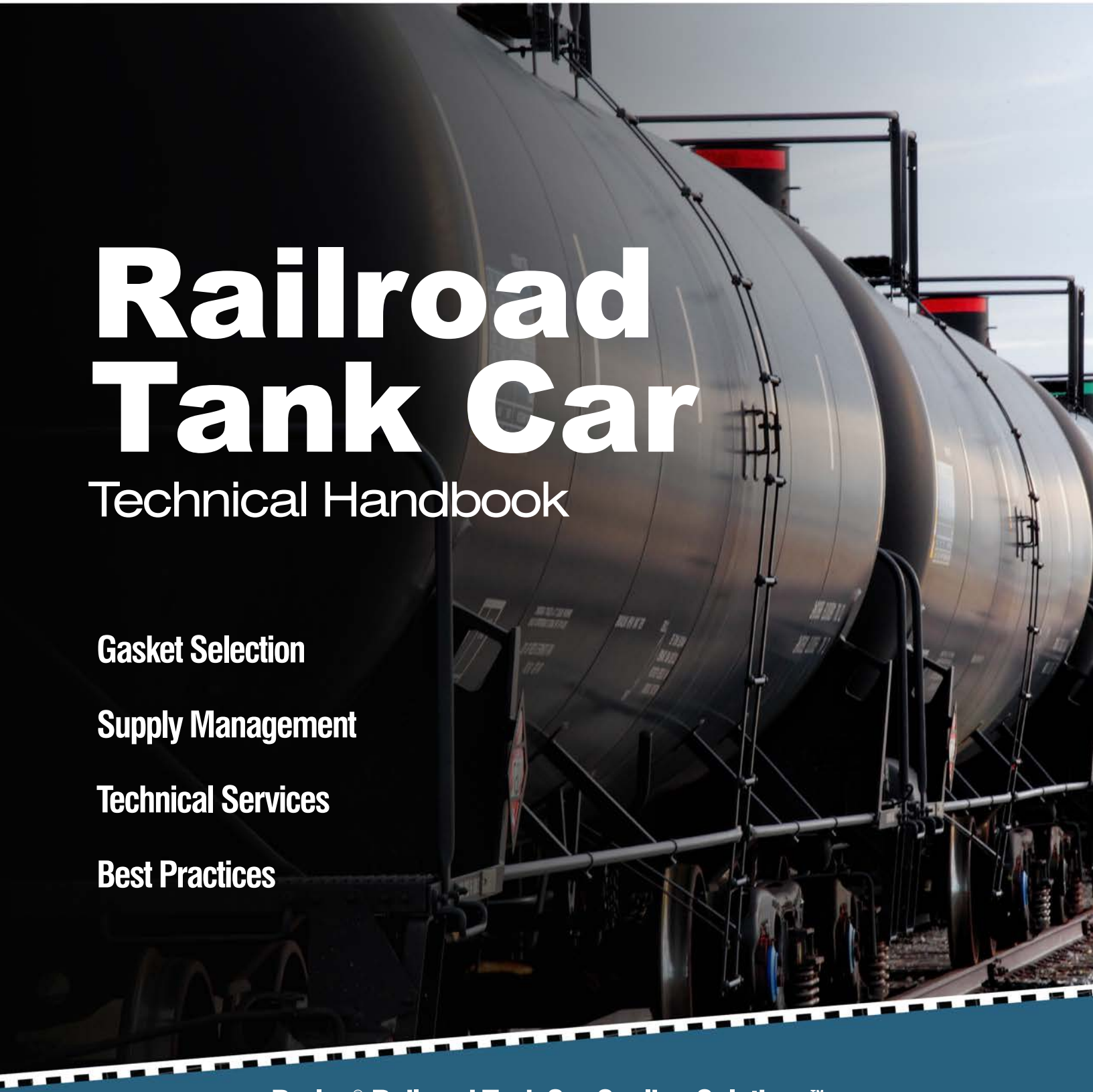
DURLON®
SEALING SOLUTIONS



Railroad Tank Car

Technical Handbook

Gasket Selection

Supply Management

Technical Services

Best Practices

Durlon® Railroad Tank Car Sealing Solutions™

Superior Manufacturing • Quality Performance

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Durlon® Gasket Materials for Railroad Tank Cars

Style	Composition	Description
7900*/7925* 7950*	Aramid-Inorganic/NBR	A general service compressed sheet with NBR rubber binder for mild service OEM & railroad applications in steam, hydrocarbons and refrigerants. An economical alternative when service ranges and applications are not severe.
8500*	Aramid-Inorganic/NBR	Our workhorse material, Durlon 8500, is excellent in steam, fuels, oils, natural gas, vegetable oils, glycols, inert gases, molten sulfur, alcohols, tall oil, plus many more chemicals. A high quality general service gasket material for use in a wide range of tank car applications for the chemical, pulp and paper, food, beverage,refinery, gas and general industries.
9000/9000N**	Pure PTFE resins with inorganic fillers	Durlon 9000/9000N is used extensively in aggressive chemicals in the railroad tank car industry. It has been tested and approved for liquid chlorine, caustics, liquid oxygen, and high purity applications in the pharmaceutical industry. The fillers in Durlon 9000/9000N are engineered shapes, homogeneously blended with pure PTFE resins and do not wick.
9200W**	Pure PTFE resins with barium sulfate filler	Suitable for use in aggressive chemicals including caustics, hydrogen peroxide, sodium hypochlorite, nitric acid, liquors and used extensively in railroad tank car applications. Applications in the chemical, pharmaceutical and plastics industries include butadiene, hydrofluoric acid, vinyl chloride, methyl methacrylates, and styrene.

*Much effort has gone into improving the anti-stick release agents of all (CNA) Compressed Non-Asbestos Durlon® products. All Durlon® CNA gasket materials have passed the MIL-G-24696B Navy Adhesion Test (366°F/48 hrs).
**Independent testing has shown the fillers in the Durlon® method to be more homogeneously blended than calendered or layered filled PTFE gasket materials, giving Durlon® filled PTFE's more consistent physical and mechanical properties without voids, separation and chemical compatibility problems found in the layered construction method.

Style	Certifications
7900, 7925, 7950	California Proposition 65, RoHS Reach Declaration
8500	California Proposition 65, RoHS Reach Declaration, API 6FB Fire Test with avg. temp >650°C, 30 mins, 40 bar, 1 ml (inch/min.) max allowable leakage, Conforms to the FDA requirements of 21 CFR 177.2600.
9000	RoHS Reach Declaration, ANSI/API 607 Fire Test*** 6th Ed., Zero leakage, Approved material for WRAS (Water Regulations Advisory Scheme), USP Class VI 121°C (250°F) for 30 min., TA-luft (VDI Guideline 2440), ABS-PDA & Pamphlet 95, the chlorine institute, DNV-GL, (EC) 1935/2004 & EU (10/2011), and conforms to FDA requirements of 21 CFR 177.1550 for food and drug contact.
9000N	RoHS Reach Declaration, USP Class VI 121°C (250°F) for 30 min., Approved material for ABS-PDA & Pamphlet 95, the chlorine institute, DNV-GL, (EC) 1935/2004 & EU (10/2011), and conforms to FDA requirements of 21 CFR 177.1550 for food and drug contact
9200W	RoHS Reach Declaration and approved material for ABS-PDA & Pamphlet 95, the chlorine institute, DNV-GL and TA-luft (VDI Guideline 2440). BAM oxygen service: gaseous & liquid up to 260°C (500°F) at 52 bar (754 psi), and conforms to FDA requirements of 21 CFR 177.1550 for food and drug contact.

Durlon® 9000 and 9000N are made with Teflon™ fluoropolymer. Teflon™ is a trademark of The Chemours Company FC, LLC used under license by Triangle Fluid Controls Ltd.

***6 inch Class 300. The test fixture was subjected to an external flame of 875°C (1607°F) average for 30 minutes. The measured leakage was 1.8 ml/min, where the max allowable limit is 1200ml/sec.

Note: ASTM properties are based on 1/16" sheet thickness, except ASTM F38 which is based on 1/32" sheet thickness. This is a general guide only and should not be the sole means of accepting or rejecting this material. The data listed here falls within the normal range of product properties, but should not be used to establish specifications limits nor used alone as the basis of design. For applications above Class 300, contact our technical department.

Warning: Durlon® gasket materials should never be recommended when both temperature and pressure are at the maximum listed. Properties and applications stated are typical. No applications should be undertaken by anyone without independent study and evaluation for suitability. Never use more than one gasket in one flange joint and never reuse a gasket. Improper use or gasket selection could cause property damage and/or serious injury. Data reported is a compilation of field testing, field service reports and/or in-house testing. While the utmost care has gone into publishing the information contained herein, we assume no responsibility for errors. Specifications and information contained in this flyer are subject to change without notice. This edition cancels and obsoletes all previous editions.

Durlon® Gasket Materials - CNA Typical Physical Properties

Compressed Non-Asbestos Gasketing Materials for Railroad Tank Cars				
Style	7900	7925	7950	8500
Color	Off White	Light Green	Blue	Green
Fiber System	Aramid/Inorganic	Aramid/Inorganic	Aramid/Inorganic	Aramid/Inorganic
Binder	NBR	NBR	NBR	NBR
Temperature: Min Max Continuous, Max	 -73°C (-100°F) 371°C (700°F) 260°C (500°F)	 -73°C (-100°F) 371°C (700°F) 260°C (500°F)	 -73°C (-100°F) 371°C (700°F) 260°C (500°F)	 -73°C (-100°F) 371°C (700°F) 287°C (548°F)
Pressure, max, bar (psi)	83 (1,200)	83 (1,200)	83 (1,200)	103 (1,500)
Density, g/cc (lbs/ft^3)	1.7 (106)	1.7 (106)	1.7 (106)	1.7 (106)
Compressibility, %	7-17	7-17	7-17	8-16
Recovery, %	40	40	40	50
Creep Relaxation, %	20	20	20	20
Tensile Strength, MPa (psi)	11 (1,600)	11 (1,600)	11 (1,600)	13.8 (2,000)
Sealability ASTM 2378 (Nitrogen)	 0.05 cc/min	 0.05 cc/min	 0.05 cc/min	 0.03 cc/min
Fluid Resistance, ASTM F146 IRM 903 Oil 5hrs at 300°F Thickness Increase, % Weight Increase, % ASTM Fuel B 5hrs at 70°F Thickness Increase, % Weight Increase, %	 0-15 15 0-10 12	 0-15 15 0-10 12	 0-15 15 0-10 12	 0-15 15 0-10 10
Flexibility, ASTM F147	10x	10x	10x	10x
Volume Resistivity, ohm-cm ASTM D257	Not Applicable	Not Applicable	Not Applicable	4.2 x 10^{13}
Dielectric Breakdown ASTM D149, kV/mm (V/mil)	Not Applicable	Not Applicable	Not Applicable	11.7 (297)

Note: ASTM properties are based on 1/16" sheet thickness, except ASTM F38 which is based on 1/32" sheet thickness. This is a general guide only and should not be the sole means of accepting or rejecting this material. The data listed here falls within the normal range of product properties, but should not be used to establish specifications limits nor used alone as the basis of design. For applications above Class 300, contact our technical department.

Warning: Durlon® gasket materials should never be recommended when both temperature and pressure are at the maximum listed. Properties and applications stated are typical. No applications should be undertaken by anyone without independent study and evaluation for suitability. Never use more than one gasket in one flange joint and never reuse a gasket. Improper use or gasket selection could cause property damage and/or serious injury. Data reported is a compilation of field testing, field service reports and/or in-house testing. While the utmost care has gone into publishing the information contained herein, we assume no responsibility for errors. Specifications and information contained in this flyer are subject to change without notice. This edition cancels and obsoletes all previous editions.

Durlon® Gasket Materials - PTFE Typical Physical Properties

PTFE Gasketing Materials for Railroad Tank Cars			
Style	9000	9000N	9200W
Color	Blue	White	Granite White
Filler System	Inorganic	Inorganic	
Temperature: Min Max Continuous, Max	 -212°C (-350°F) 271°C (520°F) 260°C (500°F)	 -212°C (-350°F) 271°C (520°F) 260°C (500°F)	 -212°C (-350°F) 271°C (520°F) 260°C (500°F)
Pressure, max, bar (psi)	103 (1,500)	103 (1,500)	103 (1,500
Density, g/cc (lbs/ft^3)	2.2 (138)	2.2 (138)	2.5 (156)
Compressibility, %	8-16	8-16	8-16
Recovery, %	40	40	35
Creep Relaxation, %	30	30	30
Tensile Strength, MPa (psi)	13.8 (2,000)	13.8 (2,000)	13.2 (1,920)
Sealability ASTM 2378 (Nitrogen)	 0.01 cc/min	 0.01 cc/min	 0.01 cc/min
Leakage, mbar .1 (m .5) TA-Luft (VDI 2440) TBar (14.5 psi) @180°C (392°F)	7.55 x 10^{-6}	7.55 x 10^{-6}	7.55 x 10^{-6}
Volume Resistivity, ohm-cm ASTM D25	1.0 x 10^5	1.0 x 10^5	Not Applicable
Dielectric Breakdown ASTM D149, kV/mm (V/mil)	16 (406)	16 (406)	Not Applicable

Note: ASTM properties are based on 1/16" sheet thickness, except ASTM F38 which is based on 1/32" sheet thickness. This is a general guide only and should not be the sole means of accepting or rejecting this material. The data listed here falls within the normal range of product properties, but should not be used to establish specifications limits nor used alone as the basis of design. For applications above Class 300, contact our technical department.

Warning: Durlon® gasket materials should never be recommended when both temperature and pressure are at the maximum listed. Properties and applications stated are typical. No applications should be undertaken by anyone without independent study and evaluation for suitability. Never use more than one gasket in one flange joint and never reuse a gasket. Improper use or gasket selection could cause property damage and/or serious injury. Data reported is a compilation of field testing, field service reports and/or in-house testing. While the utmost care has gone into publishing the information contained herein, we assume no responsibility for errors. Specifications and information contained in this flyer are subject to change without notice. This edition cancels and obsoletes all previous editions.

Durlon® - Reducing Gasket Failure

Most Bolted Flange Issues Are Usually Installation Related

- Uneven loading of flanges
- Gasket load too low
- Bolt strength too low
- Torque loss
- Bolt Relaxation/Stretch (approximately 10% in first 24 hours)
- Gasket creep
- Vibration in the system
- Thermal cycling
- Elastic interaction during bolt tightening
- Improper gasket installation procedures

Our Recommendations

- Bolt/nut lubrication- lubrication reduces low gasket compression caused by bolt friction.
- Through hardened steel washers (ASTM F-436 or similar) also reduce bolt friction.
- Belleville spring washers – Create a live load to help reduce the effect of bolt and gasket relaxation.
- RETORQUING within 4 to 24 hrs also helps reduce the effect of bolt and gasket relaxation.

Torque loss is inherent in any bolted joint. The combined effects of bolt relaxation, (can be up to 10% during the first 24 hours after installation), gasket creep, vibration in the system, thermal expansion and elastic interaction during bolt tightening contribute to torque loss. When torque loss reaches an extreme, the internal pressure exceeds the compressive force holding the gasket in place and a leak or blow-out occurs.

A key to reducing these effects is proper gasket installation. By bringing the flanges together slowly and parallel when installing a new gasket and taking a minimum of four bolt tightening passes, following the correct bolt tightening sequence or pattern, there is a payoff in reduced maintenance costs while increasing safety.

Even when the installation is ideal, where the bolt stress is uniformly applied to each bolt, and the gasket is properly compressed, problems can still arise. Inherently with time, loosening can occur due to the factors already mentioned. If other factors such as cycling, thermal upsets, or vibration are present, periodic rechecking of the fastener torque might be necessary.

For problem areas, high temperature applications, or where there is temperature cycling, or where a flange torque cannot be checked, conical spring washers have been found to be very helpful as an aid to torque retention. They act as a spring and help lessen the effects of torque loss.

Reducing Gasket Failures:

- **PROPER GASKET INSTALLATION PRACTICES**
- Use the correct components, i.e. bolts/nuts and washers
- Lubricate bolts & nut facings
- Bring the flanges together slowly and parallel
    1. Multiple passes with increasing torque
    2. Each pass following proper tightening sequence
- Use the thinnest gasket possible
- Periodic checking of fastener torque
- Use the right method of bolt up for the job
- Order of efficiency from least to greatest:
    1. Wrench and cheater bar or sledge hammer
    2. Air impact gun
    3. Torque wrench
    4. Hydraulic torque wrench
    5. Hydraulic stud tensioners

Durlon® - Bolt Tightening Work Sheet

Location/Identification: _____ Nominal Bolt Size: _____

Gasket Contact Surface Finish on Flange: _____ Lubricant Used: _____

(Initial each step in space provided below.)

_____ 1. Visually examine and clean flanges, bolts, nuts and washers. Replace components if necessary.

_____ 2. Install new gasket. **DO NOT USE MULTIPLE GASKETS**.

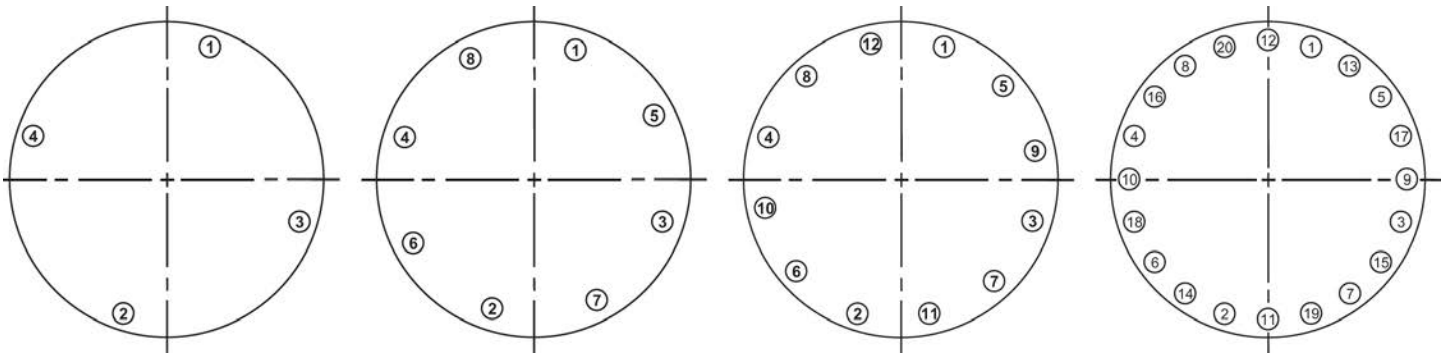
_____ 3. Lubricate bolts, nuts, AND flange surface AROUND BOLT HOLES.

_____ 4. Number bolts in cross-pattern sequence according to the appropriate sketch below.

_____ 5. Install nuts. **HAND TIGHTEN nuts all around until snug. NEXT, using a torque wrench PRETIGHTEN BOLTS to 10-20 ft-lbs** torque using the cross-pattern tightening sequence below.

_____ 6. **Check gap for uniformity**.

_____ 7. Use the appropriate cross-pattern tightening sequence in the sketch below to hand tighten, pre-tighten and for Rounds 1, 2, and 3. Each tightening sequence in the sketch below constitutes a "Round."



Target Torque: _____ ft-lbs (from torque table)

LUBRICATE, HAND TIGHTEN, PRE-TIGHTEN, then TIGHTEN, bolts in stages using cross pattern sequence.

Pre-Tighten - Hand Tighten, then 1/4 Turn with hand wrench using a cross pattern tightening sequence.

Round 1 - Tighten to _____ ft-lbs (30% of target torque)

Round 2 - Tighten to _____ ft-lbs (60% of target torque)

Round 3 - Tighten to _____ ft-lbs (100% of target torque)

Check gap around the circumference between each of these rounds, measured at every other bolt. If the gap is not reasonably uniform around the circumference, make the appropriate adjustments by selective bolt tightening before proceeding.

Rotational Round – Starting with Bolt No. 1, tighten in a ROTATIONAL, clockwise tightening sequence at 100% of Final Torque (same as Round 3 above), for at least one complete round. If necessary, continue until no further nut rotation occurs at 100% of the Final Torque value for any nut.

Final Round (optional) - RETORQUE after 4 to 24 hours. A large percentage of the short-term bolt preload loss occurs within twenty-four hours after initial tightening with most occurring after four to five hours. This Round recovers this loss.

TIGHTENING METHOD USED:

_____ Hand Wrench _____ Manual Torque Wrench _____ Hydraulic Torque Wrench

_____ Impact Wrench _____ Other

Joint Assembler: _____ Date: _____

For questions contact GRI Technical Services at (713) 856-9445, or tech@durlon.com or TFC Technical Services at (866) 537-1133, or tech@trianglefluid.com.

Durlon® - Gasket Installation

Non-Pressure Car Hinged & Bolted Manway Eyebolt Tightening Procedure

Customer: _____ Tank Car No. _____

Location: _____ Part No. _____

AAR Manway Style: _____ Gasket Dimensions: _____

(Refer to GRI/TFC MW Gasket Style/Size Chart)

Gasket Material: Durlon® 9000, Durlon® 9600, Durlon® 8500

(Durlon® CNA & PTFE materials are "Hard" manway gasket styles as noted in Appendix D of M-1002)

Eyebolt Grade: A307, A449, A193-B7, A193-B8/B8M Class 2 Eyebolt Diameter: _____

(Circle one)

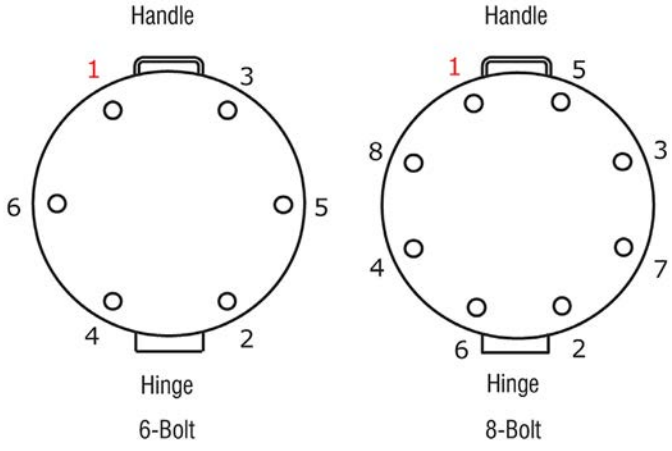
Lubrication Used: _____ Assembly Torque: _____

Assembly Sequence

Assembly requires a minimum of 5 steps:

- Pretightening. Hand tighten lubricated eyebolts then 1/4 turn with a hand wrench.
- Three star pattern tightening sequences in either a 6-bolt or 8-bolt pattern, increasing the torque in each sequence per the chart on the right.
- A rotational pass at full torque to equalize the stress on each eyebolt.
- Optional. Retorque after 4-24 hrs.

WARNING: Bolts must be tightened in the cross-pattern tightening sequence, employing the incremental rounds of tightening as prescribed in this procedure. If this is not done, the flanges may become out of parallel relative to each other, an indicator of nonuniform gasket loading and potential joint leakage.

Manway Bolt Tightening Sequence	6 Eyebolts		8 Eyebolts	
	Handtight then 1/4 turn		Handtight then 1/4 turn	
	30%	1st Sequence	30%	1st Sequence
	60%	2nd Sequence	60%	2nd Sequence
	100%	3rd Sequence	100%	3rd Sequence
	100%	Rotational	100%	Rotational

Retorque after 4 to 24 hrs. A large percentage of the short-term bolt preload loss occurs within 24 hours after initial tightening with most occurring after 4 to 5 hours. This Round recovers this loss. **Failure To Pre-Tighten The Nuts Result In Flanges That Are Not Parallel, And Could Result In Possible Leakage**

Joint Assembler: _____ Date: _____

For questions contact GRI Technical Services at (713) 856-9445, or tech@durlon.com, or TFC Technical Services at (866) 537-1133, or tech@trianglefluid.com.

Durlon® - Typical Tank Car Torque Values

General Purpose Cars								
Component	Material	Style	Gasket Material/Dimensions			Fasteners No. / Dia / Grade	Torque (ft-lbs)	
			Thk.	OD	ID		K = 0.15	K = 0.17
Manway Cover	Durlon® 9000 (Hard Dims)	AAR-1	1/8”	21-5/8”	19-1/2”	8 / 1” / A307	185	210
		AAR-1	1/8”	21-5/8”	19-1/2”	6 / 1” / A307	185	210
		AAR-1	1/8”	21-5/8”	19-1/2”	6 / 7/8”/ 1045	135	152
		TRN-1	1/8”	21-11/16”	19-5/8”	6 / 7/8” / A449	210	240
	*Viton® (Elastomeric Dims)	AAR-1	1/4”	21-11/16”	19-1/2”	8 / 1” / A307	70	80
		TRN-1	1/4”	21-1/2”	19-1/4”	6 / 7/8” / A449	70	80
Cover Flange	Durlon® 9000	-	1/8”	17-1/8”	15”	12 / 1” / A193-B7	535	600
		-	1/8”	17-3/4”	16-3/4”	12 / 3/4”/ 5	205	230
		-	1/8”	16-1/8”	14”	12 / 1” /A193-B7	535	600
Air / Liquid Valves	Durlon® 9000	1”	1/8”	2-5/8”	1-5/16”	4 / 1/2” / A193-B7	40	45
		2” RF	1/8”	4-1/8”	2-3/4”	4 / 5/8” / A193-B7	120	140
		2” FF	1/8”	4-1/8”	2-3/4”	4 / 5/8” / A193-B7	140	155
		3”	1/8”	5-3/8”	4-1/8”	4 / 5/8” / A193-B7	140	155
Gauge Device	Durlon® 9000	-	1/8”	3-3/8”	2-1/2”	4 / 3/4” / A193-B7	125	140
		-	1/8”	9-1/4”	7-3/8”	4 / 3/4” / A193-B7	250	280
		T/G	1/8”	2-1/4”	1-1/2”	4 / 5/8” / A193-B7	80	95
Safety Valve	Durlon® 9000	-	1/8”	5-3/8”	4-1/8”	4 / 3/4” / A193-B7	200	225
		-	1/8”	9”	8-1/4”	8 / 5/8” / A193-B7	110	125
Bottom Outlet	Durlon® 9000	T/G	1/8”	8-1/2”	7-1/2”	8 / 3/4” / A193-B7	190	210
		BOV / Outlet	1/8”	7”	5-1/4”	4 / 5/8” / A193-B7	140	160
			1/8”	8-3/8”	5”	4 / 5/8” / A193-B7	140	160
Number of bolts, bolt grade and lubrication can vary. *Contact GRI Technical Services for additional information. Revised May 2017								

Pressure Cars								
Component	Material	Gasket Material/Dimensions			Fasteners		Torque (ft-lbs)	
		Thk.	OD	ID	Size	Grade	Never-seize type lube	Halocarbon, or Copper lube
18” Manway	Durlon® 9000	1/8”	20-1/4”	19-1/4”	1-1/8”	A320-L7	550	485
20” Manway		1/8”	22-1/4”	21-1/4”	1-1/8”	A320-L7	600	530
22” Manway		1/8”	24-1/4”	23-1/4”	1-1/8”	A320-L7	660	580
Angle Valve / Gauging Device (C)	Durlon® 9000	1/8”	2-1/4”	1-1/2”	5/8”	A320-L7	85/95 (C)	75/83 (C)
		1/8”	2-1/4”	1-1/2”	3/4”	A320-L7	168/185 (C)	130/144 (C)
		1/8”	4”	3-1/4”	3/4”	A320-L7	168/185 (C)	130/144 (C)
PRD/Safety (C)	Durlon® 9000	1/8”	2-1/4”	1-1/2”	3/4”	A320-L7	168/185 (C)	130/144 (C)
		1/8”	4-3/4”	4”	3/4”	A320-L7	168/185 (C)	130/144 (C)
		1/8”	6-3/4”	6”	7/8”	A320-L7	273/300 (C)	212/233 (C)
K = 0.15 represents a nickel anti-seize type lubricant. K = 0.17 represents moly anti-seize type lubricant. K = 0.132 represents a copper anti-seize type lubricant. (C) designates troque using a crow’s foot wrench. For torque worksheets by component or car set, contact GRI Technical Services.								

Durlon® - Typical Tank Car Torque Values - Cont'd

The Seal

The purpose of a gasket is to create a static seal between two stationary flanges. The seal itself is created by achieving the proper compression on the gasket causing it to flow into the imperfections on the surface of the flange. This results in a tight, unbroken barrier, impervious to the fluid being contained.

In many instances, a good seal is obtained through the limited "swell" caused by the reaction of the inside edge of the gasket material with the fluid being contained.

A certain amount of swell is desirable, as long as it reaches an equilibrium and does not reach a condition of degradation where the gasket begins to breakdown. In many instances, the fluid being contained may "cauterize" the inside edge of the gasket and "seal off" the gasket from further fluid penetration.

Bolting

Bolted flange connections are only as good as the fastener system being used and unfortunately the fastener system is often overlooked within the system. The majority of fastener systems being used in the industrial world are threaded. The fastener system consists of at least the bolt/stud and the nut but it is recommended to also include washers.

The application and distribution of torque can be improved through the use of washers under the head of the bolt and between the flange and nut. Washers effectively reduce the friction between the turning surfaces of the nut and bolt head to the flange, thus translating into a more accurate load being applied to the gasket. For standard applications it is recommended to use through-hardened washers, in order to prevent washer galling.

Bolting should be of sufficient strength to achieve proper compression of the gasket, to not only seal the joint, but to maintain the seal without exceeding the yield strength of the bolts being used. The torque values in our torque tables *(pg. 10)* are based on using ASTM A193 Grade B7 studs and 2H heavy hex nuts lubricated with never seize.

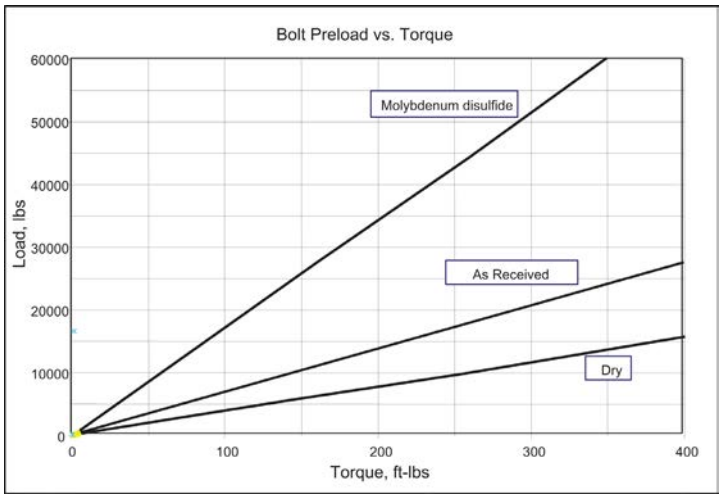
Since sheet gasket materials have micro pores, they must be sufficiently compressed to reduce porosity. Without adequate compression the system pressure can force the contained fluid into the gasket and degrade it. Therefore, when installing the gasket it is important that good technique be followed including cleaning the flanges, inspecting the flange face and the bolts and bringing the flanges together parallel and in stages. Many field problems arise from improperly installed gaskets. Refer to the Bolt Tightening Worksheet *(pg. 8)* for more information on installation procedures.

The Effect of Bolt Lubrication

Bolt lubrication greatly affects the torque values used when installing gaskets. To achieve the same gasket compression, a much higher torque value is required for a dry bolt versus using an effective lubricant such as molybdenum disulfide.

In a dry bolt up, or where an inefficient lubricant is used, the effort used in tightening is overcome by the frictional forces between the bolts and nuts and to a greater extent between the nuts and nut facings.

This can result in a lower gasket load and inadequate stress on the bolts, which can result in torque loss and eventual leakage in service. *(see graph below)*



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Durlon® - Railroad Tank Car Chemical Resistance Chart

The following information is a general guide only for the selection of a suitable gasket material as there are unlimited combinations of fluid, pressure and temperature conditions.

A = Acceptable C = Caution-Dependent on Conditions NS = Not Suitable - = No Data Available

Fluid	7900 7925 7950	8500	9000 9000N	9200
Acetaldehyde	C	C	A	A
Acetic Acid	C	C	A	A
Acetic Acid (37%)	C	A	A	A
Acetic Anhydride	C	C	A	A
Acetone	C	C	A	A
Acetonitrile	NS	NS	A	A
Acetylene	A	A	A	A
Acrolein	C	C	A	A
Acrylic Acid	NS	NS	A	A
Acrylonitrile	NS	NS	A	A
Air	A	A	A	A
Alum	A	A	A	A
Aluminum Acetate	A	A	A	A
Aluminum Chloride	A	A	A	A
Aluminum Fluoride	NS	NS	-	A
Aluminum Hydroxide	A	A	A	A
Aluminum Nitrate	A	A	A	A
Aluminum Sulfate	A	A	A	A
Amines	C	C	A	A
Ammonia, Gas	C	A	-	-
Ammonia, Gas (<150°F)	C	A	A	A
Ammonia, Gas (>150°F)	NS	NS	A	A
Ammonia (Liquid)	C	A	-	-
Ammonia, Liquid, Anhydrous	C	A	A	A
Ammonium Bisulfite	A	A	A	A
Ammonium Chloride	A	A	A	A
Ammonium Hydroxide	A	A	A	A
Ammonium Hydroxide (10%)	A	A	A	A
Ammonium Hydroxide (Sat'd)	A	A	-	-
Ammonium Nitrate	C	C	A	A
Ammonium Phosphate	A	A	A	A
Ammonium Sulfate	A	A	A	A
Ammonium Sulfide	A	A	A	A
Amyl Chloride	NS	NS	A	A
Aniline, Aniline Oil	NS	NS	A	A
Aqua Regia	NS	NS	A	A
Arsenic Acid	A	A	A	A
Asphalt	A	A	A	A
Aviation Fuels	A	A	A	A
Baking Soda	A	A	A	A
Barium Chloride	A	A	A	A
Barium Hydroxide	A	A	A	A
Barium Sulfate	A	A	-	-
Barium Sulfide	A	A	A	A
Beer	A	A	A	A
Benzaldehyde	NS	NS	A	A

Fluid	7900 7925 7950	8500	9000 9000N	9200
Benzene (Benzol)	NS	NS	A	A
Benzoic Acid	NS	NS	A	A
Benzoyl Chloride	NS	NS	A	A
Benzyl Alcohol	NS	NS	A	A
Benzyl Chloride	NS	NS	A	A
Black Sulfate Liquor	C	A	C	A
Black Sulfate Liquor (<350°F)	A	A	A	A
Black Sulfate Liquor (>350°F)	NS	NS	A	A
Bleach Solutions	C	C	A	A
Boiler Feed Water	A	A	A	A
Borax	A	A	A	A
Boric Acid	A	A	A	A
Brine	A	A	A	A
Bromine (Liquid)	NS	NS	A	A
Bromine (Gas)	NS	NS	A	A
Butadiene	NS	NS	A	A
Butane	A	A	A	A
2-Butanone	NS	NS	A	A
Butyl Acetate	NS	NS	A	A
Butyl Alcohol (Butanol)	A	A	A	A
n-Butyl Amine	C	C	A	A
tert-Butyl Amine	C	C	A	A
Butyl Methacrylate	NS	NS	A	A
Butylene (Butene)	A	A	A	A
Butyric Acid	A	A	A	A
Calcium Bisulfite	A	A	A	A
Calcium Carbonate	A	A	A	A
Calcium Chlorate	A	A	-	-
Calcium Chloride	A	A	A	A
Calcium Hydroxide	A	A	A	A
Calcium Hypochlorite	C	C	A	A
Calcium Nitrate	A	A	A	A
Calcium Sulfate	A	A	-	-
Caprolactam	NS	NS	A	A
Carbon Dioxide, dry	A	A	A	A
Carbon Dioxide, wet	A	A	A	A
Carbon Disulfide	NS	NS	A	A
Carbon Monoxide	A	A	A	A
Carbon Tetrachloride	C	C	A	A
Castor Oil	A	A	A	A
Casustic Potash	A	A	-	-
Caustic Soda (NaOH)	C	C	C	A
Cloric Acid (10%)	NS	NS	-	-
Cloric Acid (20%)	NS	NS	-	-
Chlorine, liquid (Dry)	NS	NS	A	A
Chlorine Liquid	NS	NS	A	A

Durlon® - Railroad Tank Car Chemical Resistance Chart - Cont'd

The following information is a general guide only for the selection of a suitable gasket material as there are unlimited combinations of fluid, pressure and temperature conditions.

A = Acceptable C = Caution-Dependent on Conditions NS = Not Suitable - = No Data Available

Fluid	7900 7925 7950	8500	9000 9000N	9200
Chlorine Dioxide	NS	NS	A	A
Chlorine Gas (Dry)	NS	NS	A	A
Chlorine Gas (Wet)	NS	NS	A	A
Chlorinated Water (<3500ppm)	NS	NS	A	A
Chlorinated Water (>3500ppm)	NS	NS	A	A
Chlorobenzene	NS	NS	A	A
Chloroethane	NS	NS	A	A
Chloroethylene	NS	NS	A	A
Chloroform	C	C	A	A
Chlorosulfonic Acid	NS	NS	A	A
Chromic Acid	NS	NS	A	A
Chromic Acid (10%)	-	-	A	A
Chromic Acid (30%)	-	-	A	A
Chromic Acid (40%)	-	-	A	A
Chromic Acid (50%)	-	-	A	A
Citric Acid	A	A	A	A
Coal Gas	A	A	A	A
Coconut Oil	A	A	A	A
Coke Oven Gas	NS	NS	A	A
Copper Acetate	A	A	-	-
Copper Chloride	A	A	A	A
Copper Sulfate	A	A	A	A
Corn Oil	C	C	A	A
Cotton Seed Oil	A	A	A	A
Creosote (Coal Tar)	A	A	A	A
Cresol	C	C	A	A
Crude Oil	A	A	A	A
Cumene	NS	NS	A	A
Cyclohexane	C	C	A	A
Cyclohexanone	NS	NS	A	A
Detergent Solutions	A	A	A	A
Diacetone Alcohol	NS	NS	A	A
Diazomethane	NS	NS	A	A
Dibenzyl Ether	C	C	A	A
Dibutylamine	C	C	A	A
Dichlorobenzene	NS	NS	A	A
Dichlorobenzidene	NS	NS	A	A
Dichloroethylene	NS	NS	A	A
Dichloroethyl Ether	NS	NS	A	A
Dichloromethane	NS	NS	A	A
Diesel Fuel	A	A	A	A
Dimethylamine	NS	NS	A	A
Diethyl Carbonate	NS	NS	A	A
Dimethyl Acetamide	NS	NS	A	A
Dimethylformamide (DMF)	NS	NS	A	A
Dioxane	NS	NS	A	A

Fluid	7900 7925 7950	8500	9000 9000N	9200
Dowtherm A, E	C	C	A	A
Dowtherm J	NS	NS	A	A
Epichlorohydrin	NS	NS	A	A
Ethane	A	A	A	A
Ether	NS	NS	A	A
Ethyl Acetate	C	C	A	A
Ethyl Alcohol (Ethanol)	A	A	A	A
Ethylbenzene	NS	NS	A	A
Ethylchloride	NS	NS	A	A
Ethylene	A	A	A	A
Ethylene Bromide	NS	NS	A	A
Ethylene Dichloride (EDC)	NS	NS	A	A
Ethylene Glycol	A	A	A	A
Ethyl Ether	C	C	A	A
Ethylene Oxide	NS	NS	A	A
Fatty Acids	A	A	A	A
Ferric Chloride	A	A	A	A
Ferric Hydroxide	A	A	-	-
Ferric Nitrate	A	A	-	-
Ferrous Chloride	A	A	A	A
Ferrous Sulfate	A	A	-	-
Fish Oil	A	A	-	-
Flue Gas	A	A	-	-
Fluorine Gas (Dry)	NS	NS	NS	NS
Fluorine (Gas, Liquid)	NS	NS	NS	NS
Fluorine Gas (Wet)	NS	NS	NS	NS
Formaldehyde	A	A	A	A
Formic Acid	NS	NS	A	A
Freon (See Refrigerants)	-	-	-	-
Fuel Oil	A	A	A	A
Gas, Natural	A	A	A	A
Gasoline	A	A	A	A
Gasoline Sour	A	A	A	A
Gelatin	A	A	A	A
Glucose	A	A	A	A
Glycerin (Glycerol)	A	A	A	A
Green Sulfate Liquor	C	C	A	A
Glycol	A	A	A	A
Heptane	A	A	A	A
Hexane	A	A	A	A
Hydraulic Oil (Mineral)	A	A	A	A
Hydraulic Oil (Phosp. Ester)	C	C	A	A
Hydrazine	C	C	A	A
Hydrochloric Acid	NS	NS	A	A
Hydrochloric Acid (30%)	NS	NS	A	A
Hydrofluoric Acid	NS	NS	NS	NS

Durlon® - Railroad Tank Car Chemical Resistance Chart - Cont'd

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A = Acceptable C = Caution-Dependent on Conditions NS = Not Suitable - = No Data Available

Fluid	7900 7925 7950	8500	9000 9000N	9200
Hydrogen	A	A	A	A
Hydrogen Chloride, (Dry)	NS	NS	A	A
Hydrogen Fluoride (HF)	NS	NS	NS	NS
Hydrogen Peroxide (10%)	C	C	A	A
Hydrogen Peroxide (50%)	NS	NS	A	A
Hydrogen Peroxide (90%)	NS	NS	A	A
Hydrogen Sulfide (Dry)	C	C	A	A
Hydrogen Sulfide (Wet)	C	C	A	A
Hydroquinone	NS	NS	A	A
Iodine	A	A	A	A
Isobutane	A	A	A	A
Isooctane	A	A	A	A
Isopropyl Alcohol	A	A	A	A
Isopropyl Ether	A	A	A	A
Jet Fuel	A	A	A	A
Kerosene	A	A	A	A
Lacquer Solvents	NS	NS	A	A
Lactic Acid	A	A	A	A
Lead Sulfate	A	A	-	-
Linoleic Acid	C	C	-	-
Linseed Oil	A	A	A	A
Lubricating Oil	A	A	A	A
Magnesium Carbonate	A	A	-	-
Magnesium Chloride	A	A	A	A
Magnesium Hydroxide	A	A	A	A
Magnesium Sulfate	A	A	A	A
Maleic Acid	A	A	A	A
Maleic Anhydride	NS	NS	A	A
Mercuric Chloride	A	A	A	A
Mercury	A	A	A	A
Methane	A	A	A	A
Methanol	A	A	A	A
Methylacrylic Acid	NS	NS	A	A
Methyl Acetone	NS	NS	A	A
Methyl Alcohol	A	A	A	A
Methyl Amine	C	C	-	-
Methylene Chloride	NS	NS	A	A
Methyl Ethyl Ketone, MEK	NS	NS	A	A
Methyl Isobutyl Ketone	NS	NS	A	A
Methyl Chloride	NS	NS	A	A
Methyl Isocyanate	NS	NS	A	A
Methyl Methacrylate	NS	NS	A	A
Milk	A	A	A	A
Mineral Oil	A	A	A	A
Muriatic Acid	NS	NS	A	A
Naphtha	A	A	A	A
Naphthalene	NS	NS	A	A
Natural Gas	A	A	A	A

Fluid	7900 7925 7950	8500	9000 9000N	9200
Nickel Ammonium Sulfate	NS	NS	-	-
Nickel Nitrate	A	A	-	-
Nickel Sulfate	A	A	A	A
Nitric Acid	NS	NS	A	A
Nitric Acid (< 20%)	NS	NS	A	A
Nitric Acid (50%)	NS	NS	A	A
Nitrobenzene	NS	NS	A	A
Nitrogen	A	A	A	A
Nitrogen Dioxide	NS	NS	A	A
Nitrogen Tetroxide	NS	NS	A	A
Nitrous Acid (10%)	NS	NS	-	-
Nitrous Oxide	A	A	-	-
Octane	A	A	A	A
Oil, Crude	A	A	A	A
Oil, Mineral	A	A	A	A
Oleic Acid	C	C	A	A
Oleum, Fuming H2SO4	NS	NS	A	NS
Olive Oil	A	A	-	-
Oxalic Acid	C	C	A	A
Oxalic Acid (50%)	A	A	-	-
Oxygen, gas	NS	NS	A	A
Oxygen, liquid*	NS	NS	A	A
Ozone	NS	NS	A	A
Paraffin	A	A	A	A
Pentane	A	A	A	A
Perchloroethylene	NS	NS	A	A
Petroleum	A	A	A	A
Phenol	NS	NS	A	A
Phosphoric Acid	C	C	C	A
Phosphoric Acid (45%)	C	C	A	A
Phthalic Acid	C	C	A	A
Phthalic Anhydride	NS	NS	A	A
Polyacrylonitrile	A	A	A	A
Polyvinyl Acetate	A	A	-	-
Potash	A	A	A	A
Potassium Chloride	A	A	A	A
Potassium Dichromate	A	A	A	A
Potassium Hydroxide	C	C	A	A
Potassium Nitrate	A	A	A	A
Potassium Sulfate	A	A	A	A
Potassium Sulfide	A	A	-	-
Potassium Sulfite	A	A	-	-
Propane	A	A	A	A
Propylene	NS	NS	A	A
Propyl Alcohol	A	A	A	A
Propylene Glycol	A	A	A	A

Durlon® - Railroad Tank Car Chemical Resistance Chart - Cont'd

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Fluid	7900 7925 7950	8500	9000 9000N	9200
Pydrauls, Skydrols	NS	NS	A	A
Pyridine	NS	NS	A	A
Red Sulfite Liquor	NS	NS	A	A
Red Sulfite Liquor (>380°F)	NS	NS	C	C
Refrigerant R-11 **	A	A	A	A
Refrigerant R-12 **	A	A	A	A
Refrigerant R-22 **	C	C	A	A
Refrigerant R-113 **	A	A	A	A
Refrigerant HCFC 123 **	C	C	A	A
Refrigerant HCFC 124 *	C	C	A	A
Refrigerant HFC 125 *	C	C	A	A
Refrigerant HFC 134a *	A	A	A	A
Refrigerant HCFC 141b	A	A	A	A
Refrigerant HFC 236fa	A	A	A	A
Refrigerant Blend HP 62*	A	A	A	A
Refrigerant Blend HP 80	C	C	A	A
Refrigerant Blend HP 81	C	C	A	A
Refrigerant Blend 404a*	A	A	A	A
Salicylic Acid	A	A	-	-
Sea Water	A	A	A	A
Silicone Oil	A	A	A	A
Siler Chloride	A	A	-	-
Silver Nitrate	A	A	A	A
Soap Solutions	A	A	A	A
Soda Ash	A	A	A	A
Sodium Bicarbonate	A	A	A	A
Sodium Bisulfate	A	A	-	-
Sodium Bisulfite	A	A	A	A
Sodium Carbonate	A	A	A	A
Sodium Chloride	A	A	A	A
Sodium Hydroxide	C	C	A	A
Sodium Hydroxide (<10%)	A	A	A	A
Sodium Hydroxide (10-50%)	NS	NS	C	A
Sodium Hypochlorite	NS	NS	A	A
Sodium Nitrate	A	A	A	A
Sodium Phosphate	A	A	A	A
Sodium Silicate	A	A	A	A
Sodium Sulfate	A	A	A	A
Sodium Sulfite	A	A	-	-
Sour Crude Oil	A	A	A	A
Soybean Oil	A	A	A	A
Steam (to 450°F)	A	A	A	A
Steam (over 450°F)	A	A	NS	NS
Steam (Low-med Pressure)	A	A	A	A
Steam (High Pressure)	NS	A	-	-
Stearic Acid	A	A	A	A
Stoddard Solvent	A	A	A	A
Styrene	NS	NS	A	A

Fluid	7900 7925 7950	8500	9000 9000N	9200
Sulfite Liquors	C	C	A	A
Sulfur	NS	NS	A	A
Sulfur (Molten)	C	C	A	A
Sulfur Dioxide	NS	NS	A	A
Sulfuric Acid (20%)	NS	NS	A	A
Sulfuric Acid (<50%)	NS	NS	A	A
Sulfuric Acid (60%)	NS	NS	A	A
Sulfuric Acid (70%)	NS	NS	A	C
Sulfuric Acid (>80%)	NS	NS	C	NS
Sulfuric Acid, Conc	NS	NS	A	C
Sulfuric Acid,Conc (>200°F)	NS	NS	A	NS
Fuming Sulfuric Acid, Oleum	NS	NS	A	NS
Tar	A	A	A	A
Tartaric Acid	A	A	A	A
Tetrachloroethane	C	C	A	A
Tetrahydrofuran (THF)	NS	NS	A	A
Toluene	NS	NS	A	A
Transformer Oil	A	A	A	A
Transmission Fluid	A	A	A	A
Trichloroethane	NS	NS	A	A
Trichloroethylene	C	C	A	A
Triethanolamine	C	C	A	A
Turpentine	A	A	A	A
Urea	A	A	A	A
Varsol	A	A	A	A
Vegetable Oil	A	A	A	A
Vinegar	A	A	A	A
Vinyl Acetate	C	C	A	A
Vinyl Chloride	NS	NS	A	A
Water	A	A	A	A
Water Mine Acid	C	C	A	A
Water Deionized	A	A	A	A
Water, Sea	A	A	A	A
Whiskey	A	A	A	A
White Sulfate Liquor	A	A	A	A
White Spirit	A	A	A	A
Wines	A	A	A	A
Xylene	NS	NS	A	A
Zinc Chloride	A	A	A	A
Zinc Nitrate	A	A	A	A
Zinc Sulfate	A	A	A	A

*Durlon 9000 is listed in Pamphlet 95 of the Chlorine Institute, as an acceptable gasket material for dry chlorine (liquid & gas) service. Gaskets for chlorine or oxygen service should be cleaned before installation. This Chemical Resistance Chart is accurate at time of release (May, 2020). You can view a current chart dynamically on our iGasket Plus Web App: www.igasketplus.com. Or you can download the native app to your hand-held device.

Product Development

Our product development team is tirelessly working on the next innovative Durlon® fluid sealing solution for critical service application. Durlon® Sealing Solutions have been designed, laboratory and field tested before they are introduced into the industries we serve so that we are confident that these products perform well, every time. That is the Durlon® commitment to you, our valued customer. Visit www.durlon.com to locate some of the specialized industries we serve and related information specific to your industry. We value your interest in our group of companies and look forward to working with you.

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SEALING SOLUTIONS