

# RED THREAD® IIA, DUALOY® 3000/LCX, 3000/L, 3000/MCX FUEL HANDLING PIPING SYSTEMS



**NOV** FiberGlass Systems

## RED THREAD IIA PIPE SYSTEMS

Red Thread IIA piping systems are made of fiberglass reinforced, aromatic amine cured, rigid, thermosetting epoxy resin. The pipe is manufactured using the classical reciprocal filament winding process where fibers are wound around a steel mandrel under controlled tension at a prescribed angle, optimized for stresses caused by pressure. Most fittings are made in matched-die compression molds where the pre-impregnated (pre-preg) fiberglass bands are chopped and placed in the mold cavities where heat and pressure are applied to form the consolidated part. Fittings can also be made by the filament winding process, where efficiency and practicality make this possible.

Pipe and fittings are bonded together using a two-part adhesive, specially formulated for strength, fuel resistance and ease of handling, including the ability to mix, apply and cure at ambient temperatures above the minimum.

### Joining Methods

The primary method of joining pipe-to-pipe is with a T. A. B. (threaded and bonded) coupling. Matching, low profile threads on the pipe and in the coupling allow a mechanical fit of the components while the adhesive cures, assuring a tight make-up.

Pipe-to-fittings bonds are made with matching tapers that "lock" together as they are joined with either an axial force or a slight twist while a "push" is being applied by hand (for 2-inch pipe only). Pipe with T. A. B. threads can also be bonded into smooth, tapered ends of fittings using the same method.



Complete joining instructions are available, along with a comprehensive set of tools to perform the installation procedures.

### Secondary Containment

Where secondary containment is needed, Red Thread IIA provides a true pipe-in-a-pipe system. Containment pipe is identical to the primary pipe. Sections are joined together with matching two-piece clamshells that are bonded and bolted together. One half of the clamshell fitting is pre-fitted with female threaded fasteners to make assembly fast and easy from one side of the fitting.



**Old vs. New** - Pipe in the foreground was installed in 1973 and removed 27 years later when the station closed.

## Sump Penetration Fittings



Single Wall Sump Entry Fitting for 2" - 6" Red Thread IIA Installations



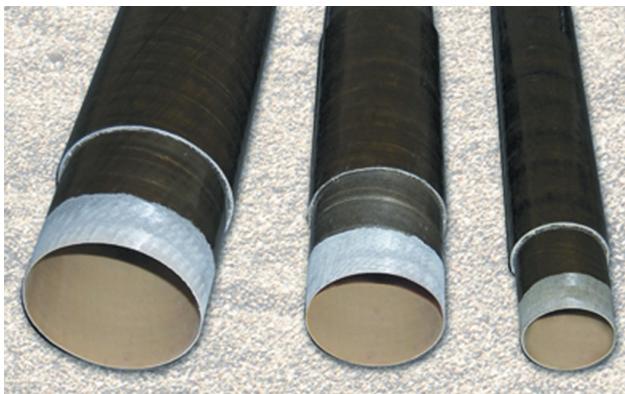
Double Wall Gasketed Sump Entry/Termination Fitting for 3"-4" Red Thread IIA Installations



Double Wall Bonded Sump Entry/Termination Fitting for 3"-4" Red Thread IIA Installations

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## DUALOY 3000/LCX PIPE SYSTEMS



The Dualoy 3000/LCX product was developed on the technology used for the Dualoy 3000/L system. The addition of the "CX" to the product name indicated the product is of coaxial construction. The common term in the marketplace for the product is "LCX" and that will be used here, also.

To build this product, first the Dualoy 3000/L primary pipe is made on a proprietary continuous process. Adhesive-backed tape is used to carry size-graded glass beads and is wrapped over the primary pipe. Another layer of adhesive-backed tape is then wound over it to form a complete, dry, porous layer, which is then over wrapped with the containment layer (or jacket) of fiberglass and resin.

### Benefits of LCX

First introduced in 1997, the LCX product has since gained in popularity and market share. The unique coaxial construction has many practical and theoretical benefits over competitive products, while retaining all the benefits of fiberglass pipe over other materials. Some of these benefits are obvious, others are less so, but probably more significant. Below is a partial list, with more entries to be added as they are realized:

- Both pipe walls are together, making it easier to carry and requiring fewer trips into the ditch
- No measuring required for containment pipe – no mistakes, no waste
- The pipe is compact, allowing less trenching, backfill and haul-off, as well as taking less warehouse space for inventory
- Fittings design makes series lay-out easy and allows cross-overs for parallel systems to be made to the same dimensions as a single-wall system
- The two pipe layers do not move relative to each other. This causes each one to support the other and enhance the strength of the pipe and the joints.
- The two layers are very close to each other, although totally separated. This narrow distance and low volume have benefits that may not be obvious:
  - No backfill or debris can get between the layers. This, along with there being no movement between the layers prevents any abrasive wear that may cause damage later
  - If water would get between the layers (unlikely), the volume is insufficient to allow any damage to occur, should that water freeze and expand (crushing primary in other cases)
  - Should a leak occur (also very unlikely), only a very small amount will be needed before it will travel to a detection point
  - During testing at installation, any communication between the two layers will be seen as it will cause a large change in the gauge pressure in the containment (because the volume of the containment is small relative to the primary – 15:1 for 2-inch pipe)
  - If a leak needs to be located, the "soapy water" test can be used to inspect the whole system (joints, fittings and pipe) – soaping the cut end of the jacket will show any leaks in that primary pipe section.
- Continuous monitoring can be done with any of the approved methods, Vacuum, Pressure or Hydrostatic, with the Hydrostatic method approved by the NWGLDE and the state of California

NOV Fiber Glass Systems has the fiberglass pipe to suit all services and product type preferences.

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Dualoy sump penetration fittings provide a permanent superior watertight termination of secondary containment lines. A variety of sizes and configurations allows a permanent fiberglass-to-fiberglass bond that withstands the test of time.

## DUALOY 3000/L PIPE SYSTEMS



Like Red Thread IIA, Dualoy 3000/L piping systems are made of fiberglass reinforced, aromatic amine cured, rigid, thermosetting epoxy resin. This pipe is manufactured using a unique process where a continuous cylinder is generated with the fibers oriented more near the circumferential and axial directions than with the reciprocal process. Dualoy 3000/L also includes a pure resin liner. Fittings are compression molded or filament wound, as is further described in the Red Thread IIA text.

Dualoy 3000/L Pipe and fittings are also using a 2-part adhesive.

### Joining Methods

All primary system bonds are made with matching tapers with the Dualoy 3000/L system. The same “lock” is made as they are joined with either an axial force or a slight twist while the force is being applied. Instructions and tools are also available.

### Secondary Containment

Where secondary containment is needed, Dualoy 3000/L is very much the same as Red Thread IIA.

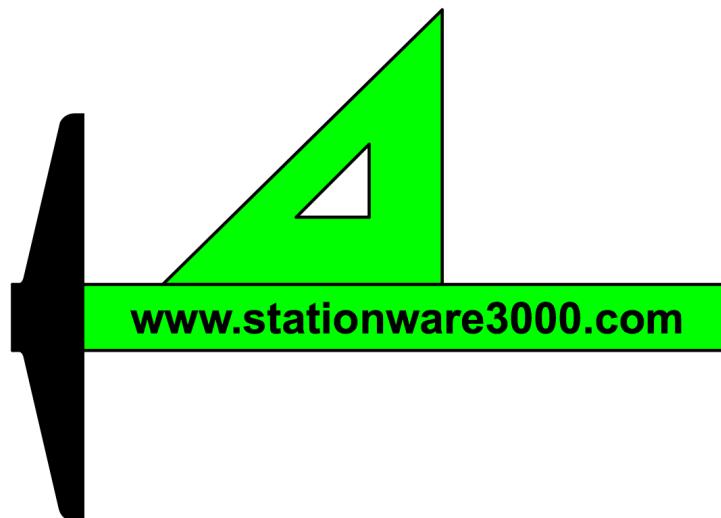
## DUALOY 3000/MCX PIPE SYSTEMS

The “MCX” product was designed similarly to the “LCX” product with the exception that the pipe exhibits enhanced fire resistance to allow it to be used above ground or above water (such as at a marina – which is where the “M” came from in its name).

The same primary and containment fittings are used for Dualoy 3000/MCX as are used for the Dualoy 3000/LCX, so a transition from underground to above ground can simply and easily be made at any fitting (using LCX pipe on one side and MCX on the other, such as at an elbow or coupling).

Dualoy 3000/MCX pipe has a smaller inside diameter than LCX to allow a thicker primary pipe to “fit” in the same fitting. This thicker wall is where the pipe gets the fire endurance properties needed to meet local, state or national requirements.

Assembly procedures are the same for MCX except the mandrels for the tapering tools are smaller to match the pipe I. D. Sized Jacket Cutters are also needed for the MCX products.



StationWare 3000 is a stand-alone CAD program that will provide a professional looking station lay-out drawing and an accurate bill of materials for the site. Users can select a variety of products and configurations to meet specifications or find the most efficient and economical design.

## History of Fiberglass Pipe in Fuel Handling

Fiberglass pipe was first Listed by Underwriters Laboratories Inc. (UL) in 1968. The product was a welcome addition to the market due to the corrosion and thread leak problems associated with single-wall steel pipe, the incumbent material.

UL physical requirements for pressure, bending and tensile performance vs. rating have remained virtually unchanged since that time. The "chemical" requirements have changed significantly since the original draft of UL Subject 971, "Standard for Nonmetallic Underground Piping for Flammable Liquids". The original requirements of the standard allowed no measurable weight change of the product holding a variety of fuels and liquids over a 180 day period. Both of the NOV products, Red Thread IIA and Dualoy 3000/L met this requirement. Another stringent requirement passed by fiberglass pipe was the required strength retention after 270 days of total immersion (open, square-cut pieces of pipe immersed in a battery of fuels and other liquids).

Since the initial authorization to apply the Listing Mark was given, the fuel market has changed, most notably with the use of alcohol in fuel (both ethanol and methanol) and the requirement for secondary containment. Requirements for the piping have changed, also. In 1995, UL relaxed the requirements for fuel permeation (tested in terms of weight loss) and also allowed candidate products to be tested with "single-sided immersion" where the test fuel or liquid was only in contact with the interior surface of the product. With fiberglass pipe already passing the more demanding test criteria, this level of performance was easily demonstrated.

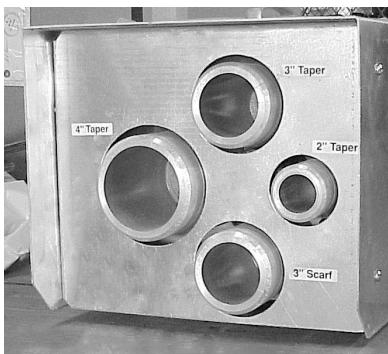
In 2004, after poor field experience with several products, UL "tightened" the requirements on permeation and instituted new criteria for dimensional stability and weight gain, and also increased the percent strength retention requirements. Following the permeation requirements for primary pipe through this chronology reveals the allowable fluid migration through piping to go from zero (from 1968 to 1995) to 4 grams per square meter per day (to 2004) to the current 1 gram per square meter per day. Put in more practical terms, this equates to a little over 1/20 (one-twentieth) of a gallon per day per 100 ft. of 2-inch pipe. This is down from the 1/5 of a gallon per day per 100 ft. of 2-inch pipe that existed between 1995 and 2004, but is still higher than the "zero" originally allowed.

The 30-year warranty against internal and external corrosion when used for underground transfer of fuels has been proven repeatedly through over 40 years of unparalleled performance by any other product offered, ever.

NOV Fiber Glass Systems (FGS) offers piping products for all fuel types, services and product types. These include:

Product	Fuel	Service
Primary Containment (P)	Motor Vehicle (MV)	Primary Containment (PC)
Secondary Containment (SC)	Concentrated (CT)	Secondary Containment (SC)
Integral Primary/Secondary (IS)	High Blend (HB) Aviation & Marine (AUM)	Normal Vent (NV) Vapor Recovery (VR)

## Tools and Equipment



**Model 2100 Tool - Tapers 2"-3" Red Thread IIA pipe, scars 3"-4". Mandrels are available for Dualoy products.**



**Model 3000 Tool - Tapers and scars 2" and 3" LCX pipe.**



**Jacket Cutter Tool - Cuts containment jacket from 2" – 4" LCX or MCX pipe**



## Adhesives

Fiber Glass Systems offers Series 7000 and 8000 adhesives for bonding Red Thread IIA pipe and fittings. For containment fittings, a thickening agent is provided should more of a build-up be needed in warmer weather. For Dualoy systems, PSX™•20 is used for connecting all primary bonds. If a thicker adhesive is needed for containment fittings, PSX™•34 is available, providing a higher viscosity.

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