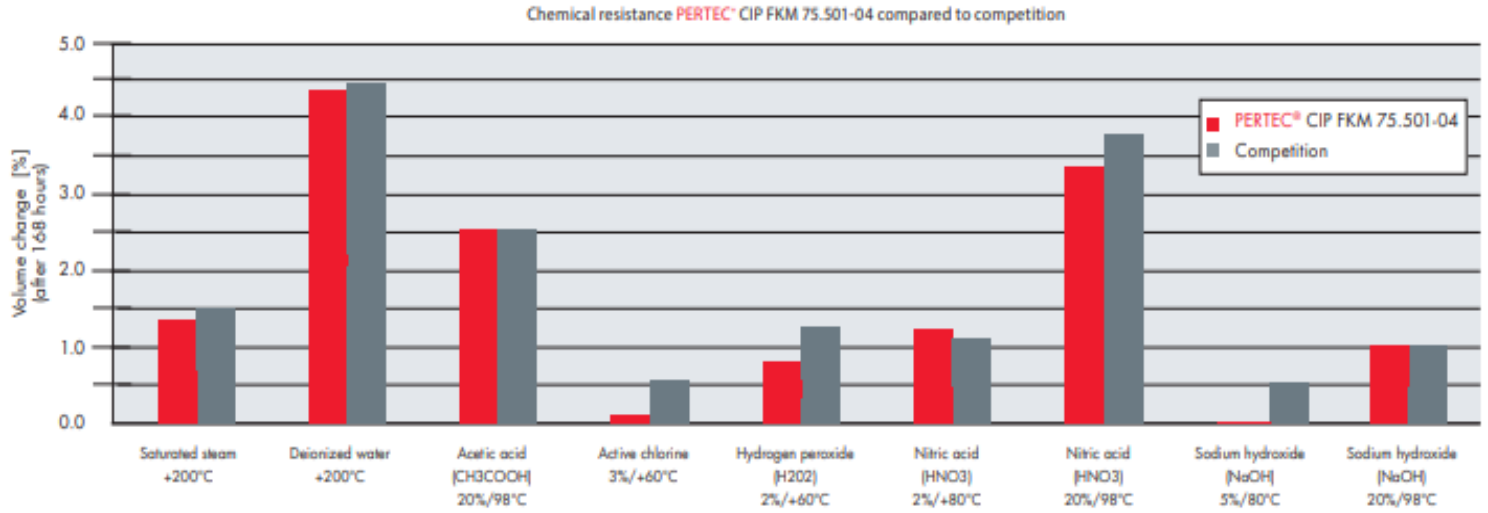
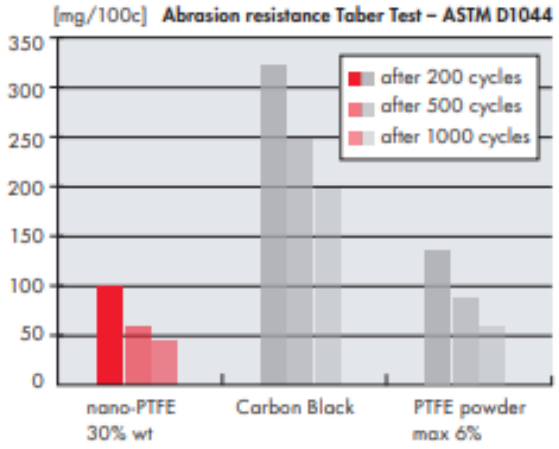
Material Competence: PERTEC® CIP FKM 75.501-04





Approvals of this compound

3-A Sanitary Standard Number 18-03 Class I
ADI free
BfR XXI (Natural and synthetic rubber) Category 4
D.M. 21/03/1973 (Migration test only)
Dlgs. 25.01.1992 n.108 Art.2 Parte D
EC 1935/2004 (excl. article 15)
FDA - CFR 21 - 177.2600 food a) - f)
French Arrete 09/11/1994 (Migration test)
GB 4806.11-2016
KIWA NSF/ANSI 51 formulation
LFGB § 30/31
SR 817.023.21
Tested and qualified by BNIC (Bureau National Interprofessionnel du Cognac)
USP Class VI Chapter <87> (In Vitro) and Chapter <88> (In Vivo) -121 °C

Proof of PAH and Phtalate of this compound

PAH Category 1 (AfPS GS 2019:01)
PAHs requirements according Regulation (EU) No 1272/2013
Phthalate free

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Business Case: Leading Manufacture of Dosing Valves

- High requirements for food applications and long-life cycle -

Challenge

Compliance: FDA-Approval, EC 1935/2004, 3-A Sanitary, NSF 51, GB 4806.11 and Cognac

Performance: Solvents and steam at +160°C
Low flavor carryover

Durability: Current EPDM O-rings have a high flavor carryover and the lifetime is not sufficient due to low chemical resistance in some media. (replacement needed after 4 weeks)

Construction: Groove according to EHEDG design (free of dead space)

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Business Case: Leading Manufacture of Dosing Valves

- High requirements for food applications and long-life cycle -

Solution of Angst+Pfister

Material:

- PERTEC FKM CIP 75-501-04
- High Fluorinated peroxide cured FKM
- Compound with very broad chemical and steam resistance up to +200°C.

Added value:

An increased life cycle of more than 18 months results in a huge reduction of maintenance cost. Being approved by USP, our solution also brings value to the pharmaceutical production.

EC No.1935:2004

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Many thanks!

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General pictures source by world wide web

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