Opteon™ XL 41

Materials Compatibility

Because Opteon™ refrigerants will be used in many different applications, it is important to assess materials of construction for compatibility with these new refrigerants when designing new equipment, retrofitting existing equipment, or preparing storage and handling facilities.

Opteon™ XL41 was evaluated for compatibility with wide array of plastics and elastomers used in refrigeration and air conditioning applications to investigate compatibility with materials commonly used in these systems. Sealed glass tubes were prepared containing XL41, POE lubricant and plastic/elastomeric material and held at 100°C for two weeks. Testing was done using more severe conditions (100°C) than typical material testing (60°C). Testing was also done with R-410A for comparison. Additional XL41 glass tubes were prepared containing PVE lubricant as well. After exposure, elastomers and plastics were removed and measured for weight change, linear swell and hardness change immediately after removing from the sealed tube and also 24 hours after exposure.

Compatibility results are listed in Tables 1-2 for XL41 and R-410A evaluations with elastomers and Tables 3-4 for XL41 and R-410A evaluations with plastics. Results demonstrate there are many elastomers and plastics suitable for use with these refrigerants and the performance of XL41 and R-410A are very similar. Compatibility results of XL41 with PVE lubricant and various elastomers and plastics are listed in Tables 5-6. Results of XL41 PVE lubricant were similar to the POE counterparts, indicating adequate compatibility with many elastomers and plastics. It should be recognized that these data reflect compatibility in sealed tube tests, and that refrigerant compatibility in real systems can be influenced by the actual operating conditions, the nature of the polymers used, compounding formulations of the polymers, and the curing or vulcanization processes used to create the polymer. Specific grades, additives, etc. can also vary and potentially affect results for different polymers and other materials. Components should always be tested under actual operating conditions before reaching final conclusions about their suitability.

Table 1: XL41 Elastomers Compatibility. 0 and 24 hours after removing from sealed tubes

XL41 + POE Elastomers after 0 hrs	0 hr Rating	0 hr % Weight Change	0 hr % Linear Swell	0 hr Hardness Change, Delta
Neoprene C1276 -70	0	5	2	1
Neoprene C0873-70	1	10	4	-6
Epichlorohydrin	1	13	5	-8
Butyl Rubber	1	12	4	-3
EPDM	0	8	3	-10
Fluorosilicone	1	11	5	-10
HNBR	1	28	9	-8
NBR	1	20	8	-9
Fluorocarbon FKM V0747-75	1	22	11	-7
Viton A	1	22	10	-10
Viton GF	1	14	6	-9

XL41+ POE Elastomers after 24 hrs	24 hr Rating	24 hr % Weight Change	24 hr % Linear Swell	24 hr Hardness Change, Delta
Neoprene C1276 -70	0	2	1	3
Neoprene C0873-70	0	8	3	-6
Epichlorohydrin	0	9	3	-6
Butyl Rubber	0	9	3	-4
EPDM	0	5	2	-7
Fluorosilicone	0	4	2	-9
HNBR	1	17	6	-7
NBR	1	11	5	-8
Fluorocarbon FKM V0747-75	1	13	7	-7
Viton A	1	13	6	-12
Viton GF	0	7	3	-9

Rating:

0 < 10% weight gain, and < 10% linear swell and < 10 hardness change
1 > 10% weight gain, or > 10% linear swell or > 10 hardness change
2 > 10% weight gain, and > 10% linear swell and > 10 hardness change

Table 2: R-410A Elastomers Compatibility. 0 and 24 hours after removing from sealed tubes

R-410A + POE Elastomers after 0 hrs	0 hr Rating	0 hr % Weight Change	0 hr % Linear Swell	0 hr Hardness Change, Delta
Neoprene C1276 -70	0	4	2	-4
Neoprene C0873-70	0	9	3	-7
Epichlorohydrin	1	10	3	-11
Butyl Rubber	0	9	4	-5
EPDM	1	7	2	-10
Fluorosilicone	1	9	3	-13
HNBR	1	27	8	-9
NBR	1	19	7	-11
Fluorocarbon FKM V0747-75	1	20	9	-15
Viton A	1	20	8	-10
Viton GF	1	14	5	-7

R-410A + POE Elastomers after 24 hrs	24 hr Rating	24 hr % Weight Change	24 hr % Linear Swell	24 hr Hardness Change, Delta
Neoprene C1276 -70	0	2	1	-2
Neoprene C0873-70	0	7	3	-6
Epichlorohydrin	1	7	3	-11
Butyl Rubber	0	8	3	-3
EPDM	0	5	2	-7
Fluorosilicone	1	4	2	-10
HNBR	1	19	6	-9
NBR	1	12	5	-10
Fluorocarbon FKM V0747-75	1	14	7	-12
Viton A	1	13	6	-8
Viton GF	0	8	3	-6

Rating:

0 < 10% weight gain, and < 10% linear swell and < 10 hardness change

1 > 10% weight gain, or > 10% linear swell or > 10 hardness change

2 > 10% weight gain, and > 10% linear swell and > 10 hardness change

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Table 3: XL41 Plastics Compatibility. 0 and 24 hours after removing from sealed tubes

XL41 + POE Plastics after 0 hrs	0 hr Rating	0 hr % Weight Change	0 hr % Linear Swell	0 hr Hardness Change, Delta
Polyester	1	14	4	-3
Nylon resin	0	0	0	1
Polyamide-imide	0	0	0	0
Polyphenylene sulfide	0	1	0	-1
PEEK	0	1	0	1
Nylon	1	0	1	0
PTFE	0	1	1	-1

XL41 + POE Plastics after 24 hrs	24 hr Rating	24 hr % Weight Change	24 hr % Linear Swell	24 hr Hardness Change, Delta
Polyester	0	9	3	-1
Nylon resin	0	0	0	-1
Polyamide-imide	0	0	0	0
Polyphenylene sulfide	0	0	0	0
PEEK	0	1	0	1
Nylon	0	0	0	-3
PTFE	0	1	1	-1

Rating:

0 < 10% weight gain, and < 10% linear swell and < 10 hardness change
1 > 10% weight gain, or > 10% linear swell or > 10 hardness change
2 > 10% weight gain, and > 10% linear swell and > 10 hardness change

Table 4: R-410A Plastics Compatibility. 0 and 24 hours after removing from sealed tubes

R-410A + POE Plastics after 0 hrs	0 hr Rating	0 hr % Weight Change	0 hr % Linear Swell	0 hr Hardness Change, Delta
Polyester	1	14	2	0
Nylon resin	0	0	3	0
Polyamide-imide	0	1	0	1
Polyphenylene sulfide	0	0	0	-2
PEEK	0	1	0	0
Nylon	0	1	0	0
PTFE	0	2	1	0

R-410A + POE Plastics after 24 hrs	24 hr Rating	24 hr % Weight Change	24 hr % Linear Swell	24 hr Hardness Change, Delta
Polyester	0	9	2	0
Nylon resin	0	0	2	1
Polyamide-imide	0	0	0	0
Polyphenylene sulfide	0	0	0	-1
PEEK	0	1	0	0
Nylon	0	1	0	0
PTFE	0	1	1	1

Rating:

0 < 10% weight gain, and < 10% linear swell and < 10 hardness change
1 > 10% weight gain, or > 10% linear swell or > 10 hardness change
2 > 10% weight gain, and > 10% linear swell and > 10 hardness change

Table 5: XL41 Elastomers Compatibility w/ PVE. 0 and 24 hours after removing from sealed tubes

XL41 + PVE32D Elastomers after 0 hrs	0 hr Rating	0 hr % Weight Change	0 hr % Linear Swell	0 hr Hardness Change, Delta
Neoprene C1276 -70	0	2	1	-3
Neoprene C0873-70	0	6	3	-8
Epichlorohydrin	1	7	3	-12
Butyl Rubber	1	12	4	-17
EPDM	1	10	3	-13
Fluorosilicone	1	8	4	-14
HNBR	1	15	5	-7
NBR	1	11	4	-11
Fluorocarbon FKM V0747-75	1	13	7	-14
Viton A	1	13	6	-14
Viton GF	1	11	5	-13

XL41 + PVE32D Elastomers after 24 hrs	24 hr Rating	24 hr % Weight Change	24 hr % Linear Swell	24 hr Hardness Change, Delta
Neoprene C1276 -70	0	-1	0	1
Neoprene C0873-70	0	4	2	-5
Epichlorohydrin	0	4	2	-9
Butyl Rubber	1	9	3	-13
EPDM	1	6	2	-11
Fluorosilicone	0	3	1	-6
HNBR	0	8	2	-5
NBR	0	5	1	-6
Fluorocarbon FKM V0747-75	1	7	4	-10
Viton A	1	7	3	-11
Viton GF	1	6	3	-11

Rating:

0 < 10% weight gain, and < 10% linear swell and < 10 hardness change
1 > 10% weight gain, or > 10% linear swell or > 10 hardness change
2 > 10% weight gain, and > 10% linear swell and > 10 hardness change

Table 6: XL41 Plastics Compatibility w/ PVE. 0 and 24 hours after removing from sealed tubes

XL41 + PVE32D Plastics after 0 hrs	0 hr Rating	0 hr % Weight Change	0 hr % Linear Swell	0 hr Hardness Change, Delta
Polyester	1	11	3	2
Nylon resin	1	1	-11	1
Polyamide-imide	0	1	0	0
Polyphenylene sulfide	0	1	0	-1
PEEK	0	1	0	-2
Nylon	0	1	0	3
PTFE	0	2	1	1

XL41 + PVE32D Plastics after 24 hrs	24 hr Rating	24 hr % Weight Change	24 hr % Linear Swell	24 hr Hardness Change, Delta
Polyester	0	6	2	2
Nylon resin	1	1	-11	1
Polyamide-imide	0	0	0	-1
Polyphenylene sulfide	0	1	0	0
PEEK	0	1	0	-1
Nylon	0	1	0	3
PTFE	0	1	1	1

Rating:

0 < 10% weight gain, and < 10% linear swell and < 10 hardness change

1 > 10% weight gain, or > 10% linear swell or > 10 hardness change

2 > 10% weight gain, and > 10% linear swell and > 10 hardness change

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Thermal Stability

Typical refrigerant thermal stability with metals was tested with refrigeration lubrication present. Stability is evaluated in sealed glass tubes, exposing the refrigerant and lubricant mixtures to temperatures much higher than those present in refrigeration and air conditioning systems. The high temperatures cause an accelerated aging of the refrigerant.

ASHRAE Standard 97, with RL32-3MAF lubricant, was used to evaluate thermal stability of Opteon™ XL41. Glass tubes were loaded with carbon steel, copper, and aluminum coupons. Refrigerant and lubricant were then added, some with air and oil with moisture contamination (2000 ppm and 500 ppm respectively). The tubes were placed in a 175 °C oven and aged for 14 days. Mixtures were made with R-410A and XL41 to compare stability to a long proven HFC refrigerant used in similar applications.

Sealed glass tube results for thermal stability are listed below in Table 7. Stability metrics included fluoride ion levels and visual inspection of the tubes. Fluoride ion levels for each mixture were similar for all refrigerant mixtures for both refrigerants. Visual appearance of each glass tubes were similar. There was no apparent dulling of the steel coupons, nor corrosion of the other metals. Furthermore, there was little acid generation in any of the mixtures. The thermal stability of XL41 was tested to be very similar to the thermal stability of R-410A.

Table7: Thermal Stability for XL41 with metal coupons.

Product	**Air** (mmHg)	**Water** (ppm)	**Metal Coupons** (yes/no)	**F-** (ppm)
R-410A	None	None	Yes	6.46
R-410A	7.6	None	Yes	11.70
R-410A	None	500	Yes	2.02
R-410A	7.6	500	Yes	3.07
XL41	None	None	Yes	3.46
XL41	7.6	None	Yes	6.06
XL41	None	500	Yes	8.06
XL41	7.6	500	Yes	7.41

For more information on the Opteon™ family of refrigerants, or other refrigerants products, visit opteon.com or call (800) 235-7882. The information set forth herein is furnished free of charge and based on technical data that Chemours believes to be reliable. It is intended for use by persons having technical skill, at their own risk. Because conditions of use are outside our control, Chemours makes no warranties, expressed or implied, and assumes no liability in connection with any use of this information. Nothing herein is to be taken as a license to operate under, or a recommendation to infringe, any patents or patent applications.

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