

KUBRICKY CONSTRUCTION CORP.
269 BALLARD ROAD

WILTON, NY 12831
518 792-5864



Rutland City BRF 3000 (2014036)
SUBMITTAL 59

Issued 05/26/15
Respond by 06/02/15

To

Timothy Pockette, PE

Topic 900.640 Ductile Iron Pipe On Bridge 6 & 10", Hanger Design
Status For Approval
Spec section 900.640
Responsibility (16) River Street
Sent to approver 5/26/15
Required from approver 6/2/15

From

Volker H.D. Burkowski

Signed by

Date

5/26/15

Proceed as Indicated

Owner Authorized Representative

Date

Design Submittal

Utility Brackets

River Street over Otter Creek
Rutland, VT

State of Vermont Agency of Transportation

Proposed Improvement Bridge Project
Project No.: BRF 3000 (16)

Prepared for:

Kubricky Construction Corp.
295 Ballard Road
Wilton, NY 12831

Prepared by:

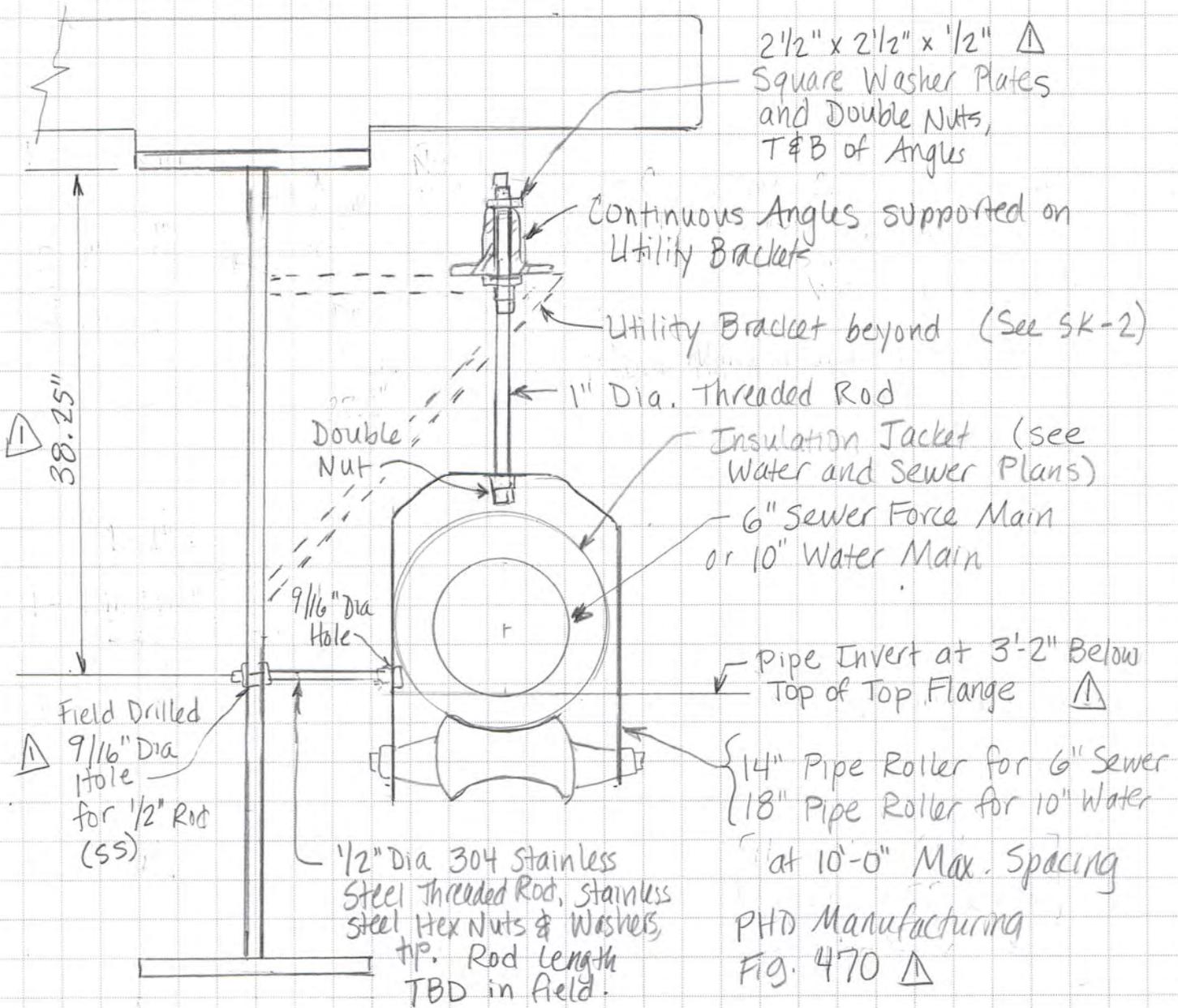
William J. Frank Engineering, P.C.
4 Old Route 6
Brewster, NY 10509
845-490-1393

April 24, 2015
Revised May 20, 2015

Job No. 14-049.03



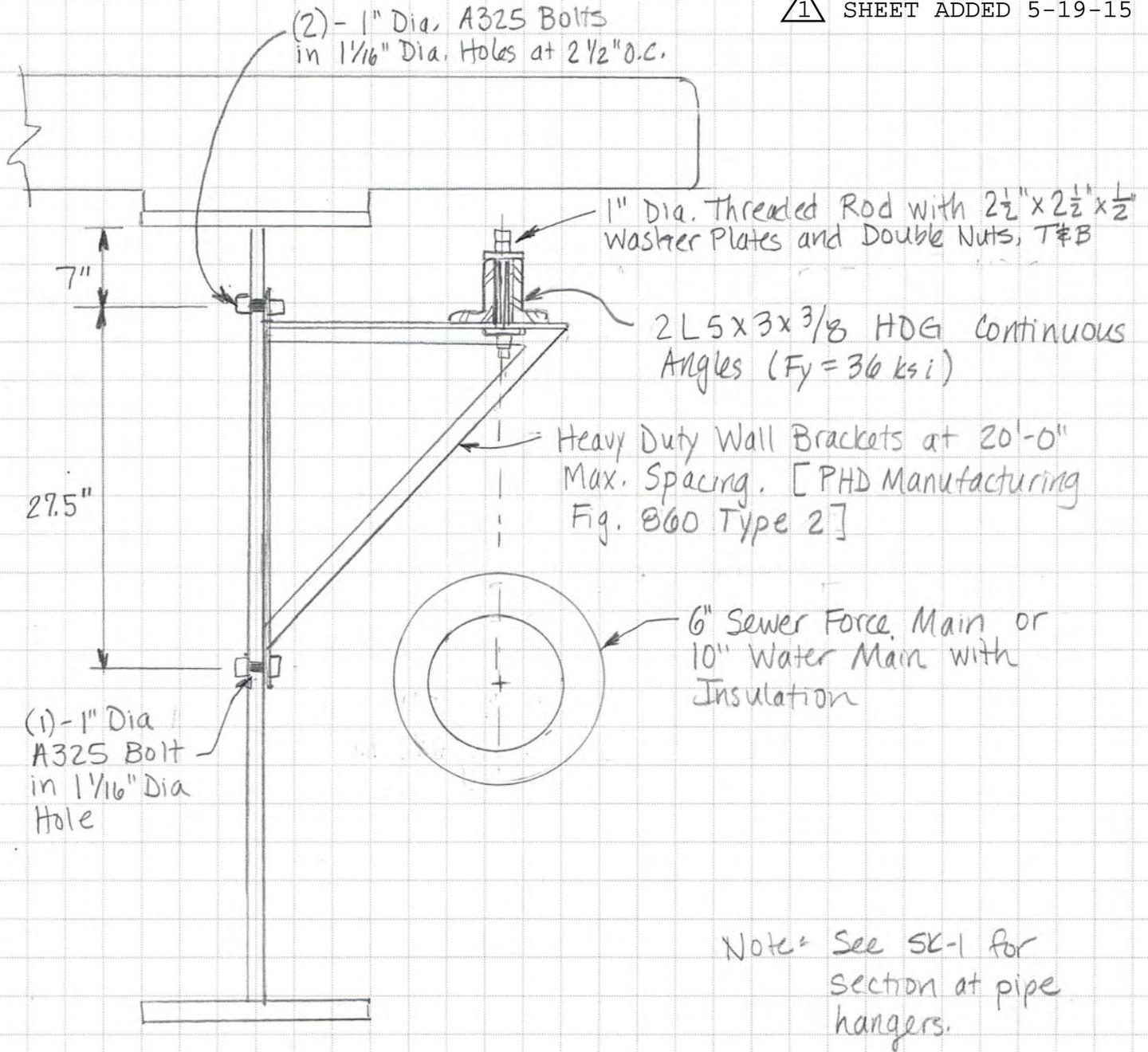
River Street over Otter Creek
 Rutland, VT



Section at Pipe Hangers

River Street over Otter Creek, Rutland, VT

1 SHEET ADDED 5-19-15



Section at Utility Brackets

SUPPORTING DESIGN CALCULATIONS

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JOB 14-049.03

SHEET NO. 1 OF 11

CALCULATED BY EMC DATE 5-20-2015

CHECKED BY WJF DATE 5/20/15

SCALE $\frac{1}{\Delta}$ SHEET REPLACED 5-20-15

REFERENCES

1. Contract Drawings for Vermont Agency of Transportation (VTrans) Project No. BRF 3000(16), Rutland City TH 8 Bridge 2
2. Shop Drawings for VTrans Project No. BRF 3000 (16), TH-8 (River Street) over Otter Creek, Bridge No. 2, Rutland City Bridge Replacement, by Casco Bay Steel Structures, Inc.
3. Water and Sewer Plans for VTrans Project No. BRF 3000 (16), Rutland City, by CLD Consulting Engineers
4. ASCE 07-10, Minimum Design Loads for Buildings and Other Structures
5. AASHTO LRFD Bridge Design Specifications, 5th Edition
6. AISC Steel Construction Manual, Fourteenth Edition

INTRODUCTION

These design calculations are for utility supports to be attached to the fascia girders for the replacement bridge carrying River Street over Otter Creek in Rutland, Vermont. A 10-inch diameter water main and a 6-inch diameter sewer force main will be supported on opposite sides of the bridge.

The utilities will be supported by Fig. 470SS (304) Pipe Roller Supports with 1-inch diameter threaded rods by PHD Manufacturing, Inc. at a 10 foot spacing. The rods will be supported by continuous back-to-back 5"x3"x3/8" angles ($F_y=36$ ksi) with the 5" legs vertical. Each hanger will have a 1/2-inch diameter threaded rod sway brace attached to the fascia girder. The continuous angles will be supported by Fig. 860 Type No. 2 Heavy Duty Wall Brackets by PHD Manufacturing, Inc. at a 20 foot spacing.

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SHEET NO. 2 OF 11
CALCULATED BY EMC DATE 4-15-2015
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Utility Dead Loads - assume 20-foot segments

6-inch sewer force main with insulation

6" pipe - Thickness Class 52 $t = 0.31"$

$$Wt = 413 \text{ lb} / 20' =$$

^ App. A

21 lb/f

Insulation with aluminum jacket - assume

10 lb/f

Total = 31 lb/f

10-inch water main with insulation

10" pipe - Thickness Class 52. $t = 0.31"$

$$Wt = 760 \text{ lb} / 20' =$$

^ App. A

38 lb/f

Insulation with aluminum jacket - assume

10 lb/f

Total = 48 lb/f

Snow Loads

Ignore snow loading since the utilities will be under the bridge deck overhang.

Utility Live Loads (contents of pipes)

6-inch sewer force main

$$O.D. = 6.90 \quad t = 0.31 \quad I.D. = 6.28''$$

$$\text{Interior volume} = \frac{\pi}{4} (6.28/12)^2 = 0.215 \text{ ft}^3/\text{f}$$

$$\text{Water weight} = 0.215 \text{ ft}^3/\text{f} \times 62.4 \text{ pcf} = \underline{14.1 \text{ lb/f}}$$

10-inch water main

$$O.D. = 11.10 \quad t = 0.35 \quad I.D. = 10.4''$$

$$\text{Interior volume} = \frac{\pi}{4} (10.4/12)^2 = 0.590 \text{ ft}^3/\text{f}$$

$$\text{Water weight} = 0.590 \text{ ft}^3/\text{f} \times 62.4 \text{ pcf} = \underline{37 \text{ lb/f}}$$

Ice Loads Due to Freezing Rain (ASCE 07-10, Section 10.4)

For Vermont, nominal ice thickness $t = 1''$ (Fig. 10-2)

Topographic factor $K_{zt} = 1.0$ for level terrain. (10.4.5)

Risk Category III or IV : $I_i = 1.25$ (Table 1.5-2)

Vertical clearance of bridge = 19' min above stream bed.
 Height of utilities $\approx 22'$ above stream bed.

$$\text{Height factor } f_z = \left(\frac{z}{33}\right)^{0.10} = \left(\frac{22}{33}\right)^{0.10} = 0.96$$

$$\begin{aligned} \text{Design ice thickness } t_d &= 2.0 t I_i f_z (K_{zt})^{0.35} \quad (\text{Eq. 10-5}) \\ &= 2.0 \times 1'' \times 1.25 \times 0.96 \times (1)^{0.35} = 2.4 \text{ inches} \end{aligned}$$

Ice density = 56 pcf

For 6" sewer force main: $D_c = 13''$
 For 10" water main: $D_c = 17.5''$ } Including insulation.
 See Contract Dwg. Sh. 9

$$\begin{aligned} \text{6" sewer: } A_i &= \pi t_d (D_c + t_d) \quad (\text{Eq. 10-1}) \\ &= \pi \times 2.4 (13 + 2.4) = 116 \text{ in}^2 \end{aligned}$$

$$D_i = 56 \text{ pcf} \times \frac{116}{144} = \underline{45 \text{ lb/ft}}$$

$$\text{10" water: } A_i = \pi \times 2.4 (17.5 + 2.4) = 150 \text{ in}^2$$

$$D_i = 56 \text{ pcf} \times \frac{150}{144} = \underline{58 \text{ lb/ft}}$$

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Load Combinations

Refer to ASCE 7-10 sections 2.4.1 and 2.4.3

Load Case #2: $D + L + 0.7 D_i$ Δ

6" sewer: $D + L + 0.7 D_i = 31 \text{ lb/f} + 14 \text{ lb/f} + 0.7(45 \text{ lb/f}) = \underline{77 \text{ lb/f}}$

10" water: $D + L + 0.7 D_i = 48 \text{ lb/f} + 37 \text{ lb/f} + 0.7(58 \text{ lb/f}) = \underline{126 \text{ lb/f}}$

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Pipe Roller Hangers

Use PHD Fig 470 Pipe Roller Supports. (App. B)

Use 14" Pipe Roller for 6" sewer. Wt = 36 lb each
Max. recommended load = 1200 lb

$$\text{max spacing} = \frac{1200 \text{ lb}}{77 \text{ lb/ft}} = 15.6 \text{ feet for 6" sewer}$$

Use 2 hangers per 20' segment

$$\text{Spacing} = 20' / 2 = 10' < 15.6' \text{ ok}$$

Use 18" Pipe Roller for 10" water Wt = 54 lb each
Max. recommended load = 1400 lb

$$\text{Max. spacing} = \frac{1400 \text{ lb}}{126 \text{ lb/ft}} = 11.1 \text{ feet for 10" water}$$

Use 2 hangers per 20' segment

$$\text{Spacing} = 20' / 2 = 10' < 11.1' \text{ ok}$$

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Utility Brackets

Use PHD Fig. 860 Heavy Duty Wall Brackets, Type 2 (App. C)

Capacity = 3000 lb per bracket

For 6" sewer and pipe rollers and continuous angles:

$$W = \underset{\text{sewer}}{77 \text{ lb/ft}} + \frac{2 \times 36 \text{ lb}}{20' \text{ rollers}} + \overset{\leftarrow \text{Assumed}}{20 \text{ lb/ft angles}} = 101 \text{ lb/ft}$$

$$\text{Max. bracket spacing} = \frac{3000 \text{ lb}}{101 \text{ lb/ft}} = 29.7'$$

Try brackets at 20' max spacing for 6" sewer

For 10" water and pipe rollers and continuous angles:

$$W = \underset{\text{water}}{126 \text{ lb/ft}} + \frac{2 \times 54 \text{ lb}}{20' \text{ rollers}} + \overset{\leftarrow \text{Assumed}}{20 \text{ lb/ft angles}} = 151 \text{ lb/ft}$$

$$\text{Max. bracket spacing} = \frac{3000 \text{ lb}}{151 \text{ lb/ft}} = 19.9', \text{ say } 20'$$

Try brackets at 20' max spacing for 10" water

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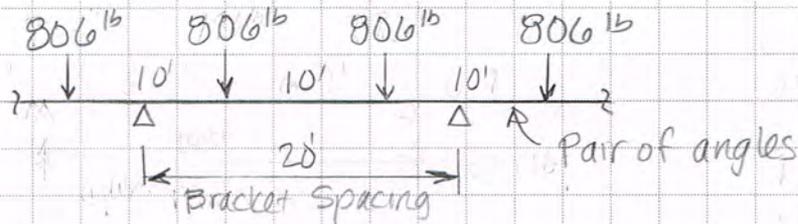
Angles to Support Hangers

For 6" sewer:

Hanger spacing = 10'

Hanger load = $(77 \text{ lb/ft} \times 10') + 36 \text{ lb} = 806 \text{ lb}$

Bracket spacing = 20' max



Bracket reaction = $\frac{806 \text{ lb}}{10'} \times 20' = 1612 \text{ lb}$

$V_{max} = 1612 \text{ lb} / 2 = 806 \text{ lb}$

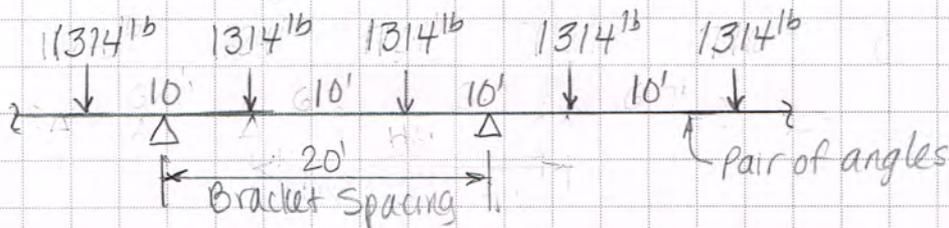
$M_{max} = 806 \text{ lb} \times 5' = 4,030 \text{ lb-ft}$

For 10" water:

Hanger spacing = 10'

Hanger load = $(126 \text{ lb/ft} \times 10') + 54 \text{ lb} = 1314 \text{ lb}$

Bracket spacing = 20' max



Bracket reaction = $\frac{1314 \text{ lb}}{10'} \times 20' = 2628 \text{ lb}$ controls

$V_{max} = 2628 \text{ lb} / 2 = 1314 \text{ lb}$ (controls)

$M_{max} = 1314 \text{ lb} \times 5' = 6,570 \text{ lb-ft}$ (controls)

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Angles to Support Hangers (typ)

$V_{max} = 1314^{lb} = 1.3k$

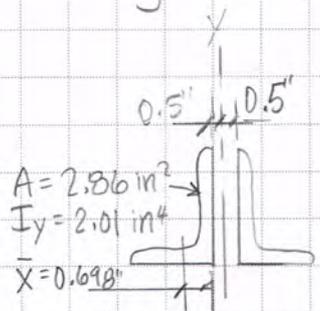
Try JL 5 x 3 x 3/8 back to back angles, long leg vertical, $F_y = 36 \text{ ksi}$

$I_x = 2 \times 7.35 = 14.7 \text{ in}^4$
 $S_x = 2 \times 2.22 = 4.44 \text{ in}^3$
 $r_x = 1.60 \text{ in}$
 $Z_x = 2 \times 3.93 = 7.86 \text{ in}^3$

$J = 2 \times 0.141 = 0.282 \text{ in}^4$
 $C_w = 2 \times 0.196 = 0.392 \text{ in}^6$
 $G = 0.385 E = 11,165 \text{ ksi}$
 $d = 5 \text{ in}$

Hanger rod diameter = 1 inch (sh. B1)

Say 1" separation between angles



$I_y = 2 [2.86 \times (0.698 + 0.5)^2 + 2.01] = 12.2 \text{ in}^4$
 $A = 2 \times 2.86 = 5.72 \text{ in}^2$

$r_y = \sqrt{I_y / A} = \sqrt{12.2 / 5.72} = 1.46 \text{ in}$

Unbraced length = hanger spacing: $L_b = 10' = 120 \text{ in}$

Yielding

(AASHTO 6.12.2.2.4)

Since the angles are continuous, the angle stems will be in both tension and compression.

$\therefore M_n = M_y = F_y S_x = 36 \times 4.44 = 160 \text{ k-in} \leftarrow \text{controls}$

Lateral Torsional Buckling

$B = -2.3 \frac{d}{L_b} \sqrt{\frac{I_y}{J}} = -2.3 \times \frac{5}{120} \sqrt{\frac{12.2}{0.282}} = -0.63$

$M_n = \frac{\pi \sqrt{E I_y G J}}{L_b} [B + \sqrt{1 + B^2}] \leq M_p$
 $= \frac{\pi \sqrt{29000 \times 12.2 \times 11165 \times 0.282}}{120} [-0.63 + \sqrt{1 + (-0.63)^2}] = 482 \text{ k-in}$

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Angles to Support Hangers (cont.)

$$M_p = F_y Z_x = 36 \times 7.86 = 283 \text{ k-in}$$

Flange Local Buckling

$$\lambda_f = \frac{b_f}{2t_f} = \frac{2 \times 3}{2 \times 0.375} = 8.0$$

$$\lambda_{pf} = 0.38 \sqrt{E/F_y} = 0.38 \sqrt{29000/36} = 10.8 > 8.0$$

\therefore Flange is compact
No need to check for flange local buckling.

Yielding controls. $M_n = 160 \text{ k-in}$

$$\phi_f = 1.0 \quad (\text{AASHTO 6.5.4.2})$$

$$M_{max} = 6570 \text{ lb-ft} \times \frac{12}{1000} = 78.8 \text{ k-in}$$

Use load factor for DC (dead load of components)

$$\gamma_p = 1.25$$

(AASHTO Table 3.4.1.2)

$$\text{Use strength I: } M_u = 1.25 \times 78.8 = \underline{98.5 \text{ k-in}} < \phi_f M_n = 160 \text{ k-in}$$

OK

Use 2L 5x3x3/8 LLBB $F_y = 36 \text{ ksi}$

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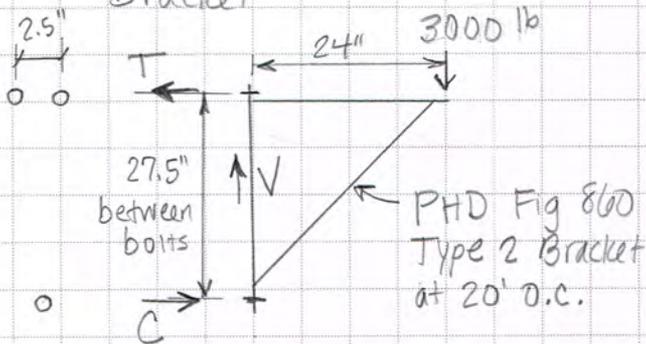
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Connection of Brackets to Fascia Girder Webs

Reaction from hanger loads: 2628 lb
JL Angle weight: $2 \times 9.8 \text{ lb/ft} \times 20' = 392 \text{ lb}$
 $\Sigma = 3020 \text{ lb per bracket}$
($\approx 3000 \text{ lb OK}$)

Conservatively assume the load acts at the edge of the bracket.



$V = 3,000 \text{ lb}$
 $T = C = \frac{3000 \text{ lb} \times 24''}{27.5''} = 2618 \text{ lb}$

There are two $1\frac{1}{16}'' \phi$ holes at the top, and one $1\frac{1}{16}'' \phi$ hole at the bottom.
Try (3) 1-inch dia A325 bolts.

$T_{\text{bolt}} = \frac{2618 \text{ lb}}{2} = 1309 \text{ lb/bolt}$

$V_{\text{bolt}} = \frac{3000 \text{ lb}}{3} = 1000 \text{ lb/bolt}$

Use $\gamma_p = 1.25$ Load Factor for DC (dead load of components)
(AASHTO Table 3.4.1.2)

$T_u = 1.25 \times 1309 = 1636 \text{ lb} = 1.64 \text{ k}$ (tension)

$P_u = 1.25 \times 1000 = 1250 \text{ lb} = 1.25 \text{ k}$ (shear)

$A_b = 0.79 \text{ in}^2$

$F_{ub} = 120 \text{ ksi}$ (AASHTO 6.4.3)

$\phi_t = 0.80$ $\phi_s = 0.80$ $\phi_{bb} = 0.80$ (AASHTO 6.5.4.2)

Shear: $R_n = 0.38 A_b F_{ub} N_s = 0.38 \times 0.79 \times 120 \times 1 = 36.0 \text{ k}$ (AASHTO 6.13.2.7-2)

$\phi_s R_n = 0.80 \times 36.0 = 28.8 \text{ k} > P_u = 1.25 \text{ k}$ (OK)

$\frac{P_u}{R_n} = \frac{1.10}{36.0} = 0.03 < 0.33 \therefore T_n = 0.76 A_b F_{ub}$ (AASHTO 6.13.2.11)

Tension: $T_n = 0.76 \times 0.79 \times 120 = 72.0 \text{ k}$ $\phi_t T_n = 0.8 \times 72 = 57.6 \text{ k} > T_u = 1.64 \text{ k}$ (OK)

Connection of Brackets to Fascia Girder Webs (cont)

Ref: Shop Dwg. Web is $3/4" \times 60"$ (App. E)

$t = 0.75"$

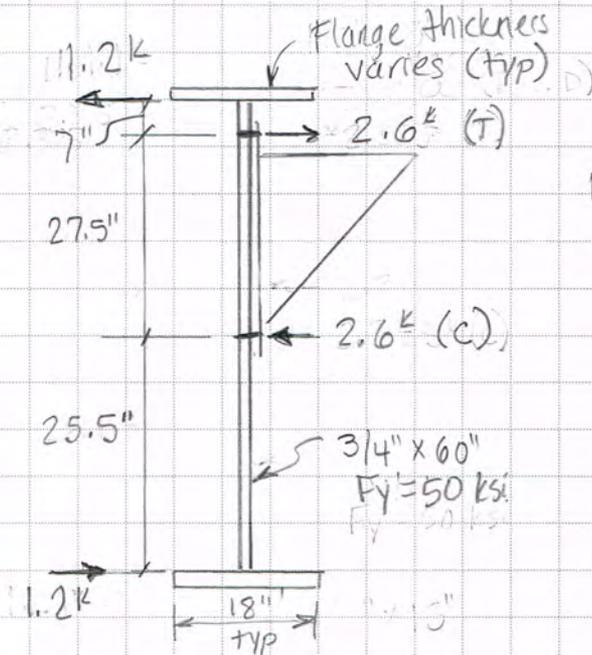
Bearing on bolts:

Clear distance between holes: $L_c = 2.5" - 1.0625" = 1.44"$
 $L_c < 2.0d = 2.0 \times 1 = 2.0"$

\therefore Bearing $R_n = 1.2 L_c t F_u$ (AASHTO 6.13.2.9-2)
 $= 1.2 \times 1.44" \times 0.75" \times 120 \text{ ksi} = 155 \text{ k}$

$\phi_{bb} R_n = 0.80 \times 155 \text{ k} = 124 \text{ k} > P_u = 1.25 \text{ k}$ (OK)

Check girder web for out-of-plane bending



$T = C = 2(18)^b = 2.6 \text{ k}$

Reaction at top flange:

$R_T = \frac{1}{60} [2.6(60-7) - 2.6(25.5)]$

$R_T = \frac{1}{60} [137.8 - 66.3] = 1.2 \text{ k} \leftarrow$

Reaction at bottom flange:

$R_B = \frac{1}{60} [2.6(7+27.5) - 2.6(7)]$

$= \frac{1}{60} [89.7 - 18.2] = 1.2 \text{ k} \rightarrow$

$V = 0$ at bottom bolts

$M_{max} = 1.2 \text{ k} \times 25.5" = 30.6 \text{ k-in}$

Consider a 9" length of web to resist the out-of-plane bending

$S = \frac{bd^2}{6} = \frac{9 \times 0.75^2}{6} = 0.84 \text{ in}^3$

$f_b = \frac{M}{S} = \frac{30.6 \text{ k-in}}{0.84 \text{ in}^3} = 36.4 \text{ ksi} < 0.75 F_y = 37.5 \text{ ksi}$ (OK)

APPENDIX 'A'

MECH-LOK Rigid Restrained Joint Pipe

⚠ Revised 5-19-15



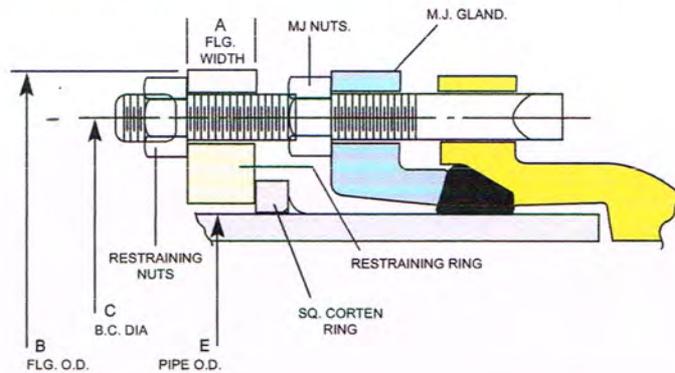
Restrained Joint Pipe

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Griffin MECH-LOK™ Rigid Restrained Joint

Certain pipeline construction projects require rigid restrained joint pipe for use on bridges or other elevated structures. The **MECH-LOK** joint combines the proven mechanical joint with a rigid restraining system. This product can be used on long-span piers at 40 ft. spacings.

The **MECH-LOK** assembly consists of a mechanical joint pipe, a ductile iron or A588 alloy steel **MECH-LOK** ring, and a factory-welded alloy steel ring on the plain end (spigot) of the pipe. The **MECH-LOK** joint is available in sizes 6" through 36" with working pressure ratings of 250 psi. It can be ordered with any standard or custom pipe laying length. **MECH-LOK** joints are supplied with the gland and fasteners. Note: **Although mechanical joint pipe is produced in 3" - 24" sizes only, MECH-LOK joints can be specified on any spigot up to 36" diameter.**



The double-nut design of the **MECH-LOK** joint allows the first nut to tighten the mechanical joint gland and compress the gasket. The second nut provides the necessary joint restraint and determines the flexibility of the finished joint. If the restraining nut is fully torqued, it will create a rigid pipeline with the capability of spanning 40-foot long span support spacings. The supports can be piers giving support from below or pipe hangers giving support from above the pipeline. Hangers can be as close as the bridge architecture demands or as distant as 40-feet on-center. The hangers are only responsible for supporting the dead weight of the pipe and its contained fluid - the rigid joint handles the thrust force. Isolated expansion is addressed by using readily available expansion joints as necessary.

6" - 36" MECH-LOK™ JOINT

Pipe Size	"A" Flange Width	"B" Flange O.D.	"C" B.C. Dia.	"E" Pipe Dia.	Bolt Length	Number of Bolts	Deflection Angle
6"	0.75	11.13	9.50	6.90	8	6	2½°
8"	1.00	13.38	11.75	9.05	8	6	2½°
10"	1.00	15.63	14.00	11.10	8	8	2½°
12"	1.00	17.88	16.25	13.20	8	8	2°
14"	1.25	20.25	18.75	15.30	8	10	2°
16"	1.50	22.50	21.00	17.40	8	12	2°
18"	1.63	25.75	23.25	19.50	8	12	2°
20"	1.75	28.32	25.50	21.60	8	14	2°
24"	2.00	32.44	30.00	25.80	8	16	2°
30"	2.50	39.25	36.88	32.00	10.5	20	½°
36"	3.00	46.00	43.75	38.30	11	24	½°

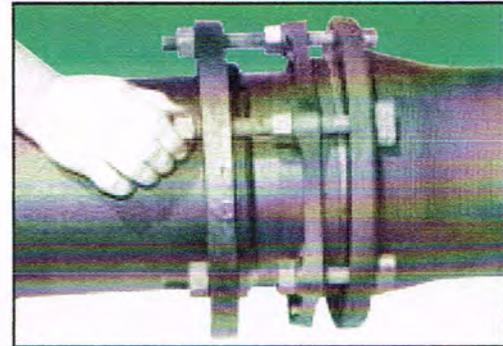
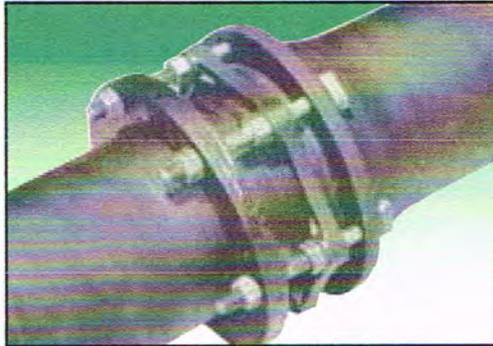


Restrained Joint Pipe

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MECH-LOK™ Rigid Restrained Joint Assembly Instructions

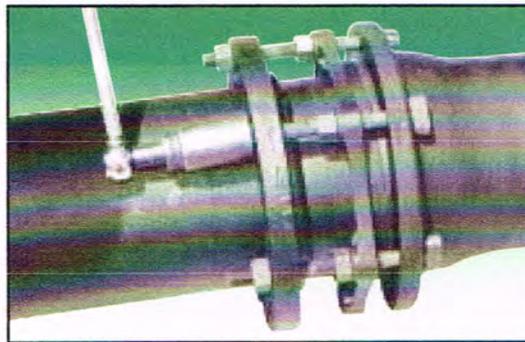
1. Assemble the mechanical joint as per the standard recommended procedure. Use reasonably straight alignment of the two pipe sections during assembly. Keep the MJ gland square with the MJ flange. Hand-tighten the nuts on the MJ gland.
2. Slide the **MECH-LOK** restraining ring over the bolts and hand tighten the nuts.



3. For non-rigid pipelines, tighten the nuts on the MJ gland using an open-end adjustable wrench. Uniformly tighten the nuts to the 120-150 ft.-lb torque range.

For applications that require subsequent joint deflection, the restraining nuts should be finger tightened.

For applications that require rigid joints, such as long span or bridge crossings, the restraining nuts should be tightened to the 120-150 ft.-lb torque range, prior to final tightening of the MJ nuts. This will ensure that the spigot is tight against the socket. After tightening the MJ bolts, retighten and torque the restraining nuts.

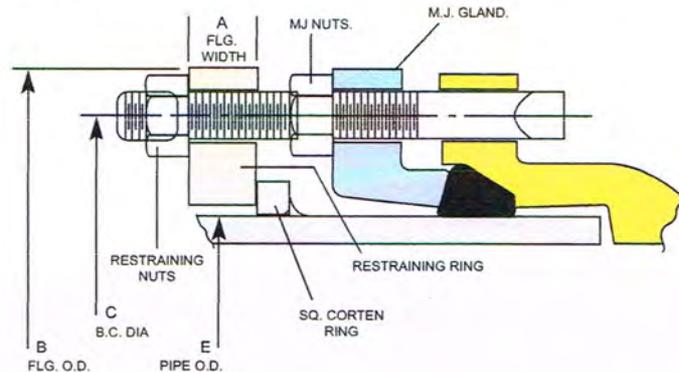


A typical **MECH-LOK** rigid restrained (long span) pipe design.

Griffin MECH-LOK™ Rigid Restrained Joint

Certain pipeline construction projects require rigid restrained joint pipe for use on bridges or other elevated structures. The **MECH-LOK** joint combines the proven mechanical joint with a rigid restraining system. This product can be used on long-span piers at 40 ft. spacings.

The **MECH-LOK** assembly consists of a mechanical joint pipe, a ductile iron or A588 alloy steel **MECH-LOK** ring, and a factory-welded alloy steel ring on the plain end (spigot) of the pipe. The **MECH-LOK** joint is available in sizes 6" through 36" with working pressure ratings of 250 psi. It can be ordered with any standard or custom pipe laying length. **MECH-LOK** joints are supplied with the gland and fasteners. Note: **Although mechanical joint pipe is produced in 3" - 24" sizes only, MECH-LOK joints can be specified on any spigot up to 36" diameter.**



The double-nut design of the **MECH-LOK** joint allows the first nut to tighten the mechanical joint gland and compress the gasket. The second nut provides the necessary joint restraint and determines the flexibility of the finished joint. If the restraining nut is fully torqued, it will create a rigid pipeline with the capability of spanning 40-foot long span support spacings. The supports can be piers giving support from below or pipe hangers giving support from above the pipeline. Hangers can be as close as the bridge architecture demands or as distant as 40-feet on-center. The hangers are only responsible for supporting the dead weight of the pipe and its contained fluid - the rigid joint handles the thrust force. Isolated expansion is addressed by using readily available expansion joints as necessary.

6" - 36" MECH-LOK™ JOINT

Pipe Size	"A" Flange Width	"B" Flange O.D.	"C" B.C. Dia.	"E" Pipe Dia.	Bolt Length	Number of Bolts	Deflection Angle
6"	0.75	11.13	9.50	6.90	8	6	2½°
8"	1.00	13.38	11.75	9.05	8	6	2½°
10"	1.00	15.63	14.00	11.10	8	8	2½°
12"	1.00	17.88	16.25	13.20	8	8	2°
14"	1.25	20.25	18.75	15.30	8	10	2°
16"	1.50	22.50	21.00	17.40	8	12	2°
18"	1.63	25.75	23.25	19.50	8	12	2°
20"	1.75	28.32	25.50	21.60	8	14	2°
24"	2.00	32.44	30.00	25.80	8	16	2°
30"	2.50	39.25	36.88	32.00	10.5	20	½°
36"	3.00	46.00	43.75	38.30	11	24	½°



Mechanical Joint Pipe

**Mechanical Joint Pipe
Pressure & Special Thickness Classes**

Similar to Mech-Lok Pipe.

Nominal Pipe Size (in.)	Pipe Dimensions				Pipe Weights				
	Pressure Class	Thickness Class	Pipe Thickness (in.)	Pipe O.D. (in.)	Weight of pipe barrel per foot (lbs.)	18-foot Laying Lengths		20-foot Laying Lengths	
						Weight per length (lbs.)	Average weight per foot** (lbs.)	Weight per length (lbs.)	Average weight per foot** (lbs.)
3	350	51	0.25	3.96	8.9	171	9.5		
		52	0.28		9.9	189	10.5		
		53	0.31		10.9	207	11.5		
		54	0.34		11.8	224	12.4		
		55	0.37		12.8	242	13.4		
		56	0.40	13.7	258	14.3			
4	350	51	0.25	4.80	10.9	211	11.7		
		52	0.26		11.3	218	12.1		
		53	0.29		12.6	241	13.4		
		54	0.32		13.8	263	14.6		
		55	0.35		15.0	284	15.8		
		56	0.38	16.1	304	16.9			
		56	0.41	17.3	326	18.1			
6	350	50	0.25	6.90	16.0	309	17.2	341	17.1
		51	0.28		17.8	342	19.0	377	18.9
		52	0.31		19.6	374	20.8	413	20.7
		53	0.34		21.4	406	22.6	449	22.5
		54	0.37		23.2	439	24.4	485	24.2
		55	0.40	25.0	471	26.2	521	26.1	
		56	0.43	26.7	502	27.9	555	27.8	
8	350	50	0.25	9.05	21.1	408	22.7	451	22.6
		51	0.27		22.8	439	24.4	485	24.3
		52	0.30		25.2	482	26.8	533	26.7
		53	0.33		27.7	527	29.3	583	29.2
		54	0.36		30.1	570	31.7	631	31.6
		55	0.39	32.5	614	34.1	679	34.0	
		56	0.42	34.8	655	36.4	725	36.3	
		56	0.45	37.2	698	38.8	773	38.7	
10	350	50	0.26	11.10	27.1	524	29.1	578	28.9
		51	0.29		30.1	578	32.1	638	31.9
		52	0.32		33.2	634	35.2	700	35.0
		53	0.35		36.2	688	38.2	760	38.0
		54	0.38		39.2	742	41.2	820	41.0
		55	0.41	42.1	794	44.1	878	43.9	
		56	0.44	45.1	848	47.1	938	46.9	
		56	0.47	48.0	900	50.0	996	49.8	
12	350	50	0.28	13.20	34.8	672	37.3	741	37.1
		51	0.31		38.4	736	40.9	813	40.7
		52	0.34		42.0	801	44.5	885	44.3
		53	0.37		45.6	866	48.1	957	47.8
		54	0.40		49.2	931	51.7	1029	51.5
		55	0.43	52.8	996	55.3	1101	55.1	
		56	0.46	56.3	1059	58.8	1171	58.6	
		56	0.49	59.9	1123	62.4	1243	62.2	

Standard Dimensions and Weights per ANSI/AWWA C151

** "Average weight per foot" shown in tables includes the weight of the bell

APPENDIX 'B'

Catalog Cuts for Pipe Roller Supports

PIPE ROLLER SUPPORTS



Fig. 470 & 475 PIPE ROLLER HANGER

FUNCTION: Designed for suspending pipe in applications where horizontal movement, due to expansion and contraction, will occur and vertical adjustment is necessary. The knurled insert provided with Fig. 475 allows easier vertical adjustment.

APPROVALS: Complies with Federal Specifications A-A-1192A (Type 43) and Manufacturers' Standardization Society ANSI/SP-69 and SP-58 (Type 43).

MATERIAL: Cast iron pipe roller with low carbon steel frame, axle and hex nuts.

FINISH: Plain or Electro-galvanized

SIZING: Pipe roller size is for bare pipe. For proper sizing with insulation, refer to pipe roller selection guide on page 49, which is for use with pipe covering protection saddles.

ORDERING: Specify pipe roller size and figure number.

Fig. 470* WITHOUT SWIVEL
Fig. 475 WITH ADJUSTING SWIVEL

*Available in stainless steel.
To order, specify 304 or 316 and add suffix SS to figure number.
Price on request.

Fig. 475
Available up to 8" (200)
Pipe
Roller Size

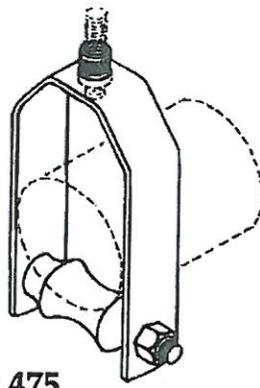


Fig. 475

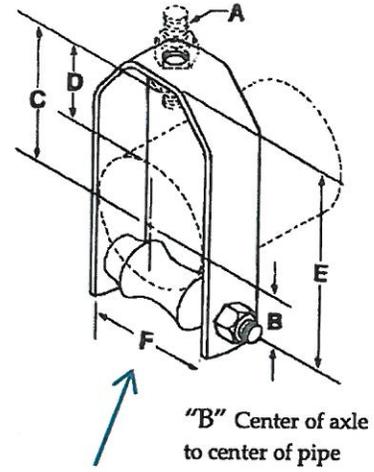
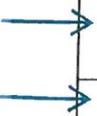


Fig. 470
HDG Frame w/ 304 SS
Roller & Hardware



Pipe Roller Size	Rod Size A	B	C	Adjustment		E	F	Max. Rec. Load		Wt. Each	
				D				lbs.	kN	lbs.	kg
2 (50)	3/8	1 5/8 (41.28)	2 5/8 (66.68)	1 1/16 (26.99)	4 3/8 (111.13)	3 (76.20)	150 (0.67)	1.05	(.48)		
2 1/2 (65)	1/2	2 (50.80)	2 3/8 (60.33)	1 3/16 (30.16)	5 (127.00)	3 1/4 (82.55)	225 (1.00)	1.29	(.59)		
3 (80)	1/2	2 1/4 (57.15)	3 1/2 (88.90)	1 3/4 (44.45)	6 3/8 (161.93)	3 7/8 (98.43)	310 (1.38)	1.56	(.71)		
3 1/2 (90)	1/2	2 5/8 (66.68)	3 3/4 (95.25)	1 3/4 (44.45)	7 (177.80)	4 3/8 (111.13)	390 (1.73)	1.83	(.83)		
4 (100)	5/8	2 3/4 (69.85)	3 15/16 (100.01)	1 11/16 (42.86)	7 1/2 (190.50)	5 (127.00)	475 (2.11)	2.81	(1.27)		
5 (125)	5/8	3 1/2 (88.90)	4 5/16 (109.54)	1 9/16 (39.69)	8 5/8 (219.08)	6 (152.40)	685 (3.05)	4.42	(2.00)		
6 (150)	3/4	4 (101.60)	5 3/8 (136.53)	2 1/16 (52.39)	10 1/4 (260.35)	7 1/8 (180.98)	780 (3.47)	5.98	(2.71)		
8 (200)	3/4	5 1/8 (130.18)	6 1/2 (165.10)	2 3/16 (55.56)	12 3/4 (323.85)	9 1/4 (234.95)	780 (3.47)	11.42	(5.18)		
10 (250)	7/8	6 3/8 (161.93)	7 3/8 (187.33)	2 (50.80)	15 (381.00)	11 1/4 (285.75)	965 (4.29)	17.36	(7.87)		
12 (300)	7/8	7 1/2 (190.50)	8 3/4 (222.25)	2 3/8 (60.33)	17 3/8 (441.33)	13 1/4 (336.55)	1200 (5.34)	24.62	(11.17)		
14 (350)	1	8 3/8 (212.73)	9 (228.60)	2 (50.80)	18 7/8 (479.43)	14 3/4 (374.65)	1200 (5.34)	36.00	(16.33)		
16 (400)	1	9 1/2 (241.30)	9 3/4 (247.65)	1 3/4 (44.45)	20 3/4 (527.05)	16 7/8 (428.63)	1200 (5.34)	44.00	(19.96)		
18 (450)	1	10 1/2 (266.70)	11 3/4 (298.45)	2 3/4 (69.85)	23 3/4 (603.25)	18 7/8 (479.43)	1400 (6.23)	54.00	(24.49)		
20 (500)	1 1/4	11 5/8 (295.28)	12 1/2 (317.50)	2 1/2 (63.50)	26 (660.40)	20 7/8 (530.23)	1600 (7.12)	74.00	(33.57)		
24 (600)	1 1/2	13 13/16 (350.84)	16 1/2 (419.10)	4 1/2 (114.30)	31 (787.40)	25 (635.00)	1600 (7.12)	126.00	(57.15)		

Note: For Fig. 470 use of an upper locknut ensures proper performance.

Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

THREADED ACCESSORIES



FUNCTION: Designed for use in hanger assemblies. The welded design allows the eye to develop the full strength of the rod.
MATERIAL: Low carbon steel
FINISH: Plain or electro-galvanized
ORDERING: Specify rod size, length and figure number.

Fig. 50 & 50L EYE ROD

Fig. 50 RIGHT-HAND THREADS
Fig. 50L LEFT-HAND THREADS

Fig. 50 & 50L

Rod Size A	B	Thread Length C	Max. Rec. Load	
			650°F (343°C)	
			lbs.	kN
3/8	5/8 (15.88)	2 1/2 (63.50)	240	(1.07)
1/2	3/4 (19.05)	2 1/2 (63.50)	440	(1.96)
5/8	7/8 (22.23)	2 1/2 (63.50)	705	(3.14)
3/4	1 (25.40)	3 (76.20)	1050	(4.67)
7/8	1 1/8 (28.58)	3 1/2 (88.90)	1470	(6.54)
1	1 1/4 (31.75)	4 (101.60)	1940	(8.63)

Available in stainless steel. To order, specify 304 or 316 and add suffix SS to figure number.
 Price on request.

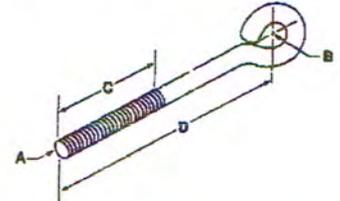


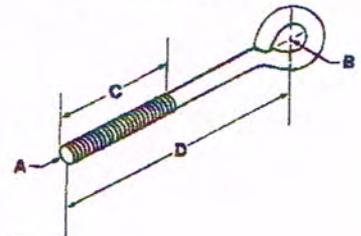
Fig. 55 & 55L WELDED EYE ROD

Fig. 55 RIGHT-HAND THREADS
Fig. 55L LEFT-HAND THREADS

Fig. 55 & 55L

Rod Size A	B	Thread Length C	Max. Rec. Load			
			650°F (343°C)		750°F (399°C)	
			lbs.	kN	lbs.	kg
3/8	5/8 (15.88)	2 1/2 (63.50)	730	(3.25)	540	(2.40)
1/2	3/4 (19.05)	2 1/2 (63.50)	1350	(6.01)	1010	(4.49)
5/8	7/8 (22.23)	2 1/2 (63.50)	1810	(8.05)	1610	(7.16)
3/4	1 (25.40)	3 (76.20)	2710	(12.05)	2420	(10.76)
7/8	1 1/8 (28.58)	3 1/2 (88.90)	3770	(16.77)	3360	(14.95)
1	1 1/4 (31.75)	4 (101.60)	4960	(22.06)	4420	(19.66)

Available in stainless steel. To order, specify 304 or 316 and add suffix SS to figure number.
 Price on request.



Rod Size A	Wt. Each													
	Length D													
	8 (203.2)		10 (254.0)		12 (304.8)		14 (355.6)		18 (457.2)		24 (609.6)		30 (762.0)	
	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
3/8	.32	(0.15)	.38	(0.17)	.44	(0.20)	.50	(0.23)	.63	(0.29)	.80	(0.36)	1.00	(0.45)
1/2	.60	(0.27)	.70	(0.32)	.82	(0.37)	.94	(0.43)	1.16	(0.53)	1.50	(0.68)	1.83	(0.83)
5/8	.97	(0.44)	1.14	(0.52)	1.31	(0.59)	1.49	(0.68)	1.84	(0.83)	2.36	(1.07)	2.88	(1.31)
3/4	1.44	(0.65)	1.68	(0.76)	1.94	(0.88)	2.19	(0.99)	2.68	(1.22)	3.44	(1.56)	4.17	(1.89)
7/8	2.04	(0.93)	2.32	(1.05)	2.68	(1.22)	3.02	(1.37)	3.73	(1.69)	4.72	(2.14)	5.74	(2.60)
1	2.67	(1.21)	3.11	(1.41)	3.56	(1.61)	4.00	(1.81)	4.89	(2.22)	6.78	(3.08)	8.18	(3.71)

Rod Size A	Wt. Each													
	Length D													
	36 (914.4)		42 (1066.8)		48 (1219.2)		54 (1371.6)		60 (1524.0)		66 (1676.4)		72 (1828.8)	
	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
3/8	1.18	(0.54)	1.39	(0.63)	1.58	(0.72)	1.76	(0.80)	1.95	(0.88)	2.14	(0.97)	2.33	(1.06)
1/2	2.17	(0.98)	2.49	(1.13)	2.83	(1.28)	3.16	(1.43)	3.49	(1.58)	3.83	(1.74)	4.06	(1.84)
5/8	3.40	(1.54)	3.92	(1.78)	4.44	(2.01)	4.96	(2.25)	5.48	(2.49)	6.00	(2.72)	6.52	(2.96)
3/4	4.94	(2.24)	5.70	(2.59)	6.45	(2.93)	7.20	(3.27)	7.95	(3.61)	8.70	(3.95)	9.45	(4.29)
7/8	6.76	(3.07)	7.81	(3.54)	8.83	(4.01)	9.85	(4.47)	10.87	(4.93)	11.89	(5.39)	12.91	(5.86)
1	8.89	(4.03)	10.48	(4.75)	11.87	(5.38)	13.19	(5.98)	14.51	(6.58)	15.91	(7.22)	17.25	(7.82)

Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

APPENDIX 'C'

Catalog Cuts for Utility Brackets



WALL BRACKETS

Fig. 860
HEAVY DUTY
WALL BRACKET

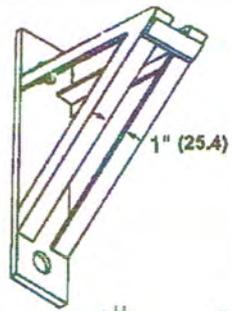
FUNCTION: Designed for the support or suspension of loads (up to 3000 lbs (13.34kN). from walls or structures. The 1" (25.4) space between the angles allows the rod to be placed anywhere along the length of the brackets.

APPROVALS: Complies with Federal Specifications A-A-1192A (Type 33) and Manufacturers' Standardization Society ANSI/SP-69 and SP-58 (Type 33).

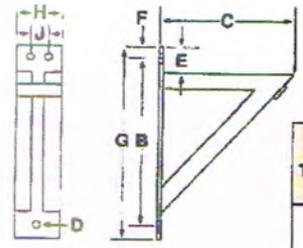
MATERIAL: Low carbon steel

FINISH: Plain or electro-galvanized

ORDERING: Specify type number and figure number.



Available in stainless steel.
To order, specify 304 or 316 and add suffix SS to figure number.
Price on request.



Type No.	B	C	Hole Size D	E	F
0	15 ¹ / ₄ (387.35)	12 (304.80)	1 ³ / ₁₆ (20.64)	2 ³ / ₄ (69.85)	1 ¹ / ₂ (38.10)
1	21 ³ / ₁₆ (542.93)	18 (457.20)	1 ⁵ / ₁₆ (23.81)	2 ³ / ₄ (69.85)	1 ³ / ₈ (34.93)
2	27 ¹ / ₂ (698.50)	24 (609.60)	1 ¹ / ₁₆ (26.99)	2 ³ / ₄ (69.85)	1 ¹ / ₄ (31.75)
3	33 ¹ / ₄ (844.55)	30 (762.00)	1 ¹ / ₁₆ (26.99)	3 (76.20)	1 ¹ / ₂ (38.10)
4	39 (990.60)	36 (914.40)	1 ¹ / ₁₆ (26.99)	3 (76.20)	1 ¹ / ₂ (38.10)
5	46 (1168.40)	42 (1066.80)	1 ¹ / ₁₆ (26.99)	3 ¹ / ₂ (88.90)	2 (50.80)

Type No.	G	H	J	Angle Iron Size	Max. Rec. Load		Wt Each	
					lbs.	kN	lbs.	kg
0	18 (457.2)	4 (101.6)	*	2 x 1 ¹ / ₂ x 1 ¹ / ₄ (50.8 x 38.1 x 6.35)	3000 (13.34)		24.33 (11.04)	
1	24 (609.6)	5 (127.0)	2 ³ / ₄ (69.85)	2 x 2 x 1 ¹ / ₄ (50.8 x 50.8 x 6.35)	3000 (13.34)		51.80 (23.50)	
2	30 (762.0)	5 (127.0)	2 ¹ / ₂ (63.50)	2 ¹ / ₂ x 2 x 5 ¹ / ₁₆ (63.5 x 50.8 x 7.94)	3000 (13.34)		65.84 (29.86)	
3	36 (914.4)	5 (127.0)	2 ¹ / ₂ (63.50)	2 ¹ / ₂ x 2 x 5 ¹ / ₁₆ (63.5 x 50.8 x 7.94)	3000 (13.34)		82.10 (37.24)	
4	42 (1066.8)	6 (152.4)	3 ¹ / ₂ (88.90)	3 ¹ / ₂ x 2 ¹ / ₂ x 3 ³ / ₈ (88.9 x 63.5 x 9.53)	3000 (13.34)		140.52 (63.74)	
5	50 (1270.0)	6 (152.4)	3 ¹ / ₂ (88.90)	3 ¹ / ₂ x 2 ¹ / ₂ x 3 ³ / ₈ (88.9 x 63.5 x 9.53)	3000 (13.34)		166.40 (75.48)	

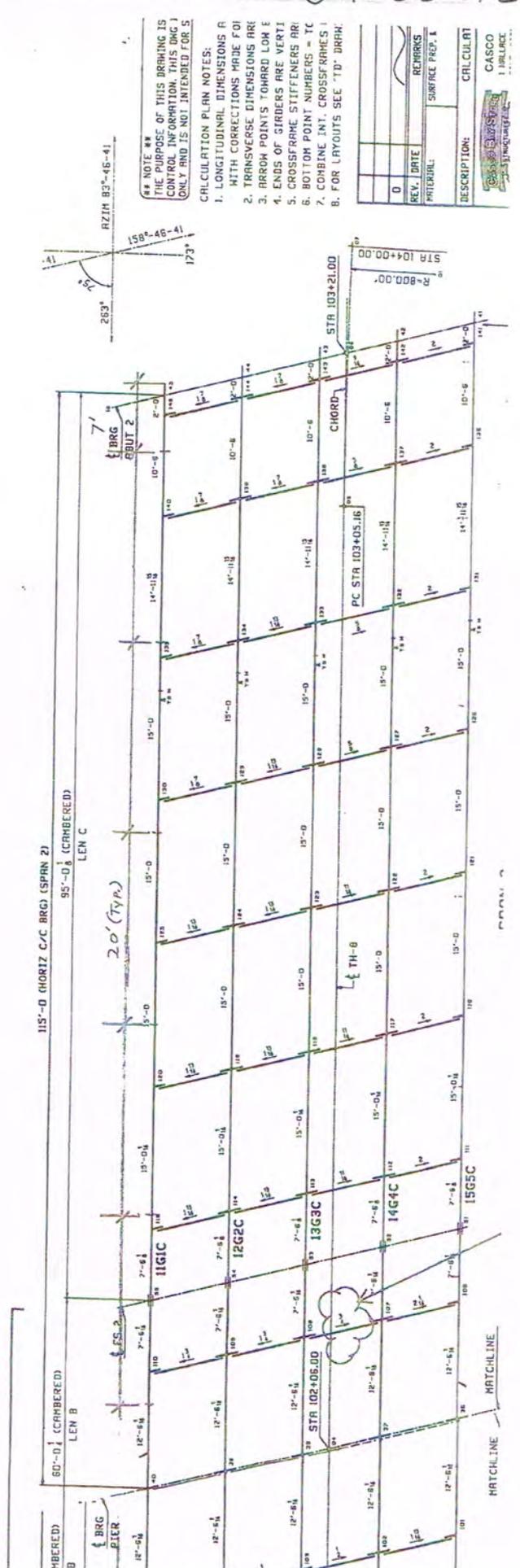
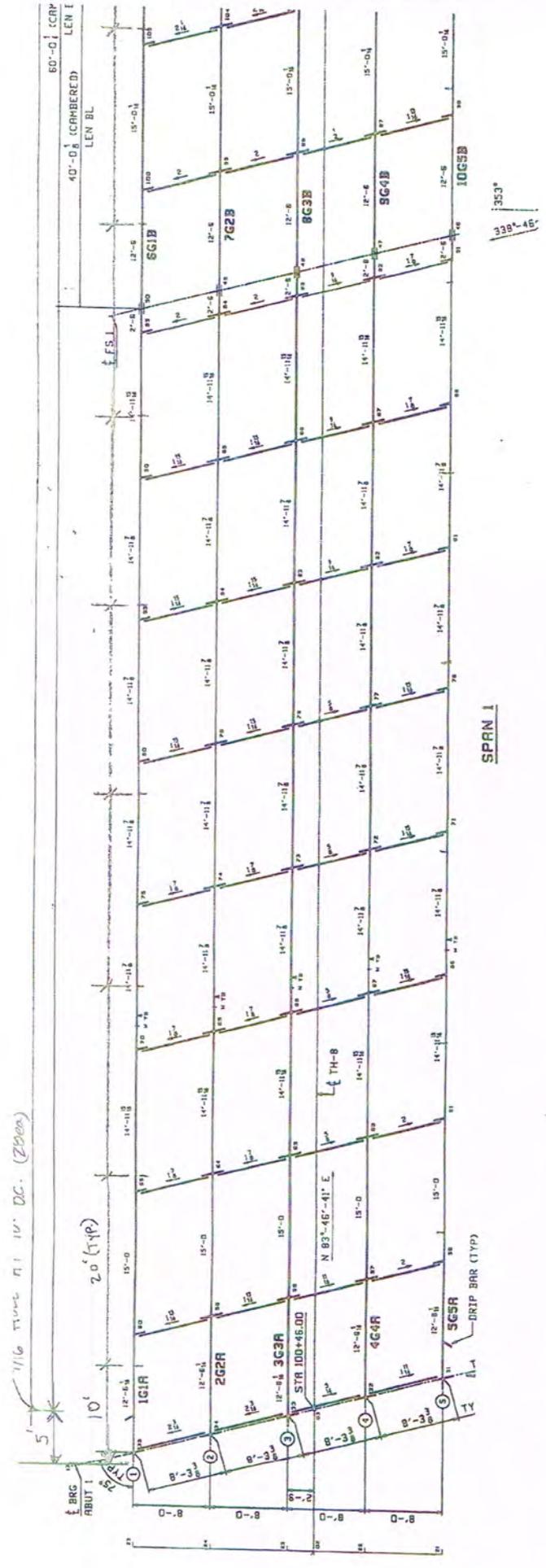
*one hole

1800-321-2736
Jonathan Covino

Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

APPENDIX 'D'

Proposed Drilled Holes in Fascia Girders



NOTE ##
 THE PURPOSE OF THIS DRAWING IS
 TO CONTROL INFORMATION. THIS DRAWING
 IS NOT INTENDED FOR S

CALCULATION PLAN NOTES:
 1. LONGITUDINAL DIMENSIONS ARE
 WITH CORRECTIONS MADE FOR
 2. TRANSVERSE DIMENSIONS ARE
 3. ARROW POINTS TOWARD LOW E
 4. ENDS OF GIRDERS ARE VERTI
 5. CROSSFRAME STIFFENERS ARE
 6. BOTTOM POINT NUMBERS = TC
 7. COMBINE INT. CROSSFRAMES I
 8. FOR LAYOUTS SEE 'TD' DRAW.

REV.	DATE	REMARKS	CALCULAT
0		SURFACE PROP. A	CASCO

APPENDIX 'E'

Selected Portions of Shop Drawings

MATERIAL SPECIFICATIONS

- 1) UNLESS OTHERWISE NOTED, ALL STEEL TO BE UNPAINTED
AASHTO M270 (ASTM A709) GRADE 50W.
- 2) MATERIAL NOTED "CVN" OR "T2" ON DETAIL DRAWINGS SHALL BE CHARPY
V-NOTCH TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF VERMONT
STANDARD SPECIFICATIONS SECTION 714.01.
- 3) HIGH STRENGTH BOLTS:
-ASTM A325 (AASHTO M164) TYPE 3 W/ A563 GRADE C3 NUTS & F436W WASHERS IN NON-PAINTED
-ASTM A325 (AASHTO M164) TYPE 1 (GALV.) W/ A563 GRADE DH NUTS & F436 WASHERS IN PAINTED
BOLTS & NUTS SHALL BE ROTATIONAL CAPACITY TESTED.
DO NOT MIX NUTS & BOLTS FROM DIFFERENT CONTAINERS
UNLESS ALL BOLTS & NUTS HAVE THE SAME LOT NUMBER.
- 4) DIRECT TENSION INDICATOR WASHERS CONFORMING TO ASTM F959
SHALL BE INSTALLED WITH ALL HIGH STRENGTH BOLTS.

FABRICATION

- 1) ALL HOLES SHALL BE PUNCHED OR DRILLED FULL SIZE (UN).

ABM INFO		SHIP	BILL OF MATERIAL						JOB NO.	DRAWING NO.	REV.
PAGE LINE	MARK	MARK	QTY	MARK	MATERIAL	LENGTH		REMARKS	WT	PROCUREMENT NOTES	
						FT	INCHES				
		IG1A	1		GIRDER				36096		
1	Q		1	wa	PL 3/4 x 60	46	0 8	M270-50WT2	7045		
1	L		1	wb	PL 3/4 x 60	75	0 13	M270-50WT2	11495		
1	G		1	ta	PL 1 1/8 x 18	47	0 7	M270-50WT2	3241		
1	C		1	tb	PL 1 1/8 x 18	73	11 8	M270-50WT2	5098		
1	G		1	ba	PL 1 1/8 x 18	46	11 7	M270-50WT2	3235		
1	C		1	bb	PL 1 1/8 x 18	73	11 8	M270-50WT2	5098		
2	H		1	x1f	PL 1 x 8 7/8	5	0	MIE	151		
2	H		1	x1g	PL 1 x 8 7/8	5	0	MIE	151		
2	J		8	x1p	PL 1 1/2 x 8 2	5	0		72		
2	K		1	x1w	PL 1 3/4 x 3 1/2	1	0 8		3		

5.1

ON DRAWING X1

ABM INFO		SHIP		BILL OF MATERIAL					JOB NO.	DRAWING NO.	REV.
PAGE LINE	MARK	QTY	MARK	MATERIAL	MARK	QTY	LENGTH FT INCHES	REMARKS	WT	PROCUREMENT NOTES	
			5G5A	GIRDER		1			36096		
1	Q	1		PL 3/4 x 60	wa	1	46 0 8	M270-50WT2	7045		
1	L	1		PL 3/4 x 60	wb	1	75 0 13	M270-50WT2	11495		
1	G	1		PL 1 1/8 x 18	ta	1	47 0 7	M270-50WT2	3241		
1	C	1		PL 1 1/8 x 18	tb	1	73 1 18	M270-50WT2	5098		
1	G	1		PL 1 1/8 x 18	ba	1	46 1 16	M270-50WT2	3235		
1	C	1		PL 1 1/8 x 18	bb	1	73 1 18	M270-50WT2	5098		
2	H	1		PL 1 x 8 7/8	x1f	1	5 0	MIE	151		
2	H	1		PL 1 x 8 7/8	x1k	1	5 0	MIE	151		
2	J	8		PL 1 1/2 x 8 2 1/4	x1p	8	5 0		72		

5.1

DRAWING X1