

**YELLOW BOX®**  
LINE PIPE



**GREEN BOX™**  
CHEMICAL GRADE LINE PIPE

**HIGH PRESSURE FIBERGLASS**



**PRODUCT CATALOGUE**

**RED BOX®**  
TUBING & CASING



**BLUE BOX®**  
CHEMICAL GRADE TUBING  
& CASING

FOR PRODUCTS MANUFACTURED IN THE UNITED STATES OF AMERICA



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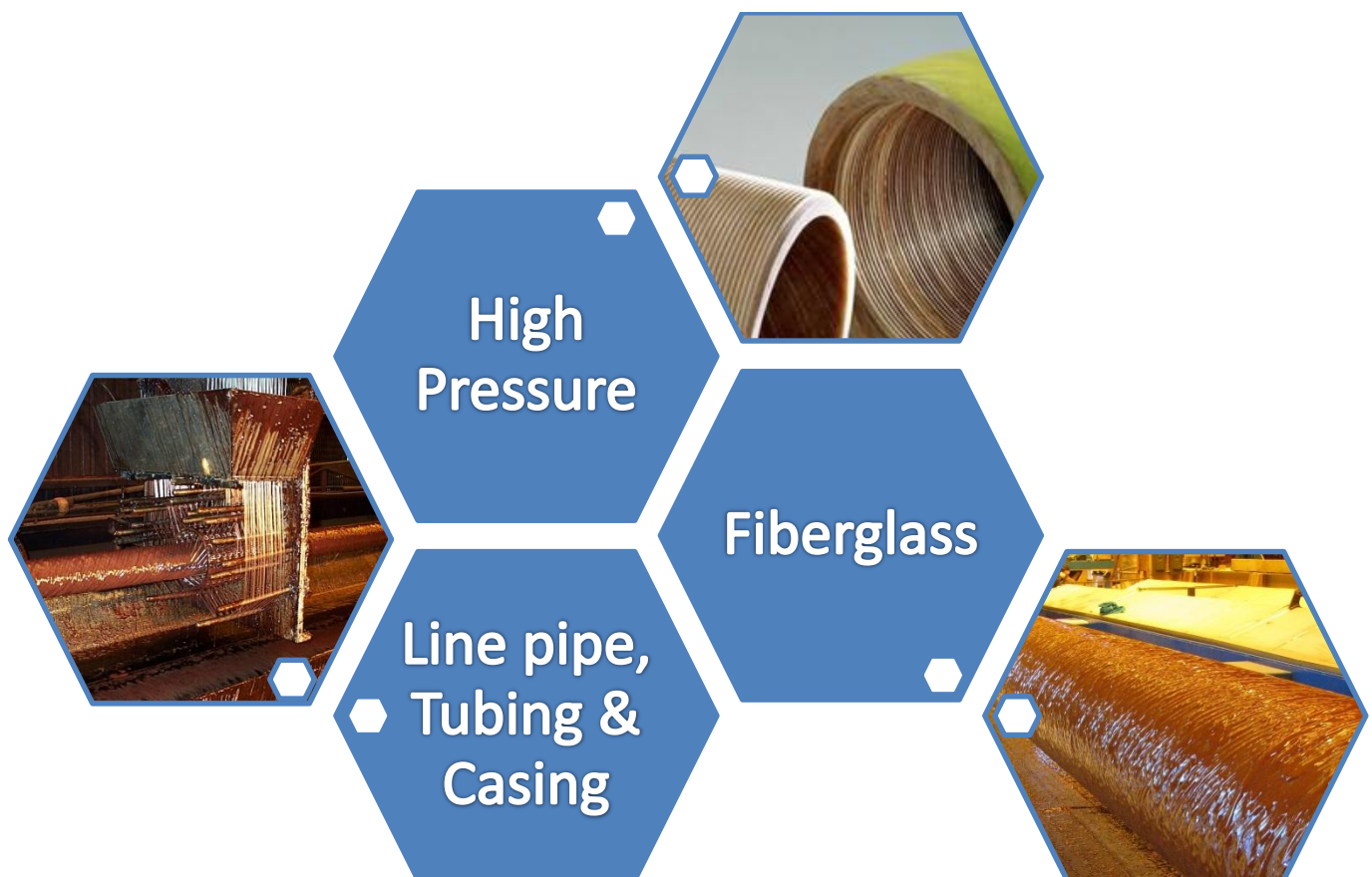
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## Part – I

### PRODUCTS AND SPECIFICATIONS



## 1.0 Introduction

Pipe systems were first developed from clay and wood, but since the Industrial Revolution, materials such as steel, ductile iron, and concrete have become more prevalent. Fiberglass pipe was first developed in the 1950s to service the oil and gas industry.

Today the world needs pipe to survive. We are reliant on water, gas, and oil, and pipes carry these materials from their source to their users. Pipes also carry away waste and sewage, from factories and homes.

Pipes are used across a diverse number of end-markets for transmission and distribution or as engineering and manufacturing components. Historically, certain pipe materials have been associated with particular end-markets and applications e.g. steel pipes for gas transmission, however, fiberglass has gained increasing acceptance in many end-markets.

Since the 1970s, fiberglass technology has evolved to enable fiberglass to be used as either the pipe material of choice or a feasible alternative for certain applications and across all end-markets.

Fiberglass possesses certain physical qualities which for many applications makes it a superior alternative to traditionally used pipe materials.

### The Competitive Attributes of Fiberglass

- Corrosion Resistant – Fiberglass is fully resistant to a broad range of aggressive corrosive chemicals that are frequently encountered in many industries today. Leakage from corrosion is significantly less than other materials meaning a longer life than other more corrosive materials.
- Lightweight - Lower transportation, installation cost, and a significantly lesser environmental impact during construction and installation than other materials such as steel or concrete.
- Durable - Survives harsh conditions with lower replacement needs than steel, ductile iron and concrete.
- Efficient carrier - Better hydraulic performance than steel, ductile iron, and concrete.
- No coatings are required and no cathodic protection systems are required.
- Versatile material - Works in a multitude of applications and end-markets.

This catalogue provides descriptions, specifications, details, and installation instructions concerning Future Pipe Industries high pressure fiberglass reinforced epoxy products.

## 2.0 Accreditations

Future Pipe Industries is accredited for the following:

- The Quality Management System (ISO 9001:2008) and (ISO/TS 29001)
- The American Petroleum Institute API 15HR Certificate that provides the specifications for a safe, dimensionally and functionally interchangeable high pressure fiberglass line pipe to meet the requirements for performance, design, materials, testing, inspection, marking, handling, storing and shipping



### 3.0 Chemical Resistance Guide

Industrial pipe systems have to meet high standards of performance with respect to temperature and chemical resistance. In most piping applications involving corrosive service, fiberglass reinforced epoxy pipe systems are the best choice. They are durable and resistant to an exceptionally wide range of corrosive chemicals and environments.

The information provided in this section will guide you through the chemical resistance tables of fiberglass reinforced epoxy pipe systems.

The data of this guide are based on more than 35 years of field experience in which field and laboratory testing has indicated good expected service life. However, it should be noted that combinations of chemicals, heat, flow rate, the presence of solids, and other considerations can influence a material's corrosion resistance capacity. Therefore, this corrosion resistance guide is to be considered as a recommendation and not a guarantee.

Service life and corrosion resistance in an aggressive chemical environment depends on the total wall thickness, the chemical type and concentration, the service temperature, the duration of use, and the type of product:

- Yellow Box® Line Pipe and Red Box® Tubing & Casing Products (without Nexus liner)
- Green Box™ Line Pipe and Blue Box® Tubing & Casing (with Nexus liner)

For the chemical resistance tables, the following should be noted:

- In cases where NR is listed, this means that the chemical specified is not recommended for usage.
- The temperature figure indicates the maximum allowable temperature limit.
- In cases where a concentration is listed, this figure means the maximum concentration limit.

For chemicals, mixtures of chemicals, or actual operating conditions not mentioned in the following tables, or circumstances wherein only "trace" quantities of NR listed chemicals are present. Please consult Future Pipe Industries before deciding on the suitability of fiberglass epoxy pipe systems for an application.

**Nexus® Liner** is synthetic surfacing veils that provide an improved longevity and physical property performance to FRP composites, due to the proven corrosion resistant performance.

Nexus® is specified to be used as the first layer of protection in an FRP corrosion barrier, Nexus® will help to provide much longer service life to FRP products with chemicals under high temperature.

## Chemical Resistance Guide Tables

| CHEMICAL                 | Max Operating Temperature F° |             |
|--------------------------|------------------------------|-------------|
|                          | Without Liner                | With Liner* |
| Acetic Acid 10%          | 150                          | 200         |
| Acetic Acid-75%          | 100                          | 120         |
| Acetic Acid-Glacial      | NR                           | NR          |
| Acetone                  | NR                           | 120         |
| Acrylic Acid             | NR                           | 100         |
| Adipic Acid, Solution    | 200                          | 200         |
| Air                      | 210                          | 230         |
| Alcohol, Ethyl           | 150                          | 150         |
| Alcohol, Isopropyl       | 150                          | 150         |
| Alcohol, Methyl          | 150                          | 150         |
| Alcohol, Methyl Isobutyl | 150                          | 150         |
| Alcohol, Secondary Butyl | 150                          | 150         |
| Allyl Chloride           | 100                          | 100         |
| Aluminum Chloride        | 200                          | 230         |
| Aluminum Fluoride        | 100                          | 150         |
| Aluminum Hydroxide       | 100                          | 150         |
| Aluminum Nitrate         | 200                          | 230         |
| Aluminum Sulfate         | 200                          | 230         |
| Alum                     | 200                          | 230         |
| Ammonia Gas-Dry          | 150                          | 230         |
| Ammonia-Wet              | NR                           | 100         |
| Ammonium Carbonate       | 100                          | 150         |
| Ammonium Chloride        | 200                          | 230         |
| Ammonium Fluoride-25%    | 100                          | 150         |
| Ammonium Hydroxide-10%   | 100                          | 150         |
| Ammonium Hydroxide-28%   | NR                           | 100         |
| Ammonium Nitrate         | 200                          | 230         |
| Ammonium Persulfate      | NR                           | 100         |
| Ammonium Phosphate       | 150                          | 150         |
| Ammonium Sulfate         | 200                          | 230         |
| Amyl Acetate             | NR                           | 100         |
| Amyl Chloride            | NR                           | 100         |
| Aniline                  | NR                           | 100         |
| Barium Carbonate         | 200                          | 230         |
| Barium Chloride          | 200                          | 230         |
| Barium Hydroxide-10%     | 200                          | 230         |
| Barium Sulfate           | 200                          | 230         |
| Barium Sulfide           | 200                          | 230         |

| CHEMICAL                     | Max Operating Temperature F° |             |
|------------------------------|------------------------------|-------------|
|                              | Without Liner                | With Liner* |
| Benzene                      | 100                          | 150         |
| Benzene Sulfonic Acid        | NR                           | 100         |
| Benzoic Acid                 | NR                           | 100         |
| Borax                        | 200                          | 230         |
| Boric Acid                   | 150                          | 200         |
| Bromic Acid                  | 100                          | 150         |
| Bromine                      | NR                           | NR          |
| Butadine                     | 100                          | 100         |
| Butane                       | 100                          | 100         |
| Butyl Acetate                | NR                           | 100         |
| Butyl Cellosolve             | 150                          | 150         |
| Butyric Acid-50%             | 150                          | 150         |
| Calcium Bisulfite            | 200                          | 200         |
| Calcium Carbonate            | 200                          | 230         |
| Calcium Chlorate             | 200                          | 200         |
| Calcium Chloride             | 200                          | 230         |
| Calcium Hydroxide-50%        | 200                          | 200         |
| Calcium Hypochlorite-20%     | NR                           | NR          |
| Calcium Nitrate              | 200                          | 230         |
| Calcium Sulfate              | 200                          | 230         |
| Carbon Bisulfide             | NR                           | NR          |
| Carbon Dioxide               | 200                          | 230         |
| Carbon Tetrachloride         | 100                          | 150         |
| Carbonic Acid                | 150                          | 200         |
| Castor Oil                   | 200                          | 200         |
| Chlorine                     | NR                           | NR          |
| Chlorinated Water 0-3000 Ppm | 150                          | 230         |
| Chloroacetic Acid-25%        | 100                          | 120         |
| Chlorobenzene                | 100                          | 150         |
| Chloroform                   | NR                           | 100         |
| Chromic Acid-10%             | NR                           | 150         |
| Chromic Fluoride             | NR                           | 100         |
| Citric Acid                  | 200                          | 230         |
| Copper Chloride              | 200                          | 230         |
| Copper Fluoride              | 200                          | 230         |
| Copper Nitrate               | 200                          | 230         |
| Copper Sulfate               | 200                          | 200         |
| Crude Oil-Sour, Sweet        | 200                          | 230         |

\* Green Box™ chemical grade line pipe and Blue Box® chemical grade tubing and casing Products are offered with Nexus Liner

| CHEMICAL                     | Max Operating Temperature F° |             |
|------------------------------|------------------------------|-------------|
|                              | Without Liner                | With Liner* |
| Diacetone Alcohol            | 150                          | 150         |
| Dimethylamine                | NR                           | NR          |
| O-Dichlorobenzene            | 100                          | 150         |
| Dichloroethylene             | NR                           | 100         |
| Diethylene Triamine          | NR                           | NR          |
| Ethyl Acetate                | NR                           | 150         |
| Ethyl Cellosolve             | NR                           | 100         |
| Ethyl Chloride               | NR                           | 100         |
| Ethyl Ether                  | NR                           | 100         |
| Ethyl Chlorohydrin           | NR                           | NR          |
| Ethyl Diamine                | NR                           | NR          |
| Ethyl Glycol                 | 200                          | 200         |
| Ethylene Oxide               | NR                           | NR          |
| Fatty Acids                  | 200                          | 200         |
| Ferric Chloride              | 150                          | 230         |
| Ferric Nitrate               | 200                          | 230         |
| Ferric Sulfate               | 200                          | 200         |
| Ferrous Chloride             | 200                          | 230         |
| Ferrous Sulfate              | 200                          | 200         |
| Fluorosilicic Acid-10%       | 200                          | 200         |
| Formaldehyde-40%             | NR                           | 100         |
| Formic Acid-25%              | NR                           | 100         |
| Freon                        | NR                           | 150         |
| Gas-Natural                  | 200                          | 230         |
| Gasoline-Sour                | 200                          | 230         |
| Gasoline-Refined, All Grades | 150                          | 150         |
| Glucose                      | 200                          | 230         |
| Glycerine                    | 200                          | 230         |
| Glycol, Ethylene             | 200                          | 200         |
| Glycol, Propylene            | 200                          | 230         |
| Heptane                      | 150                          | 150         |
| Hexane                       | NR                           | 100         |
| Hexylene Glycol Alcohol      | 150                          | 150         |
| Hydraulic Fluid              | 200                          | 200         |
| Hydrobromic Acid-50%         | NR                           | 150         |
| Hydrochloric Acid-35%        | 100                          | 150         |
| Hydrocyanic Acid-10%         | NR                           | NR          |
| Hydrofluoric Acid            | NR                           | NR          |
| Hydrogen                     | 150                          | 150         |
| Hydrogen Peroxide-10%        | NR                           | 150         |
| Hydrogen Peroxide-30%        | NR                           | 75          |
| Hydrogen Sulfide             | 150                          | 200         |
| Hypochlorous Acid-10%        | 200                          | 200         |
| Jet Fuel                     | 150                          | 200         |

| CHEMICAL                   | Max Operating Temperature F° |             |
|----------------------------|------------------------------|-------------|
|                            | Without Liner                | With Liner* |
| Kerosene                   | 200                          | 230         |
| Lactic Acid                | 150                          | 200         |
| Lauric Acid                | 200                          | 200         |
| Lead Acetate               | 200                          | 230         |
| Levulinic Acid-25%         | 200                          | 200         |
| Magnesium Carbonate        | 200                          | 230         |
| Magnesium Chloride         | 200                          | 230         |
| Magnesium Hydroxide        | 120                          | 200         |
| Magnesium Nitrate          | 200                          | 230         |
| Magnesium Sulfate          | 200                          | 230         |
| Maleic Acid                | 150                          | 150         |
| Mercury                    | 200                          | 230         |
| Methane                    | 200                          | 230         |
| Methyl Ethyl Ketone        | NR                           | 100         |
| Methyl Isobutyl Carbitol   | NR                           | 100         |
| Methyl Isobutyl Ketone     | 100                          | 150         |
| Mineral Oils               | 200                          | 230         |
| Naptha                     | 200                          | 200         |
| Napthalene                 | 150                          | 150         |
| Natural Gas                | 200                          | 230         |
| Nickel Chloride            | 200                          | 230         |
| Nickel Nitrate             | 200                          | 200         |
| Nitric Acid-10%            | NR                           | 100         |
| Oil, Sour, Crude           | 200                          | 230         |
| Oleic Acid                 | 200                          | 200         |
| Oxalic Acid                | 200                          | 200         |
| Perchloric Acid-70%        | NR                           | 100         |
| Phenol-5%                  | NR                           | 150         |
| Phosphoric Acid-50%        | NR                           | 150         |
| Phosphorous Pentoxide-50%  | NR                           | 100         |
| Pickling Acid              | NR                           | 120         |
| Plating Solution           | 200                          | 230         |
| Potassium Bicarbonate      | 200                          | 230         |
| Potassium Bromide          | 200                          | 200         |
| Potassium Carbonate        | 200                          | 230         |
| Potassium Chloride         | 200                          | 230         |
| Potassium Dichromate       | 200                          | 230         |
| Potassium Hydroxide        | 100                          | 200         |
| Potassium Nitrate          | 200                          | 230         |
| Potassium Permanganate-5%  | 150                          | 200         |
| Potassium Permanganate-10% | NR                           | 150         |
| Potassium Sulfate          | 150                          | 200         |
| Propane                    | 100                          | 100         |
|                            |                              |             |

\* Green Box™ chemical grade line pipe and Blue Box® chemical grade tubing and casing Products are offered with Nexus Liner

| CHEMICAL             | Max Operating Temperature F° |             |
|----------------------|------------------------------|-------------|
|                      | Without Liner                | With Liner* |
| Silicic Acid         | 200                          | 200         |
| Silver Nitrate       | 200                          | 200         |
| Sodium Acetate       | 200                          | 200         |
| Sodium Bicarbonate   | 200                          | 230         |
| Sodium Bisulfate     | 200                          | 230         |
| Sodium Bromide       | 200                          | 200         |
| Sodium Carbonate     | 150                          | 200         |
| Sodium Chlorate      | 200                          | 230         |
| Sodium Chloride      | 200                          | 230         |
| Sodium Cyanide       | 200                          | 230         |
| Sodium Dichromate    | 200                          | 230         |
| Sodium Ferrocyanide  | 200                          | 230         |
| Sodium Fluoride      | 200                          | 230         |
| Sodium Hydroxide     | 100                          | 150         |
| Sodium Hypochlorite  | NR                           | NR          |
| Sodium Methoxide-40% | 100                          | 150         |
| Sodium Nitrate       | 200                          | 230         |
| Sodium Peroxide      | NR                           | 75          |
| Sodium Phosphate     | 200                          | 200         |
| Sodium Silicate      | 150                          | 150         |
| Sodium Sulfate       | 200                          | 230         |
| Sodium Sulfite       | 200                          | 200         |
| Sodium Thiosulfate   | 150                          | 150         |

| CHEMICAL                   | Max Operating Temperature F° |             |
|----------------------------|------------------------------|-------------|
|                            | Without Liner                | With Liner* |
| Stannic Chloride           | 200                          | 230         |
| Stearic Acid               | 150                          | 150         |
| Sulfur Dioxide             | NR                           | 150         |
| Sulfuric Acid-25%          | NR                           | 150         |
| Sulfuric Acid-70%          | NR                           | 100         |
| Sulfurous Acid-5%          | NR                           | 150         |
| Tannic Acid                | 200                          | 200         |
| Tartaric Acid              | 200                          | 230         |
| Toluene                    | NR                           | 150         |
| Trichloroacetic Acid       | NR                           | NR          |
| Trichloroethylene-100%     | 100                          | 150         |
| Triethylamine              | NR                           | 100         |
| Trisodium Phosphate        | 150                          | 150         |
| Turpentine                 | NR                           | 100         |
| Urea                       | 150                          | 150         |
| Vinyl Acetate              | NR                           | 150         |
| Water-Distilled, Deionized | 200                          | 230         |
| Water-Fresh, Ph 2-13       | 200                          | 230         |
| Water-Salt, Brine          | 200                          | 230         |
| Xylene                     | 150                          | 150         |
| Zinc Chloride              | 200                          | 230         |
| Zinc Sulfate               | 200                          | 230         |
|                            |                              |             |

\* Green Box™ chemical grade line pipe and Blue Box® chemical grade tubing and casing Products are offered with Nexus Liner

## 4.0 Flow Rate Charts

### Introduction:

**The following Flow Rate Charts are based on Darcy-Weisbach Equation:** The Darcy-Weisbach equation states that pressure drop is proportional to the square of the velocity and the length of the pipe. It is inversely proportional to the diameter of the pipe.

$$H_f = f L (v^2) / 2 (ID) g$$

Where:

$H_f$  = Pressure Head Losses

$f$  = Friction Factor

$V$  = fluid velocity, ft/s

$ID$  = Pipe Inside Diameter

The friction factor can be determined from the Moody diagram found in most fluid mechanics

$$1/f^{0.5} = -2 \log [(e/ID) / 3.7] + 2.51 / (Re) (f^{0.5})$$

Where:

$f_t$  = Moody friction factor

$e$  = surface roughness parameter

=  $1.7 \times 10^{-5}$  for fiberglass pipe

**The flow rate charts provided are for Brine Water, Crude Oil and Fresh Water. All other fluids with different specific gravity (S.G.) and viscosity (CPS), please consult with Future Pipe Industries.**

### How to use the Flow Rate Chart:

There are four parameters used in the flow rate chart for any fluid, three parameters must be known in order to calculate the fourth parameter. The four parameters are the following:

- Pipe Diameter (d) = Pipe nominal diameter in inches
- Internal Operating Pressure (P) = Pipe internal pressure in psi
- Flow Rate (Q) = Volumetric flow rate (barrels per day or gallons per minute)
- Line Pipe Length (L) = Total length of line pipe in feet

### Example:

Flow line transmitting Brine water with no elevation changes

#### Given (Input)

Fluid type Brine water

Internal operating pressure = 1750 psi

Flow rate = 10,000 barrels per day

Total line pipe length = 20 miles

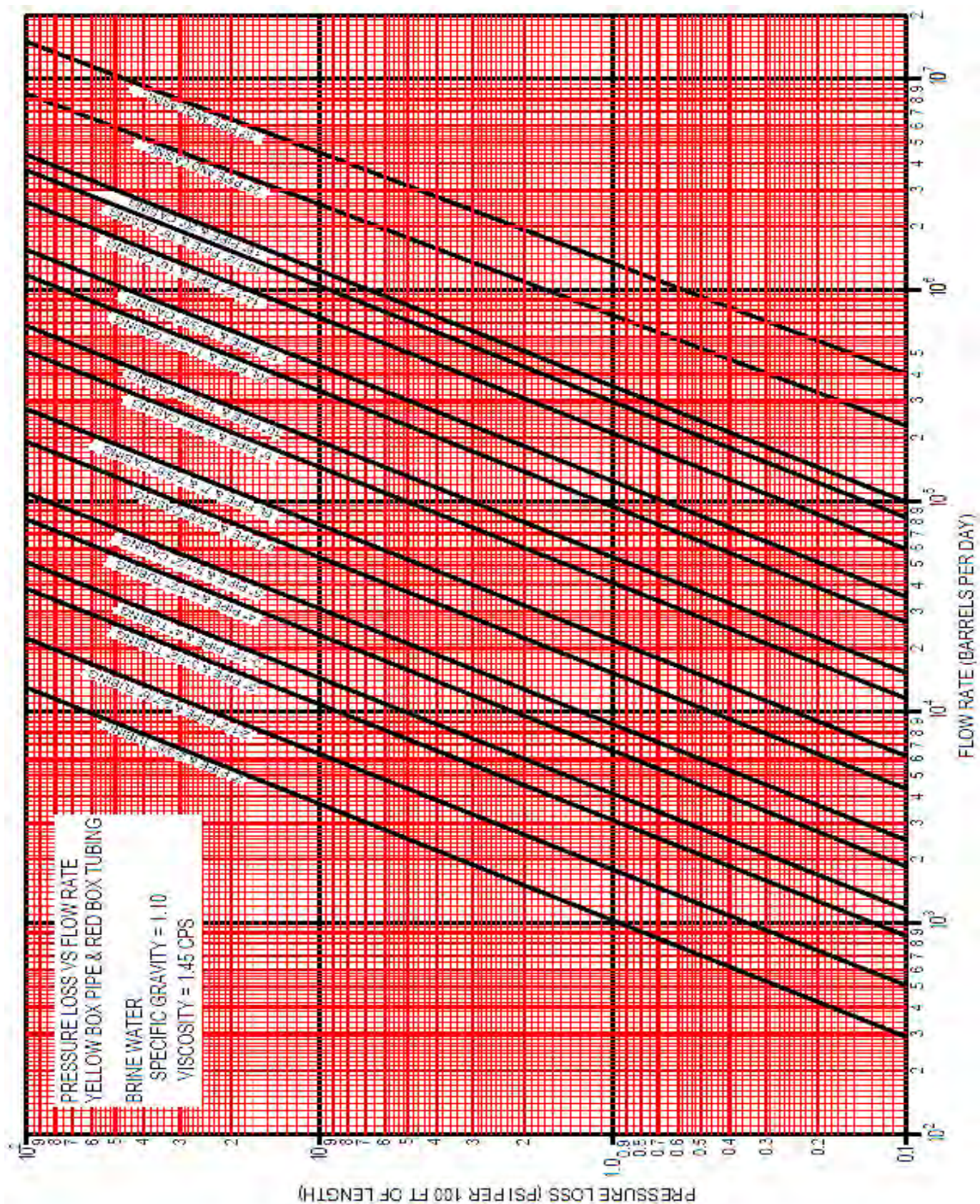
#### Required (Output)

Pipe diameter (D)

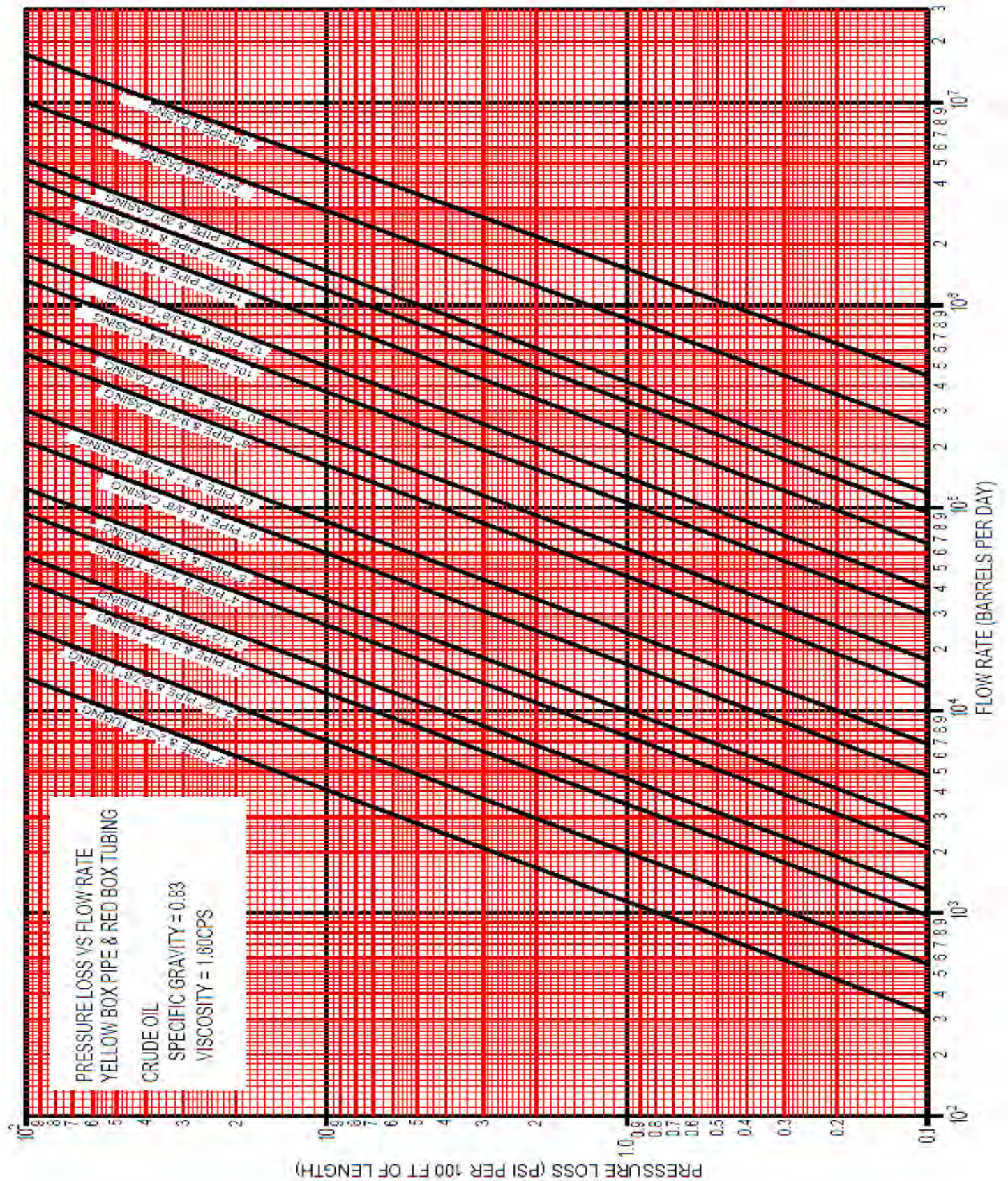
Steps:

- 1- Convert the Line pipe length into feet =  $20 \times 5280 = 105,600$  feet
- 2- Calculate the Pressure Loss (psi per 100 feet of length) =  $\frac{1750 \times 100}{105600} = 1.66$
- 3- Draw a horizontal line at the pressure loss value of 1.66 on the vertical log scale
- 4- Draw a vertical line at the flow rate value of 10,000 ( $10^4$ ) on the horizontal log scale
- 5- The Intersection of the two lines will be between 4" pipe and 5" pipe, round up to the next size pipe. Use D = 5"

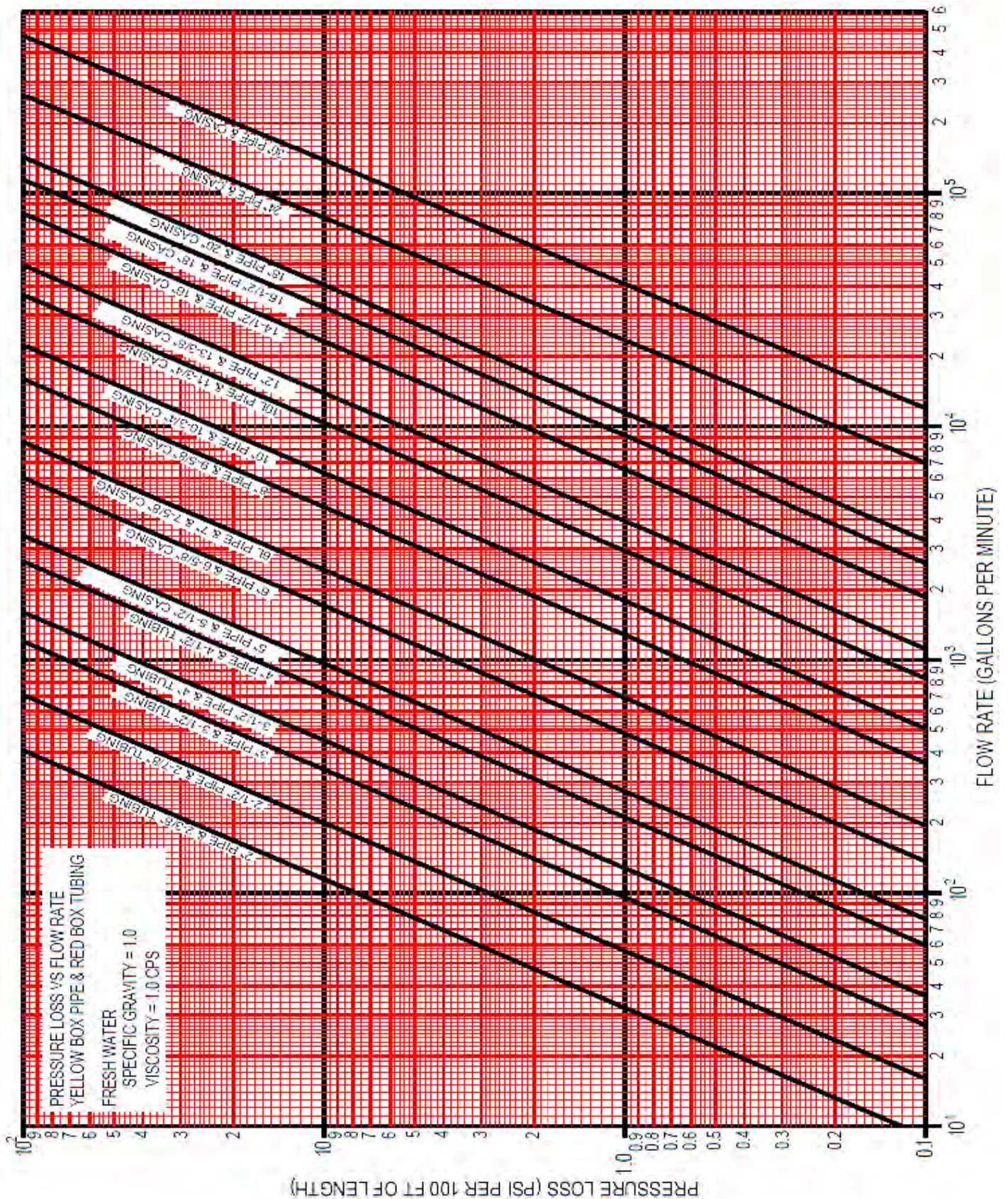
#### 4.1 Brine Water



## 4.2 Crude Oil



### 4.3 Fresh Water





## 5.0 Line Pipe Product Description

### YELLOW BOX<sup>®</sup> STANDARD LINE PIPE

### YELLOW BOX<sup>®</sup> API 15HR DESIGN LINE PIPE

### GREEN BOX<sup>™</sup> CHEMICAL GRADE LINE PIPE



## 5.1 Composition and Specifications

**Yellow Box® Standard, Yellow Box® API 15HR Design, and Green Box™ Line Pipe** is a machine-made composite material produced by the filament winding method combining high strength glass fiber filaments and corrosion resistant epoxy resin, especially formulated to result in a structurally and chemically optimum product. The epoxy resin is an aromatic amine cured system that has the highest mechanical strength, thermal resistance and best corrosion resistance of all commercially available resin systems used in the fabrication of fiberglass piping.

**Line Pipe** conforms to the following ASTM Specifications:

ASTM D 2310 – 01

Yellow Box® Designation: RTRP-11AX

Green Box™ Designation: RTRP-11FX

ASTM D 2996 – 01

Yellow Box® Designation: RTRP-11AX1-3221

Green Box™ Designation: RTRP-11FX1-3221



**Line Pipe** can be supplied with API Specification 15HR monogram, under API license number 15HR-0006. The Future Pipe Industries, Inc.'s Quality Management System is certified to be in compliance with ISO-9001:2008 and ANAB.

## 5.2 Uses and Applications

**Yellow Box® Standard, Yellow Box® API 15HR Design, and Green Box™ Line Pipe** fiberglass reinforced aromatic amine cured epoxy resin line pipe is designed for medium to high pressure oilfield and industrial service.

**Line Pipe** is available in 500, 750, 800, 1000, 1250, 1500, 1750, 2000, 2250, 2500, 2750, 3000, 3250, and 3500 psi static operating pressure ratings.

**Line Pipe** offers a high-strength, non-corroding line pipe system in 2 through 24 inch sizes that has a proven low installed cost due to its light weight and threaded connections.



**Section 6.1 and 6.2 include the technical data sheets for all the sizes available with each pressure class. Please consult Future Pipe Industries for larger diameters not listed on each specified pressure class.**

**Line Pipe** system is recommended for use in:

- Salt water injection, water flood lines
- Medium to high pressure transmission lines
- CO2 injection and recovery lines
- Crude oil and gas flow lines, gathering systems
- Chemical effluent and waste disposal lines
- Water distribution systems



### 5.3 Joining System and Fittings

**Yellow Box® Standard, Yellow Box® API 15HR Design, and Green Box™ Line Pipe** products are connected with the reliable, time proven API-5B threaded connection. For pipe size 2" to 4", an 8 Rd (API-5B) external upset end (EUE) long threaded connections is used. For pipe size 5" and up, an 8 Rd (API-5B), 6 Rd, 4 Rd casing long and casing short threaded connection are used. Dependent on pipe size, filament wound integral joint (IJ) or couplings (TC) are utilized in the connection.

**Line Pipe** is offered with a line of fittings including elbows, tees, couplings and flanges.

### 5.4 Advantages

#### Design:

- Manufactured from aromatic-amine, heat-cured epoxy resin which provides the highest mechanical strength combined with the maximum chemical and temperature resistance available for fiberglass pipe systems.
- Manufactured using the filament winding method for greater mechanical strength.
- All FPI fiberglass products are extensively heat cured to provide consistent and repeatable quality.
- Available in the highest pressure ratings in the industry.
- Suitable for a temperature range of -60°C (-76°F) to +95°C (+200°F)<sup>1</sup>.
- No concerns over the cyclic pressure changes.
- Long term reliability. Designed for service life of 20 years.

#### Connection:

- Joint sealing is obtained by fiberglass material itself. Hence, use of other sealing material such as rubber O-rings is completely avoided.
- Fluid and gas-tight threaded connections.

#### Hydraulic Performance:

- Low friction losses. Minimum Hazen-Williams coefficient (C) of 150 over the entire life time for typical oil & gas services.
- Reduced paraffin and scale build-up.

#### Chemical Resistance:

- No external corrosion from aggressive soils and ground water.
- Resists internal corrosion from brackish water, H<sub>2</sub>S, CO<sub>2</sub>, and most oilfield fluids
- Outstanding broad spectrum corrosion resistance.

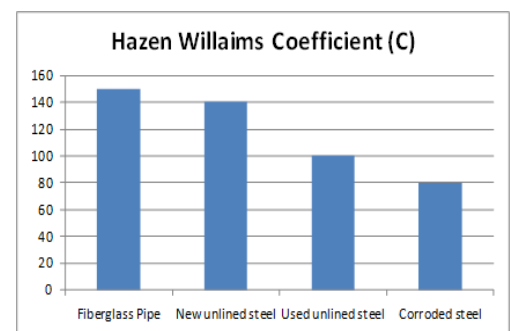
#### Quality:

- Fully compliant with API standards.
- FPI does not conduct random sampling testing. Every joint of pipe is pressure tested from 1.3 to 1.5 times the design pressure.

#### Shipping & Installation:

- Light weight, safe, easy & fast installation.
- Minimal maintenance, no coating or cathodic protection is required.
- Low transportation and installation cost.
- Less excavation, fewer, and small crew compare to steel pipe.

<sup>1</sup> For applications with a design temperature greater than 95°C (200° F), contact Future Pipe Industries to obtain a suitable de-rating factor.





## 6.0 Line Pipe Technical Data Sheets



### 6.1 Yellow Box® Standard

**Note: Please consult Future Pipe Industries for larger diameters not listed in the following pressure classes**

## YELLOW BOX 500

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.13                     | 0.06                          | 0.06                          | 0.6            | 18                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.59                     | 0.06                          | 0.06                          | 0.7            | 22                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.12                     | 0.06                          | 0.06                          | 1.0            | 30                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.46                     | 0.06                          | 0.06                          | 1.2            | 37                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.12                     | 0.07                          | 0.07                          | 1.4            | 42                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.58                     | 0.08                          | 0.07                          | 2.0            | 60                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.62                     | 0.10                          | 0.09                          | 2.8            | 84                    | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.43                     | 0.11                          | 0.11                          | 2.8            | 83                    | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.12                     | 0.14                          | 0.13                          | 4.0            | 120                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.17                     | 0.16                          | 0.15                          | 7.8            | 234                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.10                    | 0.19                          | 0.18                          | 8.4            | 252                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 12.39                    | 0.21                          | 0.20                          | 12.5           | 374                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.00                    | 0.26                          | 0.25                          | 16.7           | 500                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 16.95                    | 0.29                          | 0.28                          | 24.3           | 730                   | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 18.62                    | 0.32                          | 0.30                          | 28.0           | 839                   | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 24.63                    | 0.42                          | 0.40                          | 61.1           | 1,834                 | 24" 4Rd CSG STC L TC  |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 500                            | 650  | 500                               | 160                   | 4,000                      | 106                         |
| 2-1/2        | 500                            | 650  | 500                               | 90                    | 5,000                      | 130                         |
| 3            | 500                            | 650  | 500                               | 50                    | 6,000                      | 156                         |
| 3-1/2        | 500                            | 650  | 500                               | 40                    | 6,500                      | 173                         |
| 4            | 500                            | 650  | 500                               | 40                    | 9,000                      | 206                         |
| 5            | 500                            | 650  | 500                               | 40                    | 11,000                     | 229                         |
| 6            | 500                            | 650  | 500                               | 40                    | 17,000                     | 281                         |
| 6-L          | 500                            | 650  | 500                               | 40                    | 22,000                     | 321                         |
| 8            | 500                            | 650  | 500                               | 40                    | 35,000                     | 406                         |
| 10           | 500                            | 650  | 500                               | 40                    | 44,500                     | 458                         |
| 10-L         | 500                            | 650  | 500                               | 40                    | 65,500                     | 555                         |
| 12           | 500                            | 650  | 500                               | 40                    | 81,500                     | 620                         |
| 14-1/2       | 500                            | 650  | 500                               | 40                    | 119,500                    | 750                         |
| 16-1/2       | 500                            | 650  | 500                               | 40                    | 152,500                    | 848                         |
| 18           | 500                            | 650  | 500                               | 40                    | 184,000                    | 931                         |
| 24           | 500                            | 650  | 500                               | 40                    | 322,000                    | 1,231                       |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 800

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.13                     | 0.06                          | 0.06                          | 0.6            | 18                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.61                     | 0.07                          | 0.07                          | 0.8            | 24                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.17                     | 0.09                          | 0.08                          | 1.2            | 35                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.52                     | 0.10                          | 0.09                          | 1.5            | 45                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.21                     | 0.11                          | 0.11                          | 1.8            | 54                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.68                     | 0.13                          | 0.12                          | 2.5            | 74                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.74                     | 0.16                          | 0.15                          | 3.5            | 106                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.56                     | 0.18                          | 0.17                          | 3.8            | 114                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.29                     | 0.23                          | 0.21                          | 5.6            | 169                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.36                     | 0.25                          | 0.24                          | 9.8            | 294                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.33                    | 0.31                          | 0.29                          | 11.5           | 345                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 12.65                    | 0.34                          | 0.33                          | 16.2           | 487                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.31                    | 0.42                          | 0.40                          | 22.3           | 668                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 17.31                    | 0.47                          | 0.45                          | 31.0           | 931                   | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 19.02                    | 0.52                          | 0.49                          | 36.5           | 1,094                 | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 25.15                    | 0.68                          | 0.65                          | 74.9           | 2,248                 | 24" 4Rd CSG STC L TC  |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 800                            | 1,050  | 800                               | 160                   | 4,000                      | 106                         |
| 2-1/2        | 800                            | 1,050  | 800                               | 130                   | 5,500                      | 130                         |
| 3            | 800                            | 1,050  | 800                               | 130                   | 8,500                      | 158                         |
| 3-1/2        | 800                            | 1,050  | 800                               | 130                   | 10,500                     | 176                         |
| 4            | 800                            | 1,050  | 800                               | 130                   | 15,000                     | 211                         |
| 5            | 800                            | 1,050  | 800                               | 130                   | 18,000                     | 234                         |
| 6            | 800                            | 1,050  | 800                               | 130                   | 27,500                     | 287                         |
| 6-L          | 800                            | 1,050  | 800                               | 130                   | 36,000                     | 328                         |
| 8            | 800                            | 1,050  | 800                               | 130                   | 57,000                     | 415                         |
| 10           | 800                            | 1,050  | 800                               | 130                   | 73,000                     | 468                         |
| 10-L         | 800                            | 1,050  | 800                               | 130                   | 107,000                    | 567                         |
| 12           | 800                            | 1,050  | 800                               | 130                   | 133,000                    | 633                         |
| 14-1/2       | 800                            | 1,050  | 800                               | 130                   | 195,000                    | 766                         |
| 16-1/2       | 800                            | 1,050  | 800                               | 130                   | 249,500                    | 866                         |
| 18           | 800                            | 1,050  | 800                               | 130                   | 301,000                    | 951                         |
| 24           | 800                            | 1,050  | 800                               | 130                   | 526,000                    | 1,257                       |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 1000

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.14                     | 0.07                          | 0.07                          | 0.6            | 19                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.64                     | 0.09                          | 0.09                          | 0.9            | 27                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.21                     | 0.11                          | 0.10                          | 1.3            | 39                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.57                     | 0.12                          | 0.11                          | 1.7            | 51                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.27                     | 0.14                          | 0.14                          | 2.1            | 62                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.74                     | 0.16                          | 0.15                          | 2.9            | 86                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.82                     | 0.20                          | 0.19                          | 4.1            | 123                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.65                     | 0.22                          | 0.21                          | 4.5            | 134                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.41                     | 0.28                          | 0.27                          | 6.8            | 205                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.49                     | 0.32                          | 0.31                          | 11.3           | 338                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.49                    | 0.39                          | 0.37                          | 13.6           | 409                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 12.83                    | 0.43                          | 0.41                          | 18.8           | 565                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.53                    | 0.52                          | 0.50                          | 26.4           | 792                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 17.55                    | 0.59                          | 0.57                          | 36.5           | 1,094                 | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 19.28                    | 0.65                          | 0.62                          | 42.9           | 1,287                 | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 25.50                    | 0.86                          | 0.82                          | 87.3           | 2,619                 | 24" 4Rd CSG STC L TC  |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,000                          | 1,300  | 1,000                             | 240                   | 4,500                      | 107                         |
| 2-1/2        | 1,000                          | 1,300  | 1,000                             | 240                   | 7,000                      | 132                         |
| 3            | 1,000                          | 1,300  | 1,000                             | 240                   | 10,500                     | 161                         |
| 3-1/2        | 1,000                          | 1,300  | 1,000                             | 240                   | 13,000                     | 179                         |
| 4            | 1,000                          | 1,300  | 1,000                             | 240                   | 18,500                     | 214                         |
| 5            | 1,000                          | 1,300  | 1,000                             | 240                   | 23,000                     | 237                         |
| 6            | 1,000                          | 1,300  | 1,000                             | 240                   | 34,500                     | 291                         |
| 6-L          | 1,000                          | 1,300  | 1,000                             | 240                   | 45,500                     | 333                         |
| 8            | 1,000                          | 1,300  | 1,000                             | 240                   | 72,500                     | 420                         |
| 10           | 1,000                          | 1,300  | 1,000                             | 240                   | 92,500                     | 475                         |
| 10-L         | 1,000                          | 1,300  | 1,000                             | 240                   | 135,500                    | 575                         |
| 12           | 1,000                          | 1,300  | 1,000                             | 240                   | 169,000                    | 642                         |
| 14-1/2       | 1,000                          | 1,300  | 1,000                             | 240                   | 217,500                    | 776                         |
| 16-1/2       | 1,000                          | 1,300  | 1,000                             | 240                   | 264,500                    | 878                         |
| 18           | 1,000                          | 1,300  | 1,000                             | 240                   | 310,000                    | 964                         |
| 24           | 1,000                          | 1,300  | 1,000                             | 240                   | 640,000                    | 1,275                       |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 1250

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.18                     | 0.09                          | 0.09                          | 0.7            | 22                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.69                     | 0.11                          | 0.11                          | 1.0            | 31                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.27                     | 0.14                          | 0.13                          | 1.5            | 46                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.63                     | 0.15                          | 0.15                          | 1.9            | 58                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.35                     | 0.18                          | 0.17                          | 2.5            | 74                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.83                     | 0.20                          | 0.19                          | 3.3            | 99                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.92                     | 0.25                          | 0.24                          | 4.8            | 143                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.77                     | 0.28                          | 0.27                          | 5.5            | 164                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.56                     | 0.36                          | 0.34                          | 10.4           | 313                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.66                     | 0.40                          | 0.39                          | 13.1           | 392                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.70                    | 0.49                          | 0.47                          | 18.2           | 545                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 13.06                    | 0.55                          | 0.52                          | 22.2           | 666                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.80                    | 0.66                          | 0.63                          | 32.2           | 965                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 17.87                    | 0.75                          | 0.71                          | 45.4           | 1,362                 | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 19.62                    | 0.82                          | 0.78                          | 52.8           | 1,583                 | 20" 6Rd CSG STC TC  |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,250                          | 1,650  | 1,250                             | 450                   | 6,000                      | 109                         |
| 2-1/2        | 1,250                          | 1,650  | 1,250                             | 450                   | 9,000                      | 135                         |
| 3            | 1,250                          | 1,650  | 1,250                             | 450                   | 13,500                     | 164                         |
| 3-1/2        | 1,250                          | 1,650  | 1,250                             | 450                   | 16,500                     | 182                         |
| 4            | 1,250                          | 1,650  | 1,250                             | 450                   | 24,000                     | 217                         |
| 5            | 1,250                          | 1,650  | 1,250                             | 450                   | 29,500                     | 241                         |
| 6            | 1,250                          | 1,650  | 1,250                             | 450                   | 44,000                     | 296                         |
| 6-L          | 1,250                          | 1,650  | 1,250                             | 450                   | 58,000                     | 339                         |
| 8            | 1,250                          | 1,650  | 1,250                             | 450                   | 92,500                     | 428                         |
| 10           | 1,250                          | 1,650  | 1,250                             | 450                   | 117,500                    | 483                         |
| 10-L         | 1,250                          | 1,650  | 1,250                             | 450                   | 147,000                    | 585                         |
| 12           | 1,250                          | 1,650  | 1,250                             | 450                   | 189,500                    | 653                         |
| 14-1/2       | 1,250                          | 1,650  | 1,250                             | 450                   | 167,500                    | 790                         |
| 16-1/2       | 1,250                          | 1,650  | 1,250                             | 450                   | 336,500                    | 893                         |
| 18           | 1,250                          | 1,650  | 1,250                             | 450                   | 387,500                    | 981                         |

Please consult FPI for larger diameters availability with the above pressure rating

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 1500

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.22                     | 0.11                          | 0.11                          | 0.8            | 25                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.74                     | 0.14                          | 0.13                          | 1.2            | 36                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.33                     | 0.17                          | 0.16                          | 1.8            | 53                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.70                     | 0.18                          | 0.18                          | 2.2            | 67                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.42                     | 0.22                          | 0.21                          | 2.9            | 86                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.91                     | 0.24                          | 0.23                          | 3.8            | 113                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.03                     | 0.30                          | 0.29                          | 5.6            | 167                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.89                     | 0.34                          | 0.33                          | 6.4            | 192                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.71                     | 0.43                          | 0.41                          | 11.9           | 358                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.83                     | 0.49                          | 0.47                          | 14.9           | 448                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.90                    | 0.59                          | 0.57                          | 22.7           | 681                   | 11-3/4 8/6Rd CSG STC L TC   |
| 12                       | 11.97                    | 11.87                         | 13.29                    | 0.66                          | 0.63                          | 26.1           | 783                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 16.08                    | 0.80                          | 0.76                          | 44.3           | 1,330                 | 16 6Rd CSG STC L TC   |
| 16-1/2                   | 16.37                    | 16.27                         | 18.18                    | 0.91                          | 0.86                          | 54.2           | 1,626                 | 18" 6Rd CSG STC TC  |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,500                          | 1,950  | 1,500                             | 750                   | 7,500                      | 111                         |
| 2-1/2        | 1,500                          | 1,950  | 1,500                             | 750                   | 11,000                     | 137                         |
| 3            | 1,500                          | 1,950  | 1,500                             | 750                   | 16,500                     | 166                         |
| 3-1/2        | 1,500                          | 1,950  | 1,500                             | 750                   | 20,500                     | 185                         |
| 4            | 1,500                          | 1,950  | 1,500                             | 750                   | 29,000                     | 221                         |
| 5            | 1,500                          | 1,950  | 1,500                             | 750                   | 36,000                     | 246                         |
| 6            | 1,500                          | 1,950  | 1,500                             | 750                   | 54,000                     | 301                         |
| 6-L          | 1,500                          | 1,950  | 1,500                             | 750                   | 70,500                     | 345                         |
| 8            | 1,500                          | 1,950  | 1,500                             | 750                   | 113,000                    | 435                         |
| 10           | 1,500                          | 1,950  | 1,500                             | 750                   | 144,000                    | 492                         |
| 10-L         | 1,500                          | 1,950  | 1,500                             | 750                   | 176,500                    | 595                         |
| 12           | 1,500                          | 1,950  | 1,500                             | 750                   | 206,500                    | 665                         |
| 14-1/2       | 1,500                          | 1,950  | 1,500                             | 750                   | 167,500                    | 804                         |
| 16-1/2       | 1,500                          | 1,950  | 1,500                             | 750                   | 385,000                    | 909                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

Please consult FPI for larger diameters availability with the above pressure rating

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 1750

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.26                     | 0.13                          | 0.12                          | 0.9            | 28                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.79                     | 0.16                          | 0.15                          | 1.4            | 41                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.39                     | 0.20                          | 0.19                          | 2.0            | 60                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.76                     | 0.22                          | 0.21                          | 2.5            | 75                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.50                     | 0.26                          | 0.25                          | 3.3            | 98                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 5.00                     | 0.29                          | 0.27                          | 4.3            | 129                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.13                     | 0.35                          | 0.34                          | 6.3            | 189                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.02                     | 0.41                          | 0.39                          | 8.4            | 251                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.86                     | 0.51                          | 0.49                          | 13.5           | 405                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 10.01                    | 0.58                          | 0.55                          | 16.9           | 508                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 12.11                    | 0.70                          | 0.67                          | 26.0           | 780                   | 11-3/4 8/6Rd CSG STC L TC   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,750                          | 2,300  | 1,750                             | 1,200                 | 8,500                      | 113                         |
| 2-1/2        | 1,750                          | 2,300  | 1,750                             | 1,200                 | 13,500                     | 139                         |
| 3            | 1,750                          | 2,300  | 1,750                             | 1,200                 | 19,500                     | 169                         |
| 3-1/2        | 1,750                          | 2,300  | 1,750                             | 1,200                 | 24,000                     | 188                         |
| 4            | 1,750                          | 2,300  | 1,750                             | 1,200                 | 34,500                     | 225                         |
| 5            | 1,750                          | 2,300  | 1,750                             | 1,200                 | 42,500                     | 250                         |
| 6            | 1,750                          | 2,300  | 1,750                             | 1,200                 | 64,500                     | 307                         |
| 6-L          | 1,750                          | 2,300  | 1,750                             | 1,200                 | 84,000                     | 351                         |
| 8            | 1,750                          | 2,300  | 1,750                             | 1,200                 | 134,500                    | 443                         |
| 10           | 1,750                          | 2,300  | 1,750                             | 1,200                 | 161,500                    | 500                         |
| 10-L         | 1,750                          | 2,300  | 1,750                             | 1,200                 | 200,500                    | 606                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

Please consult FPI for larger diameters availability with the above pressure rating

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 2000

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.30                     | 0.15                          | 0.14                          | 1.0            | 31                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.84                     | 0.19                          | 0.18                          | 1.5            | 46                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.45                     | 0.23                          | 0.22                          | 2.2            | 67                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.83                     | 0.25                          | 0.24                          | 2.8            | 84                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.58                     | 0.30                          | 0.29                          | 3.7            | 112                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 5.09                     | 0.33                          | 0.32                          | 4.8            | 145                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.24                     | 0.41                          | 0.39                          | 7.1            | 213                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.14                     | 0.47                          | 0.45                          | 9.4            | 281                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 9.02                     | 0.59                          | 0.56                          | 16.6           | 499                   | 9-5/8" 8Rd CSG LTC**TC  |
| 10                       | 8.85                     | 8.76                          | 10.18                    | 0.67                          | 0.64                          | 20.9           | 626                   | 10-3/4" 8Rd CSG STC***TC  |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 2,000                          | 2,600  | 2,000                             | 1,700                 | 10,000                     | 115                         |
| 2-1/2        | 2,000                          | 2,600  | 2,000                             | 1,700                 | 15,500                     | 142                         |
| 3            | 2,000                          | 2,600  | 2,000                             | 1,700                 | 23,000                     | 172                         |
| 3-1/2        | 2,000                          | 2,600  | 2,000                             | 1,700                 | 28,000                     | 192                         |
| 4            | 2,000                          | 2,600  | 2,000                             | 1,700                 | 40,500                     | 229                         |
| 5            | 2,000                          | 2,600  | 2,000                             | 1,700                 | 50,000                     | 254                         |
| 6            | 2,000                          | 2,600  | 2,000                             | 1,700                 | 72,500                     | 312                         |
| 6-L          | 2,000                          | 2,600  | 2,000                             | 1,700                 | 95,500                     | 357                         |
| 8            | 2,000                          | 2,600  | 2,000                             | 1,700                 | 140,500                    | 451                         |
| 10           | 2,000                          | 2,600  | 2,000                             | 1,700                 | 170,000                    | 509                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 2250

**FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Thks<br>(inches) | Minimum Wall Thks<br>(inches) | Nominal Weight |                       | Connection Type <sup>2</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>1</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.34                     | 0.17                          | 0.16                          | 1.2            | 35                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.89                     | 0.21                          | 0.20                          | 1.7            | 51                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.51                     | 0.26                          | 0.24                          | 2.5            | 74                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.90                     | 0.29                          | 0.27                          | 3.1            | 94                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.67                     | 0.34                          | 0.32                          | 4.2            | 125                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 5.18                     | 0.38                          | 0.36                          | 5.4            | 162                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.35                     | 0.46                          | 0.44                          | 7.9            | 238                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.27                     | 0.53                          | 0.51                          | 10.5           | 314                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 9.18                     | 0.67                          | 0.64                          | 18.4           | 553                   | 9-5/8" 8Rd CSG LTC**TC  |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends,

d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 2,250                          | 2,950  | 2,250                             | 2,400                 | 11,500                     | 117                         |
| 2-1/2        | 2,250                          | 2,950  | 2,250                             | 2,400                 | 18,000                     | 144                         |
| 3            | 2,250                          | 2,950  | 2,250                             | 2,400                 | 26,000                     | 176                         |
| 3-1/2        | 2,250                          | 2,950  | 2,250                             | 2,400                 | 32,500                     | 195                         |
| 4            | 2,250                          | 2,950  | 2,250                             | 2,400                 | 46,500                     | 233                         |
| 5            | 2,250                          | 2,950  | 2,250                             | 2,400                 | 55,500                     | 259                         |
| 6            | 2,250                          | 2,950  | 2,250                             | 2,400                 | 72,500                     | 318                         |
| 6-L          | 2,250                          | 2,950  | 2,250                             | 2,400                 | 95,500                     | 363                         |
| 8            | 2,250                          | 2,950  | 2,250                             | 2,400                 | 152,000                    | 459                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

Please consult FPI for larger diameters availability with the above pressure rating

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## R.9.0

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

[illegible]

Please consult FPI for larger diameters availability with the above pressure rating

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## R.9.0

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

[illegible]

Please consult FPI for larger diameters availability with the above pressure rating

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## R.9.0

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

Please consult FPI for larger diameters availability with the above pressure rating

## High Pressure Product Catalogue - USA

## R.9.0

[illegible]

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

[illegible]

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## R.9.0

1. Standard Joint Length is 30 ft, 2. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

[illegible]

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |



## 6.2 Yellow Box® API 15HR Design

**Note: Please consult Future Pipe Industries for larger diameters not listed in the following pressure classes**

## YELLOW BOX 500 API 15HR DESIGN CRITERIA

MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE  
AROMATIC AMINE CURED EPOXY RESIN

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.13                     | 0.06                          | 0.06                          | 0.6            | 18                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.59                     | 0.06                          | 0.06                          | 0.7            | 22                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.12                     | 0.06                          | 0.06                          | 1.0            | 30                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.47                     | 0.07                          | 0.07                          | 1.3            | 39                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.15                     | 0.08                          | 0.08                          | 1.5            | 45                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.61                     | 0.09                          | 0.09                          | 2.1            | 64                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.65                     | 0.11                          | 0.11                          | 3.0            | 91                    | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.47                     | 0.13                          | 0.12                          | 3.0            | 91                    | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.17                     | 0.17                          | 0.16                          | 4.5            | 136                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.22                     | 0.19                          | 0.18                          | 8.4            | 253                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.17                    | 0.23                          | 0.21                          | 9.3            | 278                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 12.47                    | 0.25                          | 0.24                          | 13.5           | 405                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.09                    | 0.30                          | 0.29                          | 18.4           | 553                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 17.06                    | 0.34                          | 0.33                          | 26.3           | 788                   | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 18.74                    | 0.38                          | 0.36                          | 29.4           | 882                   | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 24.78                    | 0.50                          | 0.48                          | 62.5           | 1,875                 | 24" 4Rd CSG STC L TC  |

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 500                            | 750  | 500                               | 160                   | 4,000                      | 106                         |
| 2-1/2        | 500                            | 750  | 500                               | 90                    | 5,000                      | 130                         |
| 3            | 500                            | 750  | 500                               | 50                    | 6,000                      | 156                         |
| 3-1/2        | 500                            | 750  | 500                               | 50                    | 7,500                      | 174                         |
| 4            | 500                            | 750  | 500                               | 50                    | 10,500                     | 208                         |
| 5            | 500                            | 750  | 500                               | 50                    | 13,000                     | 230                         |
| 6            | 500                            | 750  | 500                               | 50                    | 20,000                     | 283                         |
| 6-L          | 500                            | 750  | 500                               | 50                    | 26,000                     | 323                         |
| 8            | 500                            | 750  | 500                               | 50                    | 41,500                     | 409                         |
| 10           | 500                            | 750  | 500                               | 50                    | 53,000                     | 461                         |
| 10-L         | 500                            | 750  | 500                               | 50                    | 77,500                     | 558                         |
| 12           | 500                            | 750  | 500                               | 50                    | 96,500                     | 623                         |
| 14-1/2       | 500                            | 750  | 500                               | 50                    | 141,500                    | 754                         |
| 16-1/2       | 500                            | 750  | 500                               | 50                    | 181,000                    | 853                         |
| 18           | 500                            | 750  | 500                               | 50                    | 218,500                    | 937                         |
| 24           | 500                            | 750  | 500                               | 50                    | 382,000                    | 1,239                       |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 750 API 15HR DESIGN CRITERIA

MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE  
AROMATIC AMINE CURED EPOXY RESIN

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.13                     | 0.06                          | 0.06                          | 0.6            | 18                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.62                     | 0.08                          | 0.07                          | 0.8            | 25                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.19                     | 0.10                          | 0.09                          | 1.2            | 37                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.54                     | 0.11                          | 0.10                          | 1.6            | 47                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.24                     | 0.13                          | 0.12                          | 1.9            | 57                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.70                     | 0.14                          | 0.13                          | 2.6            | 79                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.77                     | 0.17                          | 0.16                          | 3.8            | 114                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.60                     | 0.20                          | 0.19                          | 4.1            | 122                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.34                     | 0.25                          | 0.24                          | 6.1            | 183                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.41                     | 0.28                          | 0.27                          | 10.5           | 314                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.40                    | 0.34                          | 0.33                          | 12.4           | 371                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 12.73                    | 0.38                          | 0.36                          | 17.4           | 521                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.40                    | 0.46                          | 0.44                          | 23.8           | 714                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 17.41                    | 0.52                          | 0.50                          | 33.0           | 991                   | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 19.13                    | 0.57                          | 0.55                          | 37.5           | 1,125                 | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 25.30                    | 0.76                          | 0.72                          | 75.5           | 2,266                 | 24" 4Rd CSG STC L TC  |

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 750                            | 1,150  | 750                               | 170                   | 4,000                      | 106                         |
| 2-1/2        | 750                            | 1,150  | 750                               | 170                   | 6,500                      | 131                         |
| 3            | 750                            | 1,150  | 750                               | 170                   | 9,500                      | 159                         |
| 3-1/2        | 750                            | 1,150  | 750                               | 170                   | 11,500                     | 177                         |
| 4            | 750                            | 1,150  | 750                               | 170                   | 16,500                     | 212                         |
| 5            | 750                            | 1,150  | 750                               | 170                   | 20,000                     | 235                         |
| 6            | 750                            | 1,150  | 750                               | 170                   | 30,500                     | 289                         |
| 6-L          | 750                            | 1,150  | 750                               | 170                   | 40,000                     | 330                         |
| 8            | 750                            | 1,150  | 750                               | 170                   | 63,500                     | 417                         |
| 10           | 750                            | 1,150  | 750                               | 170                   | 81,000                     | 471                         |
| 10-L         | 750                            | 1,150  | 750                               | 170                   | 119,000                    | 570                         |
| 12           | 750                            | 1,150  | 750                               | 170                   | 148,000                    | 636                         |
| 14-1/2       | 750                            | 1,150  | 750                               | 170                   | 217,000                    | 770                         |
| 16-1/2       | 750                            | 1,150  | 750                               | 170                   | 264,500                    | 871                         |
| 18           | 750                            | 1,150  | 750                               | 170                   | 310,000                    | 956                         |
| 24           | 750                            | 1,150  | 750                               | 170                   | 585,000                    | 1,265                       |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

# YELLOW BOX 1000 API 15HR DESIGN CRITERIA

**MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

## DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.17                     | 0.09                          | 0.08                          | 0.7            | 21                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.68                     | 0.11                          | 0.10                          | 1.0            | 30                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.25                     | 0.13                          | 0.12                          | 1.5            | 44                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.62                     | 0.14                          | 0.14                          | 1.9            | 56                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.33                     | 0.17                          | 0.16                          | 2.4            | 71                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.80                     | 0.19                          | 0.18                          | 3.2            | 95                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 5.89                     | 0.23                          | 0.22                          | 4.6            | 138                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.74                     | 0.27                          | 0.25                          | 5.2            | 156                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.51                     | 0.34                          | 0.32                          | 7.9            | 236                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.61                     | 0.38                          | 0.36                          | 12.6           | 377                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.64                    | 0.46                          | 0.44                          | 15.6           | 467                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 12                       | 11.97                    | 11.87                         | 12.99                    | 0.51                          | 0.49                          | 21.2           | 637                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 15.73                    | 0.62                          | 0.59                          | 29.8           | 895                   | 16" 6Rd CSG STC TC  |
| 16-1/2                   | 16.37                    | 16.27                         | 17.78                    | 0.70                          | 0.67                          | 40.7           | 1,222                 | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 19.53                    | 0.77                          | 0.74                          | 46.8           | 1,404                 | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 25.83                    | 1.02                          | 0.97                          | 92.6           | 2,778                 | 24" 4Rd CSG STC L TC  |

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

## PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,000                          | 1,500  | 1,000                             | 380                   | 5,500                      | 109                         |
| 2-1/2        | 1,000                          | 1,500  | 1,000                             | 380                   | 8,500                      | 134                         |
| 3            | 1,000                          | 1,500  | 1,000                             | 380                   | 12,500                     | 163                         |
| 3-1/2        | 1,000                          | 1,500  | 1,000                             | 380                   | 15,500                     | 181                         |
| 4            | 1,000                          | 1,500  | 1,000                             | 380                   | 22,500                     | 216                         |
| 5            | 1,000                          | 1,500  | 1,000                             | 380                   | 27,500                     | 240                         |
| 6            | 1,000                          | 1,500  | 1,000                             | 380                   | 41,500                     | 295                         |
| 6-L          | 1,000                          | 1,500  | 1,000                             | 380                   | 54,500                     | 337                         |
| 8            | 1,000                          | 1,500  | 1,000                             | 380                   | 86,500                     | 426                         |
| 10           | 1,000                          | 1,500  | 1,000                             | 380                   | 110,500                    | 481                         |
| 10-L         | 1,000                          | 1,500  | 1,000                             | 380                   | 147,000                    | 582                         |
| 12           | 1,000                          | 1,500  | 1,000                             | 380                   | 189,500                    | 650                         |
| 14-1/2       | 1,000                          | 1,500  | 1,000                             | 380                   | 217,500                    | 786                         |
| 16-1/2       | 1,000                          | 1,500  | 1,000                             | 380                   | 264,500                    | 889                         |
| 18           | 1,000                          | 1,500  | 1,000                             | 380                   | 310,000                    | 976                         |
| 24           | 1,000                          | 1,500  | 1,000                             | 380                   | 640,000                    | 1,291                       |

## MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

# YELLOW BOX 1250 API 15HR DESIGN CRITERIA

**MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

## DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.22                     | 0.11                          | 0.10                          | 0.8            | 25                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.73                     | 0.13                          | 0.13                          | 1.2            | 35                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.32                     | 0.16                          | 0.16                          | 1.7            | 52                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.69                     | 0.18                          | 0.17                          | 2.2            | 66                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.42                     | 0.22                          | 0.21                          | 2.8            | 85                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 4.90                     | 0.24                          | 0.23                          | 3.7            | 112                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.02                     | 0.30                          | 0.28                          | 5.5            | 164                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 6.88                     | 0.34                          | 0.32                          | 6.3            | 189                   | 7" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.69                     | 0.43                          | 0.41                          | 11.8           | 354                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 9.81                     | 0.48                          | 0.46                          | 14.7           | 442                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 11.88                    | 0.58                          | 0.55                          | 22.4           | 672                   | 11-3/4 8/6Rd CSG STC L TC   |
| 12                       | 11.97                    | 11.87                         | 13.27                    | 0.65                          | 0.62                          | 25.3           | 759                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 14-1/2                   | 14.48                    | 14.39                         | 16.05                    | 0.79                          | 0.75                          | 42.6           | 1,277                 | 16 6Rd CSG STC L TC   |
| 16-1/2                   | 16.37                    | 16.27                         | 18.15                    | 0.89                          | 0.85                          | 51.0           | 1,529                 | 18" 6Rd CSG STC TC  |
| 18                       | 17.98                    | 17.89                         | 19.94                    | 0.98                          | 0.93                          | 67.5           | 2,024                 | 20" 6Rd CSG STC L TC  |

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

## PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,250                          | 1,900  | 1,250                             | 710                   | 7,000                      | 111                         |
| 2-1/2        | 1,250                          | 1,900  | 1,250                             | 710                   | 11,000                     | 137                         |
| 3            | 1,250                          | 1,900  | 1,250                             | 710                   | 16,000                     | 166                         |
| 3-1/2        | 1,250                          | 1,900  | 1,250                             | 710                   | 20,000                     | 185                         |
| 4            | 1,250                          | 1,900  | 1,250                             | 710                   | 28,500                     | 221                         |
| 5            | 1,250                          | 1,900  | 1,250                             | 710                   | 35,000                     | 245                         |
| 6            | 1,250                          | 1,900  | 1,250                             | 710                   | 53,000                     | 301                         |
| 6-L          | 1,250                          | 1,900  | 1,250                             | 710                   | 69,500                     | 344                         |
| 8            | 1,250                          | 1,900  | 1,250                             | 710                   | 110,500                    | 435                         |
| 10           | 1,250                          | 1,900  | 1,250                             | 710                   | 141,000                    | 491                         |
| 10-L         | 1,250                          | 1,900  | 1,250                             | 710                   | 176,500                    | 594                         |
| 12           | 1,250                          | 1,900  | 1,250                             | 710                   | 189,500                    | 663                         |
| 14-1/2       | 1,250                          | 1,900  | 1,250                             | 710                   | 315,500                    | 803                         |
| 16-1/2       | 1,250                          | 1,900  | 1,250                             | 710                   | 336,500                    | 907                         |
| 18           | 1,250                          | 1,900  | 1,250                             | 710                   | 406,000                    | 997                         |

## MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

# YELLOW BOX 1500 API 15HR DESIGN CRITERIA

**MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

## DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.26                     | 0.13                          | 0.13                          | 0.9            | 28                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.79                     | 0.16                          | 0.16                          | 1.4            | 41                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.39                     | 0.20                          | 0.19                          | 2.0            | 60                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.77                     | 0.22                          | 0.21                          | 2.5            | 76                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.51                     | 0.26                          | 0.25                          | 3.3            | 99                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 5.00                     | 0.29                          | 0.28                          | 4.4            | 131                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.14                     | 0.36                          | 0.34                          | 6.4            | 191                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.02                     | 0.41                          | 0.39                          | 8.4            | 253                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 8.88                     | 0.52                          | 0.49                          | 13.6           | 408                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 10.02                    | 0.58                          | 0.56                          | 17.0           | 510                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 12.13                    | 0.71                          | 0.67                          | 25.8           | 773                   | 11-3/4 8/6Rd CSG STC L TC   |
| 12                       | 11.97                    | 11.87                         | 13.54                    | 0.79                          | 0.75                          | 32.4           | 972                   | 13-3/8 8/6Rd CSG STC L TC   |
| 14-1/2                   | 14.48                    | 14.39                         | 16.39                    | 0.96                          | 0.91                          | 49.7           | 1,492                 | 16 6Rd CSG STC L TC   |
| 16-1/2                   | 16.37                    | 16.27                         | 18.53                    | 1.08                          | 1.03                          | 61.2           | 1,836                 | 18" 6Rd CSG STC TC  |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Monogramed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

## PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,500                          | 2,250  | 1,500                             | 1,200                 | 9,000                      | 113                         |
| 2-1/2        | 1,500                          | 2,250  | 1,500                             | 1,200                 | 13,500                     | 140                         |
| 3            | 1,500                          | 2,250  | 1,500                             | 1,200                 | 20,000                     | 170                         |
| 3-1/2        | 1,500                          | 2,250  | 1,500                             | 1,200                 | 24,500                     | 188                         |
| 4            | 1,500                          | 2,250  | 1,500                             | 1,200                 | 35,000                     | 225                         |
| 5            | 1,500                          | 2,250  | 1,500                             | 1,200                 | 43,000                     | 250                         |
| 6            | 1,500                          | 2,250  | 1,500                             | 1,200                 | 65,000                     | 307                         |
| 6-L          | 1,500                          | 2,250  | 1,500                             | 1,200                 | 85,000                     | 351                         |
| 8            | 1,500                          | 2,250  | 1,500                             | 1,200                 | 136,000                    | 444                         |
| 10           | 1,500                          | 2,250  | 1,500                             | 1,200                 | 161,500                    | 501                         |
| 10-L         | 1,500                          | 2,250  | 1,500                             | 1,200                 | 176,500                    | 606                         |
| 12           | 1,500                          | 2,250  | 1,500                             | 1,200                 | 215,000                    | 677                         |
| 14-1/2       | 1,500                          | 2,250  | 1,500                             | 1,200                 | 315,500                    | 820                         |
| 16-1/2       | 1,500                          | 2,250  | 1,500                             | 1,200                 | 385,000                    | 926                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

## MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 1750 API 15HR DESIGN CRITERIA

**MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.31                     | 0.16                          | 0.15                          | 1.1            | 32                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.85                     | 0.19                          | 0.18                          | 1.6            | 47                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.46                     | 0.23                          | 0.22                          | 2.3            | 69                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.85                     | 0.26                          | 0.25                          | 2.9            | 86                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.60                     | 0.31                          | 0.30                          | 3.8            | 115                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 5.11                     | 0.34                          | 0.33                          | 5.0            | 149                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.27                     | 0.42                          | 0.40                          | 7.3            | 219                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.17                     | 0.48                          | 0.46                          | 9.7            | 290                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 9.06                     | 0.61                          | 0.58                          | 15.5           | 465                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10                       | 8.85                     | 8.76                          | 10.23                    | 0.69                          | 0.66                          | 19.5           | 584                   | 10-3/4" 8Rd CSG STC***IJ  |
| 10-L                     | 10.72                    | 10.62                         | 12.39                    | 0.84                          | 0.80                          | 29.7           | 892                   | 11-3/4 8/6Rd CSG STC L TC   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Monogramed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 1,750                          | 2,650  | 1,750                             | 1,900                 | 10,500                     | 116                         |
| 2-1/2        | 1,750                          | 2,650  | 1,750                             | 1,900                 | 16,000                     | 143                         |
| 3            | 1,750                          | 2,650  | 1,750                             | 1,900                 | 23,500                     | 173                         |
| 3-1/2        | 1,750                          | 2,650  | 1,750                             | 1,900                 | 29,500                     | 192                         |
| 4            | 1,750                          | 2,650  | 1,750                             | 1,900                 | 42,000                     | 230                         |
| 5            | 1,750                          | 2,650  | 1,750                             | 1,900                 | 51,500                     | 256                         |
| 6            | 1,750                          | 2,650  | 1,750                             | 1,900                 | 72,500                     | 314                         |
| 6-L          | 1,750                          | 2,650  | 1,750                             | 1,900                 | 95,500                     | 359                         |
| 8            | 1,750                          | 2,650  | 1,750                             | 1,900                 | 140,500                    | 453                         |
| 10           | 1,750                          | 2,650  | 1,750                             | 1,900                 | 161,500                    | 511                         |
| 10-L         | 1,750                          | 2,650  | 1,750                             | 1,900                 | 200,500                    | 619                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 2000 API 15HR DESIGN CRITERIA

MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE  
AROMATIC AMINE CURED EPOXY RESIN

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.36                     | 0.18                          | 0.17                          | 1.2            | 36                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.91                     | 0.22                          | 0.21                          | 1.8            | 53                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.54                     | 0.27                          | 0.26                          | 2.6            | 78                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 3.93                     | 0.30                          | 0.29                          | 3.3            | 99                    | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.70                     | 0.36                          | 0.34                          | 4.4            | 131                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5                        | 4.42                     | 4.33                          | 5.22                     | 0.40                          | 0.38                          | 5.6            | 169                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.40                     | 0.49                          | 0.47                          | 8.3            | 249                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.32                     | 0.56                          | 0.53                          | 10.9           | 328                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 9.25                     | 0.71                          | 0.67                          | 19.0           | 571                   | 9-5/8" 8Rd CSG LTC**TC  |
| 10                       | 8.85                     | 8.76                          | 10.45                    | 0.80                          | 0.76                          | 23.9           | 718                   | 10-3/4" 8Rd CSG STC***TC  |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 2,000                          | 3,000  | 2,000                             | 2,500                 | 12,500                     | 118                         |
| 2-1/2        | 2,000                          | 3,000  | 2,000                             | 2,500                 | 19,000                     | 146                         |
| 3            | 2,000                          | 3,000  | 2,000                             | 2,500                 | 27,500                     | 177                         |
| 3-1/2        | 2,000                          | 3,000  | 2,000                             | 2,500                 | 34,000                     | 197                         |
| 4            | 2,000                          | 3,000  | 2,000                             | 2,500                 | 46,500                     | 235                         |
| 5            | 2,000                          | 3,000  | 2,000                             | 2,500                 | 55,500                     | 261                         |
| 6            | 2,000                          | 3,000  | 2,000                             | 2,500                 | 72,500                     | 320                         |
| 6-L          | 2,000                          | 3,000  | 2,000                             | 2,500                 | 95,500                     | 366                         |
| 8            | 2,000                          | 3,000  | 2,000                             | 2,500                 | 140,500                    | 463                         |
| 10           | 2,000                          | 3,000  | 2,000                             | 2,500                 | 170,000                    | 522                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## YELLOW BOX 2250 API 15HR DESIGN CRITERIA

**MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall Tkns<br>(inches) | Minimum Wall Tkns<br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                               |                               | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2                        | 2.00                     | 1.91                          | 2.41                     | 0.21                          | 0.20                          | 1.3            | 40                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-1/2                    | 2.47                     | 2.37                          | 2.97                     | 0.25                          | 0.24                          | 2.0            | 59                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3                        | 3.00                     | 2.90                          | 3.61                     | 0.31                          | 0.29                          | 2.9            | 88                    | 3-1/2" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.33                     | 3.24                          | 4.01                     | 0.34                          | 0.33                          | 3.7            | 110                   | 4" 8Rd EUE Long* IJ   |
| 4                        | 3.98                     | 3.89                          | 4.80                     | 0.41                          | 0.39                          | 6.0            | 181                   | 5-1/2" 8Rd CSG LTC**TC  |
| 5                        | 4.42                     | 4.33                          | 5.33                     | 0.45                          | 0.43                          | 6.3            | 189                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6                        | 5.43                     | 5.33                          | 6.54                     | 0.56                          | 0.53                          | 9.3            | 280                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 6-L                      | 6.21                     | 6.11                          | 7.48                     | 0.64                          | 0.61                          | 12.3           | 368                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8                        | 7.84                     | 7.75                          | 9.45                     | 0.81                          | 0.77                          | 21.3           | 638                   | 9-5/8" 8Rd CSG LTC**TC  |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |
|                          |                          |                               |                          |                               |                               |                |                       |   |

1. Monogramed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4,

b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Maximum Field Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Minimum Bending Radius (ft) |
|--------------|--------------------------------|--|-----------------------------------|-----------------------|----------------------------|-----------------------------|
| 2            | 2,250                          | 3,400  | 2,250                             | 2,800                 | 14,000                     | 121                         |
| 2-1/2        | 2,250                          | 3,400  | 2,250                             | 2,800                 | 21,500                     | 149                         |
| 3            | 2,250                          | 3,400  | 2,250                             | 2,800                 | 32,000                     | 181                         |
| 3-1/2        | 2,250                          | 3,400  | 2,250                             | 2,800                 | 39,500                     | 201                         |
| 4            | 2,250                          | 3,400  | 2,250                             | 2,800                 | 55,500                     | 240                         |
| 5            | 2,250                          | 3,400  | 2,250                             | 2,800                 | 55,500                     | 266                         |
| 6            | 2,250                          | 3,400  | 2,250                             | 2,800                 | 72,500                     | 327                         |
| 6-L          | 2,250                          | 3,400  | 2,250                             | 2,800                 | 95,500                     | 374                         |
| 8            | 2,250                          | 3,400  | 2,250                             | 2,800                 | 152,000                    | 473                         |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |
|              |                                |  |                                   |                       |                            |                             |

### MECHANICAL AND PHYSICAL PROPERTIES

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE AROMATIC AMINE CURED EPOXY RESIN

R.9.0

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

[illegible]

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE AROMATIC AMINE CURED EPOXY RESIN

## DIMENSIONAL SPECIFICATIONS

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

[illegible]

| Pipe Body Properties                           | Value  | Unit               | Test Method    |
|--|--------|--------------------|----------------|
| Tensile Strength, Hoop                         | 40,000 | psi                | ASTM D1599     |
| Tensile Strength, Axial                        | 20,000 | psi                | ASTM D2105     |
| Modulus of Elasticity, Axial                   | 2.0    | 10E+06 psi         | ASTM D2105     |
| 20 Years Lower Confidence Limit (LCL) at 150°F | 18,995 | psi                | ASTM D2992 (B) |
| Specific Gravity                               | 1.93   | ---                | ASTM D792      |
| Density  | 0.07   | lbs/in3            | ASTM D792      |
| Thermal Conductivity                           | 2.4    | Btu/hr/ft2/in/degF | ASTM C177      |
| Thermal Expansion Coefficient (Linear)         | 1.2    | 10E-05in/in/degF   | ASTM D696      |
| Flow Factor                                    | 150    | ---                | Hazen Williams |

## MONOGRAMED<sup>1</sup> AND NON-MONOGRAMED FIBERGLASS LINEPIPE AROMATIC AMINE CURED EPOXY RESIN

R.9.0

1. Monogrammed are only available up to nominal size 12 inches, 2. Standard Joint Length is 30 ft, 3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded & Coupled)

## MECHANICAL AND PHYSICAL PROPERTIES

High Pressure Product Catalogue - USA

### 6.3 Green Box™ Chemical Grade Line Pipe

#### Product Description

The Green Box™ product consists of the Yellow Box® product with an inner Nexus® liner to achieve more chemical resistance. Refer to Chemical Resistance Guide in **Section 3.0**

#### Product Availability

The Green Box™ products are available with the **integral joint (IJ) connection type only**. Product can be selected by using the Yellow Box® or Yellow Box® API 15HR Design Criteria product Technical data sheets in **Sections 6.1 and 6.2**.

#### Example

Find the maximum nominal size Line pipe to carry water mixed with Hydrogen Sulfide under internal pressure of 1250 psi and operating temperature of 165 F

#### Steps

- 1- Check **Section 3.0**, from the chemical resistance guide tables for the Hydrogen Sulfide with the operating temperature of 165 F. The two options are
  - a- Yellow Box® product without liner with maximum operating temperature of 150 F (Not suitable)
  - b- Green Box™ product with liner with maximum operating temperature of 200 F
- 2- Select the Green Box™ product with the Nexus® liner
- 3- Check **Section 6.1 or 6.2** and select the Yellow Box® 1250 Technical Data Sheet
- 4- The maximum nominal size for the Green Box™ line pipe with Integral joint connection type is 10 inches



## 7.0 Tubing & Casing Product Description

**RED BOX<sup>®</sup>**  
TUBING & CASING

**BLUE BOX<sup>®</sup>**  
CHEMICAL GRADE TUBING & CASING



## 7.1 Composition and Specifications

**Red Box® and Blue Box® Tubing and casing** is of a machine-made composite material, produced by the filament-winding method, combining high strength glass fiber filaments and corrosion resistant epoxy resin specially formulated to result in a structurally and chemically optimum product. The epoxy resin is an aromatic amine cured system that has the highest mechanical strength, thermal resistance and best corrosion resistance of all commercially available resin systems used in the fabrication of fiberglass piping.

**Tubing and casing** will be authorized to use the API monogram by conforming to API Specification 15TR (when issued). Future Pipe Industries, Inc.'s Quality Management System is certified to be in compliance with ISO-9001:2008 and ANAB.

**Tubing and casing** pipe conforms to the following ASTM Specifications:

ASTM D 2310 – 01

Red Box® size (2-3/8 - 10-3/4) Designation: RTRP-11AX

Red Box® size (11-3/4 - 24) Designation: RTRP-11AX

Blue Box® size (2-3/8 - 10-3/4) Designation: RTRP-11FX

Blue Box® size (11-3/4 - 24) Designation: RTRP-11FX

ASTM D 2996 – 01

Red Box® size (2-3/8 - 10-3/4) Designation: RTRP-11AX1-2332

Red Box® size (11-3/4 - 24) Designation: RTRP-11AX1-3222

Blue Box® size (2-3/8 - 10-3/4) Designation: RTRP-11FX1-2332

Blue Box® size (11-3/4 - 24) Designation: RTRP-11FX1-3222

## 7.2 Uses and Applications

**Red Box® and Blue Box® Tubing and casing** is a fiberglass reinforced aromatic amine cured epoxy resin casing and tubing designed for down hole service of medium to high pressure at depths as great as 12,000 feet.

**Tubing and casing** is available in 1000, 1250, 1500, 1750, 2000, 2250, 2500, 2750, 3000, 3250 and 3500 psi operating pressure ratings.

**Tubing and casing** offers a high-strength, non-corroding casing and tubing system in 2-3/8 through 24 inch sizes that has a proven low installed cost and long lifespan.

**Tubing and casing** system is recommended for use in:

- Production wells (oil, gas, thermal)
- Disposal wells (salt water, chemical effluent, and waste)
- Injection wells (salt water, CO<sub>2</sub>)
- Liners for the repair of corroded steel casing
- Municipal and commercial water wells



### 7.3 Joining System and Fittings

**Red Box® and Blue Box® Tubing and casing** products are connected with the reliable, time proven API-5B threaded connection. For pipe size 2" to 4", an 8 Rd (API-5B) external upset end (EUE) long threaded connections is used. For pipe size 5" and up, an 8 Rd (API-5B), 6 Rd, 4 Rd casing long and casing short threaded connection are used. Dependent on pipe size, filament wound integral joint (IJ) or couplings (TC) are utilized in the connection.

**Tubing and casing** system is offered with a line of fittings and accessories including centralizers and slotted screens.



### 7.4 Advantages

Design:

- Manufactured from aromatic-amine, heat-cured epoxy resin which provides the highest mechanical strength combined with the maximum chemical and temperature resistance available for fiberglass pipe systems.
- Manufactured using the filament winding method for greater mechanical strength.
- All FPI fiberglass products are extensively heat cured to provide consistent and repeatable quality.
- Available in the highest pressure ratings in the industry.
- Suitable for a temperature range of -60°C (-76°F) to +95°C (+200°F)<sup>2</sup>.
- No concerns over the cyclic pressure changes.
- Long term reliability. Designed for service life of 20 years.

Connection:

- Joint sealing is obtained by fiberglass material itself. Hence, use of other sealing material such as rubber O-rings is completely avoided.
- Fluid and gas-tight threaded connections.

Hydraulic Performance:

- Low friction losses. Minimum Hazen-Williams coefficient (C) of 150 over the entire life time for typical oil & gas services.
- Reduced paraffin and scale build-up.

Chemical Resistance:

- No external corrosion from aggressive soils and ground water.
- Resists internal corrosion from brackish water, H<sub>2</sub>S, CO<sub>2</sub>, and most oilfield fluids
- Outstanding broad spectrum corrosion resistance.

Quality:

- Fully compliant with API standards.
- FPI does not conduct random sampling testing. Every joint of pipe is pressure tested from 1.3 to 1.5 times the design pressure.

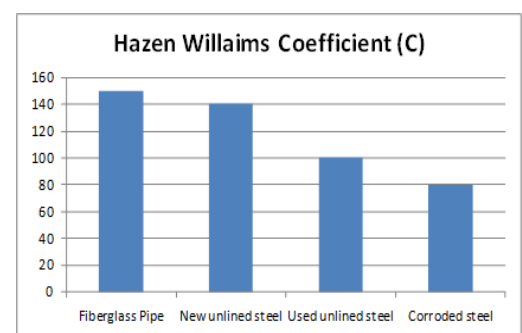
Shipping & Installation:

- Light weight, safe, easy & fast installation.
- Minimal maintenance, no coating or cathodic protection is required.
- Low transportation and installation cost.
- Less excavation, fewer, and small crew compare to steel pipe.

<sup>2</sup> For applications with a design temperature greater than 95°C (200° F), contact Future Pipe Industries to obtain a suitable de-rating factor.



**Corroded Steel Pipe**





## 8.0 Tubing & Casing Technical Data Sheets

### RED BOX<sup>®</sup> TUBING & CASING

### BLUE BOX<sup>®</sup> CHEMICAL GRADE TUBING & CASING



### 8.1 Red Box<sup>®</sup>

## RED BOX 1000

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.16                     | 0.08                     | 2.69                       | 3.43                                | 0.7            | 20                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.67                     | 0.10                     | 3.19                       | 3.93                                | 1.0            | 29                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.25                     | 0.13                     | 3.85                       | 4.82                                | 1.5            | 44                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 3.61                     | 0.14                     | 4.35                       | 5.56                                | 1.8            | 55                    | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.30                     | 0.16                     | 4.85                       | 5.76                                | 2.2            | 67                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 4.78                     | 0.18                     | 5.60                       | 7.00                                | 3.1            | 92                    | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 5.87                     | 0.22                     | 6.73                       | 8.28                                | 4.4            | 133                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7                        | 6.21                     | 6.11                          | 6.71                     | 0.25                     | 7.10                       | 8.24                                | 4.9            | 148                   | 7" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 6.71                     | 0.25                     | 7.73                       | 9.66                                | 5.9            | 177                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 8-5/8                    | 7.84                     | 7.75                          | 8.47                     | 0.31                     | 8.73                       | 9.76                                | 7.4            | 223                   | 8-5/8" 8Rd CSG LTC**IJ  |
| 10-3/4                   | 8.85                     | 8.76                          | 9.56                     | 0.36                     | 10.85                      | 13.55                               | 11.9           | 358                   | 10-3/4" 8Rd CSG STC***IJ  |
| 11-3/4                   | 10.72                    | 10.62                         | 11.49                    | 0.39                     | 11.93                      | 14.00                               | 14.1           | 424                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 13-3/8                   | 11.97                    | 11.87                         | 12.83                    | 0.43                     | 13.65                      | 15.00                               | 18.2           | 546                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 16                       | 14.48                    | 14.39                         | 15.53                    | 0.52                     | 16.33                      | 17.90                               | 25.8           | 773                   | 16" 6Rd CSG STC TC  |
| 18                       | 16.37                    | 16.27                         | 17.55                    | 0.59                     | 18.84                      | 21.45                               | 35.6           | 1,069                 | 18" 6Rd CSG STC TC  |
| 20                       | 17.98                    | 17.89                         | 19.28                    | 0.65                     | 20.20                      | 22.65                               | 41.7           | 1,251                 | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 25.50                    | 0.86                     | 26.79                      | 31.40                               | 82.6           | 2,479                 | 24" 4Rd CSG STC L TC  |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|---|
| 2-3/8        | 1,000                          | 1,300  | 310                   | 8,000                      | 0.649   |
| 2-7/8        | 1,000                          | 1,300  | 350                   | 12,500                     | 0.387   |
| 3-1/2        | 1,000                          | 1,300  | 370                   | 19,000                     | 0.249   |
| 4            | 1,000                          | 1,300  | 340                   | 22,500                     | 0.214   |
| 4-1/2        | 1,000                          | 1,300  | 310                   | 31,000                     | 0.163   |
| 5-1/2        | 1,000                          | 1,300  | 330                   | 39,500                     | 0.125   |
| 6-5/8        | 1,000                          | 1,300  | 330                   | 59,000                     | 0.084   |
| 7            | 1,000                          | 1,300  | 330                   | 76,500                     | 0.064   |
| 7-5/8        | 1,000                          | 1,300  | 330                   | 77,500                     | 0.064   |
| 8-5/8        | 1,000                          | 1,300  | 310                   | 108,500                    | 0.042   |
| 10-3/4       | 1,000                          | 1,300  | 310                   | 154,000                    | 0.033   |
| 11-3/4       | 1,000                          | 1,300  | 240                   | 135,500                    | 0.037   |
| 13-3/8       | 1,000                          | 1,300  | 240                   | 169,000                    | 0.030   |
| 16           | 1,000                          | 1,300  | 240                   | 217,500                    | 0.020   |
| 18           | 1,000                          | 1,300  | 240                   | 264,500                    | 0.016   |
| 20           | 1,000                          | 1,300  | 240                   | 310,000                    | 0.013   |
| 24           | 1,000                          | 1,300  | 240                   | 631,500                    | 0.007   |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## RED BOX 1250

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.21                     | 0.10                     | 2.69                       | 3.43                                | 0.8            | 24                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.73                     | 0.13                     | 3.19                       | 3.93                                | 1.1            | 34                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.30                     | 0.15                     | 3.85                       | 4.82                                | 1.6            | 49                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 3.68                     | 0.17                     | 4.35                       | 5.56                                | 2.1            | 64                    | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.40                     | 0.21                     | 4.85                       | 5.76                                | 2.7            | 82                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 4.87                     | 0.23                     | 5.60                       | 7.00                                | 3.6            | 107                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 5.97                     | 0.27                     | 6.73                       | 8.28                                | 5.2            | 156                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7                        | 6.21                     | 6.11                          | 6.83                     | 0.31                     | 7.10                       | 8.24                                | 5.9            | 178                   | 7" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 6.83                     | 0.31                     | 7.73                       | 9.66                                | 6.9            | 207                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 9-5/8                    | 7.84                     | 7.75                          | 8.63                     | 0.40                     | 9.73                       | 12.30                               | 11.2           | 335                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10-3/4                   | 8.85                     | 8.76                          | 9.76                     | 0.45                     | 10.85                      | 13.55                               | 14.0           | 421                   | 10-3/4" 8Rd CSG STC***IJ  |
| 11-3/4                   | 10.72                    | 10.62                         | 11.70                    | 0.49                     | 11.93                      | 14.00                               | 16.9           | 507                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 13-3/8                   | 11.97                    | 11.87                         | 13.06                    | 0.55                     | 13.65                      | 15.00                               | 21.5           | 646                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 16                       | 14.48                    | 14.39                         | 15.80                    | 0.66                     | 16.33                      | 18.20                               | 30.9           | 927                   | 16" 6Rd CSG STC TC  |
| 18                       | 16.37                    | 16.27                         | 17.87                    | 0.75                     | 18.84                      | 21.90                               | 43.6           | 1,307                 | 18" 6Rd CSG STC TC  |
| 20                       | 17.98                    | 17.89                         | 19.62                    | 0.82                     | 20.20                      | 23.00                               | 50.1           | 1,504                 | 20" 6Rd CSG STC TC  |
| 24                       | 23.78                    | 23.69                         | 25.96                    | 1.09                     | 26.79                      | 32.10                               | 97.4           | 2,921                 | 24" 4Rd CSG STC L TC  |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint, f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|---|
| 2-3/8        | 1,250                          | 1,650  | 640                   | 10,500                     | 0.467   |
| 2-7/8        | 1,250                          | 1,650  | 670                   | 16,000                     | 0.295   |
| 3-1/2        | 1,250                          | 1,650  | 600                   | 22,500                     | 0.221   |
| 4            | 1,250                          | 1,650  | 640                   | 29,000                     | 0.169   |
| 4-1/2        | 1,250                          | 1,650  | 640                   | 41,000                     | 0.118   |
| 5-1/2        | 1,250                          | 1,650  | 600                   | 49,500                     | 0.101   |
| 6-5/8        | 1,250                          | 1,650  | 590                   | 72,500                     | 0.069   |
| 7            | 1,250                          | 1,650  | 590                   | 76,500                     | 0.052   |
| 7-5/8        | 1,250                          | 1,650  | 590                   | 95,500                     | 0.052   |
| 9-5/8        | 1,250                          | 1,650  | 580                   | 140,500                    | 0.033   |
| 10-3/4       | 1,250                          | 1,650  | 600                   | 161,500                    | 0.025   |
| 11-3/4       | 1,250                          | 1,650  | 450                   | 147,000                    | 0.029   |
| 13-3/8       | 1,250                          | 1,650  | 450                   | 189,500                    | 0.023   |
| 16           | 1,250                          | 1,650  | 450                   | 217,500                    | 0.016   |
| 18           | 1,250                          | 1,650  | 450                   | 336,500                    | 0.012   |
| 20           | 1,250                          | 1,650  | 450                   | 362,000                    | 0.010   |
| 24           | 1,250                          | 1,650  | 450                   | 683,000                    | 0.006   |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## RED BOX 1500

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.26                     | 0.13                     | 2.69                       | 3.43                                | 0.9            | 28                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.77                     | 0.15                     | 3.19                       | 3.93                                | 1.3            | 38                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.37                     | 0.19                     | 3.85                       | 4.82                                | 1.9            | 57                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 3.75                     | 0.21                     | 4.35                       | 5.56                                | 2.5            | 74                    | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.48                     | 0.25                     | 4.85                       | 5.76                                | 3.2            | 95                    | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 4.96                     | 0.27                     | 5.60                       | 7.00                                | 4.1            | 123                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 6.10                     | 0.34                     | 6.73                       | 8.28                                | 6.0            | 181                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7                        | 6.21                     | 6.11                          | 6.97                     | 0.38                     | 7.10                       | 8.24                                | 7.1            | 212                   | 7" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 6.97                     | 0.38                     | 7.73                       | 9.66                                | 8.0            | 240                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 9-5/8                    | 7.84                     | 7.75                          | 8.80                     | 0.48                     | 9.73                       | 12.30                               | 12.8           | 384                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10-3/4                   | 8.85                     | 8.76                          | 9.94                     | 0.54                     | 10.85                      | 13.55                               | 16.1           | 482                   | 10-3/4" 8Rd CSG STC***IJ  |
| 11-3/4                   | 10.72                    | 10.62                         | 11.90                    | 0.59                     | 11.93                      | 14.00                               | 19.8           | 593                   | 11-3/4" 8/6Rd CSG STC***TC  |
| 13-3/8                   | 11.97                    | 11.87                         | 13.29                    | 0.66                     | 13.65                      | 15.20                               | 25.2           | 755                   | 13-3/8" 8/6Rd CSG STC***TC  |
| 16                       | 14.48                    | 14.39                         | 16.08                    | 0.80                     | 16.33                      | 18.35                               | 36.9           | 1,108                 | 16" 6Rd CSG STC TC  |
| 18                       | 16.37                    | 16.27                         | 18.18                    | 0.91                     | 18.84                      | 22.50                               | 50.6           | 1,519                 | 18" 6Rd CSG STC TC  |
| 20                       | 17.98                    | 17.89                         | 19.97                    | 1.00                     | 20.20                      | 23.40                               | 58.0           | 1,739                 | 20" 6Rd CSG STC TC  |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Intergral Joint,

f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt<br>Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|--|
| 2-3/8        | 1,500                          | 1,950  | 1,200                 | 13,000                     | 0.363  |
| 2-7/8        | 1,500                          | 1,950  | 1,000                 | 19,000                     | 0.266  |
| 3-1/2        | 1,500                          | 1,950  | 1,100                 | 28,000                     | 0.178  |
| 4            | 1,500                          | 1,950  | 1,100                 | 35,000                     | 0.138  |
| 4-1/2        | 1,500                          | 1,950  | 1,100                 | 46,500                     | 0.098  |
| 5-1/2        | 1,500                          | 1,950  | 1,000                 | 55,500                     | 0.084  |
| 6-5/8        | 1,500                          | 1,950  | 1,100                 | 72,500                     | 0.054  |
| 7            | 1,500                          | 1,950  | 1,000                 | 76,500                     | 0.042  |
| 7-5/8        | 1,500                          | 1,950  | 1,000                 | 95,500                     | 0.042  |
| 9-5/8        | 1,500                          | 1,950  | 1,000                 | 140,500                    | 0.027  |
| 10-3/4       | 1,500                          | 1,950  | 1,000                 | 161,500                    | 0.021  |
| 11-3/4       | 1,500                          | 1,950  | 750                   | 147,000                    | 0.024  |
| 13-3/8       | 1,500                          | 1,950  | 750                   | 189,500                    | 0.019  |
| 16           | 1,500                          | 1,950  | 750                   | 290,500                    | 0.013  |
| 18           | 1,500                          | 1,950  | 750                   | 336,500                    | 0.010  |
| 20           | 1,500                          | 1,950  | 750                   | 362,000                    | 0.008  |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value          | Value       | Test Method    |
|--|---------------------------------|----------------|-------------|----------------|
|  |                                 | 2-3/8 - 10-3/4 | 11-3/4 - 30 |                |
| Tensile Strength, Hoop                 | psi                             | 31,300         | 40,000      | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000         | 20,000      | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0            | 2.0         | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9            | 1.9         | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07           | 0.07        | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4            | 2.4         | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1            | 1.2         | ASTM D696      |
| Flow Factor                            | ---                             | 150            | 150         | Hazen Williams |

## RED BOX 1750

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14", 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.29                     | 0.15                     | 2.69                       | 3.43                                | 1.0            | 30                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.83                     | 0.18                     | 3.19                       | 3.93                                | 1.5            | 45                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.44                     | 0.22                     | 3.85                       | 4.82                                | 2.2            | 65                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 3.81                     | 0.24                     | 4.35                       | 5.56                                | 2.7            | 81                    | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.57                     | 0.29                     | 4.85                       | 5.76                                | 3.6            | 109                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 5.06                     | 0.32                     | 5.60                       | 7.00                                | 4.6            | 139                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 6.21                     | 0.39                     | 6.73                       | 8.28                                | 6.8            | 205                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7                        | 6.21                     | 6.11                          | 7.11                     | 0.45                     | 7.10                       | 8.24                                | 8.2            | 246                   | 7" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 7.11                     | 0.45                     | 7.73                       | 9.66                                | 9.1            | 273                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 9-5/8                    | 7.84                     | 7.75                          | 8.98                     | 0.57                     | 9.73                       | 12.30                               | 14.6           | 438                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10-3/4                   | 8.85                     | 8.76                          | 10.12                    | 0.64                     | 10.85                      | 14.70                               | 18.3           | 549                   | 10-3/4" 8Rd CSG STC***IJ  |
| 11-3/4                   | 10.72                    | 10.62                         | 12.11                    | 0.70                     | 12.65                      | 14.80                               | 24.9           | 748                   | 11-3/4 8/6Rd CSG STC L TC   |
| 13-3/8                   | 11.97                    | 11.87                         | 13.53                    | 0.78                     | 14.19                      | 16.85                               | 31.9           | 956                   | 13-3/8 8/6Rd CSG STC L TC   |
| 16                       | 14.48                    | 14.39                         | 16.37                    | 0.95                     | 16.33                      | 18.55                               | 42.4           | 1,272                 | 16" 6Rd CSG STC TC  |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint,

f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|---|
| 2-3/8        | 1,750                          | 2,300  | 1,600                 | 15,000                     | 0.333   |
| 2-7/8        | 1,750                          | 2,300  | 1,600                 | 22,500                     | 0.217   |
| 3-1/2        | 1,750                          | 2,300  | 1,600                 | 32,000                     | 0.148   |
| 4            | 1,750                          | 2,300  | 1,500                 | 40,000                     | 0.126   |
| 4-1/2        | 1,750                          | 2,300  | 1,600                 | 46,500                     | 0.084   |
| 5-1/2        | 1,750                          | 2,300  | 1,500                 | 55,500                     | 0.072   |
| 6-5/8        | 1,750                          | 2,300  | 1,600                 | 72,500                     | 0.047   |
| 7            | 1,750                          | 2,300  | 1,600                 | 76,500                     | 0.035   |
| 7-5/8        | 1,750                          | 2,300  | 1,600                 | 95,500                     | 0.035   |
| 9-5/8        | 1,750                          | 2,300  | 1,600                 | 140,500                    | 0.022   |
| 10-3/4       | 1,750                          | 2,300  | 1,500                 | 161,500                    | 0.018   |
| 11-3/4       | 1,750                          | 2,300  | 1,200                 | 192,500                    | 0.020   |
| 13-3/8       | 1,750                          | 2,300  | 1,200                 | 233,000                    | 0.016   |
| 16           | 1,750                          | 2,300  | 1,200                 | 290,500                    | 0.011   |
|              |                                |  |                       |                            |   |
|              |                                |  |                       |                            |   |
|              |                                |  |                       |                            |   |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## RED BOX 2000

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.34                     | 0.17                     | 2.69                       | 3.43                                | 1.2            | 35                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.89                     | 0.21                     | 3.19                       | 3.93                                | 1.7            | 50                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.51                     | 0.25                     | 3.85                       | 4.82                                | 2.4            | 73                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 3.88                     | 0.28                     | 4.35                       | 5.56                                | 3.1            | 92                    | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.65                     | 0.34                     | 4.85                       | 5.89                                | 4.1            | 123                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 5.17                     | 0.37                     | 5.60                       | 7.00                                | 5.3            | 159                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 6.33                     | 0.45                     | 6.73                       | 8.28                                | 7.8            | 233                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 7.25                     | 0.52                     | 7.73                       | 9.66                                | 10.3           | 308                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 9-5/8                    | 7.84                     | 7.75                          | 9.15                     | 0.65                     | 9.73                       | 13.00                               | 16.4           | 493                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10-3/4                   | 8.85                     | 8.76                          | 10.33                    | 0.74                     | 10.85                      | 14.70                               | 20.6           | 619                   | 10-3/4" 8Rd CSG STC***IJ  |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
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|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint,

f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt<br>Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|--|
| 2-3/8        | 2,000                          | 2,600  | 2,400                 | 17,500                     | 0.274  |
| 2-7/8        | 2,000                          | 2,600  | 2,400                 | 24,000                     | 0.183  |
| 3-1/2        | 2,000                          | 2,600  | 2,300                 | 32,000                     | 0.126  |
| 4            | 2,000                          | 2,600  | 2,200                 | 41,500                     | 0.108  |
| 4-1/2        | 2,000                          | 2,600  | 2,300                 | 46,500                     | 0.073  |
| 5-1/2        | 2,000                          | 2,600  | 2,300                 | 55,500                     | 0.059  |
| 6-5/8        | 2,000                          | 2,600  | 2,300                 | 72,500                     | 0.040  |
| 7-5/8        | 2,000                          | 2,600  | 2,300                 | 95,500                     | 0.030  |
| 9-5/8        | 2,000                          | 2,600  | 2,200                 | 140,500                    | 0.019  |
| 10-3/4       | 2,000                          | 2,600  | 2,200                 | 161,500                    | 0.015  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
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|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## RED BOX 2250

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.38                     | 0.19                     | 2.69                       | 3.43                                | 1.3            | 38                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.93                     | 0.23                     | 3.19                       | 3.93                                | 1.8            | 55                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.58                     | 0.29                     | 3.85                       | 4.82                                | 2.8            | 83                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 3.96                     | 0.31                     | 4.35                       | 5.56                                | 3.4            | 102                   | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.74                     | 0.38                     | 4.85                       | 5.89                                | 4.6            | 138                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 5.26                     | 0.42                     | 5.60                       | 7.00                                | 5.9            | 176                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 6.46                     | 0.52                     | 6.73                       | 8.61                                | 8.8            | 263                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 7.39                     | 0.59                     | 7.73                       | 9.83                                | 11.5           | 345                   | 7-5/8" 8Rd CSG LTC**IJ  |
| 9-5/8                    | 7.84                     | 7.75                          | 9.32                     | 0.74                     | 9.73                       | 13.00                               | 18.2           | 547                   | 9-5/8" 8Rd CSG LTC**IJ  |
| 10-3/4                   | 8.85                     | 8.76                          | 10.52                    | 0.83                     | 10.85                      | 13.89                               | 24.6           | 738                   | 10-3/4" 8Rd CSG STC***TC  |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint,

f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt<br>Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|--|
| 2-3/8        | 2,250                          | 2,950  | 2,600                 | 17,500                     | 0.255  |
| 2-7/8        | 2,250                          | 2,950  | 2,600                 | 24,000                     | 0.170  |
| 3-1/2        | 2,250                          | 2,950  | 2,700                 | 32,000                     | 0.110  |
| 4            | 2,250                          | 2,950  | 2,600                 | 41,500                     | 0.094  |
| 4-1/2        | 2,250                          | 2,950  | 2,600                 | 46,500                     | 0.064  |
| 5-1/2        | 2,250                          | 2,950  | 2,600                 | 55,500                     | 0.052  |
| 6-5/8        | 2,250                          | 2,950  | 2,600                 | 72,500                     | 0.034  |
| 7-5/8        | 2,250                          | 2,950  | 2,600                 | 95,500                     | 0.026  |
| 9-5/8        | 2,250                          | 2,950  | 2,600                 | 140,500                    | 0.017  |
| 10-3/4       | 2,250                          | 2,950  | 2,600                 | 187,000                    | 0.013  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## RED BOX 2500

**FIBERGLASS TUBING AND CASING**  
**AROMATIC AMINE CURED EPOXY RESIN**

R.9.0

### DIMENSIONAL SPECIFICATIONS

| Nominal Size<br>(inches) | Nominal I.D.<br>(inches) | Maximum Drift Dia<br>(inches) | Nominal O.D.<br>(inches) | Nominal Wall<br>(inches) | Pin Upset O.D.<br>(inches) | Max Box OD <sup>1</sup><br>(inches) | Nominal Weight |                       | Connection Type <sup>3</sup><br>API 5B, Table 14*, 7**, 6***<br>15th Edition April 2008 |
|--------------------------|--------------------------|-------------------------------|--------------------------|--------------------------|----------------------------|-------------------------------------|----------------|-----------------------|---|
|                          |                          |                               |                          |                          |                            |                                     | (lbs/ft)       | (lbs/ft) <sup>2</sup> |   |
| 2-3/8                    | 2.00                     | 1.91                          | 2.43                     | 0.22                     | 2.69                       | 3.43                                | 1.4            | 42                    | 2-3/8" 8Rd EUE Long*IJ  |
| 2-7/8                    | 2.47                     | 2.37                          | 2.99                     | 0.26                     | 3.19                       | 3.93                                | 2.1            | 62                    | 2-7/8" 8Rd EUE Long*IJ  |
| 3-1/2                    | 3.00                     | 2.90                          | 3.63                     | 0.32                     | 3.85                       | 4.82                                | 3.0            | 90                    | 3-1/2" 8Rd EUE Long*IJ  |
| 4                        | 3.33                     | 3.24                          | 4.03                     | 0.35                     | 4.35                       | 5.56                                | 3.8            | 113                   | 4" 8Rd EUE Long* IJ   |
| 4-1/2                    | 3.98                     | 3.89                          | 4.83                     | 0.42                     | 4.85                       | 5.98                                | 5.1            | 153                   | 4-1/2" 8Rd EUE Long*IJ  |
| 5-1/2                    | 4.42                     | 4.33                          | 5.36                     | 0.47                     | 5.60                       | 7.00                                | 6.5            | 194                   | 5-1/2" 8Rd CSG LTC**IJ  |
| 6-5/8                    | 5.43                     | 5.33                          | 6.59                     | 0.58                     | 6.73                       | 8.61                                | 9.8            | 293                   | 6-5/8" 8Rd CSG LTC**IJ  |
| 7-5/8                    | 6.21                     | 6.11                          | 7.54                     | 0.67                     | 7.73                       | 9.31                                | 13.3           | 400                   | 7-5/8" 8Rd CSG LTC**TC  |
| 9-5/8                    | 7.84                     | 7.75                          | 9.50                     | 0.83                     | 9.73                       | 12.49                               | 21.4           | 642                   | 9-5/8" 8Rd CSG LTC**TC  |
| 10-3/4                   | 8.85                     | 8.76                          | 10.72                    | 0.94                     | 10.85                      | 14.38                               | 27.5           | 825                   | 10-3/4" 8Rd CSG LTC**TC   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |
|                          |                          |                               |                          |                          |                            |                                     |                |                       |   |

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,

3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Integral Joint,

f. TC = Threaded &amp; Coupled)

### PERFORMANCE AND RATINGS (-60 deg F to +200 deg F)

| Nominal Size | Internal Pressure Rating (psi) | Standard Factory Hydrostatic Test Pressure (psi) | Collapse Rating (psi) | Axial Tension Rating (lbs) | Stretch vs Tension-Over-Pipe-Wt<br>Stretch (ft) = Coeff. x P x L |
|--------------|--------------------------------|--|-----------------------|----------------------------|--|
| 2-3/8        | 2,500                          | 3,250  | 2,900                 | 17,500                     | 0.217  |
| 2-7/8        | 2,500                          | 3,250  | 2,900                 | 24,000                     | 0.147  |
| 3-1/2        | 2,500                          | 3,250  | 2,900                 | 32,000                     | 0.103  |
| 4            | 2,500                          | 3,250  | 2,900                 | 41,500                     | 0.083  |
| 4-1/2        | 2,500                          | 3,250  | 2,900                 | 46,500                     | 0.057  |
| 5-1/2        | 2,500                          | 3,250  | 2,900                 | 55,500                     | 0.047  |
| 6-5/8        | 2,500                          | 3,250  | 2,900                 | 72,500                     | 0.030  |
| 7-5/8        | 2,500                          | 3,250  | 2,900                 | 107,500                    | 0.023  |
| 9-5/8        | 2,500                          | 3,250  | 2,900                 | 152,000                    | 0.015  |
| 10-3/4       | 2,500                          | 3,250  | 2,900                 | 187,000                    | 0.012  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
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|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |
|              |                                |  |                       |                            |  |

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

### MECHANICAL & PHYSICAL PROPERTIES

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## R.9.0

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,  
3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Intergral Joint,  
f. TC = Threaded & Coupled)

[illegible]

Where: P = Tensile Load (1,000 lbs), L = String Length (1,000 ft)

| Tubing/Casing Body Properties          | Unit                            | Value          | Value       | Test Method    |
|--|---------------------------------|----------------|-------------|----------------|
|  |                                 | 2-3/8 - 10-3/4 | 11-3/4 - 30 |                |
| Tensile Strength, Hoop                 | psi                             | 31,300         | 40,000      | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000         | 20,000      | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0            | 2.0         | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9            | 1.9         | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07           | 0.07        | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4            | 2.4         | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1            | 1.2         | ASTM D696      |
| Flow Factor                            | ---                             | 150            | 150         | Hazen Williams |

## R.9.0

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,  
3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Intergral Joint,  
f. TC = Threaded & Coupled)

[illegible]

## MECHANICAL & PHYSICAL PROPERTIES

High Pressure Product Catalogue - USA

## R.9.0

[illegible]

f. TC = Threaded & Coupled)

[illegible]

| Tubing/Casing Body Properties          | Unit                            | Value<br>2-3/8 - 10-3/4 | Value<br>11-3/4 - 30 | Test Method    |
|--|---------------------------------|-------------------------|----------------------|----------------|
| Tensile Strength, Hoop                 | psi                             | 31,300                  | 40,000               | ASTM D1599     |
| Tensile Strength, Axial                | psi                             | 30,000                  | 20,000               | ASTM D2105     |
| Modulus of Elasticity, Axial           | 10E+06 psi                      | 3.0                     | 2.0                  | ASTM D2105     |
| Specific Gravity                       | ---                             | 1.9                     | 1.9                  | ASTM D792      |
| Density                                | lbs/in <sup>3</sup>             | 0.07                    | 0.07                 | ASTM D792      |
| Thermal Conductivity                   | Btu/hr/ft <sup>2</sup> /in/degF | 2.4                     | 2.4                  | ASTM C177      |
| Thermal Expansion Coefficient (Linear) | 10E-05in/in/degF                | 1.1                     | 1.2                  | ASTM D696      |
| Flow Factor                            | ---                             | 150                     | 150                  | Hazen Williams |

## R.9.0

1. Depending on the application, smaller Max. Box O.D. are available, 2. Standard Joint Length is 30 ft,  
3. (a. Thread lengths may exceed API L4, b. Rd = Round thread per inch, c. EUE = External-Upset Ends, d. Csg = Casing, e. IJ = Intergral Joint,  
f. TC = Threaded & Coupled)

[illegible]

## MECHANICAL & PHYSICAL PROPERTIES

High Pressure Product Catalogue - USA

## 8.2 Blue Box®

### Chemical Grade Tubing & Casing

#### Product Description

The Blue Box® product consists of the Red Box® product with an inner Nexus® liner to achieve more chemical resistance.

Refer to Chemical Resistance Guide in **Section 3.0**

#### Product Availability

The Blue Box® products are available with the **integral joint (IJ) connection type only**. Product can be selected by using the Red Box® product Technical data sheets in **Section 9.1**

#### Example

Find the maximum nominal size tubing for water well production, fluid contains chlorinated water (2000 PPM). The tubing shall have collapse rating of 2900 psi (equivalent to internal pressure of 2500 psi) and maximum operating temperature of 165 F

#### Steps

- 1- Check **Section 3.0**, from the chemical resistance guide tables for the chlorinated water with the operating temperature of 165 F. The two options are
  - a- Red Box® product without liner with maximum operating temperature of 150 F (Not suitable)
  - b- Blue Box® product with liner with maximum operating temperature of 230 F
- 2- Select the Blue Box® product with the Nexus® liner
- 3- Check **Section 9.1**, select the Red Box® 2500 Technical Data Sheet
- 4- The maximum nominal size for the Blue Box® tubing with Integral joint connection type is 6-5/8 inches



## 9.0 Fittings



Future Pipe Industries, Inc. manufactures and sells a complete line of fiberglass fittings in sizes corresponding to the offered pipe sizes. The drawings contained in the following catalogue section detail the dimensional specifications for the fittings listed below:

### 9.1 Line Pipe Fittings

Tee  
Elbow 90°  
Elbow 45°  
Field Thread

Please contact Future Pipe industries for Elbow 11.25°, Elbow 22.5°, and any other elbow with custom angle.

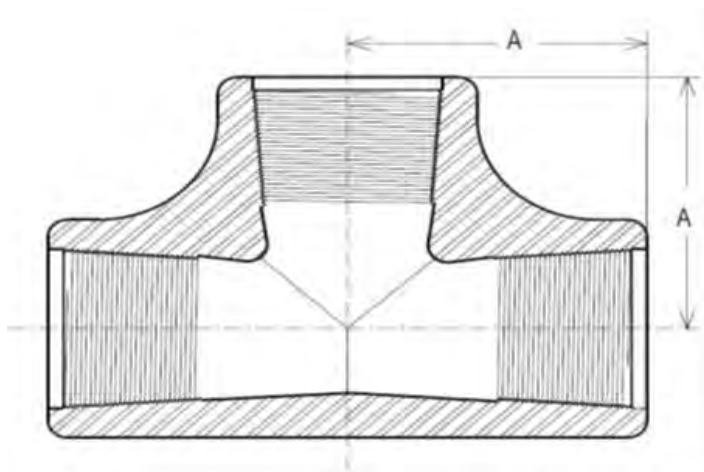
### 9.2 Line Pipe, Tubing & Casing Fittings

ANSI 150 Flat Face Flange  
ANSI 300 Flat Face Flange  
ANSI 600 Flat Face Flange  
ANSI 900 Flat Face Flange  
ANSI 1500 Flat Face Flange  
Coupling  
Nipple  
Sub Joint  
Pup Joint  
Swage  
Reducer Coupling  
Reducer Bushing

Please contact Future Pipe industries for other ANSI flanges not listed.

## 9.1 Line Pipe Fittings

### 9.1.1 Tee



| Line Pipe Nominal Size | Thread Size | A     |
|------------------------|-------------|-------|
| 2                      | 2-3/8       | 6.51  |
| 2*                     | 2-7/8       | 7.65  |
| 2-1/2                  | 2-7/8       | 7.65  |
| 2-1/2*                 | 3-1/2       | 9.85  |
| 3                      | 3-1/2       | 9.85  |
| 3*                     | 4           | 9.50  |
| 3-1/2                  | 4           | 9.50  |
| 4                      | 4-1/2       | 12.11 |
| 4*                     | 5-1/2       | 13.54 |
| 5                      | 5-1/2       | 13.54 |
| 6                      | 6-5/8       | 13.06 |
| 6* & 6-L               | 7           | 15.82 |
| 6-L*                   | 7-5/8       | 15.79 |
| 8                      | 9-5/8       | 18.40 |
| 10                     | 10-3/4      | 18.80 |
| 10-L                   | 11-3/4      | 19.63 |
| 10-L*                  | 11-3/4 L    | 20.50 |
| 12                     | 13-3/8      | 20.50 |
| 12*                    | 13-3/8 L    | 21.50 |

**Note:**

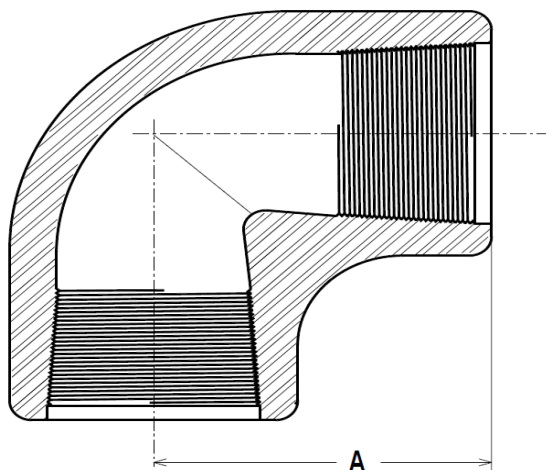
\* = Upsized Thread Size

Please consult with Future Pipe Industries for fitting diameters of more than 12 inches

## 9.1.2 Elbows

Please contact Future Pipe industries for Elbow 11.25°, Elbow 22.5°, and any other elbow with custom angle

### 9.1.2.a Elbow 90°



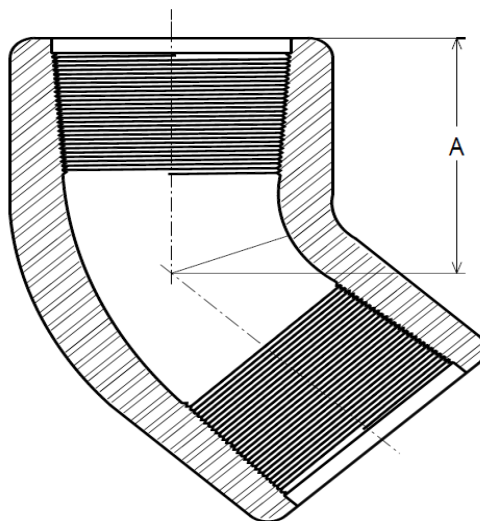
| Line Pipe Nominal Size | Thread Size | A     |
|------------------------|-------------|-------|
| 2                      | 2-3/8       | 5.01  |
| 2*                     | 2-7/8       | 5.29  |
| 2-1/2                  | 2-7/8       | 5.29  |
| 2-1/2*                 | 3-1/2       | 5.98  |
| 3                      | 3-1/2       | 5.98  |
| 3*                     | 4           | 7.68  |
| 3-1/2                  | 4           | 7.68  |
| 4                      | 4-1/2       | 7.76  |
| 4*                     | 5-1/2       | 8.59  |
| 5                      | 5-1/2       | 8.59  |
| 6                      | 6-5/8       | 9.66  |
| 6* & 6-L               | 7           | 10.58 |
| 6-L *                  | 7-5/8       | 10.92 |
| 8                      | 9-5/8       | 14.25 |
| 10                     | 10-3/4      | 12.30 |
| 10-L                   | 11-3/4      | 13.85 |
| 10-L *                 | 11-3/4 L    | 14.97 |
| 12                     | 13-3/8      | 14.88 |
| 12*                    | 13-3/8 L    | 15.88 |

**Note:**

\* = Upsized Thread Size

Please consult with Future Pipe Industries for fitting diameters of more than 12 inches

9.1.2.b Elbow 45°



| Line Pipe Nominal Size | Thread Size | A     |
|------------------------|-------------|-------|
| 2                      | 2-3/8       | 4.15  |
| 2*                     | 2-7/8       | 4.13  |
| 2-1/2                  | 2-7/8       | 4.13  |
| 2-1/2*                 | 3-1/2       | 4.52  |
| 3                      | 3-1/2       | 4.52  |
| 3*                     | 4           | 6.67  |
| 3-1/2                  | 4           | 6.67  |
| 4                      | 4-1/2       | 6.41  |
| 4*                     | 5-1/2       | 7.03  |
| 5                      | 5-1/2       | 7.03  |
| 6                      | 6-5/8       | 8.02  |
| 6* & 6-L               | 7           | 8.28  |
| 6-L*                   | 7-5/8       | 8.08  |
| 8                      | 9-5/8       | 10.22 |
| 10                     | 10-3/4      | 9.23  |
| 10-L                   | 11-3/4      | 9.72  |
| 10-L*                  | 11-3/4 L    | 10.60 |
| 12                     | 13-3/8      | 11.79 |
| 12*                    | 13-3/8 L    | 11.84 |

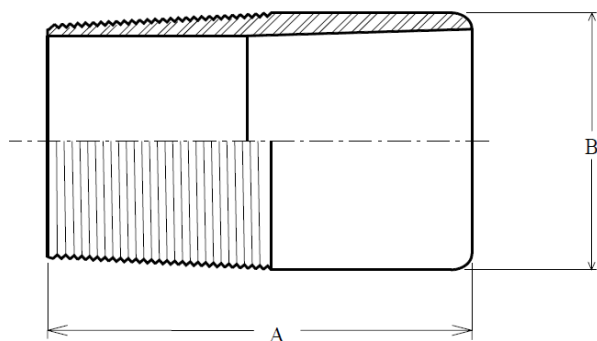
**Note:**

\* = Upsized Thread Size

Please consult with Future Pipe Industries for fitting diameters of more than 12 inches

### 9.1.3 Field Thread

Tapered bond-on field threads are available in all pipe sizes. Field threads can be installed on site and are used to break into already constructed lines in order to install parts or equipment, such as valves or tees, not originally included when the line was built. Field threads and their installation procedure are detailed in the Yellow Box® Line pipe Installation section of the catalogue.



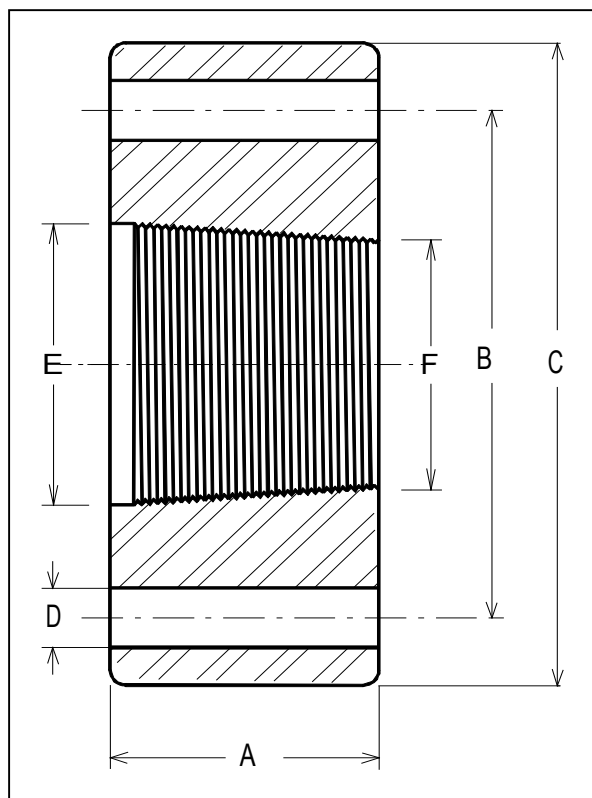
| Nominal Size | Thread Size | A     |
|--------------|-------------|-------|
| 2            | 2-3/8       | 12.13 |
| 2 1/2        | 2-7/8       | 12.38 |
| 3            | 3-1/2       | 12.63 |
| 3 1/2        | 4           | 13.00 |
| 4            | 4-1/2       | 13.00 |
| 5            | 5-1/2       | 13.25 |
| 6            | 6-5/8       | 15.50 |
| 6-L          | 7           | 15.50 |
| 8            | 9-5/8       | 16.63 |
| 10           | 10-3/4      | 18.00 |

**Note:**

- 1- Maximum Pressure Rating based on Field Thread fitting testing is 1250 psi

## 9.2 Line pipe, Tubing & Casing Fittings

### 9.2.1 Flange



A = FLANGE WIDTH (L4+0.5)  
B = BOLT CIRCLE DIAMETER  
C = FLANGE OUTSIDE DIAMETER  
D = BOLT HOLE DIAMETER  
E = "Q" DIMENSION API 5B  
F = END OF THREAD ID

ALL THREADS ARE API STD. 5B

NOMINAL SIZE YELLOW BOX

2"-4": 8 Rd EUE LONG (TABLE 14)

5"-8": 8 Rd CSG LONG (TABLE 7)

10": 8 Rd CSG SHORT (TABLE 6)

10-L-12": 6 Rd CSG SHORT (TABLE 6)

14-1/2"-18": 6 Rd CSG SHORT

**Note:**

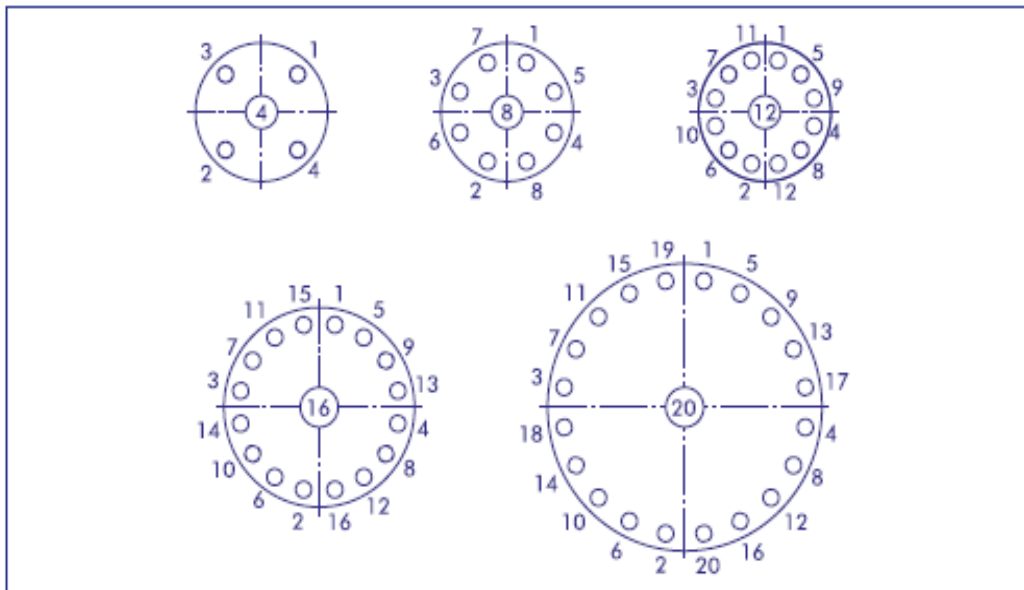
\* = Upsized Thread Size

#### DIMENSIONS - ANSI 150

| SIZE    | Thread Size | A    | B     | C     | D     | E      | F      | BOLT SIZE | BOLT QTY | Washer   |
|---------|-------------|------|-------|-------|-------|--------|--------|-----------|----------|----------|
| 2       | 2-3/8       | 3.13 | 4.75  | 6.00  | 3/4   | 2.656  | 2.350  | 5/8       | 4        | Standard |
| 2-1/2   | 2-7/8       | 3.38 | 5.50  | 7.00  | 3/4   | 3.156  | 2.830  | 5/8       | 4        | Standard |
| 3       | 3-1/2       | 3.63 | 6.00  | 7.50  | 3/4   | 3.813  | 3.471  | 5/8       | 4        | Standard |
| 3-1/2   | 4           | 4.00 | 7.00  | 8.50  | 3/4   | 4.313  | 3.947  | 5/8       | 8        | Standard |
| 4       | 4-1/2       | 4.00 | 7.50  | 9.00  | 3/4   | 4.813  | 4.447  | 5/8       | 8        | Standard |
| 5       | 5-1/2       | 4.25 | 8.50  | 10.00 | 7/8   | 5.594  | 5.181  | 3/4       | 8        | Standard |
| 6       | 6-5/8       | 4.50 | 9.50  | 11.00 | 7/8   | 6.719  | 6.291  | 3/4       | 8        | Standard |
| 6*, 6-L | 7           | 4.50 | 9.50  | 11.00 | 7/8   | 7.094  | 6.666  | 3/4       | 8        | Standard |
| 6-L*    | 7-5/8       | 5.50 | 9.50  | 11.00 | 7/8   | 7.781  | 7.225  | 3/4       | 8        | Narrow   |
| 8       | 9-5/8       | 5.63 | 11.75 | 13.50 | 7/8   | 9.781  | 9.213  | 3/4       | 8        | Narrow   |
| 10      | 10-3/4      | 7.00 | 14.25 | 16.00 | 1     | 10.906 | 10.256 | 7/8       | 12       | Standard |
| 10-L    | 11-3/4      | 5.88 | 14.25 | 16.00 | 1     | 11.923 | 11.326 | 7/8       | 12       | Narrow   |
| 10-L*   | 11-3/4 L    | 7.00 | 14.25 | 16.00 | 1     | 12.640 | 11.973 | 7/8       | 12       | Narrow   |
| 12      | 13-3/8      | 6.50 | 17.00 | 19.00 | 1     | 13.544 | 12.908 | 7/8       | 12       | Standard |
| 12*     | 13-3/8 L    | 7.50 | 17.00 | 19.00 | 1     | 14.083 | 13.385 | 7/8       | 12       | Standard |
| 14-1/2  | 16          | 8.00 | 18.75 | 21.00 | 1 1/8 | 16.228 | 15.499 | 1         | 12       | Narrow   |
| 14-1/2* | 16 L        | 8.00 | 21.25 | 23.50 | 1 1/8 | 16.985 | 16.256 | 1         | 16       | Standard |
| 16-1/2  | 18          | 8.00 | 21.25 | 23.50 | 1 1/8 | 18.733 | 18.004 | 1         | 16       | Narrow   |
| 18      | 20          | 8.00 | 22.75 | 25.00 | 1 1/4 | 20.090 | 19.361 | 1 1/8     | 16       | Narrow   |

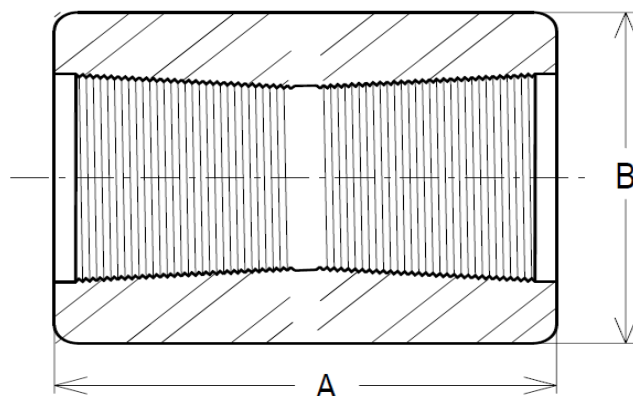
| DIMENSIONS - ANSI 300 |             |      |       |       |       |        |        |           |          |           |
|-----------------------|-------------|------|-------|-------|-------|--------|--------|-----------|----------|-----------|
| SIZE                  | Thread Size | A    | B     | C     | D     | E      | F      | BOLT SIZE | BOLT QTY | Washer OD |
| 2                     | 2-3/8       | 3.13 | 5.00  | 6.50  | 3/4   | 2.656  | 2.350  | 5/8       | 8        | Standard  |
| 2-1/2                 | 2-7/8       | 3.38 | 5.88  | 7.50  | 7/8   | 3.156  | 2.830  | 3/4       | 8        | Standard  |
| 3                     | 3-1/2       | 3.63 | 6.63  | 8.25  | 7/8   | 3.813  | 3.471  | 3/4       | 8        | Standard  |
| 3-1/2                 | 4           | 4.00 | 7.25  | 9.00  | 7/8   | 4.313  | 3.947  | 3/4       | 8        | Standard  |
| 4                     | 4-1/2       | 4.00 | 7.88  | 10.00 | 7/8   | 4.813  | 4.447  | 3/4       | 8        | Standard  |
| 5                     | 5-1/2       | 4.25 | 9.25  | 11.00 | 7/8   | 5.594  | 5.181  | 3/4       | 8        | Standard  |
| 6                     | 6-5/8       | 4.50 | 10.63 | 12.50 | 7/8   | 6.719  | 6.291  | 3/4       | 12       | Standard  |
| 6*, 6-L               | 7           | 4.50 | 10.63 | 12.50 | 7/8   | 7.094  | 6.666  | 3/4       | 12       | Standard  |
| 6-L*                  | 7-5/8       | 5.50 | 10.63 | 12.50 | 7/8   | 7.781  | 7.225  | 3/4       | 12       | Standard  |
| 8                     | 9-5/8       | 5.63 | 13.00 | 15.00 | 1     | 9.781  | 9.213  | 7/8       | 12       | Standard  |
| 10                    | 10-3/4      | 7.00 | 15.25 | 17.50 | 1 1/8 | 10.906 | 10.256 | 1         | 16       | Standard  |
| 10-L                  | 11-3/4      | 5.88 | 15.25 | 17.50 | 1 1/8 | 11.923 | 11.326 | 1         | 16       | Standard  |
| 10-L*                 | 11-3/4 L    | 7.00 | 15.25 | 17.50 | 1 1/8 | 12.640 | 11.973 | 1         | 16       | Narrow    |
| 12                    | 13-3/8      | 6.50 | 17.75 | 20.50 | 1 1/4 | 13.544 | 12.908 | 1 1/8     | 16       | Standard  |
| 12*                   | 13-3/8 L    | 7.50 | 17.75 | 20.50 | 1 1/4 | 14.083 | 13.385 | 1 1/8     | 16       | Standard  |
| 14-1/2                | 16          | 8.00 | 20.25 | 23.00 | 1 1/4 | 16.228 | 15.499 | 1 1/8     | 20       | Standard  |
| 14-1/2*               | 16 L        | 8.00 | 20.25 | 23.00 | 1 1/4 | 16.985 | 16.256 | 1 1/8     | 20       | Standard  |
| 16-1/2                | 18          | 8.00 | 22.50 | 25.50 | 1 3/8 | 18.733 | 18.004 | 1 1/4     | 20       | Standard  |
| 18                    | 20          | 8.00 | 24.75 | 28.00 | 1 3/8 | 20.090 | 19.361 | 1 1/4     | 24       | Standard  |
| DIMENSIONS - ANSI 600 |             |      |       |       |       |        |        |           |          |           |
| SIZE                  | Thread Size | A    | B     | C     | D     | E      | F      | BOLT SIZE | BOLT QTY | Washer OD |
| 2                     | 2-3/8       | 3.13 | 5.00  | 6.50  | 3/4   | 2.656  | 2.350  | 5/8       | 8        | Standard  |
| 2-1/2                 | 2-7/8       | 3.38 | 5.88  | 7.50  | 7/8   | 3.156  | 2.830  | 3/4       | 8        | Standard  |
| 3                     | 3-1/2       | 3.63 | 6.63  | 8.25  | 7/8   | 3.813  | 3.471  | 3/4       | 8        | Standard  |
| 3-1/2                 | 4           | 4.00 | 7.25  | 9.00  | 1     | 4.313  | 3.947  | 7/8       | 8        | Standard  |
| 4                     | 4-1/2       | 4.00 | 8.50  | 10.75 | 1     | 4.813  | 4.447  | 7/8       | 8        | Standard  |
| 5                     | 5-1/2       | 4.25 | 10.50 | 13.00 | 1 1/8 | 5.594  | 5.181  | 1         | 8        | Standard  |
| 6                     | 6-5/8       | 4.50 | 11.50 | 14.00 | 1 1/8 | 6.719  | 6.291  | 1         | 12       | Standard  |
| 6*, 6-L               | 7           | 4.50 | 11.50 | 14.00 | 1 1/8 | 7.094  | 6.666  | 1         | 12       | Standard  |
| 6-L*                  | 7-5/8       | 5.50 | 11.50 | 14.00 | 1 1/8 | 7.781  | 7.225  | 1         | 12       | Standard  |
| 8                     | 9-5/8       | 5.63 | 13.75 | 16.50 | 1 1/4 | 9.781  | 9.213  | 1 1/8     | 12       | Standard  |
| 10                    | 10-3/4      | 7.00 | 17.00 | 20.00 | 1 3/8 | 10.906 | 10.256 | 1 1/4     | 16       | Standard  |
| 10-L                  | 11-3/4      | 5.88 | 17.00 | 20.00 | 1 3/8 | 11.923 | 11.326 | 1 1/4     | 16       | Standard  |
| 10-L*                 | 11-3/4 L    | 7.00 | 17.00 | 20.00 | 1 3/8 | 12.640 | 11.973 | 1 1/4     | 16       | Standard  |
| 12                    | 13-3/8      | 6.50 | 19.25 | 22.00 | 1 3/8 | 13.544 | 12.908 | 1 1/4     | 20       | Standard  |
| 12*                   | 13-3/8 L    | 7.50 | 19.25 | 22.00 | 1 3/8 | 14.083 | 13.385 | 1 1/4     | 20       | Standard  |
| 14-1/2                | 16          | 8.00 | 20.75 | 23.75 | 1 1/2 | 16.228 | 15.499 | 1 3/8     | 20       | Standard  |
| 14-1/2*               | 16 L        | 8.00 | 20.75 | 23.75 | 1 1/2 | 16.985 | 16.256 | 1 3/8     | 20       | Standard  |
| 16-1/2                | 18          | 8.00 | 23.75 | 27.00 | 1 5/8 | 18.733 | 18.004 | 1 1/2     | 20       | Standard  |
| 18                    | 20          | 8.00 | 25.75 | 29.25 | 1 3/4 | 20.090 | 19.361 | 1 5/8     | 20       | Standard  |

| DIMENSIONS - ANSI 900  |             |               |       |       |       |        |        |           |          |           |
|------------------------|-------------|---------------|-------|-------|-------|--------|--------|-----------|----------|-----------|
| SIZE                   | Thread Size | A             | B     | C     | D     | E      | F      | BOLT SIZE | BOLT QTY | Washer OD |
| 2                      | 2-3/8       | 3.13          | 6.50  | 8.50  | 1     | 2.656  | 2.350  | 7/8       | 8        | Standard  |
| 2-1/2                  | 2-7/8       | 3.38          | 7.50  | 9.63  | 1 1/8 | 3.156  | 2.830  | 1         | 8        | Standard  |
| 3                      | 3-1/2       | 3.63          | 7.50  | 9.50  | 1     | 3.813  | 3.471  | 7/8       | 8        | Standard  |
| 3-1/2                  | 4           | Not Available |       |       |       |        |        |           |          |           |
| 4                      | 4-1/2       | 4.00          | 9.25  | 11.50 | 1 1/4 | 4.813  | 4.447  | 1 1/8     | 8        | Standard  |
| 5                      | 5-1/2       | 4.25          | 11.00 | 13.75 | 1 3/8 | 5.594  | 5.181  | 1 1/4     | 8        | Standard  |
| 6                      | 6-5/8       | 4.50          | 12.50 | 15.00 | 1 1/4 | 6.719  | 6.291  | 1 1/8     | 12       | Standard  |
| 6*, 6-L                | 7           | 4.50          | 12.50 | 15.00 | 1 1/4 | 7.094  | 6.666  | 1 1/8     | 12       | Standard  |
| 6-L*                   | 7-5/8       | 5.50          | 12.50 | 15.00 | 1 1/4 | 7.781  | 7.225  | 1 1/8     | 12       | Standard  |
| 8                      | 9-5/8       | 5.63          | 15.50 | 18.50 | 1 1/2 | 9.781  | 9.213  | 1 3/8     | 12       | Standard  |
| 10                     | 10-3/4      | 7.00          | 18.50 | 21.50 | 1 1/2 | 10.906 | 10.256 | 1 3/8     | 16       | Standard  |
| 10-L                   | 11-3/4      | 5.88          | 18.50 | 21.50 | 1 1/2 | 11.923 | 11.326 | 1 3/8     | 16       | Standard  |
| 10-L*                  | 11-3/4 L    | 7.00          | 18.50 | 21.50 | 1 1/2 | 12.640 | 11.973 | 1 3/8     | 16       | Standard  |
| 12                     | 13-3/8      | 6.50          | 21.00 | 24.00 | 1 1/2 | 13.544 | 12.908 | 1 3/8     | 20       | Standard  |
| 12*                    | 13-3/8 L    | 7.50          | 21.00 | 24.00 | 1 1/2 | 14.083 | 13.385 | 1 3/8     | 20       | Standard  |
| 14-1/2                 | 16          | 8.00          | 22.00 | 25.25 | 1 5/8 | 16.228 | 15.499 | 1 1/2     | 20       | Standard  |
| 14-1/2*                | 16 L        | 8.00          | 22.00 | 25.25 | 1 5/8 | 16.985 | 16.256 | 1 1/2     | 20       | Standard  |
| 16-1/2                 | 18          | 8.00          | 24.50 | 27.75 | 1 3/4 | 18.733 | 18.004 | 1 5/8     | 20       | Standard  |
| 18                     | 20          | 8.00          | 27.00 | 31.00 | 2     | 20.090 | 19.361 | 1 7/8     | 20       | Standard  |
| DIMENSIONS - ANSI 1500 |             |               |       |       |       |        |        |           |          |           |
| SIZE                   | Thread Size | A             | B     | C     | D     | E      | F      | BOLT SIZE | BOLT QTY | Washer OD |
| 2                      | 2-3/8       | 3.13          | 6.50  | 8.50  | 1     | 2.656  | 2.350  | 7/8       | 8        | Standard  |
| 2-1/2                  | 2-7/8       | 3.38          | 7.50  | 9.63  | 1 1/8 | 3.156  | 2.830  | 1         | 8        | Standard  |
| 3                      | 3-1/2       | 3.63          | 8.00  | 10.50 | 1 1/4 | 3.813  | 3.471  | 1 1/8     | 8        | Standard  |
| 3-1/2                  | 4           | Not Available |       |       |       |        |        |           |          |           |
| 4                      | 4-1/2       | 4.00          | 9.50  | 12.25 | 1 3/8 | 4.813  | 4.447  | 1 1/4     | 8        | Standard  |
| 5                      | 5-1/2       | 4.25          | 11.50 | 14.75 | 1 5/8 | 5.594  | 5.181  | 1 1/2     | 8        | Standard  |
| 6                      | 6-5/8       | 4.50          | 12.50 | 15.50 | 1 1/2 | 6.719  | 6.291  | 1 3/8     | 12       | Standard  |
| 6*, 6-L                | 7           | 4.50          | 12.50 | 15.50 | 1 1/2 | 7.094  | 6.666  | 1 3/8     | 12       | Standard  |
| 6-L*                   | 7-5/8       | 5.50          | 12.50 | 15.50 | 1 1/2 | 7.781  | 7.225  | 1 3/8     | 12       | Standard  |
| 8                      | 9-5/8       | 5.63          | 15.50 | 19.00 | 1 3/4 | 9.781  | 9.213  | 1 5/8     | 12       | Standard  |
| 10                     | 10-3/4      | 7.00          | 19.00 | 23.00 | 2     | 10.906 | 10.256 | 1 7/8     | 12       | Standard  |
| 10-L                   | 11-3/4      | 5.88          | 19.00 | 23.00 | 2     | 11.923 | 11.326 | 1 7/8     | 12       | Standard  |
| 10-L*                  | 11-3/4 L    | 7.00          | 19.00 | 23.00 | 2     | 12.640 | 11.973 | 1 7/8     | 12       | Standard  |
| 12                     | 13-3/8      | 6.50          | 22.50 | 26.50 | 2 1/8 | 13.544 | 12.908 | 2         | 16       | Standard  |
| 12*                    | 13-3/8 L    | 7.50          | 22.50 | 26.50 | 2 1/8 | 14.083 | 13.385 | 2         | 16       | Standard  |
| 14-1/2                 | 16          | 8.00          | 25.00 | 29.50 | 2 3/8 | 16.228 | 15.499 | 2 1/4     | 16       | Standard  |
| 14-1/2*                | 16 L        | 8.00          | 25.00 | 29.50 | 2 3/8 | 16.985 | 16.256 | 2 1/4     | 16       | Standard  |
| 16-1/2                 | 18          | 8.00          | 27.75 | 32.50 | 2 5/8 | 18.733 | 18.004 | 2 1/2     | 16       | Standard  |
| 18                     | 20          | 8.00          | 30.50 | 36.00 | 2 7/8 | 20.090 | 19.361 | 2 3/4     | 16       | Standard  |



**Bolt Torque sequence per ASTM D4024**

## 9.2.2 Coupling



| Nominal Size | Thread Size | A     |
|--------------|-------------|-------|
| 2            | 2-3/8       | 6.25  |
| 2*           | 2-7/8       | 6.75  |
| 2-1/2        | 2-7/8       | 6.75  |
| 2-1/2*       | 3-1/2       | 7.25  |
| 3            | 3-1/2       | 7.25  |
| 3*           | 4           | 8.00  |
| 3-1/2        | 4           | 8.00  |
| 4            | 4-1/2       | 8.00  |
| 4*           | 5-1/2       | 8.50  |
| 5            | 5-1/2       | 8.50  |
| 6            | 6-5/8       | 9.00  |
| 6* & 6-L     | 7           | 9.00  |
| 6-L*         | 7-5/8       | 11.00 |
| 8            | 9-5/8       | 11.25 |
| 10           | 10-3/4      | 14.00 |
| 10-L         | 11-3/4      | 11.75 |
| 10-L*        | 11-3/4 L    | 14.00 |
| 12           | 13-3/8      | 13.00 |
| 12*          | 13-3/8 L    | 15.00 |
| 14-1/2       | 16          | 16.00 |
| 14-1/2*      | 16 L        | 16.00 |
| 16-1/2       | 18          | 16.00 |
| 18           | 20          | 16.00 |

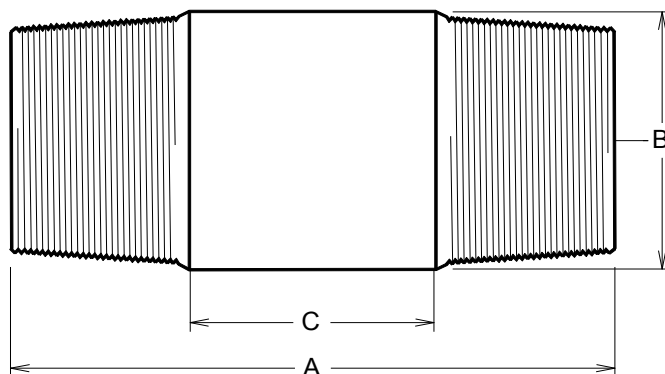
A = Coupling Length

B = Coupling Maximum Box OD, varies depending on the pressure class

**Note:**

\* = Upsized Thread Size

### 9.2.3 Nipple



| Nominal Size | Thread Size | A     | B     | C    |
|--------------|-------------|-------|-------|------|
| 2            | 2-3/8       | 11.25 | 2.69  | 5.00 |
| 2*           | 2-7/8       | 11.75 | 3.19  | 5.00 |
| 2-1/2        | 2-7/8       | 11.75 | 3.19  | 5.00 |
| 2-1/2*       | 3-1/2       | 12.25 | 3.85  | 5.00 |
| 3            | 3-1/2       | 12.25 | 3.85  | 5.00 |
| 3*           | 4           | 13.00 | 4.35  | 5.00 |
| 3-1/2        | 4           | 13.00 | 4.35  | 5.00 |
| 4            | 4-1/2       | 13.00 | 4.85  | 5.00 |
| 4*           | 5-1/2       | 13.50 | 5.60  | 5.00 |
| 5            | 5-1/2       | 13.50 | 5.60  | 5.00 |
| 6            | 6-5/8       | 16.00 | 6.73  | 7.00 |
| 6* & 6-L     | 7           | 16.00 | 7.10  | 7.00 |
| 6-L*         | 7-5/8       | 18.00 | 7.73  | 7.00 |
| 8            | 9-5/8       | 18.25 | 9.73  | 7.00 |
| 10           | 10-3/4      | 21.00 | 10.85 | 7.00 |
| 10-L         | 11-3/4      | 18.75 | 11.93 | 7.00 |
| 10-L*        | 11-3/4 L    | 21.00 | 12.65 | 7.00 |
| 12           | 13-3/8      | 20.00 | 13.65 | 7.00 |
| 12*          | 13-3/8 L    | 22.00 | 14.19 | 7.00 |
| 14-1/2       | 16          | 23.00 | 16.33 | 7.00 |
| 14-1/2*      | 16 L        | 23.00 | 17.09 | 7.00 |
| 16-1/2       | 18          | 23.00 | 18.84 | 7.00 |
| 16-1/2*      | 18L         | 23.00 | 19.53 | 7.00 |
| 18           | 20          | 23.00 | 20.20 | 7.00 |
| 18*          | 20L         | 23.00 | 21.13 | 7.00 |

A = Nipple Length

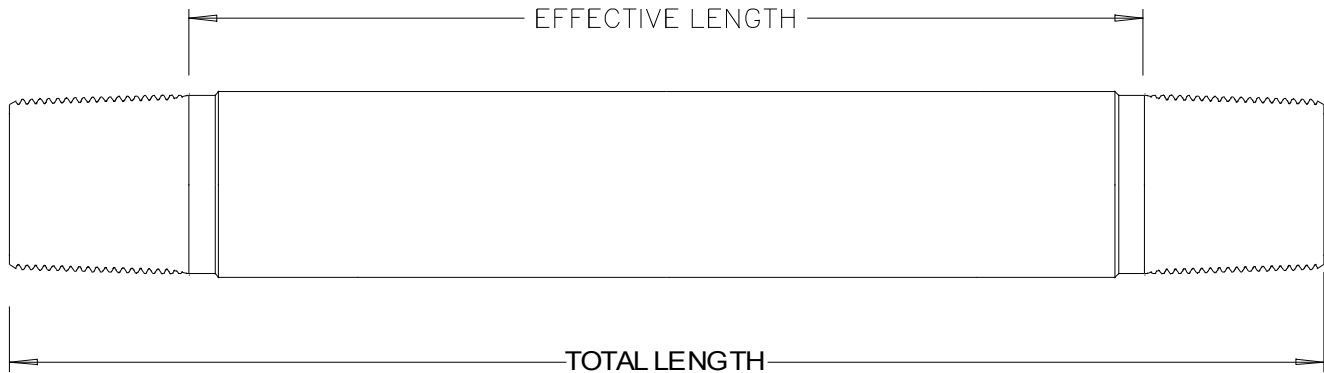
B = Pin Upset OD

C = Spacing between the threads

**Note:**

\* = Upsized Thread Size

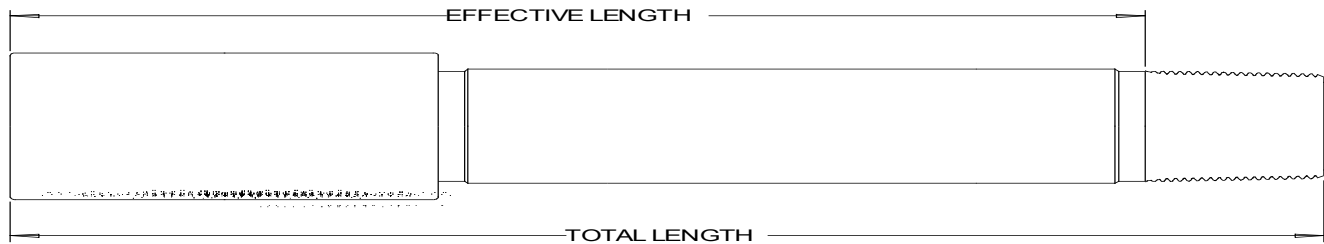
## 9.2.4 Sub Joint



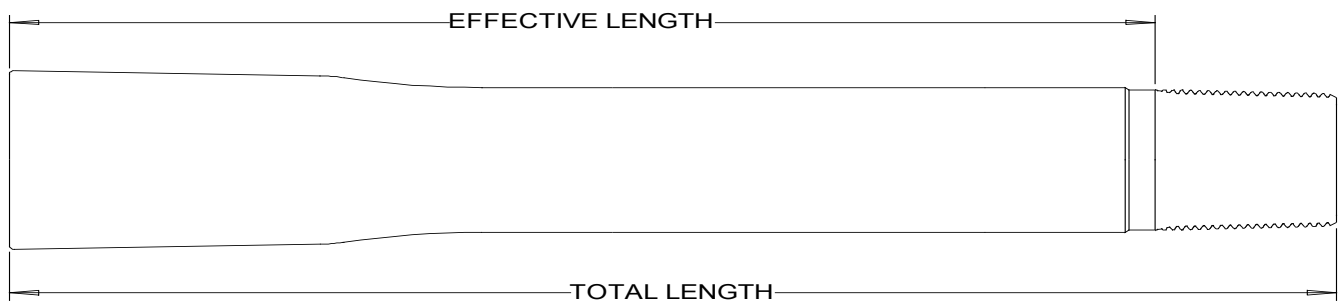
### Sub Joint

- 1- Sub joints Pin x Pin (male x male) are available both individually and in sets.
- 2- Standard sub set consist of five joints 2, 4, 6, 8, and 10 feet in length.
- 3- Custom non-standard length subs are available upon request.
- 4- All sub joints are manufactured at the maximum wall thickness available for the size ordered.

## 9.2.5 Pup Joint



### Pup Joint with Threaded and Coupled (T&C)



### Pup Joint with Integral Joint (IJ)

- 1- Pup joints Pin x Box (male x female), are available both individually and in sets.
- 2- Standard pup set consist of five joints 2, 4, 6, 8, and 10 feet in length.
- 3- Custom non-standard length pups are available upon request.
- 4- All sub joints are manufactured at the maximum wall thickness available for the size ordered.

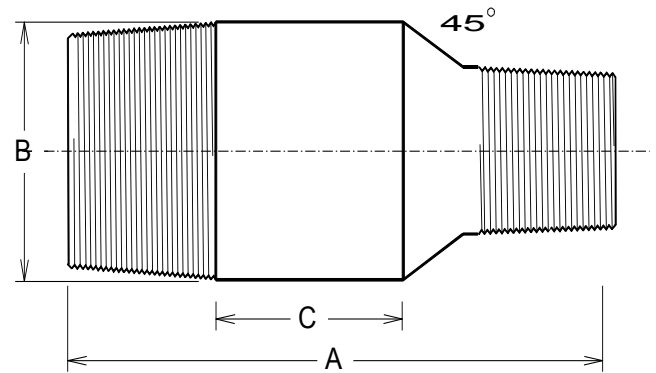
## 9.2.6 Crossovers

### 9.2.6.a Swage

| Nominal Size |            | Thread Size         | A     | B     | C    |
|--------------|------------|---------------------|-------|-------|------|
| Big Size     | Small Size |                     |       |       |      |
| 2-1/2        | 2          | 2-7/8 x 2-3/8       | 11.75 | 3.19  | 5.00 |
| 2-1/2*, 3    | 2          | 3-1/2 x 2-3/8       | 12.38 | 3.85  | 5.00 |
| 2-1/2*, 3    | 2*, 2-1/2  | 3-1/2 x 2-7/8       | 12.38 | 3.85  | 5.00 |
| 3*, 3-1/2    | 2*, 2-1/2  | 4 x 2-7/8           | 13.00 | 4.35  | 5.00 |
| 3*, 3-1/2    | 2-1/2*, 3  | 4 x 3-1/2           | 12.88 | 4.35  | 5.00 |
| 3-1/2*, 4    | 2-1/2*, 3  | 4-1/2 x 3-1/2       | 13.13 | 4.85  | 5.00 |
| 4            | 3*, 3-1/2  | 4-1/2 x 4           | 13.25 | 4.85  | 5.00 |
| 4*, 5        | 3*, 3-1/2  | 5-1/2 x 4           | 13.88 | 5.60  | 5.00 |
| 4*, 5        | 4          | 5-1/2 x 4-1/2       | 13.63 | 5.60  | 5.00 |
| 6            | 3-1/2*, 4  | 6-5/8 x 4-1/2       | 16.50 | 6.73  | 7.00 |
| 6            | 4*, 5      | 6-5/8 x 5-1/2       | 16.38 | 6.73  | 7.00 |
| 6*, 6-L      | 4          | 7 x 4-1/2           | 16.50 | 7.10  | 7.00 |
| 6*, 6-L      | 4*, 5      | 7 x 5-1/2           | 16.25 | 7.10  | 7.00 |
| 6-L*         | 6          | 7-5/8 x 6-5/8       | 16.63 | 7.73  | 7.00 |
| 6-L*         | 6*, 6-L    | 7-5/8 x 7           | 16.50 | 7.73  | 7.00 |
| 8            | 6*, 6-L    | 9-5/8 x 7           | 18.50 | 9.73  | 7.00 |
| 8            | 6-L*       | 9-5/8 x 7-5/8       | 18.25 | 9.73  | 7.00 |
| 10           | 6-L*       | 10-3/4 x 7-5/8      | 19.00 | 10.85 | 7.00 |
| 10           | 8          | 10-3/4 x 9-5/8      | 19.00 | 10.85 | 7.00 |
| 10-L         | 8          | 11-3/4 x 9-5/8      | 19.63 | 11.93 | 7.00 |
| 10-L         | 10         | 11-3/4 x 10-3/4     | 19.25 | 11.93 | 7.00 |
| 10-L*        | 8          | 11-3/4 L x 9-5/8    | 21.13 | 12.65 | 7.00 |
| 10-L*        | 10         | 11-3/4 L x 10-3/4   | 20.75 | 12.65 | 7.00 |
| 12           | 10         | 13-3/8 x 10-3/4     | 20.75 | 13.65 | 7.00 |
| 12           | 10-L       | 13-3/8 x 11-3/4     | 20.25 | 13.65 | 7.00 |
| 12           | 10-L*      | 13-3/8 x 11-3/4 L   | 21.13 | 13.65 | 7.00 |
| 12*          | 10         | 13-3/8 L x 10-3/4   | 22.00 | 14.19 | 7.00 |
| 12*          | 10-L       | 13-3/8 L x 11-3/4   | 21.63 | 14.19 | 7.00 |
| 12*          | 10-L*      | 13-3/8 L x 11-3/4 L | 22.38 | 14.19 | 7.00 |
| 14-1/2       | 12         | 16 x 13-3/8         | 22.88 | 16.33 | 7.00 |
| 14-1/2       | 12*        | 16 x 13-3/8 L       | 23.63 | 16.33 | 7.00 |
| 14-1/2*      | 12         | 16 L x 13-3/8       | 23.25 | 17.09 | 7.00 |
| 14-1/2*      | 12*        | 16 L x 13-3/8 L     | 24.38 | 17.90 | 7.00 |
| 16           | 14-1/2     | 18 x 16             | 24.38 | 18.84 | 7.00 |
| 16           | 14-1/2*    | 18 x 16 L           | 23.88 | 18.84 | 7.00 |
| 16*          | 14-1/2     | 18 L x 16           | 24.63 | 19.53 | 7.00 |
| 16*          | 14-1/2*    | 18 L x 16 L         | 24.25 | 19.53 | 7.00 |
| 18           | 16         | 20 x 18             | 23.75 | 20.20 | 7.00 |
| 18*          | 16         | 20 L x 18           | 24.25 | 21.13 | 7.00 |

A = Swage Length

B = Pin Upset OD

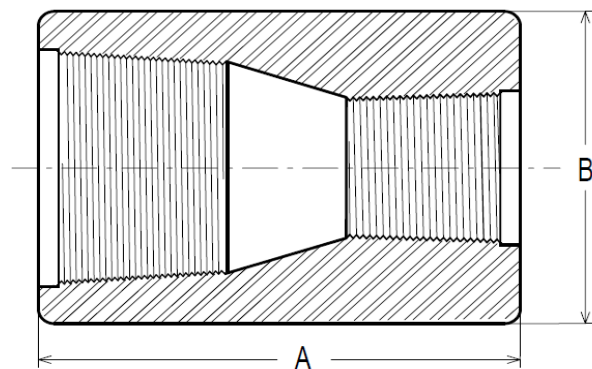


**Note:**

\* = Upsized Thread Size

### 9.2.6.b Reducer Coupler

| Nominal Size |            | Thread Size         | A     |
|--------------|------------|---------------------|-------|
| Big Size     | Small Size |                     |       |
| 2-1/2        | 2          | 2-7/8 x 2-3/8       | 7.13  |
| 2-1/2* , 3   | 2          | 3-1/2 x 2-3/8       | 8.13  |
| 2-1/2* , 3   | 2* , 2-1/2 | 3-1/2 x 2-7/8       | 7.88  |
| 3* , 3-1/2   | 2* , 2-1/2 | 4 x 2-7/8           | 8.88  |
| 3* , 3-1/2   | 2-1/2* , 3 | 4 x 3-1/2           | 8.25  |
| 3-1/2* , 4   | 2-1/2* , 3 | 4-1/2 x 3-1/2       | 8.88  |
| 4            | 3* , 3-1/2 | 4-1/2 x 4           | 8.63  |
| 4* , 5       | 3* , 3-1/2 | 5-1/2 x 4           | 9.88  |
| 4* , 5       | 4          | 5-1/2 x 4-1/2       | 9.25  |
| 6            | 3-1/2* , 4 | 6-5/8 x 4-1/2       | 10.88 |
| 6            | 4* , 5     | 6-5/8 x 5-1/2       | 10.13 |
| 6* , 6-L     | 4          | 7 x 4-1/2           | 11.50 |
| 6* , 6-L     | 4* , 5     | 7 x 5-1/2           | 10.88 |
| 6-L*         | 6          | 7-5/8 x 6-5/8       | 10.38 |
| 6-L*         | 6* , 6-L   | 7-5/8 x 7           | 10.00 |
| 8            | 6* , 6-L   | 9-5/8 x 7           | 13.38 |
| 8            | 6-L*       | 9-5/8 x 7-5/8       | 12.75 |
| 10           | 6-L*       | 10-3/4 x 7-5/8      | 14.25 |
| 10           | 8          | 10-3/4 x 9-5/8      | 12.75 |
| 10-L         | 8          | 11-3/4 x 9-5/8      | 14.25 |
| 10-L         | 10         | 11-3/4 x 10-3/4     | 13.00 |
| 10-L*        | 8          | 11-3/4 L x 9-5/8    | 16.25 |
| 10-L*        | 10         | 11-3/4 L x 10-3/4   | 15.00 |
| 12           | 10         | 13-3/8 x 10-3/4     | 15.75 |
| 12           | 10-L       | 13-3/8 x 11-3/4     | 14.50 |
| 12           | 10-L*      | 13-3/8 x 11-3/4 L   | 14.75 |
| 12*          | 10         | 13-3/8 L x 10-3/4   | 17.38 |
| 12*          | 10-L       | 13-3/8 L x 11-3/4   | 16.13 |
| 12*          | 10-L*      | 13-3/8 L x 11-3/4 L | 16.38 |
| 14-1/2       | 12         | 16 x 13-3/8         | 17.75 |
| 14-1/2       | 12*        | 16 x 13-3/8 L       | 18.13 |
| 14-1/2*      | 12         | 16 L x 13-3/8       | 18.75 |
| 14-1/2*      | 12*        | 16 L x 13-3/8 L     | 20.00 |
| 16           | 14-1/2     | 18 x 16             | 19.13 |
| 16           | 14-1/2*    | 18 x 16 L           | 18.13 |
| 16*          | 14-1/2     | 18 L x 16           | 19.88 |
| 16*          | 14-1/2*    | 18 L x 16 L         | 19.00 |
| 18           | 16         | 20 x 18             | 17.75 |
| 18*          | 16         | 20 L x 18           | 18.88 |



**Note:**

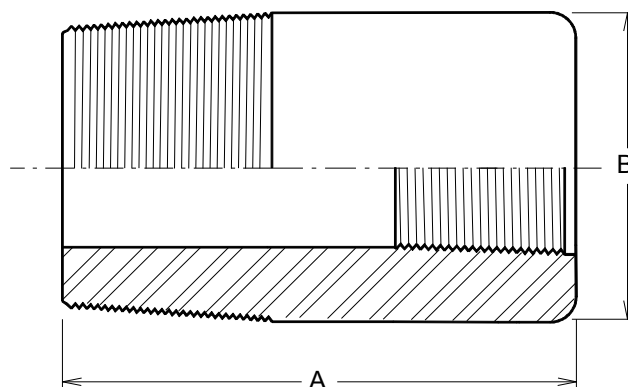
\* = Upsized Thread Size

A = Reducer Coupling Length

B = Reducer Coupling Maximum Box OD, varies depending on the pressure class

### 9.2.6.c Reducer Bushing

| Nominal Size |            | Thread Size         | A     |
|--------------|------------|---------------------|-------|
| Big Size     | Small Size |                     |       |
| 2-1/2        | 2          | 2-7/8 x 2-3/8       | 11.50 |
| 2-1/2*, 3    | 2          | 3-1/2 x 2-3/8       | 11.75 |
| 2-1/2*, 3    | 2*, 2-1/2  | 3-1/2 x 2-7/8       | 12.00 |
| 3*, 3-1/2    | 2*, 2-1/2  | 4 x 2-7/8           | 12.38 |
| 3*, 3-1/2    | 2-1/2*, 3  | 4 x 3-1/2           | 12.63 |
| 3-1/2*, 4    | 2-1/2*, 3  | 4-1/2 x 3-1/2       | 12.63 |
| 4            | 3*, 3-1/2  | 4-1/2 x 4           | 13.00 |
| 4*, 5        | 3*, 3-1/2  | 5-1/2 x 4           | 15.25 |
| 4*, 5        | 4          | 5-1/2 x 4-1/2       | 15.25 |
| 6            | 3-1/2*, 4  | 6-5/8 x 4-1/2       | 15.50 |
| 6            | 4*, 5      | 6-5/8 x 5-1/2       | 15.75 |
| 6*, 6-L      | 4          | 7 x 4-1/2           | 15.50 |
| 6*, 6-L      | 4*, 5      | 7 x 5-1/2           | 15.75 |
| 6-L*         | 6          | 7-5/8 x 6-5/8       | 16.13 |
| 6-L*         | 6*, 6-L    | 7-5/8 x 7           | 16.13 |
| 8            | 6*, 6-L    | 9-5/8 x 7           | 17.13 |
| 8            | 6-L*       | 9-5/8 x 7-5/8       | 17.25 |
| 10           | 6-L*       | 10-3/4 x 7-5/8      | 17.38 |
| 10           | 8          | 10-3/4 x 9-5/8      | 18.38 |
| 10-L         | 8          | 11-3/4 x 9-5/8      | 18.50 |
| 10-L         | 10         | 11-3/4 x 10-3/4     | 18.63 |
| 10-L*        | 8          | 11-3/4 L x 9-5/8    | 19.63 |
| 10-L*        | 10         | 11-3/4 L x 10-3/4   | 19.75 |
| 12           | 10         | 13-3/8 x 10-3/4     | 19.25 |
| 12           | 10-L       | 13-3/8 x 11-3/4     | 19.38 |
| 12           | 10-L*      | 13-3/8 x 11-3/4 L   | 20.50 |
| 12*          | 10         | 13-3/8 L x 10-3/4   | 20.25 |
| 12*          | 10-L       | 13-3/8 L x 11-3/4   | 20.38 |
| 12*          | 10-L*      | 13-3/8 L x 11-3/4 L | 21.50 |
| 14-1/2       | 12         | 16 x 13-3/8         | 21.50 |
| 14-1/2       | 12*        | 16 x 13-3/8 L       | 22.50 |
| 14-1/2*      | 12         | 16 L x 13-3/8       | 21.50 |
| 14-1/2*      | 12*        | 16 L x 13-3/8 L     | 22.50 |
| 16           | 14-1/2     | 18 x 16             | 23.00 |
| 16           | 14-1/2*    | 18 x 16 L           | 23.00 |
| 16*          | 14-1/2     | 18 L x 16           | 23.00 |
| 16*          | 14-1/2*    | 18 L x 16 L         | 23.00 |
| 18           | 16         | 20 x 18             | 23.00 |
| 18*          | 16         | 20 L x 18           | 23.00 |



**Note:**

\* = Upsized Thread Size

A = Reducer Bushing Length

B = Reducer Bushing OD, varies depending on the pressure class

## 10.0 Special Products, Features and Services

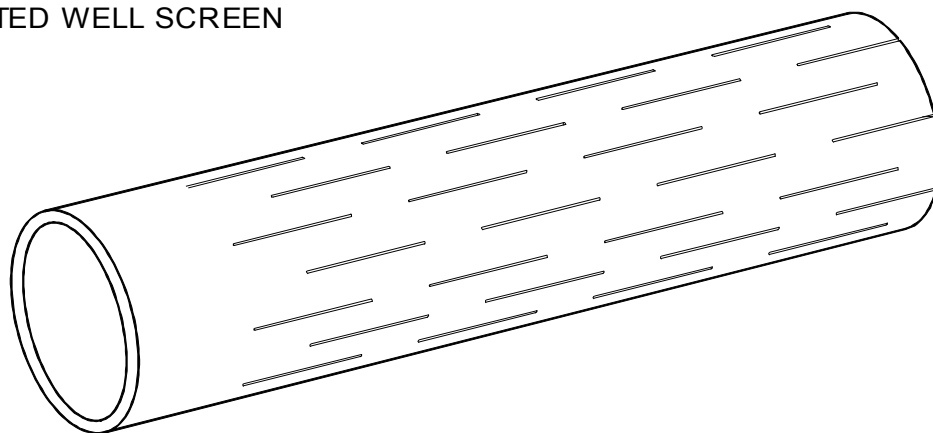
## 10.1 Special Products

- **Down-hole Crossover Joints.** In addition to the typical fitting type crossover, full or partial length crossover joints are available for mixed string down-hole applications. The connections on these crossovers are as per tubing or casing of the same size and all performance capabilities of the main string are maintained.
- **Epoxy Kits.** Complete epoxy kits for on-site bonding of fiberglass products are available. The kit includes epoxy, curing agent, cleaning solution, and the required mixing and application tools.
- **Line-pipe Repair Joints.** Repair joints, designed to replace damaged joints in the middle of a pipeline are available in all sizes produced. The repair joint and the repair procedure are detailed in the Yellow Box® Line-pipe Installation section of the catalogue. Refer to section 13.11
- **Test Coupons.** Test coupons are available for chemical resistance monitoring and testing. The coupons are typically perforated for handling and are epoxy coated on all exposed saw cut edges.
- **Thread Compound.** Several types of thread compound specifically suitable for fiberglass threaded products are available. Consult with Future Pipe Industries, Inc. to determine the compound best suited for a specific application.
- **Teflon Tape.** Teflon tape, recommended for the makeup of line pipe is available in rolls 1" wide. Consult the Installation Instructions for usage for each pipe size.
- **Flange Gaskets, Bolts, Nuts, and Washers.** Spiral wound Flexitallic style gaskets together with studs, nuts, and washers for each size and ratings of flange are available. Note that the bolt length for fiberglass flanges differs from that required for steel. The flange drawings in the fittings section of the catalogue can be used to determine the proper lengths required.

Customers with special requirements should feel free to propose any new or different products to be manufactured. Our business is to provide working solution to application problems with fiberglass products, be they standard or unique.

- **Slotted Well Screens.** Well screens in all tubing and casing sizes slotted to customer specified slot opening dimensions are available. Further details on this product are included on the drawing provided in this section.

### SLOTTED WELL SCREEN



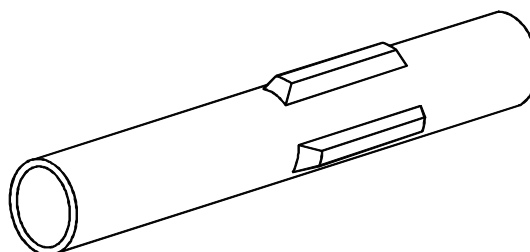
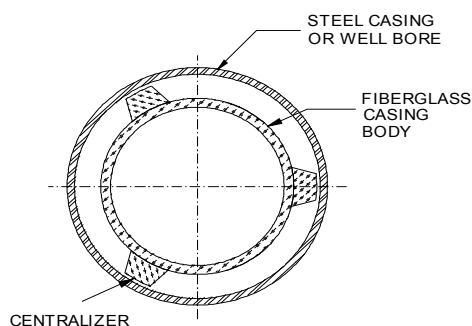
Slots per liner foot based on a minimum of 2.5% open area for 0.020" slot width and 3% open area for all other slot width

| Slot Width (Inches) | Slot Length on the ID (Inches) | Tubing / Casing Size |    |       |       |       |          |       |        |        |        |
|---------------------|--------------------------------|----------------------|----|-------|-------|-------|----------|-------|--------|--------|--------|
|                     |                                | 3-1/2                | 4  | 4-1/2 | 5-1/2 | 6-5/8 | 7, 7-5/8 | 9-5/8 | 10-3/4 | 11-3/4 | 13-3/8 |
| 0.020               | 3.00                           | 52                   | 58 | 69    | 77    | 95    | 109      | 138   | 157    | 203    | 226    |
| 0.025               |                                | 50                   | 55 | 66    | 74    | 91    | 105      | 133   | 151    | 194    | 217    |
| 0.028               |                                | 44                   | 49 | 59    | 66    | 81    | 93       | 119   | 135    | 174    | 194    |
| 0.038               |                                | 33                   | 37 | 44    | 49    | 60    | 69       | 87    | 99     | 128    | 143    |
| 0.058               |                                | 22                   | 24 | 29    | 32    | 39    | 45       | 57    | 65     | 84     | 94     |
| 0.125               |                                | 10                   | 11 | 14    | 15    | 19    | 21       | 27    | 31     | 39     | 44     |
| 0.250               |                                | 5                    | 6  | 7     | 8     | 10    | 11       | 14    | 16     | 20     | 22     |

Please Contact Future Pipe Industries for other tubing and casing diameters slotted well screen not listed

- **Centralizers.** Molded epoxy casing and tubing centralizers are available for all sizes

### CASING CENTRALIZER



CENTRALIZERS CAN BE INSTALLED AT ANY GIVEN POSITION ON THE CASING BODY AND WITH ANY GIVEN QUANTITY PER JOINT. THE CENTRALIZERS ARE DURABLE AND OF CLOSE TOLERANCE DIMENSIONS

FUTURE PIPE INDUSTRIES, INC. CENTRALIZERS ARE COMPOSED OF MOLDED EPOXY GROUT AND ARE AVAILABLE AT CUSTOMER SPECIFIED CLEARANCE DIAMETERS.

## 10.2 Special Features

In order to more closely fulfill the requirements of particular fiberglass applications, Future Pipe Industries, Inc. offers a variety of special product features to accommodating less common requirements and requests from our customers. The following list details some of the typical such features.

- **Turned Down Connections.** Particularly in the case of down-hole products where tubing, liners, and casing must be inserted into open hole or existing casing, a maximum connection outside diameter less than that of the standard product is occasionally necessary. In these circumstances the bell shaped female thread connection can, to a limited degree, be diminished by removing material on a lathe. This optional feature is more thoroughly detailed later in this section.
- **Strap-Lock Upset.** Strap wrenches and strap equipped hydraulic tongs are normally used to makeup fiberglass pipe and tubing. In order to do so the fabric belt must grip on the smooth glassy surface of the fiberglass and this frequently presents slippage problems. To resolve this common problem, Future Pipe Industries, Inc. offers, a patented process and product named **Strap-Lock**. This consists of a sparingly applied rough coat surface bonded to the upset area of the pipe. All strap type tools grip this surface firmly and positively and no performance properties of the product are diminished by this feature.
- **Rough Coat Exterior.** A rough coat exterior consisting of number 0 blasting abrasive bonded to the exterior of casing intended to be cemented into the well is available in all sizes. The abrasive is applied to the pipe surface prior to curing which results in the coating being essentially integral to the casing body. The rough coat consequently will not un-bond from the casing body and provides a strong permanent anchor pattern for the intended cement.
- **Flush Joints and Custom Connections.** In some sizes and circumstances Future Pipe Industries, Inc. offers special non-standard connections and thread forms per the customer's specification. These connections include flush joints for down-hole applications as well as varying thread forms.

### 10.3 Special Services

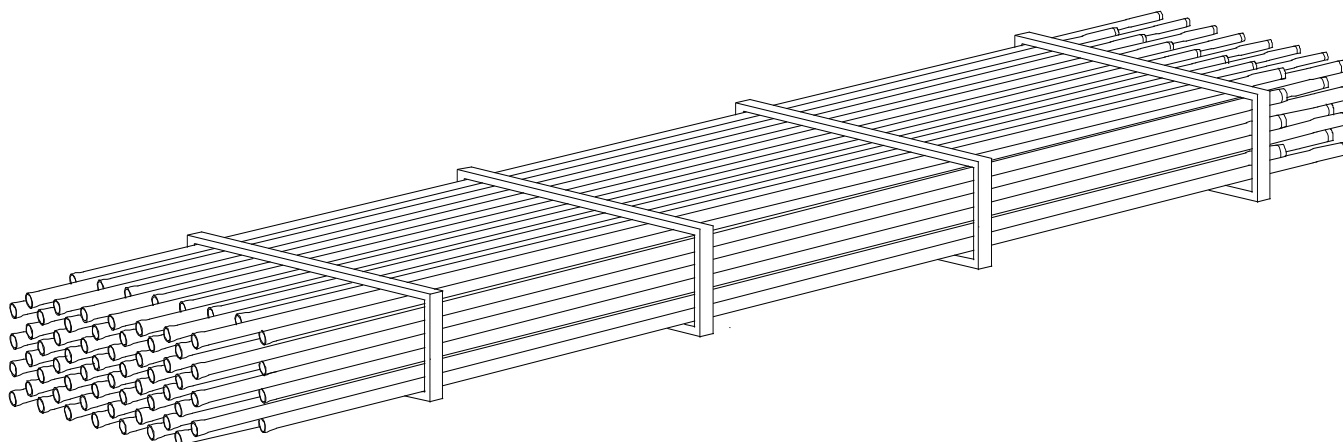
The following is a list of in-plant services available to customers of Future Pipe Industries, Inc. These services are typically charged either on a per item basis or as a package included in the price of products sold for which the services are provided. These services are available only for products manufactured by Future Pipe Industries, Inc.

- **Assembly of Products.** Manifolds, spools, cooling rings, and other assemblies of fiberglass products sold by Future Pipe Industries, Inc. can be assembled and made up in the plant to the extent practical prior to shipping to the job site. Specific and accurate dimensional control in accordance with customer provided drawings and specifications is maintained and pressure testing of the pre-assembled combinations of parts is performed.
- **Special Makeup Services.** Services to make up parts or assemblies delivered to the plant that are intended to be used in conjunction with Future Pipe Industries, Inc. products is available. Down hole tools, metallic pup or sub joints, valves, and other items can be made up to the consecutive joint of fiberglass pipe or tubing in the installation design. This service is generally performed to save rig time and to insure that the more complicated and delicate makeups are performed in the best conditions possible. The Future Pipe Industries, Inc. facility is fully equipped with the necessary handling equipment for such equipment.
- **Inspection Services.** In-plant inspection of used products delivered to the Future Pipe Industries, Inc. facility is available. Inspection services include thread inspection, pipe dimensional inspections, and chemical degradation inspections. Disposal of rejected products is available as well.
- **Rethreading of Used Tubing.** Threaded male ends on pipe or tubing can be cut off and rethreaded to reclaim used products.
- **Chemical Exposure Testing.** In-house temperature controlled long or short term chemical exposure testing is available to verify the suitability of fiberglass products in particularly severe chemical service. Fiberglass coupons are immersed in the customer provided fluid intended to be handled by fiberglass pipe or tubing and held in a temperature controlled oven. After an appropriate period of time the coupons are recovered and inspected to determine their resistance to the chemical in question.
- **Steel Pipe Overwrap.** Future Pipe Industries, Inc. offers the application of reinforced fiberglass overwrap of steel pipe, tubing, or casing for corrosion protection or other purposes. The overwrap is applied to customer specified thicknesses then cured and trimmed.



## 11.0 Shipping Procedures





**Figure 1**

| SIZE YB / RB                      | JOINTS / CRATE | FEET / CRATE |
|-----------------------------------|----------------|--------------|
| 2" / 2-3/8" (500 - 1500) PSI      | 116            | 3,480        |
| 2" / 2-3/8" (1750 - 2500) PSI     | 109            | 3,270        |
| 2" / 2-3/8" (2750 - 3500) PSI     | 102            | 3,060        |
| 2-1/2" / 2-7/8" (500 - 1750) PSI  | 81             | 2,430        |
| 2-1/2" / 2-7/8" (2000 - 2500) PSI | 75             | 2,250        |
| 2-1/2" / 2-7/8" (2750 - 3250) PSI | 69             | 2,070        |
| 3" / 3-1/2" (500 - 2250) PSI      | 53             | 1,590        |
| 3" / 3-1/2" (2500 - 3250) PSI     | 48             | 1,440        |
| 3-1/2" / 4" (500 - 2750) PSI      | 34             | 1,020        |
| 3-1/2" / 4" (3000 - 3250) PSI     | 30             | 900          |
| 4" / 4-1/2" (500 - 1500) PSI      | 34             | 1,020        |
| 4" / 4-1/2" (1750 - 2500) PSI     | 30             | 900          |
| 4" / 4-1/2" (2750 - 3000) PSI     | 20             | 600          |
| 5" / 5-1/2" (500 - 3000) PSI      | 20             | 600          |
| 6" / 6-5/8" (500 - 2750) PSI      | 12             | 360          |
| 7" (1000 - 1500) PSI              | 12             | 360          |
| 7" (1750) PSI                     | 10             | 300          |
| 6L / 7-5/8" (500 - 1500) PSI      | 12             | 360          |
| 6L / 7-5/8" (1750 - 2500) PSI     | 10             | 300          |

**Table 1**

Packing of pipe, tubing, and casing for size up to 6 inch in pipe and 6-5/8" in casing shall be in an open-side steel band reinforced wooden crate frames as per the (Figure 1) above. Depending on the wall thickness of the of the pipe/casing shipped, the individual crate weight shall be from 3,500 to 5,000 lbs. the standard crate outside dimensions are 48 inches wide, 21 inches high (for sizes marked in **Blue**) or 18 inches high (for sizes marked in **Yellow**) and 34 feet long. An estimate number of joints per crate are indicated in Table 1.

Typically eight crates can be loaded on a standard flatbed trailer. The crate loading and unloading can be done with either a crane or forklift. Nylon straps shall be used on crane lifts and padding shall be used on forklifts forks.

## 11.1 Yellow Box® Standard & Green Box™

### Truckload Load Quantities

#### Joints/Feet per Truckload

| PIPE<br>SIZE | PRESSURE RATING - LINEPIPE |        |        |        |        |        |        |        |        |        |        |        |        |
|--------------|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|              | 500                        | 800    | 1000   | 1250   | 1500   | 1750   | 2000   | 2250   | 2500   | 2750   | 3000   | 3250   | 3500   |
| 2"           | 928                        | 928    | 928    | 928    | 928    | 872    | 872    | 872    | 872    | 816    | 816    | 816    | 816    |
|              | 27,840                     | 27,840 | 27,840 | 27,840 | 27,840 | 26,160 | 26,160 | 26,160 | 26,160 | 24,480 | 24,480 | 24,480 | 24,480 |
| 2-1/2"       | 648                        | 648    | 648    | 648    | 648    | 648    | 600    | 600    | 600    | 552    | 552    | 552    |        |
|              | 19,440                     | 19,440 | 19,440 | 19,440 | 19,440 | 19,440 | 18,000 | 18,000 | 18,000 | 16,560 | 16,560 | 16,560 |        |
| 3"           | 424                        | 424    | 424    | 424    | 424    | 424    | 424    | 424    | 384    | 384    | 384    | 384    |        |
|              | 12,720                     | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 11,520 | 11,520 | 11,520 | 11,520 |        |
| 3-1/2"       | 272                        | 272    | 272    | 272    | 272    | 272    | 272    | 272    | 272    | 240    | 240    | 240    |        |
|              | 8,160                      | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 7,200  | 7,200  | 7,200  |        |
| 4"           | 272                        | 272    | 272    | 272    | 272    | 240    | 240    | 240    | 240    | 160    | 160    |        |        |
|              | 8,160                      | 8,160  | 8,160  | 8,160  | 8,160  | 7,200  | 7,200  | 7,200  | 7,200  | 4,800  | 4,800  |        |        |
| 5"           | 160                        | 160    | 160    | 160    | 160    | 160    | 160    | 160    | 160    | 160    | 160    |        |        |
|              | 4,800                      | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  |        |        |
| 6"           | 120                        | 120    | 120    | 120    | 120    | 120    | 120    | 120    | 120    | 120    |        |        |        |
|              | 3,600                      | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  |        |        |        |
| *6-L         | 120                        | 120    | 120    | 120    | 120    | 100    | 100    | 100    | 100    |        |        |        |        |
|              | 3,600                      | 3,600  | 3,600  | 3,600  | 3,600  | 3,000  | 3,000  | 3,000  | 3,000  |        |        |        |        |
| *8"          | 64                         | 64     | 64     | 64     | 64     | 64     | 64     | 64     | 64     |        |        |        |        |
|              | 1,920                      | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  |        |        |        |        |
| *10"         | 49                         | 49     | 49     | 49     | 49     | 49     | 49     | 49     | 49     |        |        |        |        |
|              | 1,470                      | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  |        |        |        |        |
| *10-L        | 49                         | 49     | 49     | 49     | 49     | 49     |        |        |        |        |        |        |        |
|              | 1,470                      | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  |        |        |        |        |        |        |        |
| *12"         | 36                         | 36     | 36     | 36     | 36     | 36     |        |        |        |        |        |        |        |
|              | 1,080                      | 1,080  | 1,080  | 1,080  | 1,080  | 1,080  |        |        |        |        |        |        |        |
| *14-1/2"     | 20                         | 20     | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        |
|              | 600                        | 600    | 600    | 600    | 600    | 600    |        |        |        |        |        |        |        |
| *16-1/2"     | 20                         | 16     | 16     | 16     | 16     |        |        |        |        |        |        |        |        |
|              | 600                        | 480    | 480    | 480    | 480    |        |        |        |        |        |        |        |        |
| *18"         | 16                         | 16     | 16     | 16     | 16     |        |        |        |        |        |        |        |        |
|              | 480                        | 480    | 480    | 480    | 480    |        |        |        |        |        |        |        |        |
| *24"         | 9                          | 9      | 9      | 9      |        |        |        |        |        |        |        |        |        |
|              | 270                        | 270    | 270    | 270    |        |        |        |        |        |        |        |        |        |

#### General Notes

- 1- The actual truckload quantities will vary by +/- 5 % based on the loading condition, and other affecting parameters.
- 2- All truckloads are based on the U.S. transportation laws.

Yellow Box® Standard &amp; Green Box™

### Container Load Quantities

#### Joints/Feet per Container

| PIPE<br>SIZE | PRESSURE RATING - LINEPIPE |        |        |        |        |        |        |        |        |        |        |        |        |
|--------------|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|              | 500                        | 800    | 1000   | 1250   | 1500   | 1750   | 2000   | 2250   | 2500   | 2750   | 3000   | 3250   | 3500   |
| 2"           | 828                        | 828    | 828    | 828    | 805    | 770    | 770    | 770    | 748    | 748    | 714    | 660    | 510    |
|              | 24,840                     | 24,840 | 24,840 | 24,840 | 24,150 | 23,100 | 23,100 | 23,100 | 22,440 | 22,440 | 21,420 | 19,800 | 15,300 |
| 2-1/2"       | 630                        | 600    | 600    | 580    | 580    | 580    | 551    | 551    | 532    | 504    | 400    | 375    |        |
|              | 18,900                     | 18,000 | 18,000 | 17,400 | 17,400 | 17,400 | 16,530 | 16,530 | 15,960 | 15,120 | 12,000 | 11,250 |        |
| 3"           | 450                        | 450    | 450    | 432    | 408    | 408    | 408    | 391    | 391    | 345    | 273    | 252    |        |
|              | 13,500                     | 13,500 | 13,500 | 12,960 | 12,240 | 12,240 | 12,240 | 11,730 | 11,730 | 10,350 | 8,190  | 7,560  |        |
| 3-1/2"       | 374                        | 374    | 352    | 352    | 336    | 336    | 336    | 336    | 294    | 273    | 240    | 220    |        |
|              | 11,220                     | 11,220 | 10,560 | 10,560 | 10,080 | 10,080 | 10,080 | 10,080 | 8,820  | 8,190  | 7,200  | 6,600  |        |
| 4"           | 285                        | 285    | 266    | 266    | 266    | 252    | 252    | 252    | 187    | 170    |        |        |        |
|              | 8,550                      | 8,550  | 7,980  | 7,980  | 7,980  | 7,560  | 7,560  | 7,560  | 5,610  | 5,100  |        |        |        |
| 5"           | 238                        | 221    | 221    | 208    | 208    | 208    | 208    | 192    | 176    |        |        |        |        |
|              | 7,140                      | 6,630  | 6,630  | 6,240  | 6,240  | 6,240  | 6,240  | 5,760  | 5,280  |        |        |        |        |
| 6"           | 168                        | 154    | 154    | 143    | 143    | 143    | 143    | 130    | 117    |        |        |        |        |
|              | 5,040                      | 4,620  | 4,620  | 4,290  | 4,290  | 4,290  | 4,290  | 3,900  | 3,510  |        |        |        |        |
| *6-L         | 117                        | 108    | 96     | 96     | 96     | 88     | 88     | 88     |        |        |        |        |        |
|              | 3,510                      | 3,240  | 2,880  | 2,880  | 2,880  | 2,640  | 2,640  | 2,640  |        |        |        |        |        |
| *8"          | 63                         | 63     | 63     | 63     | 63     | 63     | 63     | 56     |        |        |        |        |        |
|              | 1,890                      | 1,890  | 1,890  | 1,890  | 1,890  | 1,890  | 1,890  | 1,680  |        |        |        |        |        |
| *10"         | 56                         | 48     | 48     | 48     | 48     | 48     | 48     |        |        |        |        |        |        |
|              | 1,680                      | 1,440  | 1,440  | 1,440  | 1,440  | 1,440  | 1,440  |        |        |        |        |        |        |
| *10-L        | 42                         | 42     | 35     | 35     | 30     | 30     |        |        |        |        |        |        |        |
|              | 1,260                      | 1,260  | 1,050  | 1,050  | 900    | 900    |        |        |        |        |        |        |        |
| *12"         | 30                         | 30     | 30     | 30     | 30     | 30     |        |        |        |        |        |        |        |
|              | 900                        | 900    | 900    | 900    | 900    | 900    |        |        |        |        |        |        |        |
| *14-1/2"     | 20                         | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        |        |
|              | 600                        | 600    | 600    | 600    | 600    |        |        |        |        |        |        |        |        |
| *16-1/2"     | 16                         | 16     | 16     | 16     | 16     |        |        |        |        |        |        |        |        |
|              | 480                        | 480    | 480    | 480    | 480    |        |        |        |        |        |        |        |        |
| *18"         | 12                         | 12     | 12     | 12     |        |        |        |        |        |        |        |        |        |
|              | 360                        | 360    | 360    | 360    |        |        |        |        |        |        |        |        |        |
| *24"         | 9                          | 9      | 9      |        |        |        |        |        |        |        |        |        |        |
|              | 270                        | 270    | 270    |        |        |        |        |        |        |        |        |        |        |

#### General Notes:

- 1- The actual container quantities will vary by +/- 5 % based on the loading condition, packing method, and other affecting parameters such as fittings, accessories, etc.
- 2- All containers loading are based on 40 feet High Cube (HC) container.
- 3- All container load quantity is based on the use of Sled Skids to facilitate the loading and unloading process.

## 11.2 Yellow Box® API 15HR Design & Green Box™

### Truckload Load Quantities

#### Joints/Feet per Truckload

| PIPE<br>SIZE | PRESSURE RATING - LINEPIPE |        |        |        |        |        |        |        |        |        |        |      |      |
|--------------|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|------|
|              | 500                        | 750    | 1000   | 1250   | 1500   | 1750   | 2000   | 2250   | 2500   | 2750   | 3000   | 3250 | 3500 |
| 2"           | 928                        | 928    | 928    | 928    | 928    | 872    | 872    | 872    | 872    | 816    | 648    |      |      |
|              | 27,840                     | 27,840 | 27,840 | 27,840 | 27,840 | 26,160 | 26,160 | 26,160 | 26,160 | 24,480 | 19,440 |      |      |
| 2-1/2"       | 648                        | 648    | 648    | 648    | 648    | 648    | 600    | 600    | 424    | 424    | 424    |      |      |
|              | 19,440                     | 19,440 | 19,440 | 19,440 | 19,440 | 19,440 | 18,000 | 18,000 | 12,720 | 12,720 | 12,720 |      |      |
| 3"           | 424                        | 424    | 424    | 424    | 424    | 424    | 424    | 424    | 384    | 272    | 272    |      |      |
|              | 12,720                     | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 11,520 | 8,160  | 8,160  |      |      |
| 3-1/2"       | 272                        | 272    | 272    | 272    | 272    | 272    | 272    | 272    | 272    | 272    | 272    |      |      |
|              | 8,160                      | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  |      |      |
| 4"           | 272                        | 272    | 272    | 272    | 272    | 240    | 160    | 160    | 160    | 160    |        |      |      |
|              | 8,160                      | 8,160  | 8,160  | 8,160  | 8,160  | 7,200  | 4,800  | 4,800  | 4,800  | 4,800  |        |      |      |
| 5"           | 160                        | 160    | 160    | 160    | 160    | 160    | 160    | 160    | 160    |        |        |      |      |
|              | 4,800                      | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  |        |        |      |      |
| 6"           | 120                        | 120    | 120    | 120    | 120    | 120    | 120    | 120    | 120    |        |        |      |      |
|              | 3,600                      | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  |        |        |      |      |
| *6-L         | 120                        | 120    | 120    | 120    | 120    | 100    | 100    | 100    |        |        |        |      |      |
|              | 3,600                      | 3,600  | 3,600  | 3,600  | 3,600  | 3,000  | 3,000  | 3,000  |        |        |        |      |      |
| *8"          | 64                         | 64     | 64     | 64     | 64     | 64     | 64     | 64     |        |        |        |      |      |
|              | 1,920                      | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  |        |        |        |      |      |
| *10"         | 49                         | 49     | 49     | 49     | 49     | 49     | 49     |        |        |        |        |      |      |
|              | 1,470                      | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  |        |        |        |        |      |      |
| *10-L        | 49                         | 49     | 49     | 49     | 49     | 49     |        |        |        |        |        |      |      |
|              | 1,470                      | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  |        |        |        |        |        |      |      |
| *12"         | 36                         | 36     | 36     | 36     | 36     | 36     |        |        |        |        |        |      |      |
|              | 1,080                      | 1,080  | 1,080  | 1,080  | 1,080  | 1,080  |        |        |        |        |        |      |      |
| *14-1/2"     | 20                         | 20     | 20     | 20     | 20     |        |        |        |        |        |        |      |      |
|              | 600                        | 600    | 600    | 600    | 600    |        |        |        |        |        |        |      |      |
| *16-1/2"     | 20                         | 16     | 16     | 16     | 16     |        |        |        |        |        |        |      |      |
|              | 600                        | 480    | 480    | 480    | 480    |        |        |        |        |        |        |      |      |
| *18"         | 16                         | 16     | 16     | 16     |        |        |        |        |        |        |        |      |      |
|              | 480                        | 480    | 480    | 480    |        |        |        |        |        |        |        |      |      |
| *24"         | 9                          | 9      | 9      |        |        |        |        |        |        |        |        |      |      |
|              | 270                        | 270    | 270    |        |        |        |        |        |        |        |        |      |      |

#### General Notes

- 1- The actual truckload quantities will vary by +/- 5 % based on the loading condition, and other affecting parameters.
- 2- All truckloads are based on the U.S. transportation laws.

Yellow Box® API 15HR Design &amp; Green Box™

### Container Load Quantities

#### Joints/Feet per Container

| PIPE<br>SIZE | PRESSURE RATING - LINEPIPE |        |        |        |        |        |        |        |        |        |        |      |      |
|--------------|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|------|
|              | 500                        | 750    | 1000   | 1250   | 1500   | 1750   | 2000   | 2250   | 2500   | 2750   | 3000   | 3250 | 3500 |
| 2"           | 828                        | 828    | 828    | 805    | 770    | 770    | 770    | 748    | 714    | 660    | 510    |      |      |
|              | 24,840                     | 24,840 | 24,840 | 24,150 | 23,100 | 23,100 | 23,100 | 22,440 | 21,420 | 19,800 | 15,300 |      |      |
| 2-1/2"       | 630                        | 600    | 600    | 580    | 580    | 551    | 532    | 532    | 400    | 375    | 325    |      |      |
|              | 18,900                     | 18,000 | 18,000 | 17,400 | 17,400 | 16,530 | 15,960 | 15,960 | 12,000 | 11,250 | 9,750  |      |      |
| 3"           | 450                        | 450    | 432    | 408    | 408    | 408    | 391    | 368    | 322    | 252    | 231    |      |      |
|              | 13,500                     | 13,500 | 12,960 | 12,240 | 12,240 | 12,240 | 11,730 | 11,040 | 9,660  | 7,560  | 6,930  |      |      |
| 3-1/2"       | 374                        | 374    | 352    | 336    | 336    | 336    | 315    | 273    | 260    | 220    | 190    |      |      |
|              | 11,220                     | 11,220 | 10,560 | 10,080 | 10,080 | 10,080 | 9,450  | 8,190  | 7,800  | 6,600  | 5,700  |      |      |
| 4"           | 285                        | 285    | 266    | 266    | 252    | 252    | 204    | 187    | 160    | 144    |        |      |      |
|              | 8,550                      | 8,550  | 7,980  | 7,980  | 7,560  | 7,560  | 6,120  | 5,610  | 4,800  | 4,320  |        |      |      |
| 5"           | 238                        | 221    | 221    | 208    | 208    | 208    | 176    | 160    | 144    |        |        |      |      |
|              | 7,140                      | 6,630  | 6,630  | 6,240  | 6,240  | 6,240  | 5,280  | 4,800  | 4,320  |        |        |      |      |
| 6"           | 168                        | 126    | 117    | 117    | 117    | 117    | 117    | 104    | 84     |        |        |      |      |
|              | 5,040                      | 3,780  | 3,510  | 3,510  | 3,510  | 3,510  | 3,510  | 3,120  | 2,520  |        |        |      |      |
| *6-L         | 117                        | 96     | 96     | 96     | 88     | 88     | 88     | 77     |        |        |        |      |      |
|              | 3,510                      | 2,880  | 2,880  | 2,880  | 2,640  | 2,640  | 2,640  | 2,310  |        |        |        |      |      |
| *8"          | 63                         | 63     | 63     | 63     | 63     | 63     | 56     | 48     |        |        |        |      |      |
|              | 1,890                      | 1,890  | 1,890  | 1,890  | 1,890  | 1,890  | 1,680  | 1,440  |        |        |        |      |      |
| *10"         | 56                         | 48     | 48     | 48     | 48     | 42     | 42     |        |        |        |        |      |      |
|              | 1,680                      | 1,440  | 1,440  | 1,440  | 1,440  | 1,260  | 1,260  |        |        |        |        |      |      |
| *10-L        | 42                         | 35     | 35     | 30     | 30     | 30     |        |        |        |        |        |      |      |
|              | 1,260                      | 1,050  | 1,050  | 900    | 900    | 900    |        |        |        |        |        |      |      |
| *12"         | 30                         | 30     | 30     | 30     | 30     | 24     |        |        |        |        |        |      |      |
|              | 900                        | 900    | 900    | 900    | 900    | 720    |        |        |        |        |        |      |      |
| *14-1/2"     | 20                         | 20     | 20     | 20     | 20     |        |        |        |        |        |        |      |      |
|              | 600                        | 600    | 600    | 600    | 600    |        |        |        |        |        |        |      |      |
| *16-1/2"     | 16                         | 16     | 16     | 16     | 12     |        |        |        |        |        |        |      |      |
|              | 480                        | 480    | 480    | 480    | 360    |        |        |        |        |        |        |      |      |
| *18"         | 12                         | 12     | 12     | 12     |        |        |        |        |        |        |        |      |      |
|              | 360                        | 360    | 360    | 360    |        |        |        |        |        |        |        |      |      |
| *24"         | 9                          | 9      | 6      |        |        |        |        |        |        |        |        |      |      |
|              | 270                        | 270    | 180    |        |        |        |        |        |        |        |        |      |      |

#### General Notes:

- 1- The actual container quantities will vary by +/- 5 % based on the loading condition, packing method, and other affecting parameters such as fittings, accessories, etc.
- 2- All containers loading are based on 40 feet High Cube (HC) container.
- 3- All container load quantity is based on the use of Sled Skids to facilitate the loading and unloading process.

### 11.3 Red Box® & Blue Box®

#### Truckload Load Quantities

##### Joints/Feet per Truckload

| PIPE<br>SIZE    | PRESSURE RATING - TUBING & CASING |        |        |        |        |        |        |        |        |        |        |
|-----------------|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                 | 1000                              | 1250   | 1500   | 1750   | 2000   | 2250   | 2500   | 2750   | 3000   | 3250   | 3500   |
| <b>2-3/8"</b>   | 928                               | 928    | 928    | 872    | 872    | 872    | 872    | 816    | 816    | 816    | 816    |
|                 | 27,840                            | 27,840 | 27,840 | 26,160 | 26,160 | 26,160 | 26,160 | 24,480 | 24,480 | 24,480 | 24,480 |
| <b>2-7/8"</b>   | 648                               | 648    | 648    | 648    | 600    | 600    | 600    | 552    | 552    | 552    |        |
|                 | 19,440                            | 19,440 | 19,440 | 19,440 | 18,000 | 18,000 | 18,000 | 16,560 | 16,560 | 16,560 |        |
| <b>3-1/2"</b>   | 424                               | 424    | 424    | 424    | 424    | 424    | 384    | 384    | 384    | 384    |        |
|                 | 12,720                            | 12,720 | 12,720 | 12,720 | 12,720 | 12,720 | 11,520 | 11,520 | 11,520 | 11,520 |        |
| <b>4"</b>       | 272                               | 272    | 272    | 272    | 272    | 272    | 272    | 272    | 240    | 240    |        |
|                 | 8,160                             | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 8,160  | 7,200  | 7,200  |        |
| <b>4-1/2"</b>   | 272                               | 272    | 272    | 240    | 240    | 240    | 240    | 160    | 160    |        |        |
|                 | 8,160                             | 8,160  | 8,160  | 7,200  | 7,200  | 7,200  | 7,200  | 4,800  | 4,800  |        |        |
| <b>5-1/2"</b>   | 160                               | 160    | 160    | 160    | 160    | 160    | 160    | 160    | 160    |        |        |
|                 | 4,800                             | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  | 4,800  |        |        |
| <b>6-5/8"</b>   | 120                               | 120    | 120    | 120    | 120    | 120    | 120    | 120    |        |        |        |
|                 | 3,600                             | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  | 3,600  |        |        |        |
| <b>*7"</b>      | 120                               | 120    | 120    | 100    |        |        |        |        |        |        |        |
|                 | 3,600                             | 3,600  | 3,600  | 3,000  |        |        |        |        |        |        |        |
| <b>*7-5/8"</b>  | 100                               | 100    | 100    | 100    | 100    | 100    | 100    | 100    |        |        |        |
|                 | 3,000                             | 3,000  | 3,000  | 3,000  | 3,000  | 3,000  | 3,000  | 3,000  |        |        |        |
| <b>*9-5/8"</b>  | 64                                | 64     | 64     | 64     | 64     | 64     | 64     | 64     |        |        |        |
|                 | 1,920                             | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  | 1,920  |        |        |        |
| <b>*10-3/4"</b> | 49                                | 49     | 49     | 49     | 49     | 49     | 49     |        |        |        |        |
|                 | 1,470                             | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  | 1,470  |        |        |        |        |
| <b>*11-3/4"</b> | 49                                | 49     | 49     | 49     |        |        |        |        |        |        |        |
|                 | 1,470                             | 1,470  | 1,470  | 1,470  |        |        |        |        |        |        |        |
| <b>*13-3/8"</b> | 36                                | 36     | 36     | 36     |        |        |        |        |        |        |        |
|                 | 1,080                             | 1,080  | 1,080  | 1,080  |        |        |        |        |        |        |        |
| <b>*16"</b>     | 20                                | 20     | 20     | 20     |        |        |        |        |        |        |        |
|                 | 600                               | 600    | 600    | 600    |        |        |        |        |        |        |        |
| <b>*18"</b>     | 16                                | 16     | 16     |        |        |        |        |        |        |        |        |
|                 | 480                               | 480    | 480    |        |        |        |        |        |        |        |        |
| <b>*20"</b>     | 16                                | 16     | 16     |        |        |        |        |        |        |        |        |
|                 | 480                               | 480    | 480    |        |        |        |        |        |        |        |        |
| <b>*24"</b>     | 9                                 | 9      |        |        |        |        |        |        |        |        |        |
|                 | 270                               | 270    |        |        |        |        |        |        |        |        |        |

#### General Notes

- 1- The actual truckload quantities will vary by +/- 5 % based on the loading condition, and other affecting parameters.
- 2- All truckloads are based on the U.S. transportation laws.

Red Box® &amp; Blue Box®

### Container Load Quantities

#### Joints/ Feet per Container

| PIPE<br>SIZE    | PRESSURE RATING - TUBING & CASING |        |        |        |        |        |        |        |        |        |        |
|-----------------|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                 | 1000                              | 1250   | 1500   | 1750   | 2000   | 2250   | 2500   | 2750   | 3000   | 3250   | 3500   |
| <b>2-3/8"</b>   | 828                               | 805    | 770    | 770    | 770    | 748    | 714    | 714    | 627    | 561    | 528    |
|                 | 24,840                            | 24,150 | 23,100 | 23,100 | 23,100 | 22,440 | 21,420 | 21,420 | 18,810 | 16,830 | 15,840 |
| <b>2-7/8"</b>   | 600                               | 580    | 580    | 551    | 551    | 532    | 532    | 476    | 420    | 378    |        |
|                 | 18,000                            | 17,400 | 17,400 | 16,530 | 16,530 | 15,960 | 15,960 | 14,280 | 12,600 | 11,340 |        |
| <b>3-1/2"</b>   | 432                               | 408    | 408    | 408    | 408    | 391    | 345    | 299    | 276    | 264    |        |
|                 | 12,960                            | 12,240 | 12,240 | 12,240 | 12,240 | 11,730 | 10,350 | 8,970  | 8,280  | 7,920  |        |
| <b>4"</b>       | 352                               | 336    | 336    | 336    | 336    | 315    | 273    | 240    | 220    | 200    |        |
|                 | 10,560                            | 10,080 | 10,080 | 10,080 | 10,080 | 9,450  | 8,190  | 7,200  | 6,600  | 6,000  |        |
| <b>4-1/2"</b>   | 266                               | 266    | 252    | 252    | 252    | 216    | 198    | 160    | 144    |        |        |
|                 | 7,980                             | 7,980  | 7,560  | 7,560  | 7,560  | 6,480  | 5,940  | 4,800  | 4,320  |        |        |
| <b>5-1/2"</b>   | 221                               | 208    | 208    | 208    | 192    | 176    | 160    | 135    | 120    |        |        |
|                 | 6,630                             | 6,240  | 6,240  | 6,240  | 5,760  | 5,280  | 4,800  | 4,050  | 3,600  |        |        |
| <b>6-5/8"</b>   | 143                               | 143    | 143    | 143    | 130    | 117    | 104    | 91     |        |        |        |
|                 | 4,290                             | 4,290  | 4,290  | 4,290  | 3,900  | 3,510  | 3,120  | 2,730  |        |        |        |
| <b>*7"</b>      | 96                                | 96     | 96     | 96     |        |        |        |        |        |        |        |
|                 | 2,880                             | 2,880  | 2,880  | 2,880  |        |        |        |        |        |        |        |
| <b>*7-5/8"</b>  | 96                                | 96     | 96     | 88     | 88     | 88     | 66     | 66     |        |        |        |
|                 | 2,880                             | 2,880  | 2,880  | 2,640  | 2,640  | 2,640  | 1,980  | 1,980  |        |        |        |
| <b>*9-5/8"</b>  | 63                                | 63     | 63     | 63     | 56     | 56     | 48     |        |        |        |        |
|                 | 1,890                             | 1,890  | 1,890  | 1,890  | 1,680  | 1,680  | 1,440  |        |        |        |        |
| <b>*10-3/4"</b> | 48                                | 48     | 48     | 48     | 42     | 35     | 35     |        |        |        |        |
|                 | 1,440                             | 1,440  | 1,440  | 1,440  | 1,260  | 1,050  | 1,050  |        |        |        |        |
| <b>*11-3/4"</b> | 35                                | 35     | 35     | 30     |        |        |        |        |        |        |        |
|                 | 1,050                             | 1,050  | 1,050  | 900    |        |        |        |        |        |        |        |
| <b>*13-3/8"</b> | 30                                | 30     | 30     | 30     |        |        |        |        |        |        |        |
|                 | 900                               | 900    | 900    | 900    |        |        |        |        |        |        |        |
| <b>*16"</b>     | 20                                | 20     | 20     | 20     |        |        |        |        |        |        |        |
|                 | 600                               | 600    | 600    | 600    |        |        |        |        |        |        |        |
| <b>*18"</b>     | 16                                | 16     | 16     |        |        |        |        |        |        |        |        |
|                 | 480                               | 480    | 480    |        |        |        |        |        |        |        |        |
| <b>*20"</b>     | 12                                | 12     | 12     |        |        |        |        |        |        |        |        |
|                 | 360                               | 360    | 360    |        |        |        |        |        |        |        |        |
| <b>*24"</b>     | 9                                 | 6      | 6      |        |        |        |        |        |        |        |        |
|                 | 270                               | 180    | 180    |        |        |        |        |        |        |        |        |

#### General Notes:

- 1- The actual container quantities will vary by +/- 5 % based on the loading condition, packing method, and other affecting parameters such as fittings, accessories, etc.
- 2- All containers loading are based on 40 feet High Cube (HC) container.
- 3- All container load quantity is based on the use of Sled Skids to facilitate the loading and unloading process.

## IMPORTANT NOTICE

The information published in our catalogue and on our web site is intended as a guide to our clients and customers. While Future Pipe Industries, Inc. makes a good faith effort to ensure the accuracy of such information and content, the reader should be aware that any information, graphics and content contained in our catalogue and on our web site does not constitute a warranty of any kind or sort. All rights and obligations relating to sales and purchases of our products and services are governed by the terms and conditions of the written documents evidencing each such sale and purchase.

## **FUTURE PIPE INDUSTRIES, INC. WARRANTY AND DISCLAIMER OF WARRANTIES**

The pipe, tubing, casing, fittings and other products and product components manufactured and sold by FUTURE PIPE INDUSTRIES, INC. ("Manufacturer") have the following warranty and disclaimer of warranties:

Subject to the conditions set forth herein, Manufacturer warrants that all products manufactured and sold by Manufacturer to its customer ("Purchaser") shall be free from defects in material and workmanship under normal use and service by Purchaser ("Covered Defect") for a period of one (1) year from date of purchase by Purchaser. Should a Covered Defect arise within said time period, provided Purchaser notifies Manufacturer of such Covered Defect within twenty one (21) days from the date of Purchaser's discovery, Manufacturer shall, upon its determination that an actual defect exists and that such defect constitutes a Covered Defect, at Manufacturer's sole option, either (i) replace such defective product or component of such product with a replacement product or component, (ii) repair such defective product or component or (iii) refund the sales price to Purchaser. All costs of transportation of replaced, damaged and/or repaired product or components, including freight, insurance and carrying costs shall be prepaid by Purchaser.

A Covered Defect shall not include, and this warranty shall not apply, to any products or components of products of Manufacturer which: (i) have been subjected to any accident, faulty installation, misapplication, abuse, neglect, misuse or prolonged exposure to ultraviolet rays; (ii) have been repaired or altered by any party other than Manufacturer without the express prior written consent of Manufacturer; (iii) have been used after discovery of a defect without the express prior written consent of Manufacturer; (iv) any user refuses to permit Manufacturer to examine; (v) have been used with any thread compound other than TFC#15 or Manufacturer's approved equivalent for makeup of pipe joints; or (vi) are installed without the supervision or instruction of Manufacturer's authorized representative. With respect to any products or components of products of Manufacturer which have been used in chemical/waste disposal services or systems, the warranty hereunder extends only through the installation period, including acceptance testing of the product, or for a period of one (1) year from the date of purchase, whichever occurs first.

The foregoing warranty contained herein is exclusive and in lieu of all other warranties, whether express, implied or statutory, including, but not by way of limitation, any warranty of merchantability or fitness for any particular purpose. No other warranty is made with respect to Manufacturer's products and components of products except as expressly provided hereunder, nor is there any warranty made whatsoever concerning the installation or use of Manufacturer's products or components of products.

Manufacturer's warranty herein extends solely to the original Purchaser of Manufacturer's product and is not transferable, and does not extend, to any subsequent owner or user of Manufacturer's product.

The remedies provided in this warranty constitute the sole recourse of Purchaser against Manufacturer for breach of any of Manufacturer's obligations under the sales contract with Purchaser regarding the sale of Manufacturer's product to Purchaser, whether the claim is made in tort or in contract. Manufacturer shall not be liable to Purchaser or any party for any special, incidental or consequential damages resulting from the use or performance of Manufacturer's product sold to Purchaser. Furthermore, in no event, shall Manufacturer's liability to Purchaser or any party relating to the use or performance of Manufacturer's product sold to Purchaser exceed the purchase price of Manufacturer's product to Purchaser.

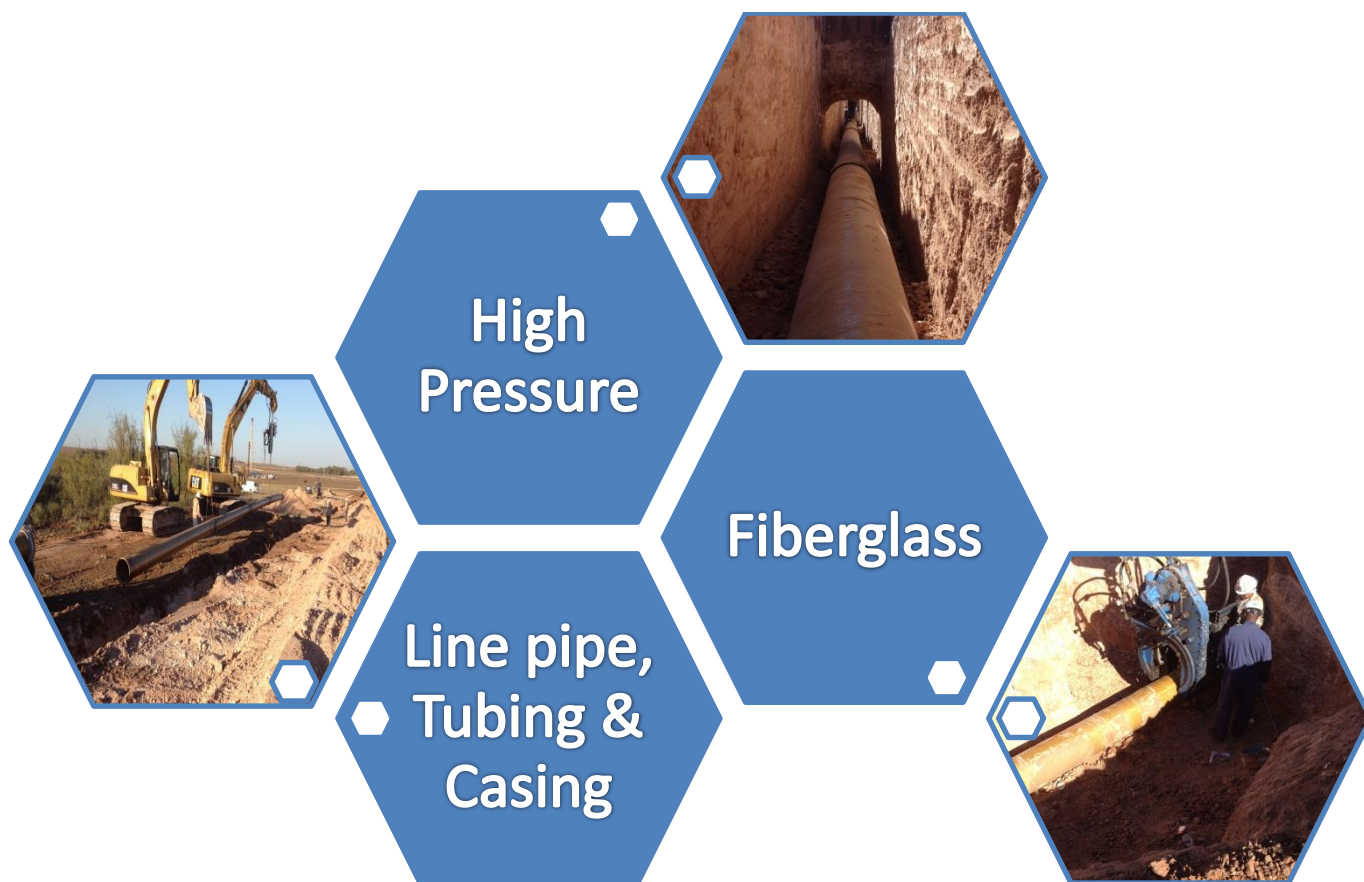
Manufacturer reserves the right to make revisions from time to time of its product without extending or renewing its warranty with regard to previously manufactured products and components and without obligation to retrofit, replace or reinstall previously manufactured products to incorporate revisions therein.

All disputes regarding this warranty and the contents hereof shall be resolved through binding arbitration administered by the American Arbitration Association ("AAA") pursuant to the Federal Arbitration Act in accordance with the Commercial Arbitration Rules of the AAA to be conducted in an arbitration proceeding to be held in Houston, Harris County, Texas.

MANUFACTURER SPECIFICALLY DISAVOWS ANY OTHER REPRESENTATION, WARRANTY OR LIABILITY NOT CONTAINED HEREIN RELATING TO THE CONDITION, USE OR INSTALLATION OF MANUFACTURER'S PRODUCT SOLD TO PURCHASER.

## Part – II

### INSTALLATION INSTRUCTIONS AND FIELD SERVICES GUIDE



HPIG - Rev. 5.5  
Issue Date: July, 2014 - Replace Rev. 5.0 Dated May, 2013

## Terms of Use

This guide is specifically for Future Pipe Industries' (FPI's) medium- and high pressure line pipe with threaded end connections.

As this pipe may contain corrosive fluids and/or operate at a high pressure level, the instructions in this manual must be followed to avoid serious personal injury or property damage.

Improper installation can cause injury or damage. Installation contractors should read and follow all cautions and warnings to avoid personal injury. They should also: observe general safety practices with all the tools, wear protective clothing when necessary and pay particular attention to section # 7 in this guide on testing.

We highly recommend that all installation contractors be trained by FPI before installing our fiberglass line pipe. For current information on field training, installation training seminars or FPI's Field Service, please contact FPI.

It is the policy of FPI to improve its products continually. In accordance with this policy, FPI reserves the right to make changes in specifications, descriptions, and illustrative material contained in this manual as the conditions warrant. The information contained herein is general in nature and does not intend to express any warranty of any type whatsoever nor shall any be implied.

This is a dynamic, live and in-process document which can be revised at any time by FPI based on the engineering analysis of a given pipe system, changes in products or ongoing improvements in installation techniques.

We accept no responsibility for the interpretation of statements made.

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## 12.0 General Instructions

### 12.1 Inspection

Upon arrival of a shipment, each pipe must be inspected. Check to see if the load has shifted, or shows signs of unusual or rough handling. Unless rough handling is evident, usually only a normal visual inspection is sufficient. A shifted load or other signs of rough treatment are cause for careful inspection of each joint. Look for light, discolored spots on the outside of the pipe resulting from impact or mechanical damage. Check pipe ends for damage, especially when the material is transported on a common carrier. Damaged or missing items should be marked on the delivery receipt. Notify the carrier's agent immediately and leave the material as received for their inspection. Replacements for shortages and damaged materials are not automatically reshipped. Replacement materials must be ordered in the normal manner. Also check the bill of lading to assure accountability of all items.

### 12.2 Transportation

#### 12.2.1 Pipes (All products)

1. Ensure the pipe ends are always protected with thread protectors.
2. Pin end and box end thread protectors shall cover the full length of the thread.
3. Ensure that the trailer bed is free from nails and sharp objects. Protect pipe against point loading or impact damage at all times.
4. Flatbed trailers or other full surface trailers are recommended for hauling fiberglass pipe. Pole trailers are specifically not recommended and any flatbed trailer used should be of sufficient length to avoid any unsupported overhang of pipe ends.
5. Side stanchions, padded either with wood or carpet type padding are recommended for loads of a height over five feet above the trailer bed. Four stanchions per side of the trailer within the length of the pipe load are sufficient.
6. Pipe layers should be stripped at four points along the axis of the pipe, one each three feet from each end and two equally spaced between those end pieces. Stripping should be placed on the trailer bed as well as between layers. In placement of the stripping attention should be given to the varying diameters of any given pipe caused by the upsets and integral joint boxes. Stripping should be placed between a maximum of every third layer for pipe of three inch size and down, between a maximum of every second layer for four inch through six inch, and between each layer for larger than six inch. Stripping must be free of nails, staples, etc.
7. Crated pipe should be stripped with one two by six across the top of each frame layer within the load. Hence, between each layer four stripping pieces should be positioned. These stripping pieces can be nailed to the top piece of each crate.
8. Tie downs must be of a fabric type as opposed to bare chain or cable. Properly padded and sleeved chains and cables may be used if the padding is in good condition.

#### 12.2.2 Fittings

1. Fittings are normally dispatched pre-packed in pallets or wooden boxes (Figure 3). All fittings in the box are separated by corrugated sheet to prevent damage. It is recommended to store fittings in the same box until they are required to be installed.
2. During shipping, strap the wooden boxes to the vehicle using pliable straps or nylon ropes.
3. When fittings are shipped individually, handle them manually (for small sized fittings) or on wooden pallets.
4. When loading and unloading, any mechanical handling equipment (such as metal slings, hooks and chains) must not come into direct contact with fiberglass pipe nor fittings.
5. Unprotected flange faces should never be placed directly on the ground or on concrete floors.

## 12.3 Storage

### 12.3.1 Pipes (All products)

1. Ensure the storage surface is clear, leveled, firm and free from rocks or any other sharp objects.
2. Pipe should be stored separately according to pressure class and diameter.
3. During storage, pipe shall be uniformly supported throughout the pipe length at all times by flat, cross boards placed under each pipe layer with spacing not greater than 6 feet. The wooden supports shall cover the length of the entire pipe until a maximum of 3 feet from the ends. Wooden wedges are used to prevent the stored pipe from sliding. Wedges should be placed on both sides of the stack on the cross timbers.
4. If Fiberglass products will be stored for long periods (6 – 12 months) or subjected to high temperatures, they must be covered with tarpaulins or polyethylene sheeting.
5. Crated pipe can be stacked and stored in the same crate as shipped.
6. It is important to note that pipe threads (both male and female) shall not be subjected to direct Ultraviolet (UV) rays. Exposure to UV rays from the sun for an extended period of time causes thread disintegration. Hence it is vital to cover them using the FPI-supplied thread protectors. In case no thread protectors are available at site, cover the threads temporarily using dark tarpaulin sheet, and arrange for replacements. The pipe surface is resistant to UV rays. For the pipe surface (non-threaded area), ultraviolet effects are only limited to surface discoloration.  
 Fiber bloom or fading may occur if the pipe is exposed to sunlight for a long period of time (1 – 2 years). As this effect is only limited to the outer 0.1 to 0.25 mm of the pipe surface, the mechanical integrity of the pipe system is not affected in any way. Pipe will operate at 100% of its rating with no effect on its physical properties

### 12.3.2 Teflon® Thread Compound

1. Teflon® thread compound must be stored in its original packaging at temperatures between 10°C to 50°C. Make sure that the container lid is always closed when not in use to prevent any contamination.
2. Keep the thread compound dry, away from frost and direct sunlight.
3. The shelf life of Teflon® thread compound is 5 years from the production date, if stored at proper conditions.
4. Teflon® thread compound does not cure after application on the threads as it is grease-based.

### 12.3.3 Thread Sealant

1. Thread sealant must be stored in its original packaging at temperatures between 10°C to 21°C.
2. Keep the thread sealant dry, away from frost and direct sunlight.
3. The Shelf Life is 6 months from the date of delivery if stored properly.

**YELLOW BOX®**  
LINE PIPE

**GREEN BOX™**  
CHEMICAL GRADE LINE PIPE

## LINE PIPE INSTALLATION INSTRUCTIONS

## 13.0 Yellow Box® Field Service and Installation Instructions

### 13.1 Field Installation Service – Line pipe

Future Pipe Industries, Inc. FPI recommends that customers with anything less than extensive experience in the installation of eight round threaded fiberglass products utilize the services of our field service technicians. Services provided range from furnishing an experienced fiberglass expert to advise and assist in the pipeline, tubing, or casing installation to, in the case of line pipe and in some locations, the actual provision of the appropriate equipment, crew, and supplies required to string, makeup, and test a fiberglass line. These services are charged on a day rate plus expenses basis and are available worldwide.

Note that the services provided do not include earthwork, excavation, construction, design, or any activities not specifically related to the assembly and makeup of the fiberglass products provided by Future Pipe Industries, Inc. Below are lists of services typically provided for line pipe installations. Due to logistical constraints not all these services are available in some locations.

Services and equipment available for the installation of fiberglass line pipe and fittings include the following:

- Hands-on supervision and assistance in the unloading, storing, handling, and stringing of the pipe along the pipeline right-of-way.
- Expertise and recommendations relative to the ditch condition, padding, and general configuration of the pipeline, manifold, or other fiberglass installation.
- Supervision and active participation in the makeup of the fiberglass pipe and fittings.
- Supervision and active participation in the hydrostatic testing of the completed pipeline.
- Cleaning and inspection of used fiberglass pipe and fittings.
- Provision of an appropriate hydraulic tong for the makeup of larger size fiberglass pipe.
- Provision of a torque monitoring computerized load cell to measure the makeup torque on the fiberglass connection.
- Provision of strap wrenches, jack stands, pipe cradles, and other miscellaneous tools required for the makeup procedure.
- The furnishing of a crew to perform the stringing, makeup, and testing of the fiberglass pipeline.
- Provision of a pickup truck.
- Provision of a stringing pipe trailer.
- Provision of the required test headers.
- Provision of pressure test equipment including a pump truck, water, and the related connection equipment required to test the pipeline.

Future Pipe Industries, Inc. field personnel have extensive and effective experience in the installation of fiberglass products in all forms of applications. Typically they can be of assistance in many aspects of a fiberglass project, only some of which are listed above. Their responsibilities, however, do not include the success or failure of a given project and their authority on a customer's work site is restricted to advice and recommendations given to the customer and his employees. Field installation services are typically not available for products not manufactured by Future Pipe Industries, Inc.

### 13.2 Stringing

1. Pipe unloading alongside the trench may be done from a frame trailer or a regular truck provided that each joint is handled individually and is set carefully on the ground. The thread protectors must remain in place throughout the stringing operation.
2. Pipe stringing should be done on the ditch side opposite to the excavated dirt as close as possible to the ditch to avoid any additional handling.
3. Allow sufficient space between the pipe and the trench for excavator, cranes, etc. Avoid placing the pipe where it can be damaged by equipment traffic. If possible, store all pipe on soft level ground (ex: sand), wooden supports, or sand bags.
4. Pipe stringing should be done with the pin end in the direction of flow and the box end toward the pressure source. The flow should flow out of the pin and into the following box.



Pipe stringing inside the trench



Pipe stringing above the trench

### 13.3 Trench Preparation

1. Trench excavation should not be too far ahead of the pipe laying team to ensure better control of the trench as well as for safety reasons. The excavated soil should be placed on one side of the trench, while allotting the other side for pipe or lifting equipment. If the trench consists of various layers of soils, these should be placed separately in order to use stone-free material for backfill.
2. Trench width must be maintained within certain limits. Minimum trench width depends on the method which is used to make-up the pipe. The minimum recommended trench width is given in Table A.
3. The trench should be deep enough to allow the deposit of a protective padding layer of sand or fine grain soil. The bottom of the trench should be uniform in depth to avoid uneven bearing on the pipeline. When there is no traffic load over the pipe, the minimum burial depth is 3.5 feet. In case of traffic loads, refer to Table B.
4. After the excavation of the trench, any sharp objects or rocks left in the trench should be removed or padded prior to laying the line pipe inside the trench.
5. Do not violate the bending radius limitations indicated in the product technical data sheets. Any bends in excess of such radii should be accommodated by an appropriate fitting or by adjustment of the trench.
6. Conduit is recommended for road crossings and centralizers are recommended within the conduit as well. Centralizers must be placed such that at no point is the pipe in contact with the steel conduit. In lieu of conduit, an additional one foot layer of pad sand may be used above the pipe. See **figure – 1**, and **picture – 1**.
7. In configurations involving fittings where the line changes directions, reduces, or where excessive expansion variations are anticipated, thrust blocks, particularly in cases where the operating pressure exceeds 1500 psi, are recommended. Thrust blocks should be constructed from cast concrete and should surround the fitting entirely to the following dimensions in all directions:

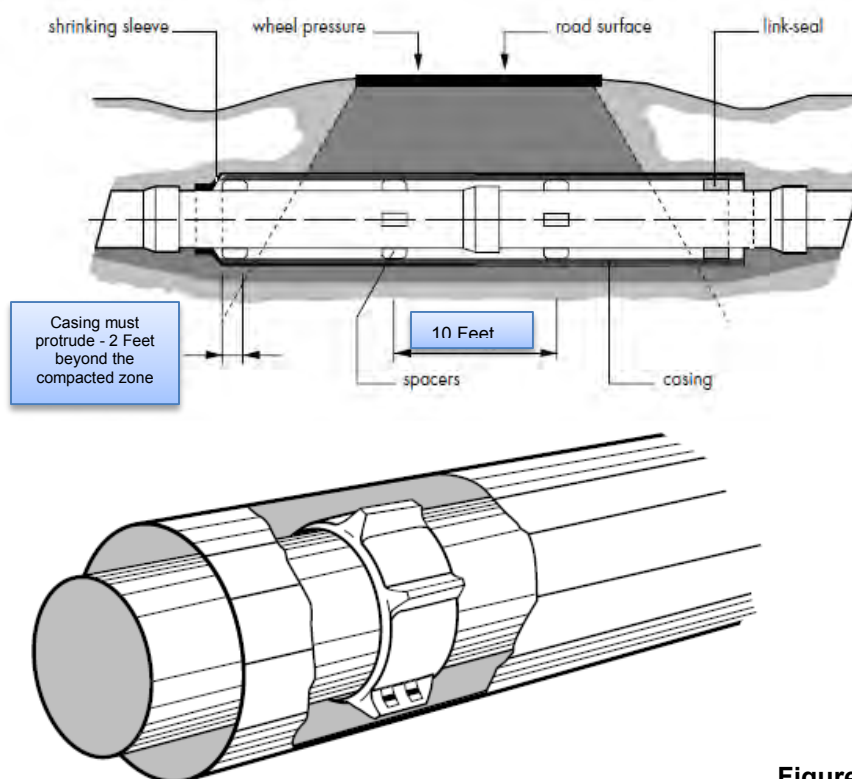
|                   |     |
|-------------------|-----|
| 2" - 3" Fittings  | 18" |
| 4" - 6" Fittings  | 24" |
| 8" - 12" Fittings | 36" |

**Table A:** Minimum recommended trench width

| Pipe Size | Min. Trench Width while making up the joints inside the trench | Min. Trench Width while making up the joints above the trench |
|-----------|--|---|
| All Sizes | 10 X Pipe DN,  | 3.5 X Pipe DN,<br>with a minimum width of 20 inches           |

**Table B:** Recommended trench depth in the presence of occasional traffic loads.

| Load Type    | Traffic (wheel Load) |        | Minimum burial depth |
|--------------|----------------------|--------|----------------------|
|              | KN                   | Lbs.   | Feet                 |
| ATV LKW 12   | 40                   | 9,000  | 3.5                  |
| ATV SLW 30   | 50                   | 11,000 | 3.5                  |
| AASHTO HS-20 | 72                   | 16,000 | 3.5                  |
| AASHTO HS-25 | 90                   | 20,000 | 5.0                  |
| ATV SLW 60   | 100                  | 22,000 | 5.0                  |



**Figure 1**

#### **Note: High Water Table Conditions**

Pipe lowering should always take place in a dry trench. It is not acceptable to lay pipe in flooded trenches. The civil contractor should provide necessary dewatering equipment to enable the installation in a dry trench. In order to prevent pipe from floating, a minimum cover depth equal to one pipe diameter of granular soil (minimum dry density of 118 lbs/ft<sup>3</sup>) must be provided. If a specific analysis is made of the buoyant force of an empty pipe compared to the submerged weight of soil over the pipe, this minimum cover may be reduced. Always ensure that this minimum cover is available before turning off the dewatering pump.



**Picture 1:** Centralizer and rubber end-sleeve

## 13.4 Basic Tools & Equipment

### 13.4.1 Wrenches

All joints supplied are designed with an extra thickness or upset at each end. During the makeup, breakout, or any operations involving the application of a strap wrench, chain tong, or other gripping device, only this upset area should be used.

**Warning:** Do not use conventional steel pipe wrenches to make up fiberglass pipe. Steel pipe wrenches apply concentrated point loading on the pipe wall and can easily damage the pipe. Use of pipe wrenches will void Future Pipe warranty.

See **Table C** for the recommended type and number of wrenches for make-up of Yellow Box® and Green Box®

- **Strap Wrench**

Strap wrenches (**Picture 2** and **Picture 3**) distribute the torque circumferentially and are recommended to help prevent placing too much torque on the connection. For best results when using strap wrenches, the strap should be free from grease, thread lubricant, etc. Use a silica-based powder (Comet or Ajax powder) to prevent the strap wrench from slipping. A wire brush may be needed to clean any residue from the straps prior to fresh powder to the inside of the strap.

When using a strap wrench, ensure not to point-load the tubing. Point loading can collapse or damage the pipe wall when the wrench is pointed perpendicular into the pipe.

Two types of strap wrenches are commonly used:

1. Ridgid® No. 5 strap wrench (**Picture 2**) is normally used for makeup of 3" diameters and smaller. The handle of this wrench is approximately 18" long.
2. The 24" cast aluminum strap wrench (**Picture Error! Reference source not found.3**) is normally used with 4" and arger diameter pipe during makeup, or as a backup wrench on smaller diameters. The handle of this wrench is about 24" long. This strap wrench could also be used in "hand-tightening" for larger diameter pipe.

**Picture 2:** Ridgid® No. 5 strap wrench



**Picture 3:** Cast Aluminum strap wrench



- **Friction Wrench**

Friction wrenches (**Picture 4**) are heavy duty wrenches with curved or 360° wrap-around jaws. The curvature of the jaws should be the same as the pipe OD. Friction wrenches work well as back-up wrenches. Friction wrenches are recommended for 4" and larger diameters.

Note: Check the ID and adjustability of the friction wrench versus the OD of the pipe being installed.

**Picture 4:** Manual friction wrench fitted with an optional torque indicator



- **Chain Tong**

Chain tongs (**Picture 5**) can be used as long as the nose of the wrench does not point-load the pipe.

- **Power Tong**

Power tongs are used to generate torque values which are difficult to achieve manually. If used correctly, power tongs provide a more consistent make up versus manual make up. See **Picture 6**.

**Picture 5:** Chain tong



**Picture 6:** Power tong



**Table C:** Recommended installation tools per crew

| Pipe Diameters | Wrenches               |
|----------------|------------------------|
| 2"             | 1A & 1B or 2B          |
| 2 1/2"         | 1A & 1B or 2B          |
| 3"             | 1A & 1B or 2B          |
| 4"             | 1A & 2B or 1A, 1B & 1C |
| 5"             | 1A & 2B or 1A, 1B & 1C |
| 6"             | 1A & 2B or 1A, 1B & 1C |
| 6"-L           | 1A & 3B or 1A, 2B & 1C |
| 8"             | 1A & 4B or 1A, 2B & 1C |
| 10"            | 1A, 2B & 1C            |
| 10"-L          | 1A, 2B & 1C            |

**Key:**

- A            Ridgid® No. 5 or 24" Cast aluminium strap wrench
- B            Friction wrench or chain tong
- C            Power tong
- 1, 2, 3 or 4   Indicates the quantity of required wrenches

#### 12.4.2 Brushes

Two types of brushes are commonly used:

1. Dope brush for applying Teflon® thread compound (**Picture 7**).
2. Stiff bristle brush to clean threads (**Picture 8**).

#### 13.4.3 Pipe Stands

Two types of stands are commonly used to support the pipe during joint makeup:

1. Pipe jack (**Picture 9**) or adjustable pipe-stand (**Picture 10**).
2. Lazy board or fixed pipe-stand (**Picture 11 & Picture 12**).

#### 13.4.4 Thread Compound or Sealant

##### • Teflon® and Thread Compound

FPI recommends using TF-15 thread compound and Teflon® tape for all liquid applications. Teflon® tape should be 25 mm wide and 0.1 mm thick and shall contain 100% Teflon®.

Minimum properties of Teflon® thread compound for use on the threads:

1. 15% minimum Teflon® content.
1. 60 to 120 mesh Teflon® particle size (powder is unacceptable).
2. The lubricant must be of API standard oilfield thread lube composition.
3. The lubricant should not be thickened with abrasives, clay, etc.

##### • Thread Sealant

For all dry gas applications, FPI recommends a polysulfide based thread sealant. This one-part sealant cures in between 10-15 minutes once exposed to moisture or humidity. Once the sealant is applied on the threads, a small amount of water is sprayed before the joint makeup by using a water spray bottle. This thread sealant should be considered permanent in that disassembly of a connection made with this compound is problematic. This thread sealant should also be used on all large-diameter with 6 round threaded connections, and on all pressure classes above 172.5 bar (2,500 psig).

**Picture 7:** Dope brush



**Picture 8:** Stiff bristle brush



**Picture 9:** Pipe jack



**Picture 10:** Adjustable pipe stand



**Picture 111:** Fixed pipe-stands made of steel



**Picture 12:** Fixed pipe-stands made of light-weight material (hard plastic or hard rubber)



## 13.5 Crew Size & Visual Inspection

### 13.5.1 Crew Size

It is difficult to give a broad recommendation for the number of people needed on a specific installation since this varies with the type of installation. The personnel requirements vary depending on the pipe size, pipe weight, and installation location, surroundings of the job site, weather conditions and other similar influences. Generally, a minimum of five people are needed to install threaded fiberglass line pipe. The normal number of personnel required to operate each installation tool is given below:

| Tool type       | No. of personnel required |
|-----------------|---------------------------|
| Strap wrench    | 1                         |
| Friction wrench | 2                         |
| Chain tong      | 2                         |
| Power tong      | 2                         |
| Pipe stand      | 1                         |

### 13.5.2 General Precautions

If it is required that the pipeline be left unattended for more than 1 hour (example: during lunch hour), thread caps or similar protection should be installed on open ends of the installed line. This is to avoid any sand / dirt / mud from intruding into the line. It is required that any open ends of the line be capped overnight.

In case of sand/dust storm, snow, hail or rain, use an appropriate shelter such that the joint to be made up is protected from adverse weather conditions. In case of sunny, cold, humid or foggy weather, joint installation can continue as normal provided the sealing compound is stored at the correct conditions described in sections 13.4.2 and 13.4.3

### 13.5.3 Visual Inspection: Pipe & Fittings

All pipe, fittings and components shall be visually inspected for damages that may have occurred during shipment. 100% of the exterior surface shall be inspected visually and the internal surface shall be inspected where accessible. Defective pipe or fittings must not be used in the pipe system.

### 13.5.4 Visual Inspection: Threads

Threads shall be cleaned before any visual inspection. In case the integrity of the threads is under doubt, the site supervisor shall be contacted to check the fitness of the thread. A detached thread may lead to cross threading, in which case the joint needs to be backed out and the threads must be re-examined for any possible damage.

Threads shall be free from visible tears, cuts, grinds, shoulders or any other imperfections which break the continuity of the threads within the normal mating surface on the pin and the box at the final makeup position. Superficial scratches and surface irregularities that do not affect the continuity of thread surfaces are occasionally encountered and may not necessarily be detrimental. Use API 15HR as a reference for acceptable visual standards for threads. As a guide to acceptance, the most critical consideration is to ensure that there are no detectable protrusions on the threads to score mating surfaces. During installation, if thread damage is suspected, lay the joint aside and replace it. In case a wrong makeup is observed, break out the connection and continue installation as normal after inspecting the retrieved threads.

If the thread has been previously used and is being reinstalled, remove sand, dirt or any foreign material which may cause improper make up and sealing. Wash pin and box threads with mineral spirit or a solvent such as acetone which will remove the old thread lubricant, tape or foreign material. Dry both threads completely. Any liquid left in the base of the threads will prevent good thread lubrication.

### 13.5.5 Visual Inspection: Thread Compound / Thread Sealant

Thread compound shall be inspected prior to its use, ensuring that there is no foreign matter

- In case the Teflon® thread compound is used, ensure that it is between 10°C and 50°C for optimum brush-ability.
- In case thread sealant is used, ensure that its temperature is between 40°C and 55°C to ensure correct application.

## 13.6 Pipe Assembly

The procedures in this section are general in nature. More specific, additional details may be provided during the actual installation in the form of project specific work instructions. It must be ensured that all levels of staff are aware of these procedures in order to ensure the quality of connection. It is important that only qualified personnel perform the thread makeup procedure. The objective is to ensure that the installed pipeline will meet the specified performance requirements. Although these procedures are as complete as possible, it is impossible to describe every circumstance that may be encountered in the field. Because of this, FPI's experienced site supervisor may vary the described procedure in order to achieve an optimum solution using the latest installation techniques.

In case the joining is performed without the supervision of FPI's supervisor, the responsibility of proper makeup (torque application) lies with the end-user, or their contractor.

1. On some occasions the trench dimensions allow the makeup of joints to be performed in the ditch. In most cases, it is not feasible and the pipeline must be assembled outside the trench and then lowered into the ditch.
2. The following procedure should be observed when performing the actual makeup of the joints.
  - a. The thread protectors should remain in place until immediately prior to the actual makeup process. Once removed the threads should be inspected to insure that they are clean and dry. If necessary, a light application of a dry hard bristle brush may be used to remove any sand or dirt from the box and pin threads.
  - b. Once clean, the Teflon tape can be applied to the pin thread. Teflon tape is recommended for any line pipe applications. Though 8Rd threads will seal with thread compound only, Teflon tape allows a wider and more forgiving margin in terms of the accuracy of the makeup torque applied to the joint. To apply the tape, a one inch or wider roll (**Picture 13**)
    - i. Should be rolled, under tension, around the pin threads in a clockwise direction.
    - ii. Starting at the pin nose, or smallest thread of the pin, wind clockwise up the pin thread to the fourth thread from the end. Reverse direction and continue winding back down the pin to the last and smallest thread or starting point. The tape should be lapped enough to ensure full coverage on every application revolution.
  - c. After application of the tape, both the box and pin should be covered thoroughly with thread compound. The compound must be a low shear type compound. Dependent on conditions, TFC#15, Enhanced TFC#15, or OCT sealant, without Teflon tape, are recommended. Consult with FUTURE PIPE INDUSTRIES, INC. for the appropriate recommendation for each application. (**Picture 14**)

The following are typical compound and tape usage rates:

| Pipe Size | Per Gallon Pail                     | Per Roll of Tape                 |
|-----------|-------------------------------------|----------------------------------|
| 2"        | 3,200 ft. (approx. 107 connections) | 240 ft (approx. 8.0 connections) |
| 2-1/2"    | 2,800 ft. (approx. 93 connections)  | 210 ft (approx. 7.0 connections) |
| 3"        | 2,500 ft. (approx. 83 connections)  | 150 ft (approx. 5.0 connections) |
| 4"        | 1,800 ft. (approx. 60 connections)  | 120 ft (approx. 4.0 connections) |
| 5"        | 1,400 ft. (approx. 47 connections)  | 90 ft (approx. 3.0 connections)  |
| 6"        | 1,300 ft. (approx. 43 connections)  | 60 ft (approx. 2.0 connections)  |
| 6"-L      | 1,100 ft. (approx. 37 connections)  | 60 ft (approx. 2.0 connections)  |
| 8"        | 600 ft. (approx. 20 connections)    | 30 ft (approx. 1.0 connection)   |
| 10"       | 500 ft. (approx. 17 connections)    | 26 ft (approx. 0.8 connections)  |
| 10"-L     | 450 ft. (approx. 15 connections)    | 22 ft (approx. 0.7 connections)  |
| 12"       | 390 ft (approx. 13 connections)     | 20 ft (approx. 0.67 connections) |

- d. Once the thread compound is applied, the single joint should be raised and lined upon an axis common to the preceding line and the pin gently introduced into the box. Both the made up line and the consecutive single joint should be supported. Adjustable pipe jacks or pipe stands are recommended for this support and much care must be given to proper alignment both at the start of the makeup and throughout the torque application process. Poor alignment at the start of the makeup will cause a cross thread in the connection, and poor alignment later in the makeup will produce inaccurate and misleading torque indications.

- e. The thread makeup should be delicately started by hand and the alignment of the connection should be constantly observed to avoid cross threading.

The position of the far end of the single joint should be adjusted as the initial makeup proceeds in order to maintain a smooth constant rotation which will require a steady increase of torque necessary to turn the joint deeper into the connection. The connection should be made up in this fashion until hand tight and then, in sizes 4" and smaller, tightened with a strap wrench.

**Position the Strap Wrench on the heavier upset area of the pipe where the Strap-Lock is applied.** If the pipe does not make up properly, and at the first indication of a misaligned or improper makeup, back the joint out, clean the threads, inspect the threads carefully for cross thread damage, reapply Teflon tape and sealing compound, and remake the joint.

- f. For sizes 5" and larger, after the hand tight makeup as described above is concluded, the connection should be tightened with 36" chain wrenches. One wrench should serve as the backup on the existing line while the other wrench, equipped with a four foot cheater is used to tighten the single joint. Be certain to latch the chain wrench only on the Strap-Lock area in the heavier upset area of the pipe a few inches back from the threads. Pipe wrenches are not recommended as they apply a less distributed bearing on the circumference of the pipe. Apply torque as per the table below without "bouncing" on the wrench.
- g. Power tongs, if particularly designed to apply controlled torque to fiberglass pipe without damaging the pipe body, are recommended for all pipe sizes and are strongly recommended for the larger sizes where the higher torques are difficult to apply accurately by hand.
- h. The following Table shows the recommended torques required for each pipe size using TFC#15 thread compound. Proper and controlled torque is required to ensure a leak tight connection.

|                                  | Pipe Size | Torque |   |                |
|----------------------------------|-----------|--------|---|----------------|
|                                  |           |        |   |                |
| <b>Integral Joint Pipe</b>       | 2"        | 110    | - | 140 ft. lbs.   |
|                                  | 2 1/2"    | 175    | - | 200 ft. lbs.   |
|                                  | 3"        | 275    | - | 325 ft. lbs.   |
|                                  | 4"        | 350    | - | 400 ft. lbs.   |
|                                  | 5"        | 475    | - | 525 ft. lbs.   |
|                                  | 6"        | 700    | - | 750 ft. lbs.   |
|                                  | 6"-L      | 950    | - | 1,000 ft. lbs. |
|                                  | 8"        | 1,200  | - | 1,300 ft. lbs. |
|                                  | 10"       | 1,400  | - | 1,500 ft. lbs. |
| <b>Threaded and Coupled Pipe</b> | 8"        | 1,400  | - | 1,600 ft. lbs. |
|                                  | 10"       | 1,500  | - | 1,700 ft. lbs. |
|                                  | 10-L      | 1,600  | - | 1,800 ft. lbs. |
|                                  | 12"       | 1,700  | - | 1,900 ft. lbs. |

- i. When lowering the line into the ditch, care must be taken not to allow it to "whip" into the trench. It should be gently and consecutively lowered and control over the position of the line must be maintained at all times. Care must also be exercised against the tendency to dislodge rocks and other sharp or hard material from the trench sidewalls or from the surface onto the line by the lowering action.

**Picture 13:** Application of Teflon® tape.



**Picture 14:** Thread compound application.



**Picture 15:** An example on the use of cradle and cargo-crane truck to achieve alignment



**Picture 16:** Joint makeup tools

**Picture 17:** Making up the elbow directly on the pipeline

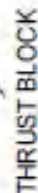


**Picture 18:** Making up the elbow with a pipe nipple



**Picture 19:** Typical thrust block





IN THE DIRECTION OF THRUST POUR THE BLOCK FULLY AGAINST THE FRESH CUT DITCH WALL.

|   |         |      |         |           |         |
|---|---------|------|---------|-----------|---------|
| REV#  |         | DATE | APP#    | REVISIONS |         |
|   |         |      |         |           |         |
|   |         |      |         |           |         |
|   |         |      |         |           |         |
|   |         |      |         |           |         |
| <p><b>FUTURE PIPE INDUSTRIES, INC.</b><br/>HOUSTON, TEXAS (281) 847-2987</p> <p><b>THRUST BLOCK DIAGRAM</b></p> |         |      |         |           |         |
| CATALOGUE INSERT  |         |      |         |           |         |
| PROJECT   | 04/25-1 | DATE | 4/23/01 | NO. M     | REVISED |
| BY  |         | LAST |         | BY        | DATE    |
| APP#  |         | DATE |         | APP#      | DATE    |

### 13.7 Pressure Testing

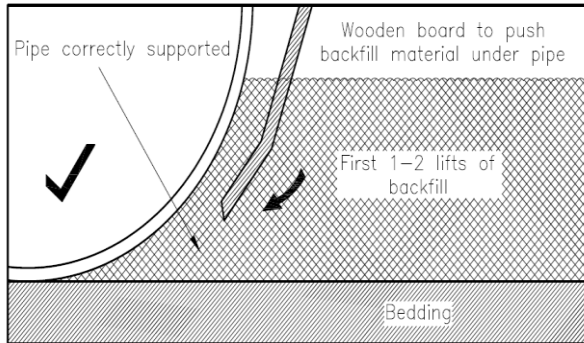
1. Pressure testing is normally required to ensure that the assembled line will withstand the required operating pressures.
2. Prior to testing, the line should be padded and fully back-filled over the body area of the pipe between the connections to secure the line and minimize the movement caused by the testing pressure. At this stage thrust blocks, if required, should be in place and cured. Connections should be left open and observable for inspection during the test.
3. Water is the most common media used to perform the test and the necessary quantity should be introduced into the pipeline in such a manner as to evacuate all air from the line prior to introducing the test pressure. Shorter lines may be configured in such a manner as to allow one end to be elevated whereby the air will naturally evacuate as the line fills. Most lines however will require the use of a simple flexible foam pig which is introduced into the line at the pressure end and pumped through the line under continuous pressure. Any significant amount of air which remains entrapped in the line during the test will become compressed during the pressurization and may produce confusing and misleading fluctuations in the pressure readings. On longer and larger lines be sure to have enough test water on hand to fill the line continuously as significant interruptions to wait for additional water will defeat the pig's purpose to evacuate the air from the line.
4. Once filled and free of air, the line should be closed off at the far end and the pressure increased in increments with a waiting period of a minimum of three minutes between each increase. 400 psi per increment is recommended until the desired pressure is reached. The waiting periods allow the minor movement and growth in the line caused by the pressure to stabilize.
5. The field test pressure should not exceed **1.0 times the internal rated pressure** of the pipe, unless discussed otherwise with Future Pipe Industries. Typical site hydro test duration is 2 to 4 hours. After reaching test pressure the pump apparatus should be isolated from the line by the valve on the test header. Several pressure fluctuations which are not leak related may then be observed. Initially the pressure will drop slightly as the line moves and grows to accommodate the pressure. This fluctuation will then stabilize. The pressure may, however, be significantly affected by changes in the ambient temperature; an increase in temperature will produce an increase in pressure while a decrease in temperature will produce a decrease in pressure. Further, the pressure may fluctuate either up or down as the temperature of the test water adjusts to the difference in environment between the truck's tank and the pipeline. If the pressure increases above the intended test pressure of the pipe, it must be bled off accordingly.

**Ensure that all the Line-pipe is in the ditch during the testing. Never test the pipe that is partially in or partially out of the ditch.**

### 13.8 Back-Filling

1. Back-filling should be accomplished as soon as possible after testing to avoid any damage due to cave-in, flooding, or freezing of the test water in the line. Release the test pressure from the line prior to back-filling. If weather conditions have the potential to freeze the test water in the line, the water must be cleared from the line by forcing a flexible foam pig through the line with compressed air. Frozen test water will, in virtually all circumstances, cause the pipeline to crack.
2. Sand or loose fine particle soil pad should be placed over the line at a thickness of one foot. The natural fill can then be deposited on top of that pad. Be certain that the line is well and evenly supported by the padding beneath the line. Avoid any bridging configurations and keep the line in the center of the trench surrounded on all sides by padding. Multiple lines that are in the same ditch should be separated by padding and not allowed to contact.
3. Appropriate hand or mechanical tamping shall be carried out by the civil contractor to achieve the specified degree of compaction required. During the first one or two lifts, special care should be taken to place and to compact the backfill material under the pipe haunches, which could be achieved manually by means of a wooden board. This step is important during installation and should be executed with care. Refer to **Figure – 2**.
4. The Contractor should note that the compaction of clean and mixed sand is best achieved when the material is at

its optimum moisture content. While the wetting of sand is recommended prior to compaction, trench flooding should be avoided to prevent the pipe from floating. Following the first two layers where the backfill has been correctly placed, compaction should proceed from the sides of the trench towards the pipe. Clean backfill must be used with vibrator equipment to avoid driving stones or foreign material into the pipe wall. Refer to **Picture 20**.



**Figure - 2: Backfilling pipe-haunches**



**Picture - 20: Compaction after backfill.**

### 13.9 Steel to Fiberglass Threaded Connections

FUTURE PIPE INDUSTRIES, INC.'S connections up to and including 4" are manufactured with API 8Rd EUE Long Form Threads. When connecting into steel female 8Rd threads, which are API 8Rd EUE short form, a number of excess threads must be cut off the fiberglass pin. The following table details the length of the cuts required for each pipe size. When making up a steel short form pin into a fiberglass box, no adjustments are necessary. The connections on pipe sizes larger than 4" are API 8Rd Casing Long Form, which typically is the thread type used on the same larger steel pipe.

|                |   |                               |
|----------------|---|-------------------------------|
| 2"             | - | Cut off 5 threads (5/8" long) |
| 2-1/2"         | - | Cut off 6 threads (3/4" long) |
| 3"             | - | Cut off 6 threads (3/4" long) |
| 4"             | - | Cut off 7 threads (7/8" long) |
| Larger than 4" | - | No adjustment necessary       |

A regular hacksaw can be used to cut off the excess threads. When making up fiberglass to steel threaded connections always use the fiberglass torque value detailed previously in **Section 13.9**

### 13.10 Installation of Fittings and Flanges

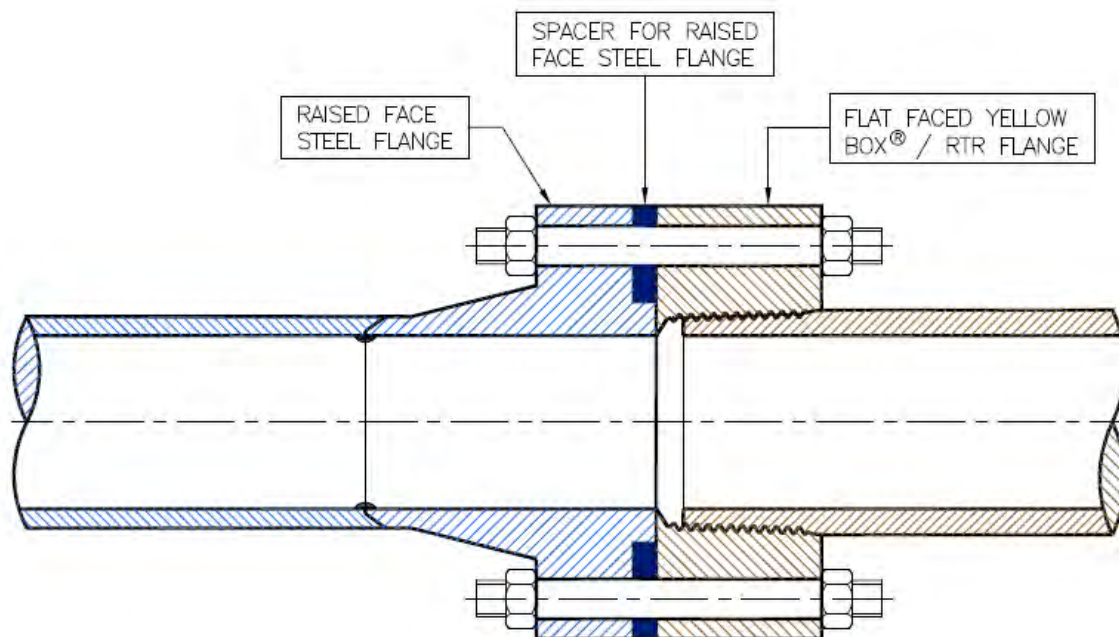
All fittings involving a change in direction, such as elbows or tees, require concrete thrust blocks to avoid distorting and cracking the fitting as a consequence of the misdirected axial thrust of the two intersecting lines. Future Pipe Industries, Inc. recommends that thrust blocks be poured to encapsulate the entirety of the fitting extending a minimum of two and a half pipe diameters in length down the incoming and outgoing joints of pipe connected into the fitting. Further, the concrete should extend around the fitting two and a half times the fitting diameter in all directions. See the diagram in this section for details. Fittings should be made up to the same torque value as that specified for the equivalent size pipe.

Fiberglass flanges are flat face configuration flanges and should be mated with flat face steel flanges only. If a raised face flange must be used a spacer ring should be used to take up the raised face shoulder and present a flat surface to the fiberglass flange face. See **Figure 3**. Flange bolt torque values are detailed below and should be observed.

| PIPE SIZE | 2  | 2-1/2 | 3   | 4   | 5   | 6-5/8 | 7-5/8 | 8   | 10   | 12   |
|-----------|----|-------|-----|-----|-----|-------|-------|-----|------|------|
| ANSI 150  | 74 | 87    | 128 | 92  | 124 | 178   | 178   | 252 | 353  | 261  |
| ANSI 300  | 37 | 48    | 71  | 106 | 144 | 134   | 134   | 237 | 317  | 411  |
| ANSI 600  | 42 | 59    | 88  | 164 | 261 | 241   | 241   | 401 | 474  | 488  |
| ANSI 900  | 77 | 114   | 132 | 251 | 379 | 317   | 317   | 545 | 629  | 717  |
| ANSI 1500 | 77 | 114   | 205 | 334 | 489 | 458   | 458   | 740 | 1390 | 1339 |

Torque values (lbs-ft)

**Figure 3:** Examples of raised face (RF) flange, flat faced (FF) flange and spacer for RF flange.



**Note:** Gasket is not shown in this figure

**Picture 21:** Example of a SS316 spacer for raised face steel flange and a steel backing plate / ring for YB flange.



## **13.11 Repair Joints and Field Threads**

Depending on site conditions, there are primarily three methods for repairing a leaking RTR line:

### **13.11.1 Spare Joint with Flanges & Coupling**

If a spare joint of pipe of correct length and correct configuration is available on site, it may be easier to replace the leaking joint by using a spare joint and a set of fiberglass flanges.

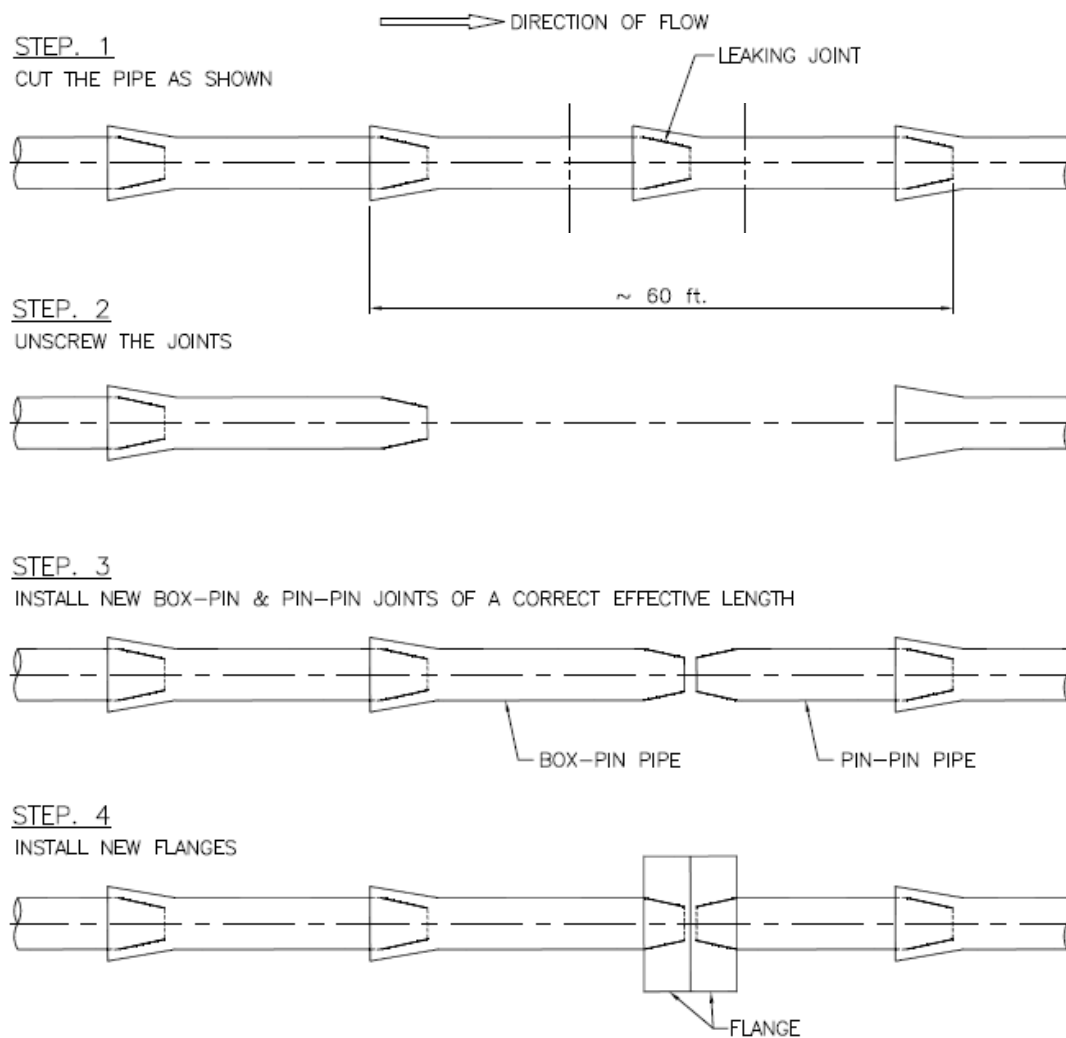
Prior to initiation of this repair procedure, ensure that enough backfill is excavated so as to enable movement of pipeline during repair and flange alignment. If site conditions do not allow such excavation, then two sets of flanges can be used instead of one set to minimize excavation length.

There are 4 different types of leakage:

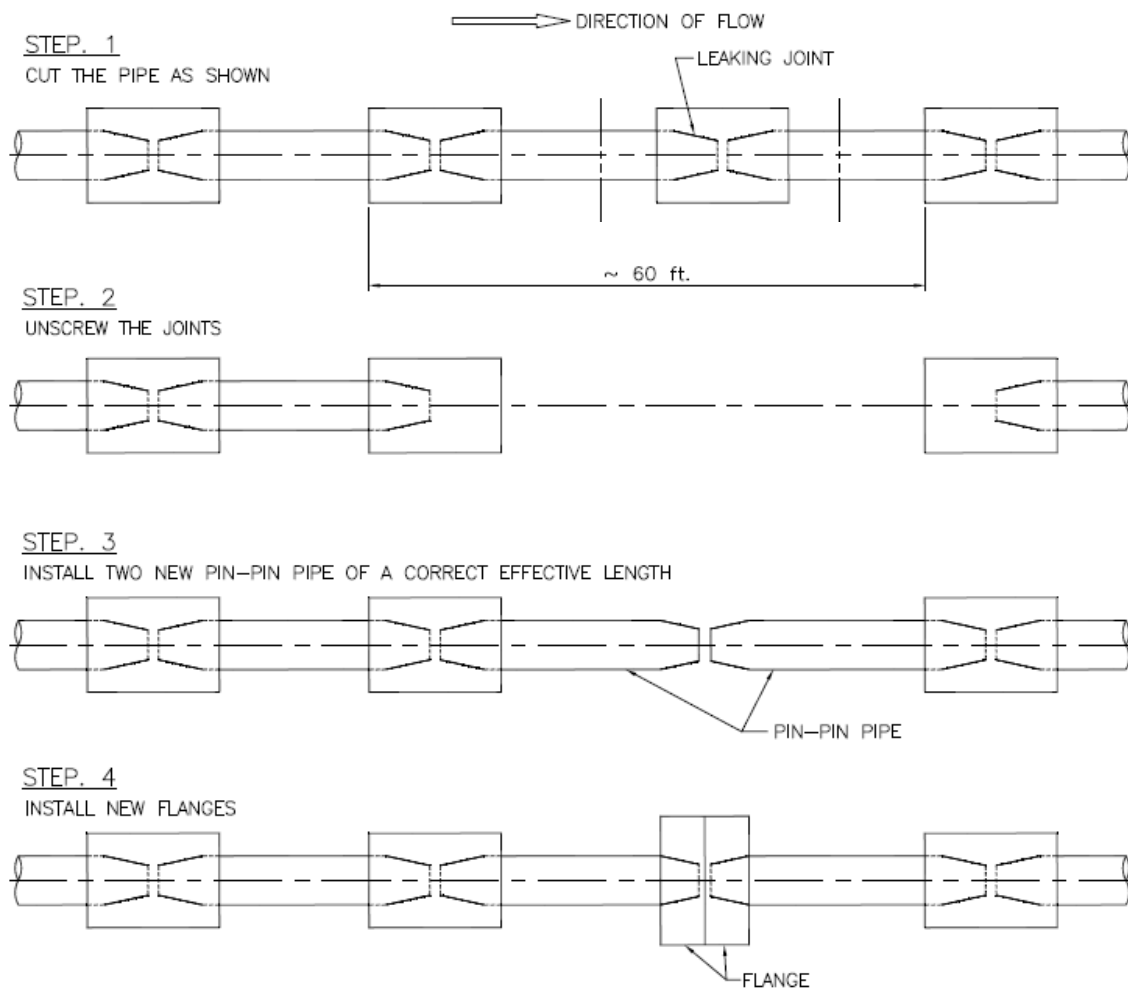
1. Leaking joint (integral box).
2. Leaking joint (coupling).
3. Leaking pipe (between integral boxes).
4. Leaking pipe (between couplings).

Replacement of the leaking line with each of these types is outlined in Figure 4, Figure 5, Figure 6 and Figure 7 respectively.

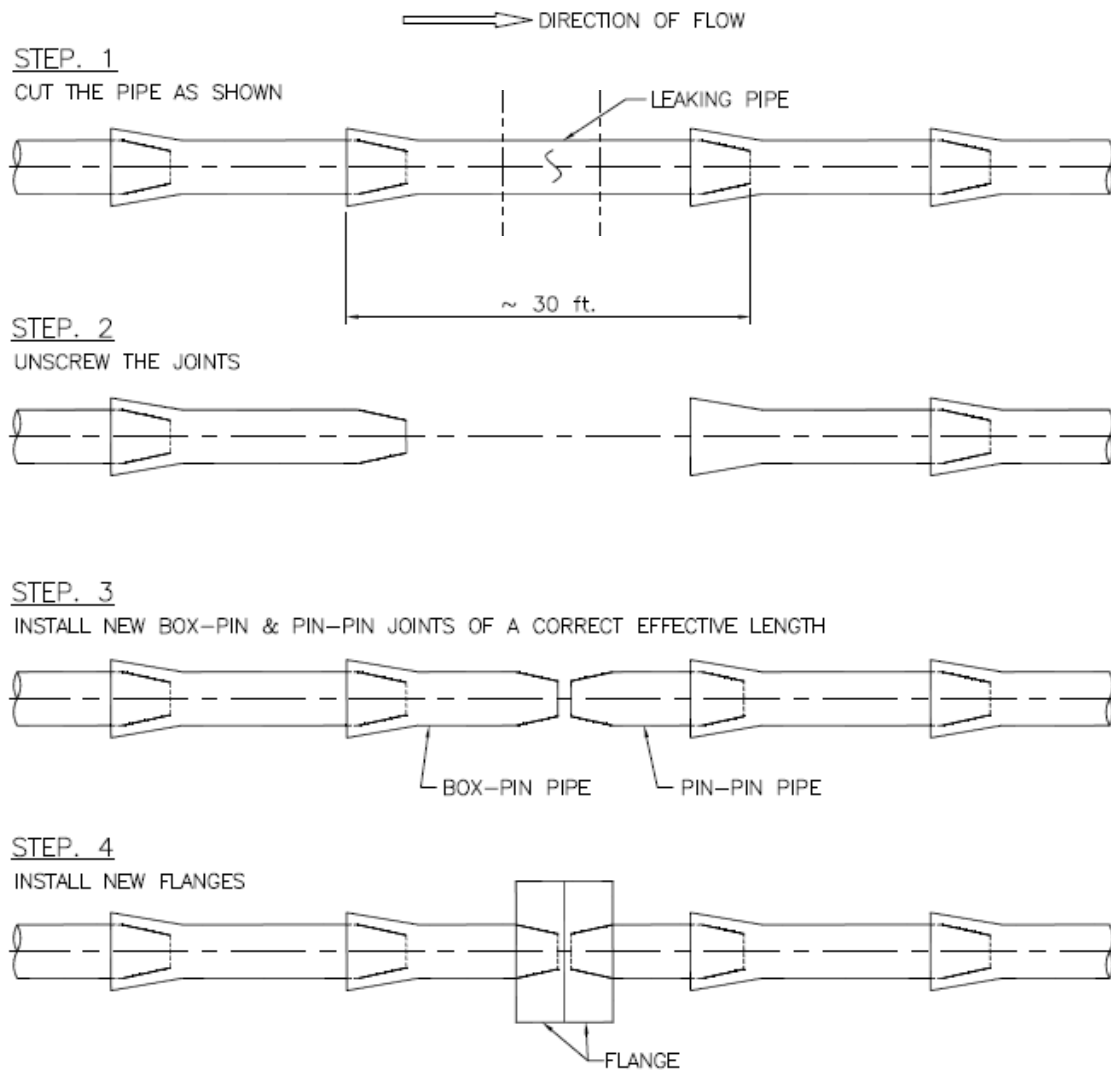
**Figure 4: Replacement of a leaking Joint (Integral box).**



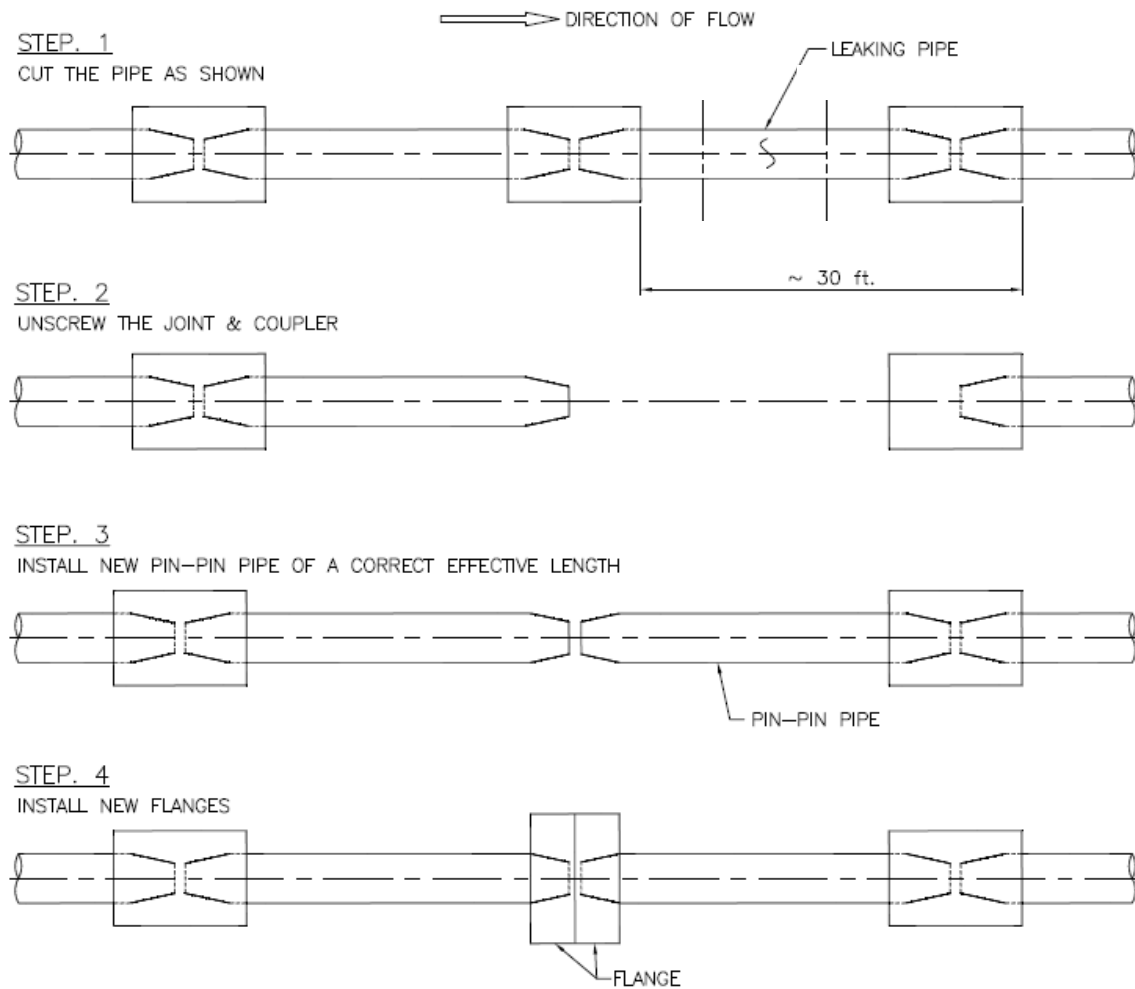
**Figure 5: Replacement of a leaking Joint (Coupling).**



**Figure 6:** Replacement of a leaking pipe section (between integral boxes).



**Figure 7:** Replacement of a leaking straight pipe section (between couplings).



### 13.11.2 Factory Repair Joint

1. A factory repair joint is simply a full length joint of pipe cut into two sections with a set of flanges in the middle.
2. This repair joint is shipped from the factory in two sections, such that it forms a full pipe length from end-to-end when assembled. These two sections consist of box-flange and pin-flange configuration respectively.
3. The leaking pipe in the field is cut into two sections and each section is unscrewed from the adjacent joints.
4. Both sections of the repair joint are installed and the flanges are then bolted up.

The installation procedures for field threads (**Figure 8**) and repair joints (**Figure 9 & Figure 10**) are detailed on the three drawings as follows:

## FUTURE PIPE INDUSTRIES, INC. THREAD KIT INSTALLATION

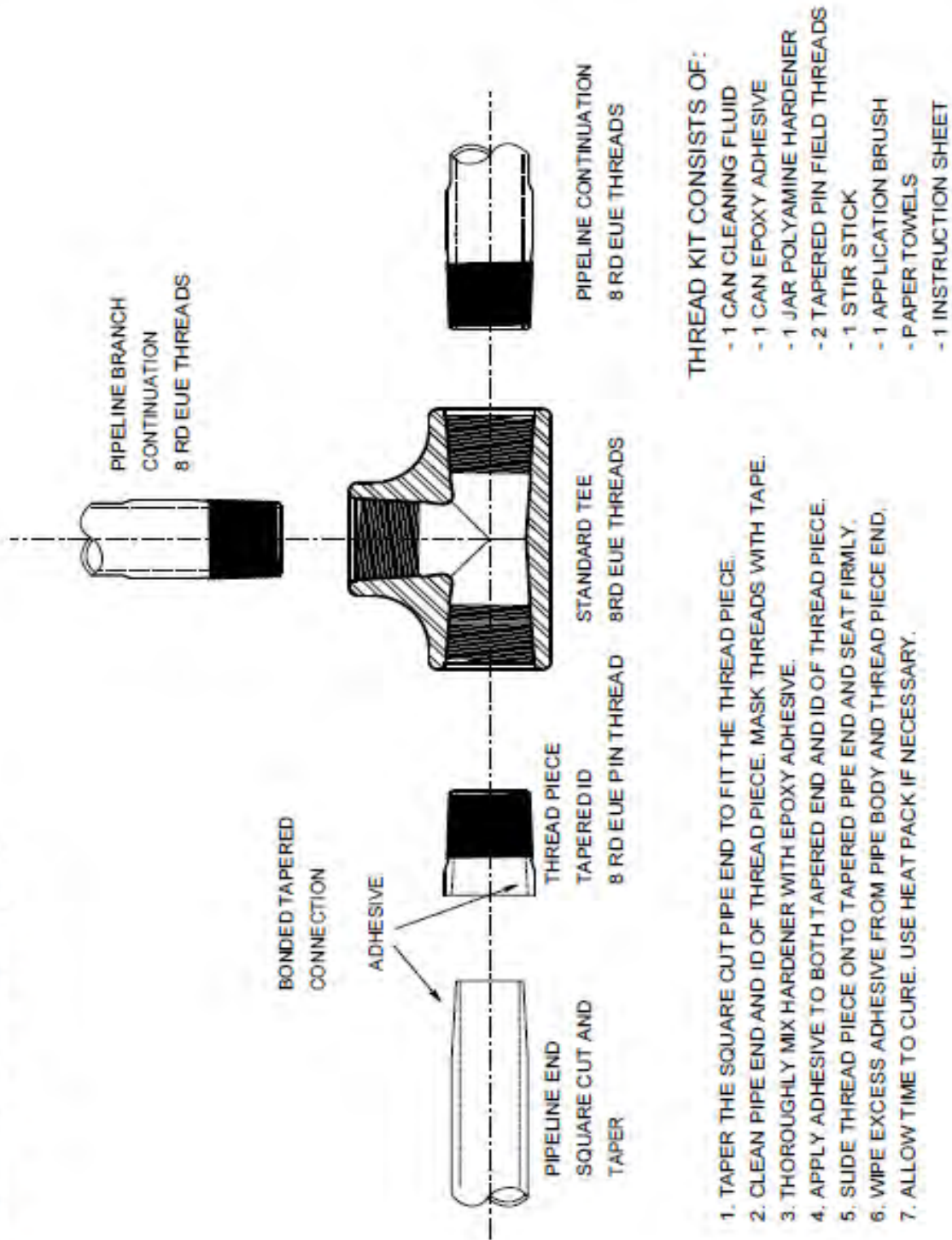


Figure 8

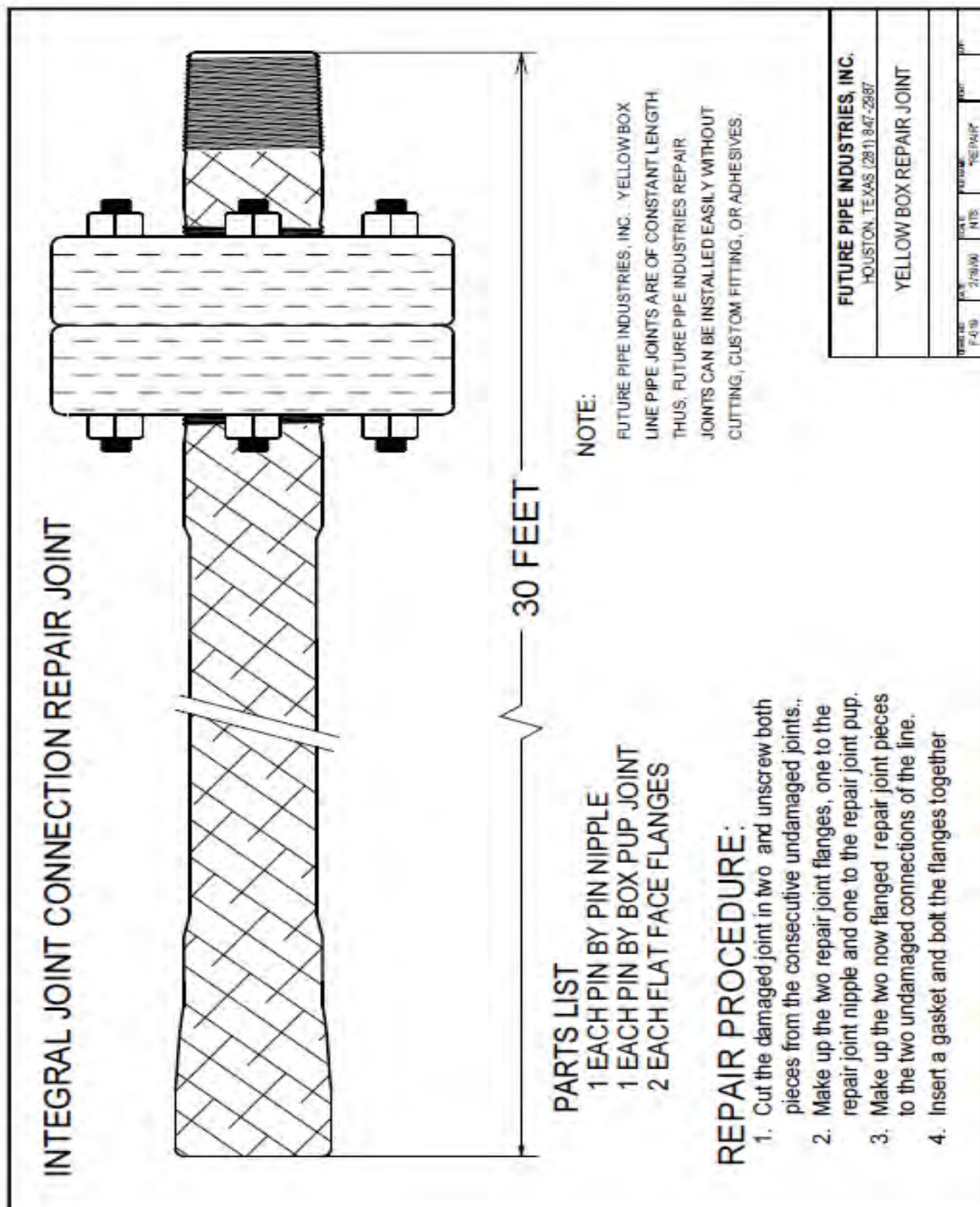


Figure 9

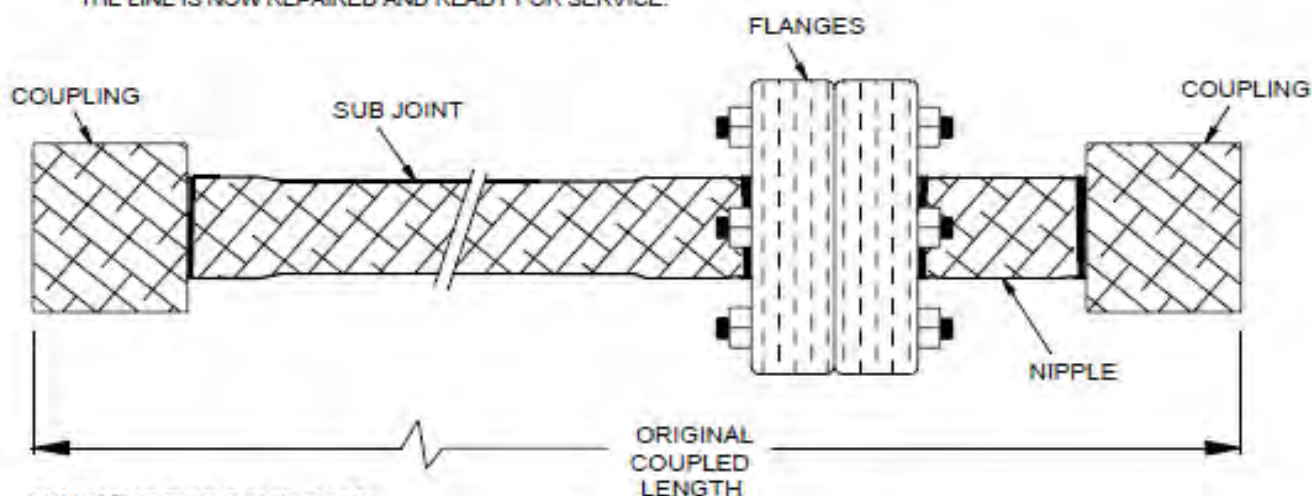
### LARGER SIZE COUPLED CONNECTION REPAIR JOINT

On some larger size threaded and coupled pipe backing off the coupled connection is occasionally problematic. In these circumstances the couplings to either end of a damaged joint must be cut off their respective pin ends. The following procedure details that operation.

#### REPAIR PROCEDURE:

- Remove the damaged joint by cutting the couplings off the adjacent male ends in the line.
- Make up the two new couplings to each exposed male thread on the line.
- Make up the sub joint and nipple into each coupling.
- Make up the two flanges to the exposed male ends of the sub joint and nipple.
- Bolt the two flanges together with a flexitallic gasket between them.
- On all threaded connections apply thread compound to both the male and female ends.

THE LINE IS NOW REPAIRED AND READY FOR SERVICE.



#### REMOVING THE COUPLINGS

- Using a skill saw with a masonry blade make two axial cuts down the entire coupling length about 30 degrees apart taking care not to cut into the threads.
- With a hammer and flat chisel remove the coupling material
- Using a pencil grinder and a small flat chisel remove additional material above the thread, again taking care not to cut into the threads.
- When you have cut and removed the material close to the threads the coupling will crack open along the cut line.
- The coupling can then be removed with a strap wrench without damaging the male pipe threads.

#### PARTS LIST

1 EACH PIN BY PIN SUB JOINT  
1 EACH PIN BY PIN NIPPLE  
2 EACH COUPLINGS  
2 EACH FLAT FACE FLANGES  
THREAD COMPOUND

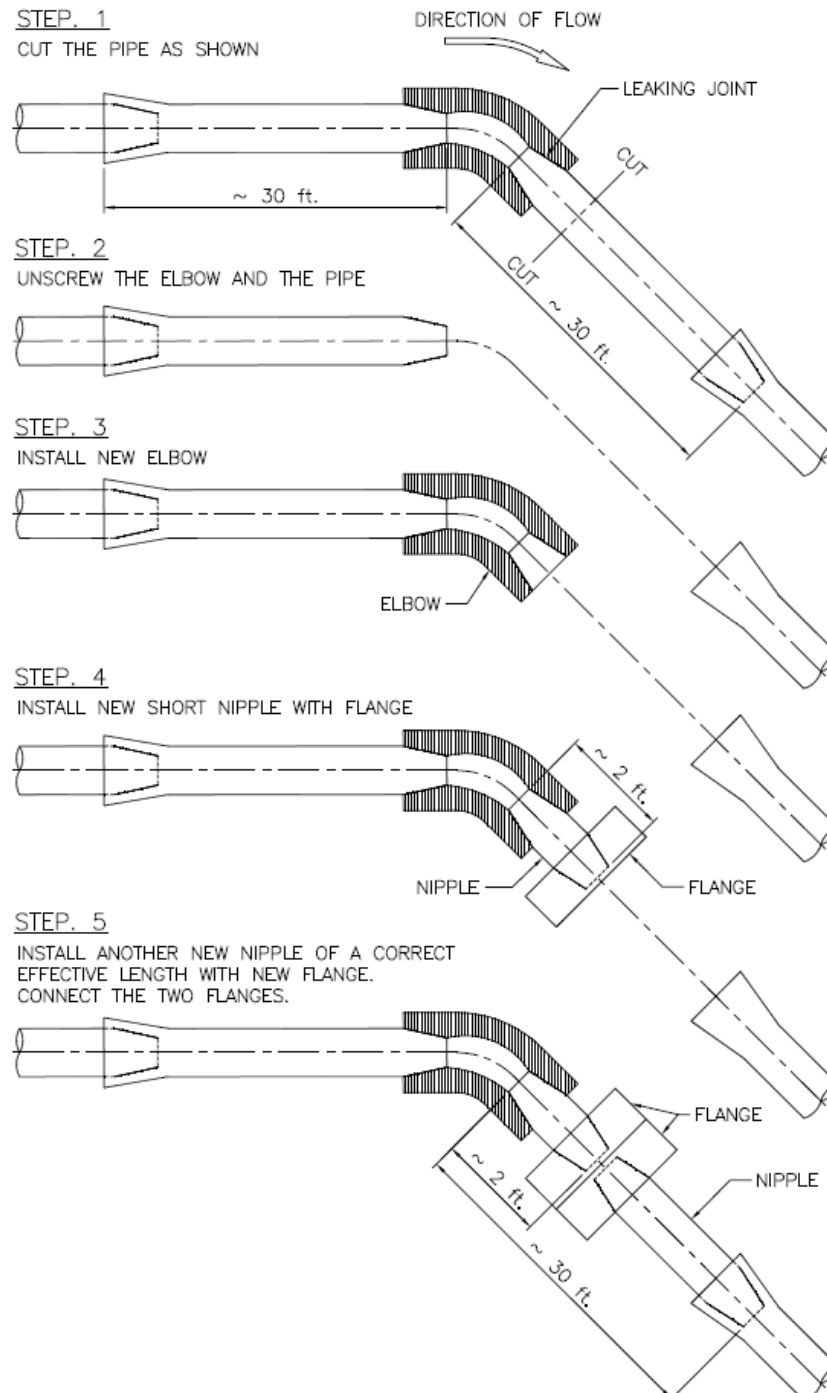
|                                 |         |        |           |     |      |
|---------------------------------|---------|--------|-----------|-----|------|
| FUTURE PIPE INDUSTRIES, INC.    |         |        |           |     |      |
| HOUSTON, TEXAS (281) 847-2987   |         |        |           |     |      |
| COUPLED YELLOW BOX REPAIR JOINT |         |        |           |     |      |
| REVISED:                        | DATE:   | SCALE: | REVISION: | BY: | CHK: |
| 01/13/02                        | 4/19/05 | NTS    | "REPAIR"  |     | LPM  |

Figure 10

### 13.11.3 Leaking Elbow Replacement

Follow the steps given in **Figure 11** for replacement of a leaking elbow.

**Figure 11:** Replacing a leaking elbow (the integral joint is shown here as a primary connection for demonstration).



FOR FURTHER INSTALLATION DETAILS, PLEASE CONTACT **FUTURE PIPE INDUSTRIES, INC.**

**RED BOX<sup>®</sup>**  
TUBING & CASING

**BLUE BOX<sup>®</sup>**  
CHEMICAL GRADE TUBING & CASING

## **TUBING & CASING INSTALLATION INSTRUCTIONS**

## 14.0 Red Box® Field Service and Installation Instructions

### 14.1 Field Installation Services - Down hole

Services and equipment available for the installation of down-hole tubing and casing include the following:

- Hands-on supervision and assistance in the unloading, storing, and handling of the tubing or casing at the well site.
- Expertise and recommendations relative to the rig equipment in use for the running of the string, the packer, wellhead, and other well equipment intended to be used in the installation.
- Active supervision and participation in the makeup and running of the fiberglass string.
- Expertise, recommendations, and active participation in the space out procedure of the installation.
- Expertise, recommendations, and active participation in the testing of the completed string.
- Expertise and recommendations relative to setting the fiberglass string.
- Cleaning and inspection of used fiberglass tubular.
- On-site reinforced fiberglass overwrap of steel casing connections.
- For some sizes and in some locations, provision of a power tong, torque computer, slips. Single joint compensator and necessary hand tools.

Future Pipe Industries, Inc. field personnel have extensive and effective experience in the installation of fiberglass products in all forms of installations. Typically they can be of assistance in many aspects of a fiberglass project, only some of which are listed above. Their responsibilities, however, do not include the success or failure of a given project and their authority on a customer's work site is restricted to advice and recommendations given to the customer and his employees. Field installation services are not available for products not manufactured by Future Pipe Industries, Inc.

### 14.2 Basic Tools & Equipment

#### 14.2.1 Wrenches

All joints supplied are designed with an extra thickness at the ends called pipe upset. While using to makeup a pipe, all wrenches shall be applied only on the upset area.

Warning: Do not use steel pipe wrenches to make up fiberglass pipe. Steel pipe wrenches will cause point loading or wall deformation. This can give a false sense of tightness and can damage the product and void the warranty.

**See Table C** for the recommended type and number of wrenches for make-up of Red Box® and Blue Box® tubing and casing

- Strap Wrench

Strap wrenches (**Picture 22** and **Picture 23**) distribute the torque circumferentially and are recommended to help prevent placing too much torque on the connection. For best results when using strap wrenches, the strap should be free from grease, thread lubricant, etc. Use a silica-based powder (Comet or Ajax powder) to prevent the strap wrench from slipping. A wire brush may be needed to clean any dirt or residue from the strap.

When using a strap wrench, ensure not to point-load the tubing. Point loading can collapse or damage the pipe wall when the wrench is pointed perpendicular into the pipe.

Two types of strap wrenches are commonly used:

1. Ridgid® No. 5 strap wrench (**Picture 22**) is normally used for makeup of 3" diameters and smaller. The handle of this wrench is approximately 18" long.
2. The 24" cast aluminum strap wrench (**Picture 23**) is normally used with 4" and larger diameter pipe during makeup, or as a backup wrench on smaller diameters. The handle of this wrench is about 24" long. This strap wrench could also be used in "hand-tightening" for larger diameter pipe.

**Picture 22:** Ridgid® No. 5 strap wrench



**Picture 23:** Cast Aluminum strap wrench



- Power Tong

Power tongs are used to generate torque values which are difficult to achieve manually. Power tongs typically provide a more consistent make up manual make up. See **Picture 24**

**Picture 24:** Power tong



**Table C:** Recommended installation tools per crew

| Pipe Diameters | Wrenches               |
|----------------|------------------------|
| 2"             | 1A & 1B or 2B          |
| 2 1/2"         | 1A & 1B or 2B          |
| 3"             | 1A & 1B or 2B          |
| 4"             | 1A & 2B or 1A, 1B & 1C |
| 5"             | 1A & 2B or 1A, 1B & 1C |
| 6"             | 1A & 2B or 1A, 1B & 1C |
| 6"-L           | 1A & 3B or 1A, 2B & 1C |
| 8"             | 1A & 4B or 1A, 2B & 1C |
| 10"            | 1A, 2B & 1C            |
| 10"-L          | 1A, 2B & 1C            |

Key:

- A            Ridgid® No. 5 or 24" Cast aluminum strap wrench  
B            Friction wrench or chain tong  
C            Power tong  
1, 2, 3 or 4   Indicates the quantity of required wrenches

#### 14.2.2 Elevators

A. Conventional Square Shoulder Elevators: can be used to install fiberglass tubing with the threaded and coupled connection. However, due to the larger outside diameter (O.D.) of fiberglass tubing, the next larger size elevator may be required. See product data sheets to determine proper elevator size. Conventional elevators can lock up on the integral joints or point load which can causes damage to the integral joint/build-up area.

B. Slip-Type Elevators: are required when installing fiberglass tubing with the integral joint connection, unless lift pins or pick up subs are used.

#### 14.2.3 Slips

Refer to Red Box ® and Blue Box ® Product Data sheets for Maximum box O.D. dimensions. Use these dimensions to determine the proper size slips.

- Conventional air slips or spider slips may be used during installation.
- Fiberglass tubing Button-type slips are not recommended.
- Do not let slips ride on the tubing while the tubing is being installed.

#### 14.2.4 Packers

Fiberglass tubing is suitable for use with most packers, but in most cases it is not recommended to set the packer with the fiberglass string. While the tensile capacities of the fiberglass typically exceed the setting requirements for most tension set packers, if there are problems during running or setting the packer, the fiberglass string is not likely to be strong enough to take the punishment required to resolve those problems. Hence, it is recommended that the packer, equipped with an on-off tool, be set with a steel work string. The work string is then pulled and the fiberglass is run into the hole with the on-off tool and latched into the packer.

Installation temperatures vs. operating temperatures must be accounted for in design and installation. The injection or production of hot fluids may cause fiberglass tubing to elongate and release the packer or on/off tool. Cold fluids may apply extra tensile forces to the tubing string.

A. Tension Packers: are normally used with fiberglass tubing in high fluid level wells. FPI recommends using tension packers with a 25,000 lbs. shear ring. Standard elements or soft elements may be used as long as the tensile ratings of the product are not exceeded. Scale and build-up may occur below the packer where salt water exits the packer. Since releasing a tension packer requires movement down the hole, this build-up may prevent the packer's release. In most cases, this problem can be avoided by running a tubing sub or full joint below the packer.

- B. Permanent (or Drillable) Packers: are often set by wire line or a steel work string. Either locator or anchor type seal assemblies can be run on the tubing. If seal assemblies are used, a latch-in assembly is recommended to prevent cyclic tensile loading and to prevent pumping the seals out of the packer bore during operation.

Red Box ® & Blue Box ® tubing and casing may be set in compression under circumstances which will alleviate the possibility of buckling. When setting a packer or latching into a permanent packer, note the following:

- 1) The weight of the tubing string prior to pulling tension shall not exceed the tensile rating of the tubing.
- 2) Packers should be equipped with a soft (50-65 durometer hardness) rubber to insure a seal at lower tensile levels.

In most cases, FPI recommends the commonly referred to “over-shot with dog ears” or “J latch” type of on/off tool for latching into permanent packers. A right-hand release on all packers or on/off tools is recommended.

#### 14.2.5 Single Joint Compensator

On larger diameter fiberglass tubing the weight of a single joint can be several hundred pounds. This weight can cause problems when applying proper torque. This dead weight can be offset by a compensator or counter weight, single joint compensator makes applying torque much easier and more precise.

#### 14.2.6 Blow-Out Preventers

FPI recommends an annular blow out preventer for potential well control closure. Most fiberglass tubing products have larger O.D.'s than steel tubing. Therefore, tubing ram preventers may not properly mate and seal.

When closed, both annular and tubing ram preventers exert a closure force on the tubing. The force depends on:

- 1) The type of the preventer.
- 2) The amount of hydraulic closing pressure to the preventer.
- 3) The well bore pressure or test pressure applied below the closed preventer.

#### 14.2.7 Well Heads

##### 1. Slip Type Well Heads

Refer to dimensional data in Red Box ® & Blue Box ® Product Data sheets before selecting the proper slip type well head, since the fiberglass tubing normally has a larger O.D. than the steel tubing.

If the well head slips, rings and rubber do not match the fiberglass tubing O.D., options are the following:

- To machine the slips and pack off rings from an old well head to match the fiberglass tubing O. D.
- Special landing subs with exact O.D.'s which are available from FPI.

##### 2. Flanged Type Well Heads

FPI recommends the following procedure when using flanged type well heads. A stainless steel sub, coated sub, etc. should be used between a flanged type well head and the fiberglass tubing string. Or, the flanged type well head should have an 8-round EUE long tapered thread form per API Standard 5B, Table 6, 7 or 14.

The fiberglass tubing string must not hang directly from a connection of fiberglass to steel with a short thread form. Do not screw the flanged type well head directly onto the tubing with valves, etc. on top of the flange. The extra weight may damage the FRP tubing threads. Separate them before installing.

#### 14.2.8 Weight Indicators

Because of fiberglass tubing's high buoyancy factor (about 0.5), weight indicators are required for installing or pulling fiberglass tubing. Indicators should be calibrated for accuracy just prior to installation and be capable of displaying a minimum of 500 pound increments. Accurate weight indicators must be on the rig and working at all times.

#### 14.2.9 Connecting to Steel

1. On all steel-to-fiberglass connections examine the steel threads carefully to insure that no burrs are present. Any steel burrs will damage the fiberglass threads. In order to insure that there are no burrs, chase the steel thread (making up and breaking out) with another steel thread.

2. If a full joint of steel tubing is to be added to a fiberglass string, care must be taken to insure that the weight of the hanging steel joint is supported by a single joint compensator and that the fiberglass female connection at no time during the makeup be required to support the steel joint. If the weight of the steel joint is supported by the fiberglass threads during the makeup, damage to the fiberglass threads may occur.

### 14.3 Installation

#### Introduction

Fiberglass tubing and casing differs from steel and requires different handling and running techniques. The method of manufacture results in dimensions that do not always correspond with steel tubular dimensions. Of particular concern are the variations in outside and upset diameters which do not, in general, correspond with the standard dimensions of steel tubing.

Care should be taken when unloading tubing and casing. Do not drop or throw. A minimum of two (2) men are required to move fiberglass tubular of less than 4 inches in nominal diameter. On larger sizes a third man or handling equipment is recommended.

Most fiberglass tubing failures are the result of improper makeup of the threaded connections. FPI, INC. Tubing and casing utilize an integral joint or threaded and coupled 8Rd or 6Rd threaded connections. To achieve a structurally sound, leak tight connection, it must be properly made-up to a controlled torque level using the proper thread compound. The following procedures are recommended.

1. When picking up joints from the racks do not allow pin threads to be exposed. Replace any thread protectors that may be missing. Unprotected pin ends may drag and be damaged.
2. Standard elevators can, in most cases, be used to run fiberglass tubing. It is always advisable to measure the upset diameter of the fiberglass tubing and to make sure that the slip dimensions are correct. In some cases, the slips must be dressed to fit the fiberglass tubing in order to avoid any single point contact that might damage the tubing. Square shoulder elevators can be used up to a maximum 3,000 lbs. string weight or for any threaded and coupled strings.  
 Use: MYT elevators for 2-3/8" and 2-7/8" size tubing,  
 YT elevators for 3-1/2" and 4-1/2" size tubing, and  
 YC elevators for 5-1/2" and larger size tubing or casing

Special considerations may be required when string weight exceeds 20,000 lbs. to assure trouble free running for fiberglass tubular. (Note that the weights may refer to immersed weights, which account for the weight reducing effect of buoyancy. Buoyancy Factor for fiberglass is about 0.5, much lower than for steel).

3. Do not set the slips while the fiberglass tubing is being raised or lowered.
4. If steel-to-fiberglass connections are required examine the steel threads carefully to insure that no burrs are present. In connecting any steel connections to fiberglass the fiberglass torque values must be used.
5. If a full joint of steel tubular is to be added to a fiberglass string, care must be taken to insure that the weight of the hanging steel joint be supported by a single joint compensator and that the fiberglass female connection at no time during the makeup be required to support the steel joint. If the weight of the steel joint is supported by the fiberglass threads during the makeup, damage to the fiberglass threads may occur.
6. When connecting into a steel female thread such as a submersible pump or packer, make sure that the steel thread is a 8Rd long thread up to 4-1/2" size, 8Rd casing long thread for sizes 5-1/2" through 9-5/8", and 8Rd casing short for 10-3/4". In sizes larger than 10-3/4" fiberglass crossover couplings or male threads may be required to cross from the 6 round thread to the conventional 8 round thread.  
 In the smaller sizes, if the steel thread is 8Rd short thread and cannot be changed out to long thread, a steel changeover to long thread is recommended. In case the fiberglass pin must be made up into steel short thread, use the following guide in cutting off fiberglass long form 8Rd threads.

- 2-3/8" size - Cut off 5 threads (5/8" long)
- 2-7/8" size - Cut off 6 threads (3/4" long)
- 3-1/2" size - Cut off 6 threads (3/4" long)
- 4-1/2" size - Cut off 7 threads (7/8" long)

There will be some loss of tensile strength from published values because of the shortened pin thread.

7. Thread compound must be a low shear type compound. Dependent on conditions, TFC#15, Enhanced TFC#15, or APT sealant are recommended. Consult with FUTURE PIPE INDUSTRIES, INC. for the appropriate recommendation for each application.
  - a. Apply the TFC#15 compounds to the pin and box using a "moustache" type brush. The compound is to be lightly and uniformly applied. The general thread form should be just visible after application of compound. Teflon tape may be recommended on some larger diameter casing applications and it is always recommended on fiberglass to steel connections. Apply two passes of tape, down and up the pin threads.
  - b. APT sealant is applied using a caulking gun and a comb to distribute the compound over the threads. See the written instructions with the compound for full details as to the application procedure. Refer to **Picture 25 & Picture 26**.
  - c. NOTE: Field experience indicates that thread compounds formulated with silicon base grease or oils will significantly reduce makeup torque requirements.

Typical thread compound usage:

| Size    | Per Gallon Pail                     |
|---------|-------------------------------------|
| 2-3/8"  | 3,200 ft. (Approx. 107 connections) |
| 2-7/8"  | 2,800 ft. (Approx. 93 connections)  |
| 3-1/2"  | 2,500 ft. (Approx. 83 connections)  |
| 4-1/2"  | 1,800 ft. (Approx. 60 connections)  |
| 5-1/2"  | 1,400 ft. (Approx. 47 connections)  |
| 6-5/8"  | 1,300 ft. (Approx. 43 connections)  |
| 7"      | 1,200 ft. (Approx. 40 connections)  |
| 7-5/8"  | 1,100 ft. (Approx. 37 connections)  |
| 9-5/8"  | 600 ft. (Approx. 20 connections)    |
| 10-3/4" | 500 ft. (Approx. 17 connections)    |
| 11-3/4" | 420 ft. (Approx. 14 connections)    |
| 13-3/8" | 360 ft. (Approx. 12 connections)    |

It is advisable to order at least one extra gallon of thread compound over the calculated requirement.



**Picture 25**



**Picture 26**

8. Start the connections by hand and makeup to the hand tight position. Do not force threads. If hand makeup becomes a problem, back out the connection, clean, re-apply thread compound and try again.
9. Complete the makeup using a strap wrench or a power tong that has been demonstrated to be capable of makeup without damage to the pipe body. Position the strap or the tong jaws on the heavier upset area of the tubing. Controlled torque is required to ensure a leak tight connection. On larger sizes a chain wrench can be used to make up and to back up. See **Picture 27** & **Picture 28**

#### DO NOT OVER TIGHTEN CONNECTION

It is recommended that torque control be established using an electronic strain gage/load cell type device. Hydraulic pressure gages that monitor the hydraulic pressure delivered to a hydraulic tong have proven unreliable for this application.

NOTE: Fiberglass-to-fiberglass tightening torque levels are significantly lower than those required for steel connections.

#### RECOMMENDED FIBERGLASS TUBING TORQUE TABLE USING TFC#15 THREAD COMPOUND

| Integral Joint Pipe:       | Pipe Size | Torque for Tubing |                  | Torque for Casing |                  |
|----------------------------|-----------|-------------------|------------------|-------------------|------------------|
|                            |           |                   |                  |                   |                  |
|                            | 2-3/8"    | 110               | - 140 ft. lbs.   | 110               | - 140 ft. lbs.   |
|                            | 2-7/8"    | 150               | - 175 ft. lbs.   | 175               | - 200 ft. lbs.   |
|                            | 3-1/2"    | 250               | - 280 ft. lbs.   | 275               | - 300 ft. lbs.   |
|                            | 4-1/2"    | 340               | - 380 ft. lbs.   | 350               | - 400 ft. lbs.   |
|                            | 5-1/2"    | 430               | - 470 ft. lbs.   | 475               | - 520 ft. lbs.   |
|                            | 6-5/8"    | 680               | - 730 ft. lbs.   | 700               | - 750 ft. lbs.   |
|                            | 7"        | 780               | - 830 ft. lbs.   | 750               | - 900 ft. lbs.   |
|                            | 7-5/8"    | 880               | - 930 ft. lbs.   | 950               | - 1,000 ft. lbs. |
|                            | 9-5/8"    | 1100              | - 1,200 ft. lbs. | 1200              | - 1,300 ft. lbs. |
|                            | 10-3/4"   | 1400              | - 1,500 ft. lbs. | 1400              | - 1,500 ft. lbs. |
| Threaded and Coupled Pipe: | 9-5/8"    | 1400              | - 1,600 ft. lbs. | 1400              | - 1,600 ft. lbs. |
|                            | 10-3/4"   | 1500              | - 1,700 ft. lbs. | 1500              | - 1,700 ft. lbs. |
|                            | 11-3/4"   | 1600              | - 2,000 ft. lbs. | 1600              | - 2,000 ft. lbs. |
|                            | 13-3/8"   | 1700              | - 2,400 ft. lbs. | 1700              | - 2,400 ft. lbs. |
|                            | 16"       | 2200              | - 3,000 ft. lbs. | 2200              | - 3,000 ft. lbs. |
|                            | 18"       | 2400              | - 3,500 ft. lbs. | 2400              | - 3,500 ft. lbs. |



Picture 27



Picture 28

10. When making-up steel-to-fiberglass connections, use the torque value for the fiberglass.
11. Red Box® tubing may be set in compression only under particular circumstances which alleviate the possibility of buckling. If considering a compression set, contact Future Pipe Industries, Inc. personnel for information. When setting a packer or latching into a permanent packer, note the weight of the tubing string prior to pulling tension. Be certain not to exceed the tensile rating of the tubing when setting the string in tension. Packers should be equipped with soft, 50 durometer hardness rubber to insure a seal at the lesser tensile values of fiberglass tubing.
12. When pulling fiberglass tubing, do not rotate the connection after threads have disengaged. Do not allow the threads to jump out under tension or jump out and fall back on the stationary threads.
13. When pulling fiberglass tubular, do not allow the slip dies to rub against the pipe body. Set the slips carefully to avoid impact damage. Make certain the blocks are completely stopped before setting the slips.
14. All threaded connections should be cleaned prior to use. Cleaning on the rack with a medium pressure water jet or steam cleaner is recommended. Do not use powered brushes or wire bristle brushes. Solvent cleaning with a fast drying non-residue solvent, such as methylene chloride is acceptable. Do not use diesel fuel as a final cleaning agent. Following cleaning, thread protectors should be installed.

## 14.4 Testing Recommendations

Installed FPI down-hole tubing should be tested prior to use to assure soundness of all joints and connections. Sudden pressure surges or “water hammer” must be avoided during testing. In some instances surge or hammer can produce pressures of several times the operating pressure and or rating of the tubing. Testing with air or gas is extremely dangerous and should not be done.

Note: All fiberglass tubing strings should be anchored at the bottom to prevent compressive loads or cyclic tensile loading which can damage the tubing and shorten life expectancy.

### A. Annular Testing

Tubing is normally tested by pressurizing the annulus after the string has been installed. Most state regulatory agencies require this type of testing. Note: If a string is installed with a tension packer, pressurizing the annulus will place a downward force on the packer. This downward force will be converted to an added tensile load on the tubing if the packer moves.

When tubing is installed with a tension packer, caution should be used not to exceed the collapse and tensile ratings of the tubing.

Fluid differentials should be calculated prior to testing to assure that collapse ratings are not exceeded. The formula most often used in the industry to calculate differential (i.e. bottom hole head pressure vs. collapse pressure) is as follows:

Head Pressure, psi =  $0.052 \times \text{weight of fluid (lbs./gal.)} \times \text{depth of packer (ft.)}$

### B. Internal Testing of Single Joints

Red Box ® tubing can be internally tested during installation by using a tubing test truck. FPI recommends using a bar tool or mandrel with expandable elements. This tool is also referred to as a sliding piston with a double hose hook up.

A single hose joined by rods with cups and slips can also be used, but the cups must be replaced every few joints due to the sharp pin ends on fiberglass tubing. FPI recommends hydro testing by this method above the slips.

### C. Filling and Pressurizing the System

FPI recommends introducing water into the annulus or tubing, preferably with a 1" line and bleed off the air. Allow ample time for all air or gas to escape. This procedure may require adding water to the annulus or tubing several times until all air or gas have escaped. After the system is filled and all air purged, the outlet can be slowly brought up to the desired test pressure. Increase the pressure in maximum 250 psi increments every five minutes to the desired pressure rating. Do not exceed the operating and or pressure rating of the lowest rated element in the system.

FPI recommends that in low static fluid level wells to never apply the total injection pressure without first filling the tubing with fluid. If pressure is applied without first bleeding off all the air or gas, severe water hammer may occur producing pressures of several times the system's operating pressures and/or the rating of the tubing.

These procedures should be followed every time the well has been removed from operation and is being put back into service.

If a tubing string is tested with air or gas, FPI will not be responsible for any resulting injury to personnel or damage to property, including the pipe or tubing. If there is no alternative to testing with air or gas, FPI will recommend test procedures and precautions to minimize possible hazards, but will not bear responsibility for damage or injury under any circumstances. Such testing is done entirely at the risk of the owner.

## 14.5 Tubing Stretch Calculations

Please consult Future Pipe Industries for tubing stretch calculations.

## IMPORTANT NOTICE

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## **FUTURE PIPE INDUSTRIES, INC. WARRANTY AND DISCLAIMER OF WARRANTIES**

The pipe, tubing, casing, fittings and other products and product components manufactured and sold by FUTURE PIPE INDUSTRIES, INC. ("Manufacturer") have the following warranty and disclaimer of warranties:

Subject to the conditions set forth herein, Manufacturer warrants that all products manufactured and sold by Manufacturer to its customer ("Purchaser") shall be free from defects in material and workmanship under normal use and service by Purchaser ("Covered Defect") for a period of one (1) year from date of purchase by Purchaser. Should a Covered Defect arise within said time period, provided Purchaser notifies Manufacturer of such Covered Defect within twenty one (21) days from the date of Purchaser's discovery, Manufacturer shall, upon its determination that an actual defect exists and that such defect constitutes a Covered Defect, at Manufacturer's sole option, either (i) replace such defective product or component of such product with a replacement product or component, (ii) repair such defective product or component or (iii) refund the sales price to Purchaser. All costs of transportation of replaced, damaged and/or repaired product or components, including freight, insurance and carrying costs shall be prepaid by Purchaser.

A Covered Defect shall not include, and this warranty shall not apply, to any products or components of products of Manufacturer which: (i) have been subjected to any accident, faulty installation, misapplication, abuse, neglect, misuse or prolonged exposure to ultraviolet rays; (ii) have been repaired or altered by any party other than Manufacturer without the express prior written consent of Manufacturer; (iii) have been used after discovery of a defect without the express prior written consent of Manufacturer; (iv) any user refuses to permit Manufacturer to examine; (v) have been used with any thread compound other than TFC#15 or Manufacturer's approved equivalent for makeup of pipe joints; or (vi) are installed without the supervision or instruction of Manufacturer's authorized representative. With respect to any products or components of products of Manufacturer which have been used in chemical/waste disposal services or systems, the warranty hereunder extends only through the installation period, including acceptance testing of the product, or for a period of one (1) year from the date of purchase, whichever occurs first.

The foregoing warranty contained herein is exclusive and in lieu of all other warranties, whether express, implied or statutory, including, but not by way of limitation, any warranty of merchantability or fitness for any particular purpose. No other warranty is made with respect to Manufacturer's products and components of products except as expressly provided hereunder, nor is there any warranty made whatsoever concerning the installation or use of Manufacturer's products or components of products.

Manufacturer's warranty herein extends solely to the original Purchaser of Manufacturer's product and is not transferable, and does not extend, to any subsequent owner or user of Manufacturer's product.

The remedies provided in this warranty constitute the sole recourse of Purchaser against Manufacturer for breach of any of Manufacturer's obligations under the sales contract with Purchaser regarding the sale of Manufacturer's product to Purchaser, whether the claim is made in tort or in contract. Manufacturer shall not be liable to Purchaser or any party for any special, incidental or consequential damages resulting from the use or performance of Manufacturer's product sold to Purchaser. Furthermore, in no event, shall Manufacturer's liability to Purchaser or any party relating to the use or performance of Manufacturer's product sold to Purchaser exceed the purchase price of Manufacturer's product to Purchaser.

Manufacturer reserves the right to make revisions from time to time of its product without extending or renewing its warranty with regard to previously manufactured products and components and without obligation to retrofit, replace or reinstall previously manufactured products to incorporate revisions therein.

All disputes regarding this warranty and the contents hereof shall be resolved through binding arbitration administered by the American Arbitration Association ("AAA") pursuant to the Federal Arbitration Act in accordance with the Commercial Arbitration Rules of the AAA to be conducted in an arbitration proceeding to be held in Houston, Harris County, Texas.

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**NOTES**