

LIMITED WARRANTY

Underground Petroleum Storage Tanks

Xerxes Corporation ("Xerxes") warrants to owner ("Owner") that our underground petroleum storage tanks, if installed, used, and maintained in the United States or Canada in accordance with Xerxes' published specifications, installation instructions and operating guidelines, applicable supplemental materials, all applicable laws and regulations, and limited to storage of the products listed below at ambient temperatures or fuel oils, used in oil burning equipment, at temperatures not to exceed 150°F (65° C):

- 1) Will not fail for a period of thirty (30) years from date of original delivery by Xerxes due to natural external corrosion.
- 2) Will not fail for a period of thirty (30) years from date of original delivery by Xerxes due to internal corrosion, provided the tank is used solely, with or without tank water bottoms, to store the following products:
 - a. gasoline, jet fuel, aviation fuels, motor oils, motor vehicle waste oils, kerosene, diesel fuel, or fuel oils
 - gasoline with up to 20%, by volume, of methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), di-isopropyl ether (DIPE), tertiary butyl alcohol (TBA), tertiary amyl methyl ether (TAME), or tertiary amyl ethyl ether (TAEE)
 - b. **gasoline and ethanol blended motor fuels (per applicable ASTM fuel standards)**
 - **E10 (90% gasoline and 10% ethanol)**
 - **E15 (85% gasoline and 15% ethanol)**
 - **E85 (85% ethanol and 15% gasoline)**
 - **other ethanol blends up to and including 100% ethanol**
 - c. gasoline and methanol blended motor fuels (per applicable ASTM fuel standards)
 - M85 (85% methanol and 15% gasoline)
 - other methanol blends up to and including 100% methanol
 - Oxinol-50 waiver (90.5% gasoline and 9.5% Oxinol-50 comprised of a 4.75% methanol and 4.75% gasoline-grade tertiary butyl alcohol (GTBA) mixture)
 - Dupont EPA waiver (gasoline with 5% methanol and a minimum of 2.5% cosolvent – the blend may contain a maximum concentration of up to 3.7%, by weight, oxygen in the final fuel)
 - d. biodiesel fuel blends up to 100% biodiesel (per applicable ASTM fuel standards)
- 3) Will not fail for a period of thirty (30) years from date of original delivery by Xerxes due to structural failure (defined as spontaneous breaking or collapse caused by material defects in materials or workmanship).
- 4) Will meet Xerxes' published specifications and will be free of material defects in materials and workmanship for a period of one (1) year following the date of original delivery by Xerxes.

Xerxes warrants to Owner that all Xerxes-manufactured tank accessories, if installed, used and maintained in Canada or the United States in accordance with Xerxes' published specifications, installation instructions and operating guidelines, applicable supplemental materials, and all applicable laws and regulations, will be free of material defects in materials and workmanship for a period of one (1) year following the date of original delivery by Xerxes.

If any tank or accessory is to be removed from an installation, moved and reinstalled at Owner's new location and is intended for active service at the new location, the tank and accessories must be recertified by Xerxes to continue the balance of the limited warranty as originally extended.

The foregoing limited warranty does not extend to tanks or accessories ("individually and collectively Goods") damaged due to acts of God, war, terrorism, or failure of Goods caused, in whole or in part, by misuse, unlawful use, improper installation, storage, servicing or maintenance, or operation in excess of their rated capacity or contrary to their recommended use, whether intentional or otherwise, or any other cause or damage of any kind not the fault of Xerxes. Xerxes only warrants repairs or alterations performed by Xerxes or its authorized contractors performing work authorized in advance, in writing, by Xerxes. Xerxes does not warrant any product, components or parts manufactured by others. All consumable components including but not limited to o-rings and gaskets are excluded from this limited warranty.

Owner's sole and exclusive remedy for breach of warranty is limited at Xerxes' option to: (a) repair of the defective tank or accessory, (b) delivery of a replacement tank or accessory to the point of original delivery, or (c) refund of the original purchase price. No warranty claim will be considered without removing the tank and any accessory from the ground if Xerxes deems it necessary to evaluate a warranty claim. In the event of a breach of warranty claim, a claimant must give Xerxes the opportunity to observe and inspect the installation prior to the removal of any backfill below the tank top, and the removal of the tank and any accessory from the ground, or the claim will be forever barred. All claims must be made in writing within one (1) year after tank or accessory failure or be forever barred. ALL RIGHTS, OBLIGATIONS AND CLAIMS UNDER THIS LIMITED WARRANTY SHALL BE EXCLUSIVELY MADE AND DETERMINED IN THE COURTS OF, AND GOVERNED BY THE LAWS OF, THE STATE OF MINNESOTA, U.S.A., EXCLUDING ITS CONFLICT OF LAW PRINCIPLES.

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Consumer Notice: This warranty gives you (Owner) specific legal rights. You (Owner) may also have other rights which vary from state to state.

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Effective: June 1, 2015
United States

Dualoy® 3000/LCX Product Data

Applications

Rigid fiberglass coaxial fuel handling systems requiring Underwriters Laboratories Listing for integral primary and containment piping conveying the following fuels:

- Motor Vehicle (MV)
- Aviation and Marine A&M)
- High Blend (HB)
- Bio-Diesel
- Concentrated (CT)
- Diesel Exhaust Fluid

Description

Dualoy 3000/LCX rigid fiberglass coaxial piping is a cost-effective solution for contained piping systems. LCX is used for product delivery lines in underground fuel handling systems to convey fuel from the tank to the dispensers. Dualoy 3000/LCX pipe is UL Listed for use with motor vehicle (MV), high blend (HB), concentrated (CT) and aviation and marine (A&M) fuels. Based on currently known tests, **NOV Fiber Glass Systems found this product to be suitable for conveying all blends of biodiesel and ethanol type fuels and the conveyance of DEF.**

The LCX pipe is manufactured as an integral unit. The primary is made of chemically inert, non-permeable, fiberglass reinforced epoxy resin which is inherently resistant to deterioration due to water and microbial attack. This layer is covered with a porous layer to provide the small volume interstitial space, which facilitates rapid leak detection. Then, the containment layer, comprised of the same material as the primary, is wound over the primary and porous layers.

The containment system is installed with custom designed clamshell containment fittings. Both the primary and containment systems are bonded for long-term, reliable performance.

- Dualoy 3000/LCX containment fittings are typically bolted in place while the adhesive cures.
- Dualoy 3000/LCX reduces installation and inspection time dramatically, retaining system integrity.
- Dualoy 3000/LCX double wall design significantly improves impact resistance over single wall pipe.
- Dualoy 3000/LCX systems provide true double wall design which permits rapid communication through the interstice.

Listings and Approvals

The rigid fiberglass piping used in Dualoy 3000/LCX is Listed in the United States with Underwriters Laboratories for nonmetallic underground piping for MV, HB, CT and A&M fuels under File No. MH9162. Dualoy 3000/LCX pipe and fittings are also Listed with Underwriters Laboratories of Canada for Petroleum Products and Oxygenated Fuels (File CMH715). Underwriters Laboratories has also approved Dualoy 3000/L and Dualoy 3000/LCX for use with MTBE fluids.

Performance

Primary operating pressures to 200 psig (13.8 bar)

Continuous operating temperature to 150°F (66°C)

Containment system pressures to 50 psig (3.45 bar)

Individual system components may not have the same ratings as the pipe. Refer to the detailed product information for the specific components to determine the pressure rating for the system as a whole.

Composition

Primary pipe: Filament-wound fiberglass reinforced epoxy pipe with integral epoxy liner. When classified in accordance with ASTM D2310 and ASTM D2996, the pipe meets the following cell limits: RTRP 11CF1-5420.

Pipe containment: Filament-wound fiberglass reinforced epoxy pipe.

Interstitial space: Dry, graded glass beads secured in place with adhesive backed tape.

Fittings: Compression molded or filament-wound fiberglass reinforced epoxy primary fittings. Containment fittings are molded.

Adhesive: PSX™ •20 or PSX™ •34 ambient-cure, two-part epoxy for all services (including alcohols and MTBE).

Joining System Primary:

Bell and spigot taper/taper adhesive-bonded joint

Containment:

Adhesive-bonded clamshell fittings. Parts are compression molded for exact fit and match. Material is identical to primary fittings and is UL Listed for all services, including use in MTBE fluids.

Pipe Lengths

Standard 20 ft. (6.1 m) random lengths 17 to 21 ft. (5.2 to 6.4 m) and 30 ft. (9.1 m) random lengths 27 to 32 ft. (8.2 to 9.7 m)

Other lengths up to 42 ft. (12.8 m) available upon request.

Fittings

Primary	Adapters: bell x NPT male ⁽¹⁾ Adapters: bell x NPT female ⁽²⁾ Adapters: spigot x NPT female ⁽²⁾ Adapters: spigot x NPT male ⁽²⁾ 45° elbows ⁽¹⁾ 90° elbows ⁽¹⁾ End caps ⁽¹⁾ Flange rings ⁽¹⁾	Flange stub ends ⁽¹⁾ Isolation bushings ⁽¹⁾ Nipples ⁽²⁾ Reducer bushings ⁽¹⁾ Repair couplings ⁽¹⁾ Sleeve couplings ⁽²⁾ Tees ⁽¹⁾ Dispenser pan penetration fittings ⁽¹⁾
Containment	45° elbows ⁽¹⁾ 90° elbows ⁽¹⁾ Termination sleeves ^{(1), (3)}	Couplings ⁽¹⁾ Tees ⁽¹⁾

⁽¹⁾ Molded fitting

⁽²⁾ Filament-wound fitting

⁽³⁾ 2" (50 mm) available with or without test valve. 3" and 4" (80 and 100 mm) available only with test valve

Typical Pipe Dimensions and Weights

Pipe Size		Primary Pipe ID		Primary Pipe OD ⁽¹⁾		Primary Wall Thickness		Containment OD		Capacity		Weight	
in	mm	in	mm	in	mm	in	mm	in	mm	gal/ft	l/m	lb/ft	kg/m
2	50	2.21	56	2.37	60	0.080	2.03	2.59	66	0.20	0.76	0.90	1.34
3	80	3.32	84	3.50	89	0.085	2.16	3.70	94	0.45	1.70	1.30	1.93
4	100	4.33	110	4.50	114	0.087	2.21	4.70	119	0.77	2.92	1.74	2.59

⁽¹⁾ Typical outside diameters of 2"-4" (50 -100 mm) pipe are within API, ASTM and ANSI fiberglass and steel pipe dimensions.

Typical Primary Pipe Performance

Pipe Size		Pressure Rating ⁽¹⁾		Ultimate Internal Pressure ⁽¹⁾		Ultimate Collapse Pressure ⁽²⁾	
in	mm	psig	MPa	psig	MPa	psig	MPa
2	50	200	2.07	1500	10.3	153	1.05
3	80	200	1.38	1000	6.9	90	0.62
4	100	175	1.21	750	5.2	39	0.27

⁽¹⁾ At 80°F (27°C)

⁽²⁾ At 80°F (27°C) For continuous service do not exceed 75% of these values.

Fittings Pressure Performance

Pipe Size		Primary All Fittings		Containment Clamshell Fittings	
in	mm	psig	MPa	psig	kPa
2	50	200	1.38	50 ⁽¹⁾	345
3	80	125	0.86	50 ⁽¹⁾	345
4	100	100	0.69	20	138

⁽¹⁾ With reinforcing rings

For dimensions of primary fittings, consult Dualoy 3000/L Fittings Dimensions document. Pressure ratings of fittings without UL Listing are available on request.

Dualoy 3000/LCX piping systems are designed to function at temperatures ranging from -40 to 150°F (-40 to 66°C) at service pressures between -1 and 13.8 bar. Dualoy 3000/LCX pipe conforms to ASTM D2310, D2517 and D2996.

Typical Physical Properties of Primary Pipe			
Pipe Property	Units	Value	ASTM
Thermal conductivity	Btu-in/(h•ft ² •°F)	1.7	C177
	W/m•°C	7.6	
Linear thermal expansion	10 ⁻⁶ in/in/°F	8.5	D696
	10 ⁻⁶ cm/cm/°C	15.3	
Friction factor	Hazen-Williams	150.0	—
Absolute roughness	10 ⁻⁶ ft	15.0	—
	10 ⁻⁶ m	4.6	
Specific gravity	—	1.81	D792
Barcol Hardness	Impressor 934-1	65.0	D2583

Typical Mechanical Properties of Primary Pipe			
Pipe Property ⁽¹⁾	Units	Value ⁽¹⁾	ASTM
Tensile strength Longitudinal	10 ³ psi MPa	35.0	D2105
		241.0	
Circumferential	10 ³ psi MPa	70.0	D1599
		483.0	
Tensile modulus Longitudinal	10 ⁶ psi GPa	2.5	D2105
		17.2	
Circumferential	10 ⁶ psi GPa	3.8	FGSTM
		26.2	
Compressive strength Longitudinal	10 ³ psi MPa	24.5	FGSTM
		168.9	
Compressive modulus Longitudinal	10 ⁶ psi GPa	2.6	FGSTM
		17.8	
Cyclic	10 ³ psi MPa	8.0	D2992(A)
		55.0	
Poisson's Ratio ⁽²⁾	—	0.16	FGSTM
		0.17	FGSTM

⁽¹⁾ Based on structural wall thickness.

⁽²⁾ The first subscript denotes the direction of applied stress and the second that of measured contraction
 x denotes longitudinal direction.
 y denotes circumferential direction.

Bending Radius						
Pipe Size		Minimum Bending Radius ⁽¹⁾		Maximum Deflection per 20 ft Joint	Minimum Length Required for 10° Change	
in	mm	ft	m	deg	ft	m
2	50	75	23	15	13	4
3	80	100	38	9	22	7
4	100	150	46	7.5	27	8

⁽¹⁾ At rated pressure. Sharper bends may create excessive stress concentrations. Do not bend pipe until adhesive has cured.

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