

Series Specifications 20JF.E3 (Series 20JF, 20JF-C)
 Rev 3.0C, Feb-19-2009

**Table 20JF.E3.1A
 (Series 20JF, 20JF-C)
 Mechanical Specifications**

Series	20JF, 20JF-C
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Temp (F)	Pipe Strengths (psi)					Pipe Moduli (psi)				
	Axial Tensile	Hoop Tensile	Axial Flex.	Hoop Flex.	Axial Comp.	Axial Tensile	Hoop Tensile	Axial Flex.	Hoop Flex.	Axial Comp.
Ambient	8,400	26,400	16,800	N/A	18,000	1,400,000	2,200,000	1,400,000	2,200,000	1,500,000
150	8,400	26,400	16,800	N/A	18,000	1,400,000	2,200,000	1,400,000	2,200,000	1,500,000
175	7,980	25,080	15,540	N/A	17,100	1,330,000	2,090,000	1,295,000	2,035,000	1,425,000
200	7,560	23,760	14,280	N/A	16,200	1,260,000	1,980,000	1,190,000	1,870,000	1,350,000
225										
250										

ASTM D4024 / D5421 Flange Codes

2" - 6" Flanges, 200psi	RTR-111D-445; CM-B4I
8" Flanges, 200psi	RTR-111D-446; CM-B4I
10" - 12" Flanges, 200psi	RTR-111D-447; CM-B4I
14" - 24" Flanges, 150psi	RTR-111C-337; CM-B4IF-66
All materials are contact molded (closest definition to filament wound in D4024), epoxy vinyl ester resin, integrally molded flange. The grade epoxy is interpreted to include epoxy vinyl esters. ASTM D5421 does not have ratings above 150psi.	

ASTM D2310 / D2996 Pipe Codes

2" - 3" Pipe	RTRP-11FT1-1112
4" Pipe	RTRP-11FT1-1113
6" Pipe	RTRP-11FT1-1114
8" and larger Pipe	RTRP-11FT1-1116
All materials are filament wound, epoxy vinyl ester resin, reinforced liner, HDB of > 5,000psi for joints, > 10,000psi for pipe (axial loads included). Short term hoop strength > 10,000psi; long. tensile strength > 8,000psi; Long. tensile modulus > 1,000,000psi; stiffness factor varies with pipe size. The grade epoxy is interpreted to include epoxy vinyl esters. Replace 'T' with 'Q' for the HDB rating of joints.	

ASTM F1173 / ISO15840 Codes

Type I, Resin 2, Class B, Rating Method 1 and 4 Fire Endurance: Fluid S, Fire Type IF, Integrity B, Duration 30

ASTM F1173 / ISO15840 Codes (continued)

Fire Endurance: Fluid EF, Fire Type JF, Integrity C, Duration 25 Fire Endurance: Fluid EF, Fire Type IF, Integrity B, Duration 30

Other Properties

Density (lb/cu in.)	0.06
Shear Modulus (psi)	1,400,000
Thermal Expansion Coefficient (in./in./F)	0.00001
Thermal Conductivity (BTU-in./ft^2-hr-F)	1.3
Minor Poisson's Ratio, $\nu_{min} = \nu_{ha}$	0.55
Major Poisson's Ratio, $E_a/E_h * \nu_{ha} = \nu_{ah}$	0.35
Hazen Williams Coefficient	150
Specific Roughness (in.)	0.0002

ASTM D5685 Fittings Codes

2" - 12" Fittings, 200psi	RTRF 52E4E
Contact molded fittings, epoxy vinyl ester resin, reinforced liner, butt & strap joint, 200psig rating	
14" - 24" Fittings, 150psi	RTRF 52E4D
butt & strap joint, 150psig rating	

Notes:
 1. Axial flexural is also termed bending; hoop flexural is also termed circumferential.
 2. Blank areas are Not Recommended.

Series Specifications 20JF.E3 (Series 20JF, 20JF-C)
 Rev 3.0C, Feb-19-2009

**Table 20JF.E3M.1A (Metric)
 (Series 20JF, 20JF-C)
 Mechanical Specifications**

Series	20JF, 20JF-C
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Temp (C)	Pipe Strengths (MPa)					Pipe Moduli (GPa)				
	Axial Tensile	Hoop Tensile	Axial Flex.	Hoop Flex.	Axial Comp.	Axial Tensile	Hoop Tensile	Axial Flex.	Hoop Flex.	Axial Comp.
Ambient	57.9	182.0	115.8	N/A	124.1	9.7	15.2	9.7	15.2	10.3
65.6	57.9	182.0	115.8	N/A	124.1	9.7	15.2	9.7	15.2	10.3
79.4	55.0	172.9	107.1	N/A	117.9	9.2	14.4	8.9	14.0	9.8
93.3	52.1	163.8	98.5	N/A	111.7	8.7	13.7	8.2	12.9	9.3
107.2										
121.1										

ASTM D4024 / D5421 Flange Codes

2" - 6" Flanges, 200psi	RTR-111D-445; CM-B4I
8" Flanges, 200psi	RTR-111D-446; CM-B4I
10" - 12" Flanges, 200psi	RTR-111D-447; CM-B4I
14" - 24" Flanges, 150psi	RTR-111C-337; CM-B4IF-66

All materials are contact molded (closest definition to filament wound in D4024), epoxy vinyl ester resin, integrally molded flange.
 The grade epoxy is interpreted to include epoxy vinyl esters.
 ASTM D5421 does not have ratings above 150psi.

ASTM D2310 / D2996 Pipe Codes

2" - 3" Pipe	RTRP-11FT1-1112
4" Pipe	RTRP-11FT1-1113
6" Pipe	RTRP-11FT1-1114
8" and larger Pipe	RTRP-11FT1-1116

All materials are filament wound, epoxy vinyl ester resin, reinforced liner, HDB of > 5,000psi for joints, > 10,000psi for pipe (axial loads included).
 Short term hoop strength > 10,000psi; long. tensile strength > 8,000psi;
 Long. tensile modulus > 1,000,000psi; stiffness factor varies with pipe size.
 The grade epoxy is interpreted to include epoxy vinyl esters.
 Replace 'T' with 'Q' for the HDB rating of joints.

ASTM F1173 / ISO15840 Codes

Type I, Resin 2, Class B, Rating Method 1 and 4
Fire Endurance: Fluid S, Fire Type IF, Integrity B, Duration 30

ASTM F1173 / ISO15840 Codes (continued)

Fire Endurance: Fluid EF, Fire Type JF, Integrity C, Duration 25
Fire Endurance: Fluid EF, Fire Type IF, Integrity B, Duration 30

Other Properties

Density (g/cu cm)	1.7
Shear Modulus (GPa)	9.7
Thermal Expansion Coefficient (mm/mm/C)	0.000018
Thermal Conductivity (W-cm/cm^2-C)	0.0019
Minor Poisson's Ratio, $\nu_{min} = \nu_{ha}$	0.55
Major Poisson's Ratio, $E_a/E_h * \nu_{ha} = \nu_{ah}$	0.35
Hazen Williams Coefficient	150
Specific Roughness (cm)	0.0005

ASTM D5685 Fittings Codes

2" - 12" Fittings, 200psi	RTRF 52E4E
Contact molded fittings, epoxy vinyl ester resin, reinforced liner, butt & strap joint, 200psig rating	
14" - 24" Fittings, 150psi	RTRF 52E4D
butt & strap joint, 150psig rating	

Notes:
 1. Axial flexural is also termed bending; hoop flexural is also termed circumferential.
 2. Blank areas are Not Recommended.

Design Envelope Data
 Rev 3.0B, May-01-2007

Table 20JF.E3.2A
(Series 20JF, 20JF-C)
Design Envelope Data

Series	20JF, 20JF-C
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ASTM D2992-96 Data

Identification	Pipe
Procedure	B (Static)
End Closure	Free (2:1 Loading)
Test Environment	Water (inside and outside), 150F (65c)
LTHS (psi)	10,065
r	0.96
Slope of Regression Line	-0.064
HDB (psi)	10,000

ASME B31.3 Data

HDB (psi)	10,000
HDS (psi)	5,000

ISO14692 Data

	Pipe	Fittings	Joints
NPRman (psi) (f2=0.67)	(f3=0.7)	(f3=1.0)	(f3=1.0)
2"	738	598	451
6"	358	285	215
12"	298	297	224
Pq = LCL = f1*LTHP (psi)			
2"	1,574	893	673
6"	763	425	320
12"	636	443	334

Recommended Design Data

	Sustained (f2=0.67)	Sust+Temp (f2=0.83)	Occasional (f2=0.89)
Allowable Hoop Stress (psi)	5,732	7,101	7,614
Allowable Axial Stress (psi)	1,824	2,259	2,423
Allowable Bending Stress (psi)	3,283	4,067	4,361
Allowable Shear Stress (Cross-laminar) (psi)	2,606	3,228	3,461
Allowable "Secondary Bond" Shear Stress (psi)	100		

Notes:

1. For recommended design data, axial and bending stresses may have to be considered simultaneously. In this case, the combined axial and bending stresses must not exceed the allowable bending stress, which is the larger of these values.

Design Envelope Data
 Rev 3.0B, May-01-2007

Table 20JF.E3M.2A
(Series 20JF, 20JF-C)
Design Envelope Data (SI)

Series	20JF, 20JF-C
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ASTM D2992-96 Data

Identification	Pipe
Procedure	B (Static)
End Closure	Free (2:1 Loading)
Test Environment	Water (inside and outside), 150F (65c)
LTHS (MPa)	69.4
r	0.96
Slope of Regression Line	-0.064
HDB (MPa)	69.0

ASME B31.3 Data

HDB (MPa)	69.0
HDS (MPa)	34.5

ISO14692 Data

	Pipe	Fittings	Joints
NPRman (MPa) (f2=0.67)	(f3=0.7)	(f3=1.0)	(f3=1.0)
2"	5.1	4.1	3.1
6"	2.5	2.0	1.5
12"	2.1	2.0	1.5
Pq = LCL = f1*LTHP (MPa)			
2"	10.9	6.2	4.6
6"	5.3	2.9	2.2
12"	4.4	3.1	2.3

Recommended Design Data

	Sustained (f2=0.67)	Sust+Temp (f2=0.83)	Occasional (f2=0.89)
Allowable Hoop Stress (MPa)	39.5	49.0	52.5
Allowable Axial Stress (MPa)	12.6	15.6	16.7
Allowable Bending Stress (MPa)	22.6	28.0	30.1
Allowable Shear Stress (Cross-laminar) (MPa)	18.0	22.3	23.9
Allowable "Secondary Bond" Shear Stress (MPa)	0.7		

Notes:

1. For recommended design data, axial and bending stresses may have to be considered simultaneously. In this case, the combined axial and bending stresses must not exceed the allowable bending stress, which is the larger of these values.

Design Envelope Data
 Rev 3.0C, Apr-24-2008

Table 20JF.E3.4A
(20JF, 20JF-C)

ISO 14692 Part 3 - Annex D Calculations

Stress Intensification Factors (SIFs), Flexibility Factors (Kappa), Pressure Stress Multipliers (PSMs)
 (BS7159, Type 2 Laminate, 0.0012 design strain)

Size (in.)	Series 20JF, 20JF-C									
	Flexibility Factor	Elbows			Tees					
		Axial bending SIF		Hoop bending SIF	SIF	PSM				
	In-plane	Out-of-plane	In-plane	Out-of-plane						
2	1.3	1.1	1.2	1.9	1.7	1.1	1.0			
3	1.9	1.5	1.6	2.5	2.2	1.3	1.0			
4	2.5	1.7	1.8	2.5	2.5	1.5	1.0			
6	2.9	1.9	2.1	2.5	2.5	1.7	1.0			
8	2.8	1.9	2.0	2.5	2.5	1.7	1.0			
10	3.0	2.0	2.1	2.5	2.5	1.8	1.0			
12	2.9	1.9	2.1	2.5	2.5	1.7	1.0			
14	3.0	2.2	2.4	2.5	2.5	2.0	1.0			
16	3.0	2.1	2.3	2.5	2.5	1.9	1.0			
18	3.0	2.3	2.4	2.5	2.5	2.0	1.0			
20	3.0	2.3	2.4	2.5	2.5	2.1	1.0			
24	3.0	2.3	2.5	2.5	2.5	2.1	1.0			
30	3.0	2.5	2.5	2.5	2.5	2.3	1.0			
36	3.0	2.5	2.5	2.5	2.5	2.3	1.0			
42	3.0	2.5	2.5	2.5	2.5	2.3	1.0			
48	3.0	2.5	2.5	2.5	2.5	2.3	1.0			

Note: Tees that are qualified according to ISO14692 have a PSM of 1.0. Tees that are not qualified will typically have PSMs ranging from 1.8 to 3.0. Reducing tees will have slightly different SIFs than tees; however, it is acceptable to use the same values as the same-size tees. e.g., a 6"x2" reducing tee or olet would have the same SIF as a 6" tee.

Stress Analysis Data
 Rev 3.0C, Feb-19-2009

Table 20JF.E3.5A
(Series 20JF, 20JF-C)
Stress Analysis Data

Series	20JF, 20JF-C
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Material Properties

C_t	0.000010 in./in./F	0.000018 mm/mm/C
$E_a = E_x$	1,400,000 psi	9.7 GPa
$\nu_{min} = \nu_{ha}$	0.55	0.55
E_h	2,200,000 psi	15.2 GPa
rho	0.060 lb/in. ³	1.7 g/cm ³
$E_a/E_h * \nu_{ha} = \nu_{ah}$	0.35	0.35

UKOOA Data

SH, $f_1 * LT_{HS}$	10,000 psi	68.95 MPa
R, Sa(0:1) / Sa(2:1)	0.64	0.64
f_2 - sustained	0.67	0.67
f_2 - thermal	0.83	0.83
f_2 - occasional	0.89	0.89
K	Mean temperature change multiplier, 0.85 for liquids, 0.8 for gases, 1.0 for amb. temp changes.	

BS7159 Data

SH, $\epsilon_d * E_a$	2,520 psi	17.38 MPa
	(based on 0.0018 design strain)	
E_h/E_a	1.57	1.57
K	Mean temperature change multiplier, 0.85 for liquids, 0.8 for gases, 1.0 for amb. temp changes.	
Kn	Fatigue factor, 1.0 for static applications	

Figure 20JF.E3.C1 Rev 3.0A, Feb-15-2005
ISO 14692 Design Envelope - FIBERBOND® Pipe
f1*LTHP=763psi; f1*LTHS=8556psi; STHP=2356psi; STHS=26400psi
Short Term Axial Strength=8400psi; Est'd Long Term Axial Strength=2722psi; r=0.64

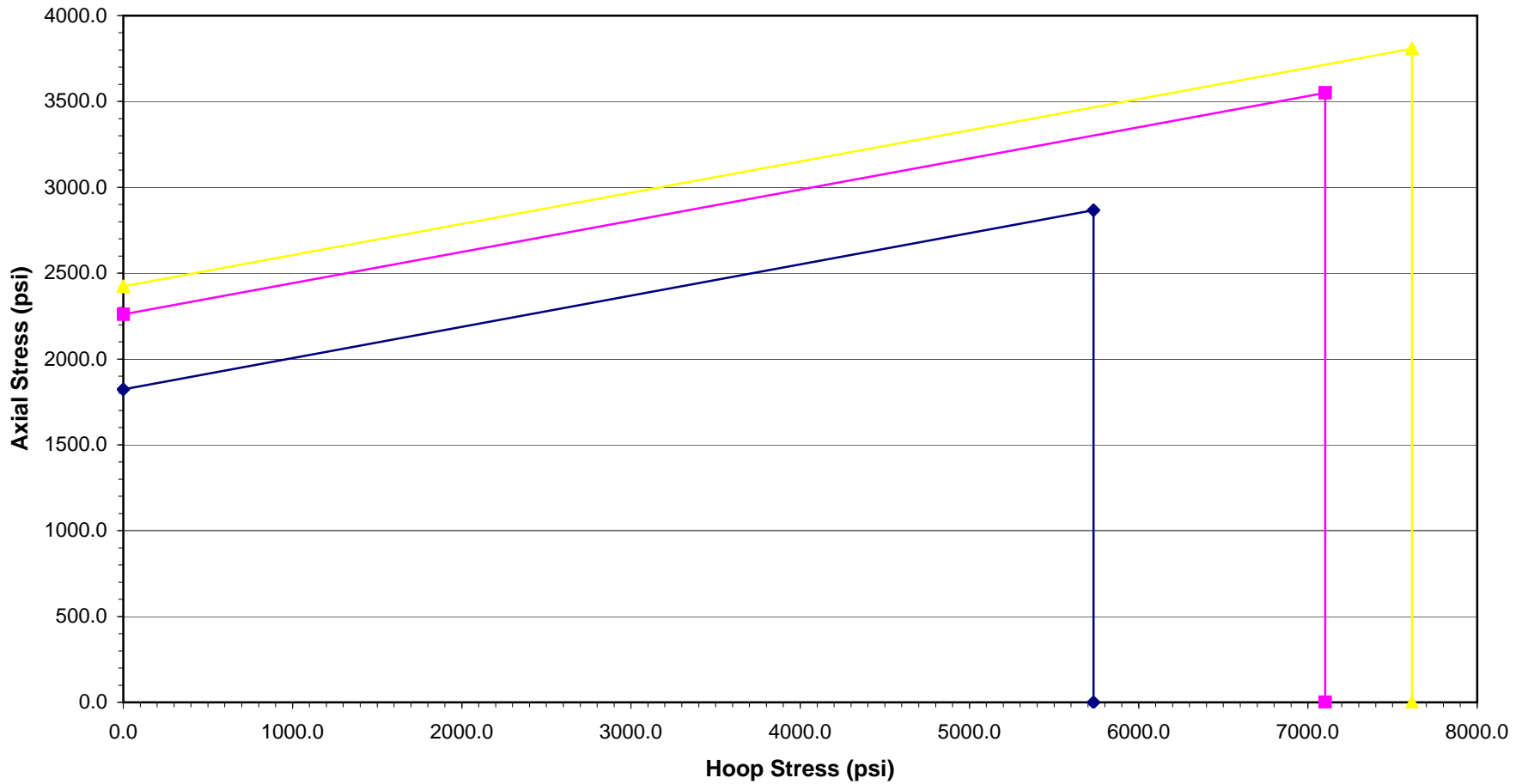


Figure 20JF.E3.C2 Rev 3.0A, Feb-15-2005
ISO 14692 Design Envelope - FIBERBOND(R) Fittings
f1*LTHP=425psi; f1*LTHS=4851psi; STHP=1139psi; STHS=13000psi
Short Term Axial Strength = 12200psi; Est'd Long Term Axial Strength = 4552psi; r=1.9

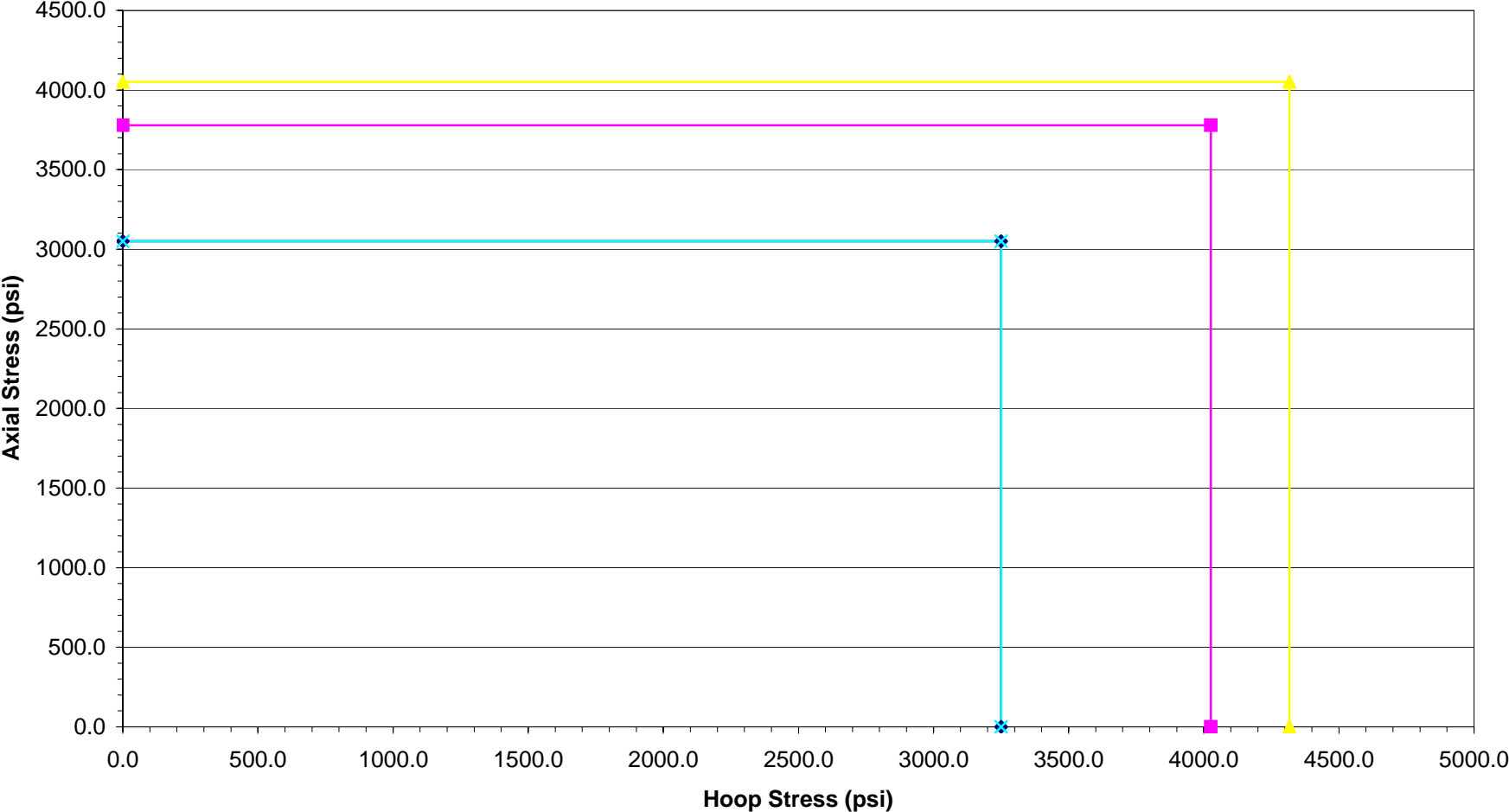


Figure 20JF.E3.C3 Rev 3.0A, Feb-15-2005
ISO 14692 Design Envelope - FIBERBOND® Butt Weld Joints
f1*LTHP=320psi; f1*LTHS=3657psi; STHP=859psi; STHS=9800psi
Short Term Axial Strength = 11000psi; Est'd Long Term Axial Strength = 4104psi; r=2.2

