Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

Date: **February 22, 2017**

JACOBS
Jacobs Engineering Group, Inc.
5449 Bells Ferry Road
Acworth, GA 30102
770-701-2500

Timothy Howell
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

| | | |
|---|---|---|
| **Subject:** | **Structural Analysis Report** | |
| ***Carrier Designation:*** | ***US Cellular* Co-Locate** | |
| | **Carrier Site Number:** | 853337 |
| | **Carrier Site Name:** | North Portland |
| ***Crown Castle Designation:*** | **Crown Castle BU Number:** | 878783 |
| | **Crown Castle Site Name:** | PORTLAND NORTH |
| | **Crown Castle JDE Job Number:** | 375976 |
| | **Crown Castle Work Order Number:** | 1367448 |
| | **Crown Castle Application Number:** | 343122 Rev. 3 |
| ***Engineering Firm Designation:*** | **Jacobs Engineering Group Inc. Project Number:** | 1367448 |
| ***Site Data:*** | **517 Presumpscot Street, Portland, Cumberland County, ME**<br>**Latitude *43° 41' 58.53"*, Longitude *-70° 15' 30.64"***<br>**178 Foot - Monopole Tower** | |

Dear Timothy Howell,

*Jacobs Engineering Group Inc.* is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 1004897, in accordance with application 343122, revision 3.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA-222-G standard and 2009 International Building Code based upon a wind speed of 100 mph 3-second gust, exposure category C

All modifications and equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at *Jacobs Engineering Group Inc.* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Structural analysis prepared by:

Jeremy Earnest, EIT
Structural Engineer

Reviewed By:

STATE OF MAINE
PAUL L. MUCCI
10479
REGISTERED PROFESSIONAL ENGINEER

Paul L. Mucci P.E.
Sr. Project Engineer

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## 1) INTRODUCTION

This tower is a 178 ft Monopole tower designed by PITTSBURG MONOPOLE in December of 1996. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F.

The tower has been modified multiple times in the past to accommodate additional loading.

## 2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA-222-G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a 3-second gust wind speed of 100 mph with no ice, 40 mph with 1 inch ice thickness and 60 mph under service loads, exposure category C.

**Table 1 - Proposed Antenna and Cable Information**

| Mounting Level (ft) | Center Line Elevation (ft) | Number of Antennas | Antenna Manufacturer | Antenna Model | Number of Feed Lines | Feed Line Size (in) | Note |
|---|---|---|---|---|---|---|---|
| 134.0 | 135.0 | 3 | kmw communications | AM-X-CD-17-65-00T-RET w/ Mount Pipe | - | - | - |

**Table 2 - Existing and Reserved Antenna and Cable Information**

| Mounting Level (ft) | Center Line Elevation (ft) | Number of Antennas | Antenna Manufacturer | Antenna Model | Number of Feed Lines | Feed Line Size (in) | Note |
|---|---|---|---|---|---|---|---|
| 178.0 | 180.0 | 2 | decibel | DB978G30E-M w/ Mount Pipe | 6 | 1-5/8 | 1 |
| | | 4 | decibel | DB978H65E-M w/ Mount Pipe | | | |
| | | 1 | tower mounts | Miscellaneous [NA 510-1] | | | |
| | 178.0 | 1 | tower mounts | Platform Mount [LP 1201-1] | | | |
| 168.0 | 171.0 | 3 | ericsson | KRY 112 144/1 | 12 | 1-5/8 | 1 |
| | | 3 | rfs celwave | APX16DWV-16DWV-S-E-A20 w/Mount Pipe | | | |
| | 170.0 | 6 | ericsson | KRY 112 71 | | | |
| | | 6 | rfs celwave | APXV18-206517-C w/Mount Pipe | | | |
| | 168.0 | 1 | tower mounts | Platform Mount [LP 305-1] | | | |
| 160.0 | 160.0 | 1 | andrew | SBNH-1D6565C w/ Mount Pipe | 12<br>1<br>2 | 1-5/8<br>3/8<br>3/4 | 1 |
| | | 3 | ericsson | RRUS 11 B4 | | | |
| | | 3 | ericsson | RRUS-11 | | | |
| | | 6 | kathrein | 782 10254 | | | |
| | | 1 | kmw communications | AM-X-CD-16-65-00T-RET w/ Mount Pipe | | | |
| | | 6 | powerwave technologies | 7020.00 | | | |
| | | 3 | powerwave technologies | 7770.00 w/Mount Pipe | | | |

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| Mounting Level (ft) | Center Line Elevation (ft) | Number of Antennas | Antenna Manufacturer | Antenna Model | Number of Feed Lines | Feed Line Size (in) | Note |
|---|---|---|---|---|---|---|---|
| 160.0 | 160.0 | 6 | powerwave technologies | LGP21401 | - | - | 1 |
| | | 6 | powerwave technologies | LGP21903 | | | |
| | | 1 | powerwave technologies | P65-17-XLH-RR w/ Mount Pipe | | | |
| | | 1 | raycap | DC6-48-60-18-8F | | | |
| | | 1 | tower mounts | T-Arm Mount [TA 602-3] | | | |
| | | 1 | cci antennas | HPA-65R-BUU-H6 w/ Mount Pipe | 2<br>1 | 3/4<br>3/8 | 3 |
| | | 2 | cci antennas | HPA-65R-BUU-H8 w/ Mount Pipe | | | |
| | | 3 | ericsson | RRUS12/RRUS A2 | | | |
| | | 1 | raycap | DC6-48-60-18-8F | | | |
| 149.0 | 151.0 | 1 | alcatel lucent | RRH2X40-AWS | 19 | 1-5/8 | 1 |
| | | 1 | andrew | HBX-6517DS-T2M w/ Mount Pipe | | | |
| | | 2 | andrew | LNX-6514DS-VTM w/ Mount Pipe | | | |
| | | 1 | commscope | HBX-6516DS-A1M w/ Mount Pipe | | | |
| | | 1 | commscope | LNX-6514DS-VTM w/ Mount Pipe | | | |
| | 150.0 | 2 | alcatel lucent | RRH2X40-AWS | | | |
| | | 2 | andrew | HBX-6517DS-T2M w/ Mount Pipe | | | |
| | | 2 | commscope | LNX-6514DS-VTM w/ Mount Pipe | | | |
| | | 1 | andrew | LNX-6514DS-VTM w/ Mount Pipe | | | |
| | | 2 | commscope | HBX-6516DS-A1M w/ Mount Pipe | | | |
| | | 1 | rfs celwave | DB-B1-6C-12AB-0Z | | | |
| | 149.0 | 1 | tower mounts | Platform Mount [LP 1201-1] | | | |
| 134.0 | 135.0 | 3 | powerwave tech | P65-17-XL-R w/ Mount Pipe | - | - | 2 |
| | | 6 | antel | BSA-185065/10CF w/ Mount Pipe | 6<br>6 | 1-5/8<br>7/8 | 1 |
| | | 3 | ericsson | KRC 115 032/2 | | | |
| | 134.0 | 1 | tower mounts | Platform Mount [LP 403-1] | | | |

Notes:
1) Existing Equipment
2) Equipment to be removed; Not Considered in this Analysis
3) Reserved Equipment

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**Table 3 - Design Antenna and Cable Information**

| Mounting Level (ft) | Center Line Elevation (ft) | Number of Antennas | Antenna Manufacturer | Antenna Model | Number of Feed Lines | Feed Line Size (in) |
|---|---|---|---|---|---|---|
| 180.0 | 180.0 | 12 | Generic | 4 SQ. FT. | - | - |
| 170.0 | 170.0 | 2 | Generic | 6' DISHES | - | - |
| 160.0 | 160.0 | 12 | Generic | 4 SQ. FT. | - | - |

## 3) ANALYSIS PROCEDURE

**Table 4 - Documents Provided**

| Document | Remarks | Reference | Source |
|---|---|---|---|
| 4-GEOTECHNICAL REPORTS | FDH Velocitel | 1620506 | CCISITES |
| 4-POST-MODIFICATION INSPECTION | TEP | 3455671 | CCISITES |
| 4-POST-MODIFICATION INSPECTION | PSG | 3630219 | CCISITES |
| 4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS | Pittsburg | 1620582 | CCISITES |
| 4-REINFORCEMENT DESIGN/DRAWINGS/DATA | PSG | 2415719 | CCISITES |
| 4-REINFORCEMENT DESIGN/DRAWINGS/DATA | FDH | 3175691 | CCISITES |
| 4-TOWER MANUFACTURER DRAWINGS | Pittsburg | 3633205 | CCISITES |

### 3.1) Analysis Method

tnxTower (version 7.0.7.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

### 3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) The existing base plate grout was not considered in this analysis.

This analysis may be affected if any assumptions are not valid or have been made in error. Jacobs Engineering Group Inc. should be notified to determine the effect on the structural integrity of the tower.

## 4) ANALYSIS RESULTS

**Table 5 - Section Capacity (Summary)**

| Section No. | Elevation (ft) | Component Type | Size | Critical Element | P (K) | SF*P_allow (K) | % Capacity | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| L1 | 178 - 140 | Pole | P24x1/2 | 1 | -16.58 | 1162.78 | 70.8 | Pass |
| L2 | 140 - 100 | Pole | P36x1/2 | 2 | -30.78 | 1756.54 | 103.8 | Pass[2] |

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| Section No. | Elevation (ft) | Component Type | Size | Critical Element | P (K) | SF*P_allow (K) | % Capacity | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| L3 | 100 - 60 | Pole | P48x5/8 | 3 | -48.99 | 2930.15 | 85.7 | Pass |
| L4 | 60 - 20 | Pole | P54x5/8 | 4 | -69.38 | 3301.25 | 104.0 | Pass[2] |
| L5 | 20 - 0 | Pole | P60x5/8 | 5 | -80.56 | 3649.51 | 101.0 | Pass[2] |
| | | | | | | | Summary | |
| | | | | | | Pole (L4) | 104.0 | Pass[2] |
| | | | | | | Rating = | 104.0 | Pass[2] |

**Table 6 - Tower Component Stresses vs. Capacity – LC7**

| Notes | Component | Elevation (ft) | % Capacity | Pass / Fail |
|---|---|---|---|---|
| 1 | Anchor Rods | 0 | 95.3 | Pass |
| 1 | Base Plate | 0 | 39.9 | Pass |
| 1 | Base Foundation Structural | 0 | 15.8 | Pass |
| 1 | Base Foundation Soil Interaction | 0 | 94.2 | Pass |
| 1 | Bolts | 20 | 102.7 | Pass[2] |
| | Top Flange Plate | | 23.8 | Pass |
| | Bottom Flange Plate | | 31.2 | Pass |
| 1 | Bolts | 60 | 89.9 | Pass |
| | Top Flange Plate | | 25.3 | Pass |
| | Bottom Flange Plate | | 33.3 | Pass |
| 1 | Bolts | 100 | 94.4 | Pass |
| | Top Flange Plate | | 49.1 | Pass |
| | Bottom Flange Plate | | 68.9 | Pass |
| 1 | Bolts | 140 | 88.9 | Pass |
| | Top Flange Plate | | 50.7 | Pass |
| | Bottom Flange Plate | | 73.2 | Pass |

| Structure Rating (max from all components) = | 104.0[2]% |
|---|---|

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.
2) Capacities up to 105% are considered acceptable based on analysis methods used.

## 4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved and proposed loads. No modifications are required at this time.

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# APPENDIX A

# TNXTOWER OUTPUT

| Section | Size | Length (ft) | Grade | Weight (K) |
|---|---|---|---|---|
| 1 | P24x1/2 | 38.0000 | A53-B-35 | 4.8 |
| 2 | P36x1/2 | 40.0000 | | 7.6 |
| 3 | P48x5/8 | 40.0000 | | 12.7 |
| 4 | P54x5/8 | 40.0000 | | 14.3 |
| 5 | P60x5/8 | 20.0000 | | 7.9 |
| | | | | 47.2 |

*ALL REACTIONS ARE FACTORED*

*AXIAL 137 K*

*SHEAR 8 K* *MOMENT 1069 kip-ft*

*TORQUE 1 kip-ft*
*40.00 mph WIND - 1.0000 in ICE*

*AXIAL 81 K*

*SHEAR 41 K* *MOMENT 5230 kip-ft*

*TORQUE 3 kip-ft*
*REACTIONS - 100.00 mph WIND*

## DESIGNED APPURTENANCE LOADING

| TYPE | ELEVATION | TYPE | |
|---|---|---|---|
| Top Hat 2' 3" x 31.83" | 179 | RRUS-11 | |
| Lighting Rod 5/8" x 8' | 178 | RRUS-11 | |
| (2) DB978H65E-M w/ Mount Pipe | 178 | RRUS-11 | |
| (2) DB978G30E-M w/ Mount Pipe | 178 | RRUS 11 B4 | |
| (2) DB978H65E-M w/ Mount Pipe | 178 | RRUS 11 B4 | 160 |
| (2) 4' x 2" Pipe Mount | 178 | RRUS 11 B4 | 160 |
| (2) 4' x 2" Pipe Mount | 178 | (2) LGP21903 | 160 |
| (2) 4' x 2" Pipe Mount | 178 | (2) LGP21903 | 160 |
| 6' x 2" Horiz. Pipe | 178 | (2) LGP21903 | 160 |
| 6' x 2" Horiz. Pipe | 178 | (2) 782 10254 | 160 |
| 6' x 2" Horiz. Pipe | 178 | (2) 782 10254 | 160 |
| Miscellaneous [NA 510-1] | 178 | (2) 782 10254 | 160 |
| Platform Mount [LP 1201-1] | 178 | RRUS12/RRUS A2 | 160 |
| APX16DWV-16DWV-S-E-A20 w/Mount Pipe | 168 | RRUS12/RRUS A2 | 160 |
| | | RRUS12/RRUS A2 | 160 |
| APX16DWV-16DWV-S-E-A20 w/Mount Pipe | 168 | T-Arm Mount [TA 602-3] | 160 |
| APX16DWV-16DWV-S-E-A20 w/Mount Pipe | 168 | (2) LNX-6514DS-VTM w/ Mount Pipe | 149 |
| | | (2) LNX-6514DS-VTM w/ Mount Pipe | 149 |
| (2) APXV18-206517-C w/Mount Pipe | 168 | LNX-6514DS-VTM w/ Mount Pipe | 149 |
| (2) APXV18-206517-C w/Mount Pipe | 168 | LNX-6514DS-VTM w/ Mount Pipe | 149 |
| (2) APXV18-206517-C w/Mount Pipe | 168 | HBX-6517DS-T2M w/ Mount Pipe | 149 |
| (2) KRY 112 71 | 168 | HBX-6517DS-T2M w/ Mount Pipe | 149 |
| (2) KRY 112 71 | 168 | HBX-6517DS-T2M w/ Mount Pipe | 149 |
| (2) KRY 112 71 | 168 | HBX-6516DS-A1M w/ Mount Pipe | 149 |
| KRY 112 144/1 | 168 | HBX-6516DS-A1M w/ Mount Pipe | 149 |
| KRY 112 144/1 | 168 | HBX-6516DS-A1M w/ Mount Pipe | 149 |
| KRY 112 144/1 | 168 | DB-B1-6C-12AB-0Z | 149 |
| Platform Mount [LP 305-1] | 168 | RRH2X40-AWS | 149 |
| HPA-65R-BUU-H6 w/ Mount Pipe | 160 | RRH2X40-AWS | 149 |
| HPA-65R-BUU-H8 w/ Mount Pipe | 160 | RRH2X40-AWS | 149 |
| HPA-65R-BUU-H8 w/ Mount Pipe | 160 | 6' x 2" Horiz. Pipe | 149 |
| 7770.00 w/Mount Pipe | 160 | 6' x 2" Horiz. Pipe | 149 |
| 7770.00 w/Mount Pipe | 160 | 6' x 2" Horiz. Pipe | 149 |
| 7770.00 w/Mount Pipe | 160 | Platform Mount [LP 1201-1] | 149 |
| AM-X-CD-16-65-00T-RET w/ Mount Pipe | 160 | Miscellaneous [NA 510-1] | 149 |
| P65-17-XLH-RR w/ Mount Pipe | 160 | AM-X-CD-17-65-00T-RET w/ Mount Pipe | 134 |
| SBNH-1D6565C w/ Mount Pipe | 160 | AM-X-CD-17-65-00T-RET w/ Mount Pipe | 134 |
| (2) 7020.00 | 160 | AM-X-CD-17-65-00T-RET w/ Mount Pipe | 134 |
| (2) 7020.00 | 160 | (2) BSA-185065/10CF w/ Mount Pipe | 134 |
| (2) 7020.00 | 160 | (2) BSA-185065/10CF w/ Mount Pipe | 134 |
| (2) LGP21401 | 160 | (2) BSA-185065/10CF w/ Mount Pipe | 134 |
| (2) LGP21401 | 160 | KRC 115 032/2 | 134 |
| (2) LGP21401 | 160 | KRC 115 032/2 | 134 |
| DC6-48-60-18-8F | 160 | KRC 115 032/2 | 134 |
| DC6-48-60-18-8F | 160 | Platform Mount [LP 403-1] | 134 |

## MATERIAL STRENGTH

| GRADE | Fy | Fu | GRADE | Fy | Fu |
|---|---|---|---|---|---|
| A53-B-35 | 35 ksi | 60 ksi | | | |

## TOWER DESIGN NOTES

1. Tower is located in Cumberland County, Maine.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 100.00 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 40.00 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60.00 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.0000 ft
8. TOWER RATING: 104%

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*Jacobs Engineering Group, Inc.*
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| | | |
|---|---|---|
| Job: **PORTLAND NORTH** | | |
| Project: **BU878783 WO1341150** | | |
| Client: Crown Castle | Drawn by: J. Earnest | App'd: |
| Code: TIA-222-G | Date: 02/22/17 | Scale: NTS |
| Path: C:\Users\EARNESJT\Desktop\878783\BU878783_WO1367448_LC7.eri | | Dwg No. E-1 |

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# Tower Input Data

There is a pole section.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Cumberland County, Maine.
Basic wind speed of 100.00 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.0000 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56.00 pcf.
A wind speed of 40.00 mph is used in combination with ice.
Temperature drop of 50.00 °F.
Deflections calculated using a wind speed of 60.00 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

# Options

Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
SR Members Have Cut Ends
SR Members Are Concentric

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
Use Clear Spans For KL/r
Retension Guys To Initial Tension
√ Bypass Mast Stability Checks
√ Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
Add IBC .6D+W Combination
Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing
Treat Feed Line Bundles As Cylinder

Use ASCE 10 X-Brace Ly Rules
Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
SR Leg Bolts Resist Compression
All Leg Panels Have Same Allowable
Offset Girt At Foundation
√ Consider Feed Line Torque
Include Angle Block Shear Check
Use TIA-222-G Bracing Resist. Exemption
Use TIA-222-G Tension Splice Exemption
Poles
√ Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets

# Pole Section Geometry

| *Section* | *Elevation* *ft* | *Section Length* *ft* | *Pole Size* | *Pole Grade* | *Socket Length* *ft* |
|---|---|---|---|---|---|
| L1 | 178.0000-140.0000 | 38.0000 | P24x1/2 | A53-B-35 (35 ksi) | |
| L2 | 140.0000-100.0000 | 40.0000 | P36x1/2 | A53-B-35 (35 ksi) | |

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| Section | Elevation<br>ft | Section Length<br>ft | Pole Size | Pole Grade | Socket Length<br>ft |
|---|---|---|---|---|---|
| L3 | 100.0000-60.0000 | 40.0000 | P48x5/8 | A53-B-35<br>(35 ksi) | |
| L4 | 60.0000-20.0000 | 40.0000 | P54x5/8 | A53-B-35<br>(35 ksi) | |
| L5 | 20.0000-0.0000 | 20.0000 | P60x5/8 | A53-B-35<br>(35 ksi) | |

| Tower Elevation<br>ft | Gusset Area (per face)<br>$ft^2$ | Gusset Thickness<br>in | Gusset Grade | Adjust. Factor $A_f$ | Adjust. Factor $A_r$ | Weight Mult. | Double Angle Stitch Bolt Spacing Diagonals<br>in | Double Angle Stitch Bolt Spacing Horizontals<br>in | Double Angle Stitch Bolt Spacing Redundants<br>in |
|---|---|---|---|---|---|---|---|---|---|
| L1<br>178.0000-140.0000 | | | | 1 | 1 | 1 | | | |
| L2<br>140.0000-100.0000 | | | | 1 | 1 | 1 | | | |
| L3<br>100.0000-60.0000 | | | | 1 | 1 | 1 | | | |
| L4<br>60.0000-20.0000 | | | | 1 | 1 | 1 | | | |
| L5<br>20.0000-0.0000 | | | | 1 | 1 | 1 | | | |

## Feed Line/Linear Appurtenances - Entered As Round Or Flat

| Description | Sector | Component Type | Placement<br>ft | Total Number | Number Per Row | Start/End Position | Width or Diameter<br>in | Perimeter<br>in | Weight<br>plf |
|---|---|---|---|---|---|---|---|---|---|
| **<br>T-Brackets (Af) | C | Surface Af<br>(CaAa) | 178.0000 - 3.0000 | 1 | 1 | 0.200<br>0.200 | 1.0000 | 4.0000 | 8.40 |
| Safety Line 3/8 | C | Surface Ar<br>(CaAa) | 178.0000 - 3.0000 | 1 | 1 | 0.000<br>0.000 | 0.3750 | | 0.22 |
| **<br>HB158-1-08U8-S8J18(1-5/8) | B | Surface Ar<br>(CaAa) | 149.0000 - 0.0000 | 1 | 1 | 0.170<br>0.170 | 1.9800 | | 1.30 |

## Feed Line/Linear Appurtenances - Entered As Area

| Description | Face or Leg | Allow Shield | Component Type | Placement<br>ft | Total Number | | $C_AA_A$<br>$ft^2/ft$ | Weight<br>plf |
|---|---|---|---|---|---|---|---|---|
| **<br>***<br>LDF7-50A(1-5/8) | A | No | Inside Pole | 178.0000 - 0.0000 | 6 | No Ice | 0.0000 | 0.82 |
| | | | | | | 1/2" Ice | 0.0000 | 0.82 |
| | | | | | | 1" Ice | 0.0000 | 0.82 |

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| Description | Face or Leg | Allow Shield | Component Type | Placement ft | Total Number | | $C_AA_A$ $ft^2/ft$ | Weight plf |
|---|---|---|---|---|---|---|---|---|
| LDF7-50A(1-5/8) | C | No | Inside Pole | 168.0000 - 0.0000 | 12 | No Ice | 0.0000 | 0.82 |
| | | | | | | 1/2" Ice | 0.0000 | 0.82 |
| | | | | | | 1" Ice | 0.0000 | 0.82 |
| AL7-50(1-5/8) | A | No | Inside Pole | 160.0000 - 0.0000 | 12 | No Ice | 0.0000 | 0.52 |
| | | | | | | 1/2" Ice | 0.0000 | 0.52 |
| | | | | | | 1" Ice | 0.0000 | 0.52 |
| FB-L98B-002-75000(3/8) | A | No | Inside Pole | 160.0000 - 0.0000 | 1 | No Ice | 0.0000 | 0.06 |
| | | | | | | 1/2" Ice | 0.0000 | 0.06 |
| | | | | | | 1" Ice | 0.0000 | 0.06 |
| WR-VG86ST-BRD(3/4) | A | No | Inside Pole | 160.0000 - 0.0000 | 2 | No Ice | 0.0000 | 0.58 |
| | | | | | | 1/2" Ice | 0.0000 | 0.58 |
| | | | | | | 1" Ice | 0.0000 | 0.58 |
| FB-L98B-034-XXX(3/8) | A | No | Inside Pole | 160.0000 - 0.0000 | 1 | No Ice | 0.0000 | 0.06 |
| | | | | | | 1/2" Ice | 0.0000 | 0.06 |
| | | | | | | 1" Ice | 0.0000 | 0.06 |
| WR-VG86ST-BRD(3/4) | A | No | Inside Pole | 160.0000 - 0.0000 | 2 | No Ice | 0.0000 | 0.58 |
| | | | | | | 1/2" Ice | 0.0000 | 0.58 |
| | | | | | | 1" Ice | 0.0000 | 0.58 |
| LDF7-50A(1-5/8) | B | No | Inside Pole | 149.0000 - 0.0000 | 18 | No Ice | 0.0000 | 0.82 |
| | | | | | | 1/2" Ice | 0.0000 | 0.82 |
| | | | | | | 1" Ice | 0.0000 | 0.82 |
| LDF5-50A(7/8) | C | No | Inside Pole | 134.0000 - 0.0000 | 6 | No Ice | 0.0000 | 0.33 |
| | | | | | | 1/2" Ice | 0.0000 | 0.33 |
| | | | | | | 1" Ice | 0.0000 | 0.33 |
| LDF7-50A(1-5/8) | C | No | Inside Pole | 134.0000 - 0.0000 | 6 | No Ice | 0.0000 | 0.82 |
| | | | | | | 1/2" Ice | 0.0000 | 0.82 |
| | | | | | | 1" Ice | 0.0000 | 0.82 |

## Feed Line/Linear Appurtenances Section Areas

| Tower Section | Tower Elevation ft | Face | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|
| L1 | 178.0000-140.0000 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.36 |
| | | B | 0.000 | 0.000 | 1.782 | 0.000 | 0.14 |
| | | C | 0.000 | 0.000 | 7.758 | 0.000 | 0.60 |
| L2 | 140.0000-100.0000 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.54 |
| | | B | 0.000 | 0.000 | 7.920 | 0.000 | 0.64 |
| | | C | 0.000 | 0.000 | 8.167 | 0.000 | 0.97 |
| L3 | 100.0000-60.0000 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.54 |
| | | B | 0.000 | 0.000 | 7.920 | 0.000 | 0.64 |
| | | C | 0.000 | 0.000 | 8.167 | 0.000 | 1.01 |
| L4 | 60.0000-20.0000 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.54 |
| | | B | 0.000 | 0.000 | 7.920 | 0.000 | 0.64 |
| | | C | 0.000 | 0.000 | 8.167 | 0.000 | 1.01 |
| L5 | 20.0000-0.0000 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.27 |
| | | B | 0.000 | 0.000 | 3.960 | 0.000 | 0.32 |
| | | C | 0.000 | 0.000 | 3.471 | 0.000 | 0.48 |

## Feed Line/Linear Appurtenances Section Areas - With Ice

| Tower Section | Tower Elevation ft | Face or Leg | Ice Thickness in | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|
| L1 | 178.0000-140.000 | A | 2.341 | 0.000 | 0.000 | 0.000 | 0.000 | 0.36 |

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| Tower Section | Tower Elevation ft | Face or Leg | Ice Thickness in | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|
| | 0 | B | | 0.000 | 0.000 | 5.995 | 0.000 | 0.26 |
| | | C | | 0.000 | 0.000 | 43.337 | 0.000 | 1.34 |
| L2 | 140.0000-100.000 | A | 2.276 | 0.000 | 0.000 | 0.000 | 0.000 | 0.54 |
| | 0 | B | | 0.000 | 0.000 | 26.127 | 0.000 | 1.12 |
| | | C | | 0.000 | 0.000 | 44.582 | 0.000 | 1.71 |
| L3 | 100.0000-60.0000 | A | 2.186 | 0.000 | 0.000 | 0.000 | 0.000 | 0.54 |
| | | B | | 0.000 | 0.000 | 25.407 | 0.000 | 1.09 |
| | | C | | 0.000 | 0.000 | 43.141 | 0.000 | 1.71 |
| L4 | 60.0000-20.0000 | A | 2.042 | 0.000 | 0.000 | 0.000 | 0.000 | 0.54 |
| | | B | | 0.000 | 0.000 | 24.253 | 0.000 | 1.04 |
| | | C | | 0.000 | 0.000 | 40.832 | 0.000 | 1.63 |
| L5 | 20.0000-0.0000 | A | 1.775 | 0.000 | 0.000 | 0.000 | 0.000 | 0.27 |
| | | B | | 0.000 | 0.000 | 11.060 | 0.000 | 0.48 |
| | | C | | 0.000 | 0.000 | 15.540 | 0.000 | 0.69 |

## Feed Line Center of Pressure

| Section | Elevation ft | $CP_X$ in | $CP_Z$ in | $CP_X$ Ice in | $CP_Z$ Ice in |
|---|---|---|---|---|---|
| L1 | 178.0000-140.0000 | -0.1086 | 0.2147 | -0.2705 | 0.8019 |
| L2 | 140.0000-100.0000 | 0.0997 | 0.1752 | 0.1681 | 0.7568 |
| L3 | 100.0000-60.0000 | 0.0997 | 0.1795 | 0.1784 | 0.8223 |
| L4 | 60.0000-20.0000 | 0.0997 | 0.1811 | 0.1789 | 0.8199 |
| L5 | 20.0000-0.0000 | 0.1275 | 0.1487 | 0.2466 | 0.6567 |

## Shielding Factor Ka

| Tower Section | Feed Line Record No. | Description | Feed Line Segment Elev. | $K_a$ No Ice | $K_a$ Ice |
|---|---|---|---|---|---|
| L1 | 2 | T-Brackets (Af) | 140.00 - 178.00 | 1.0000 | 1.0000 |
| L1 | 3 | Safety Line 3/8 | 140.00 - 178.00 | 1.0000 | 1.0000 |
| L1 | 14 | HB158-1-08U8-S8J18(1-5/8) | 140.00 - 149.00 | 1.0000 | 1.0000 |
| L2 | 2 | T-Brackets (Af) | 100.00 - 140.00 | 1.0000 | 1.0000 |
| L2 | 3 | Safety Line 3/8 | 100.00 - 140.00 | 1.0000 | 1.0000 |
| L2 | 14 | HB158-1-08U8-S8J18(1-5/8) | 100.00 - 140.00 | 1.0000 | 1.0000 |
| L3 | 2 | T-Brackets (Af) | 60.00 - 100.00 | 1.0000 | 1.0000 |
| L3 | 3 | Safety Line 3/8 | 60.00 - 100.00 | 1.0000 | 1.0000 |
| L3 | 14 | HB158-1-08U8-S8J18(1-5/8) | 60.00 - 100.00 | 1.0000 | 1.0000 |
| L4 | 2 | T-Brackets (Af) | 20.00 - 60.00 | 1.0000 | 1.0000 |
| L4 | 3 | Safety Line 3/8 | 20.00 - 60.00 | 1.0000 | 1.0000 |
| L4 | 14 | HB158-1-08U8-S8J18(1-5/8) | 20.00 - 60.00 | 1.0000 | 1.0000 |
| L5 | 2 | T-Brackets (Af) | 3.00 - 20.00 | 1.0000 | 1.0000 |
| L5 | 3 | Safety Line 3/8 | 3.00 - 20.00 | 1.0000 | 1.0000 |
| L5 | 14 | HB158-1-08U8-S8J18(1-5/8) | 0.00 - 20.00 | 1.0000 | 1.0000 |

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# Discrete Tower Loads

| Description | Face or Leg | Offset Type | Offsets: Horz Lateral Vert<br>ft ft ft | Azimuth Adjustment<br>° | Placement<br>ft | | $C_AA_A$ Front<br>$ft^2$ | $C_AA_A$ Side<br>$ft^2$ | Weight<br>K |
|---|---|---|---|---|---|---|---|---|---|
| Lighting Rod 5/8" x 8' | C | From Leg | 0.0000 | 0.0000 | 178.0000 | No Ice | 0.5000 | 0.5000 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 1.3135 | 1.3135 | 0.04 |
| | | | 4.00 | | | 1" Ice | 2.1437 | 2.1437 | 0.05 |
| Top Hat 2' 3" x 31.83" | C | None | | 0.0000 | 179.0000 | No Ice | 2.9841 | 2.9841 | 0.10 |
| | | | | | | 1/2" Ice | 4.4685 | 4.4685 | 0.17 |
| | | | | | | 1" Ice | 4.7691 | 4.7691 | 0.25 |
| **178** | | | | | | | | | |
| (2) DB978H65E-M w/ Mount Pipe | A | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 3.1431 | 2.8097 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 3.5154 | 3.4107 | 0.05 |
| | | | 2.00 | | | 1" Ice | 3.8856 | 4.0226 | 0.09 |
| (2) DB978G30E-M w/ Mount Pipe | B | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 6.0537 | 4.3281 | 0.04 |
| | | | 0.00 | | | 1/2" Ice | 6.4678 | 5.0073 | 0.09 |
| | | | 2.00 | | | 1" Ice | 6.8840 | 5.6680 | 0.14 |
| (2) DB978H65E-M w/ Mount Pipe | C | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 3.1431 | 2.8097 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 3.5154 | 3.4107 | 0.05 |
| | | | 2.00 | | | 1" Ice | 3.8856 | 4.0226 | 0.09 |
| (2) 4' x 2" Pipe Mount | A | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 0.7852 | 0.7852 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 1.0284 | 1.0284 | 0.04 |
| | | | 2.00 | | | 1" Ice | 1.2809 | 1.2809 | 0.04 |
| (2) 4' x 2" Pipe Mount | B | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 0.7852 | 0.7852 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 1.0284 | 1.0284 | 0.04 |
| | | | 2.00 | | | 1" Ice | 1.2809 | 1.2809 | 0.04 |
| (2) 4' x 2" Pipe Mount | C | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 0.7852 | 0.7852 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 1.0284 | 1.0284 | 0.04 |
| | | | 2.00 | | | 1" Ice | 1.2809 | 1.2809 | 0.04 |
| 6' x 2" Horiz. Pipe | A | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 0.5938 | 0.5938 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 1.1977 | 1.1977 | 0.17 |
| | | | 0.00 | | | 1" Ice | 1.5738 | 1.5738 | 0.32 |
| 6' x 2" Horiz. Pipe | B | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 0.5938 | 0.5938 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 1.1977 | 1.1977 | 0.17 |
| | | | 0.00 | | | 1" Ice | 1.5738 | 1.5738 | 0.32 |
| 6' x 2" Horiz. Pipe | C | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 0.5938 | 0.5938 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 1.1977 | 1.1977 | 0.17 |
| | | | 0.00 | | | 1" Ice | 1.5738 | 1.5738 | 0.32 |
| Miscellaneous [NA 510-1] | C | From Leg | 4.0000 | 0.0000 | 178.0000 | No Ice | 6.0000 | 6.0000 | 0.26 |
| | | | 0.00 | | | 1/2" Ice | 8.5000 | 8.5000 | 0.34 |
| | | | 2.00 | | | 1" Ice | 8.6000 | 8.6000 | 0.34 |
| Platform Mount [LP 1201-1] | C | None | | 0.0000 | 178.0000 | No Ice | 23.1000 | 23.1000 | 2.10 |
| | | | | | | 1/2" Ice | 26.8000 | 26.8000 | 2.50 |
| | | | | | | 1" Ice | 30.5000 | 30.5000 | 2.90 |
| **168** | | | | | | | | | |
| APX16DWV-16DWV-S-E-A 20 w/Mount Pipe | A | From Leg | 4.0000 | 0.0000 | 168.0000 | No Ice | 6.6275 | 3.2856 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 7.0134 | 3.9182 | 0.10 |
| | | | 3.00 | | | 1" Ice | 7.4067 | 4.5675 | 0.16 |
| APX16DWV-16DWV-S-E-A 20 w/Mount Pipe | B | From Leg | 4.0000 | 0.0000 | 168.0000 | No Ice | 6.6275 | 3.2856 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 7.0134 | 3.9182 | 0.10 |
| | | | 3.00 | | | 1" Ice | 7.4067 | 4.5675 | 0.16 |

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| Description | Face or Leg | Offset Type | Offsets: Horz Lateral Vert<br>ft ft ft | Azimuth Adjustment<br>° | Placement<br>ft | | $C_AA_A$ Front<br>$ft^2$ | $C_AA_A$ Side<br>$ft^2$ | Weight<br>K |
|---|---|---|---|---|---|---|---|---|---|
| APX16DWV-16DWV-S-E-A 20 w/Mount Pipe | C | From Leg | 4.0000<br>0.00<br>3.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 6.6275<br>7.0134<br>7.4067 | 3.2856<br>3.9182<br>4.5675 | 0.06<br>0.10<br>0.16 |
| (2) APXV18-206517-C w/Mount Pipe | A | From Leg | 4.0000<br>0.00<br>2.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 5.2062<br>5.6723<br>6.1415 | 4.5021<br>5.4702<br>6.2880 | 0.02<br>0.07<br>0.12 |
| (2) APXV18-206517-C w/Mount Pipe | B | From Leg | 4.0000<br>0.00<br>2.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 5.2062<br>5.6723<br>6.1415 | 4.5021<br>5.4702<br>6.2880 | 0.02<br>0.07<br>0.12 |
| (2) APXV18-206517-C w/Mount Pipe | C | From Leg | 4.0000<br>0.00<br>2.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 5.2062<br>5.6723<br>6.1415 | 4.5021<br>5.4702<br>6.2880 | 0.02<br>0.07<br>0.12 |
| (2) KRY 112 71 | A | From Leg | 4.0000<br>0.00<br>2.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 0.5833<br>0.6876<br>0.7993 | 0.3980<br>0.4883<br>0.5856 | 0.01<br>0.02<br>0.03 |
| (2) KRY 112 71 | B | From Leg | 4.0000<br>0.00<br>2.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 0.5833<br>0.6876<br>0.7993 | 0.3980<br>0.4883<br>0.5856 | 0.01<br>0.02<br>0.03 |
| (2) KRY 112 71 | C | From Leg | 4.0000<br>0.00<br>2.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 0.5833<br>0.6876<br>0.7993 | 0.3980<br>0.4883<br>0.5856 | 0.01<br>0.02<br>0.03 |
| KRY 112 144/1 | A | From Leg | 4.0000<br>0.00<br>3.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 0.3523<br>0.4284<br>0.5119 | 0.1617<br>0.2195<br>0.2846 | 0.01<br>0.01<br>0.02 |
| KRY 112 144/1 | B | From Leg | 4.0000<br>0.00<br>3.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 0.3523<br>0.4284<br>0.5119 | 0.1617<br>0.2195<br>0.2846 | 0.01<br>0.01<br>0.02 |
| KRY 112 144/1 | C | From Leg | 4.0000<br>0.00<br>3.00 | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 0.3523<br>0.4284<br>0.5119 | 0.1617<br>0.2195<br>0.2846 | 0.01<br>0.01<br>0.02 |
| Platform Mount [LP 305-1] | C | None | | 0.0000 | 168.0000 | No Ice<br>1/2" Ice<br>1" Ice | 18.0100<br>23.3300<br>28.6500 | 18.0100<br>23.3300<br>28.6500 | 1.12<br>1.35<br>1.58 |
| **160** | | | | | | | | | |
| HPA-65R-BUU-H6 w/ Mount Pipe | A | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 9.8953<br>10.4700<br>11.0098 | 8.1125<br>9.3041<br>10.2095 | 0.08<br>0.16<br>0.25 |
| HPA-65R-BUU-H8 w/ Mount Pipe | B | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 13.5881<br>14.1897<br>14.7983 | 10.7958<br>12.1244<br>13.1669 | 0.08<br>0.18<br>0.29 |
| HPA-65R-BUU-H8 w/ Mount Pipe | C | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 13.5881<br>14.1897<br>14.7983 | 10.7958<br>12.1244<br>13.1669 | 0.08<br>0.18<br>0.29 |
| 7770.00 w/Mount Pipe | A | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 5.5473<br>5.9163<br>6.2926 | 4.0355<br>4.6682<br>5.3175 | 0.05<br>0.10<br>0.15 |
| 7770.00 w/Mount Pipe | B | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 5.5473<br>5.9163<br>6.2926 | 4.0355<br>4.6682<br>5.3175 | 0.05<br>0.10<br>0.15 |
| 7770.00 w/Mount Pipe | C | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 5.5473<br>5.9163<br>6.2926 | 4.0355<br>4.6682<br>5.3175 | 0.05<br>0.10<br>0.15 |
| AM-X-CD-16-65-00T-RET w/ Mount Pipe | A | From Leg | 4.0000<br>0.00<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice<br>1" Ice | 8.2619<br>8.8215<br>9.3462 | 6.3042<br>7.4790<br>8.3676 | 0.07<br>0.14<br>0.21 |
| P65-17-XLH-RR w/ Mount Pipe | B | From Leg | 4.0000<br>0.00 | 0.0000 | 160.0000 | No Ice<br>1/2" Ice | 11.7042<br>12.4240 | 8.9375<br>10.4499 | 0.09<br>0.18 |

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| Description | Face or Leg | Offset Type | Offsets: Horz Lateral Vert ft ft ft | Azimuth Adjustment ° | Placement ft | | $C_AA_A$ Front $ft^2$ | $C_AA_A$ Side $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.00 | | | 1" Ice | 13.1530 | 11.9863 | 0.27 |
| SBNH-1D6565C w/ Mount Pipe | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 11.6828 | 9.8418 | 0.10 |
| | | | 0.00 | | | 1/2" Ice | 12.4043 | 11.3657 | 0.19 |
| | | | 0.00 | | | 1" Ice | 13.1351 | 12.9138 | 0.29 |
| (2) 7020.00 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.1021 | 0.1750 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.1469 | 0.2393 | 0.01 |
| | | | 0.00 | | | 1" Ice | 0.1991 | 0.3109 | 0.01 |
| (2) 7020.00 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.1021 | 0.1750 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.1469 | 0.2393 | 0.01 |
| | | | 0.00 | | | 1" Ice | 0.1991 | 0.3109 | 0.01 |
| (2) 7020.00 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.1021 | 0.1750 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.1469 | 0.2393 | 0.01 |
| | | | 0.00 | | | 1" Ice | 0.1991 | 0.3109 | 0.01 |
| (2) LGP21401 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 1.1040 | 0.2070 | 0.01 |
| | | | 0.00 | | | 1/2" Ice | 1.2388 | 0.2738 | 0.02 |
| | | | 0.00 | | | 1" Ice | 1.3810 | 0.3475 | 0.03 |
| (2) LGP21401 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 1.1040 | 0.2070 | 0.01 |
| | | | 0.00 | | | 1/2" Ice | 1.2388 | 0.2738 | 0.02 |
| | | | 0.00 | | | 1" Ice | 1.3810 | 0.3475 | 0.03 |
| (2) LGP21401 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 1.1040 | 0.2070 | 0.01 |
| | | | 0.00 | | | 1/2" Ice | 1.2388 | 0.2738 | 0.02 |
| | | | 0.00 | | | 1" Ice | 1.3810 | 0.3475 | 0.03 |
| DC6-48-60-18-8F | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.9167 | 0.9167 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 1.4583 | 1.4583 | 0.05 |
| | | | 0.00 | | | 1" Ice | 1.6431 | 1.6431 | 0.07 |
| DC6-48-60-18-8F | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.9167 | 0.9167 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 1.4583 | 1.4583 | 0.05 |
| | | | 0.00 | | | 1" Ice | 1.6431 | 1.6431 | 0.07 |
| RRUS-11 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 2.5217 | 1.0680 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 2.7187 | 1.2106 | 0.07 |
| | | | 0.00 | | | 1" Ice | 2.9231 | 1.3606 | 0.10 |
| RRUS-11 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 2.5217 | 1.0680 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 2.7187 | 1.2106 | 0.07 |
| | | | 0.00 | | | 1" Ice | 2.9231 | 1.3606 | 0.10 |
| RRUS-11 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 2.5217 | 1.0680 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 2.7187 | 1.2106 | 0.07 |
| | | | 0.00 | | | 1" Ice | 2.9231 | 1.3606 | 0.10 |
| RRUS 11 B4 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 2.8333 | 1.1821 | 0.05 |
| | | | 0.00 | | | 1/2" Ice | 3.0426 | 1.3299 | 0.07 |
| | | | 0.00 | | | 1" Ice | 3.2593 | 1.4848 | 0.10 |
| RRUS 11 B4 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 2.8333 | 1.1821 | 0.05 |
| | | | 0.00 | | | 1/2" Ice | 3.0426 | 1.3299 | 0.07 |
| | | | 0.00 | | | 1" Ice | 3.2593 | 1.4848 | 0.10 |
| RRUS 11 B4 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 2.8333 | 1.1821 | 0.05 |
| | | | 0.00 | | | 1/2" Ice | 3.0426 | 1.3299 | 0.07 |
| | | | 0.00 | | | 1" Ice | 3.2593 | 1.4848 | 0.10 |
| (2) LGP21903 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.2310 | 0.1575 | 0.01 |
| | | | 0.00 | | | 1/2" Ice | 0.2941 | 0.2129 | 0.01 |
| | | | 0.00 | | | 1" Ice | 0.3647 | 0.2756 | 0.02 |
| (2) LGP21903 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.2310 | 0.1575 | 0.01 |
| | | | 0.00 | | | 1/2" Ice | 0.2941 | 0.2129 | 0.01 |
| | | | 0.00 | | | 1" Ice | 0.3647 | 0.2756 | 0.02 |
| (2) LGP21903 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.2310 | 0.1575 | 0.01 |
| | | | 0.00 | | | 1/2" Ice | 0.2941 | 0.2129 | 0.01 |
| | | | 0.00 | | | 1" Ice | 0.3647 | 0.2756 | 0.02 |
| (2) 782 10254 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.1421 | 0.0800 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.1936 | 0.1221 | 0.00 |

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| Description | Face or Leg | Offset Type | Offsets: Horz Lateral Vert<br>ft ft ft | Azimuth Adjustment<br>° | Placement<br>ft | | $C_AA_A$ Front<br>$ft^2$ | $C_AA_A$ Side<br>$ft^2$ | Weight<br>K |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.00 | | | 1" Ice | 0.2525 | 0.1727 | 0.01 |
| (2) 782 10254 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.1421 | 0.0800 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.1936 | 0.1221 | 0.00 |
| | | | 0.00 | | | 1" Ice | 0.2525 | 0.1727 | 0.01 |
| (2) 782 10254 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 0.1421 | 0.0800 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.1936 | 0.1221 | 0.00 |
| | | | 0.00 | | | 1" Ice | 0.2525 | 0.1727 | 0.01 |
| RRUS12/RRUS A2 | A | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 3.1435 | 1.8351 | 0.07 |
| | | | 0.00 | | | 1/2" Ice | 3.3632 | 2.0121 | 0.10 |
| | | | 0.00 | | | 1" Ice | 3.5904 | 2.1965 | 0.13 |
| RRUS12/RRUS A2 | B | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 3.1435 | 1.8351 | 0.07 |
| | | | 0.00 | | | 1/2" Ice | 3.3632 | 2.0121 | 0.10 |
| | | | 0.00 | | | 1" Ice | 3.5904 | 2.1965 | 0.13 |
| RRUS12/RRUS A2 | C | From Leg | 4.0000 | 0.0000 | 160.0000 | No Ice | 3.1435 | 1.8351 | 0.07 |
| | | | 0.00 | | | 1/2" Ice | 3.3632 | 2.0121 | 0.10 |
| | | | 0.00 | | | 1" Ice | 3.5904 | 2.1965 | 0.13 |
| T-Arm Mount [TA 602-3] | C | None | | 0.0000 | 160.0000 | No Ice | 11.5900 | 11.5900 | 0.26 |
| | | | | | | 1/2" Ice | 15.4400 | 15.4400 | 0.33 |
| | | | | | | 1" Ice | 19.2900 | 19.2900 | 0.42 |
| **149** | | | | | | | | | |
| (2) LNX-6514DS-VTM w/ Mount Pipe | A | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 8.4106 | 7.0817 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 8.9745 | 8.2729 | 0.13 |
| | | | 2.00 | | | 1" Ice | 9.5048 | 9.1847 | 0.21 |
| (2) LNX-6514DS-VTM w/ Mount Pipe | B | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 8.3164 | 7.0042 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 8.8765 | 8.1855 | 0.13 |
| | | | 1.00 | | | 1" Ice | 9.4016 | 9.0806 | 0.20 |
| LNX-6514DS-VTM w/ Mount Pipe | C | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 8.3164 | 7.0042 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 8.8765 | 8.1855 | 0.13 |
| | | | 2.00 | | | 1" Ice | 9.4016 | 9.0806 | 0.20 |
| LNX-6514DS-VTM w/ Mount Pipe | C | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 8.3164 | 7.0042 | 0.06 |
| | | | 0.00 | | | 1/2" Ice | 8.8765 | 8.1855 | 0.13 |
| | | | 1.00 | | | 1" Ice | 9.4016 | 9.0806 | 0.20 |
| HBX-6517DS-T2M w/ Mount Pipe | A | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 5.4805 | 5.0210 | 0.04 |
| | | | 0.00 | | | 1/2" Ice | 6.0509 | 6.2225 | 0.08 |
| | | | 2.00 | | | 1" Ice | 6.5922 | 7.1672 | 0.14 |
| HBX-6517DS-T2M w/ Mount Pipe | B | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 5.4805 | 5.0210 | 0.04 |
| | | | 0.00 | | | 1/2" Ice | 6.0509 | 6.2225 | 0.08 |
| | | | 1.00 | | | 1" Ice | 6.5922 | 7.1672 | 0.14 |
| HBX-6517DS-T2M w/ Mount Pipe | C | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 5.4805 | 5.0210 | 0.04 |
| | | | 0.00 | | | 1/2" Ice | 6.0509 | 6.2225 | 0.08 |
| | | | 1.00 | | | 1" Ice | 6.5922 | 7.1672 | 0.14 |
| HBX-6516DS-A1M w/ Mount Pipe | A | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 3.5559 | 3.2406 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 3.9559 | 3.9135 | 0.06 |
| | | | 2.00 | | | 1" Ice | 4.3492 | 4.5638 | 0.10 |
| HBX-6516DS-A1M w/ Mount Pipe | B | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 3.5559 | 3.2406 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 3.9559 | 3.9135 | 0.06 |
| | | | 1.00 | | | 1" Ice | 4.3492 | 4.5638 | 0.10 |
| HBX-6516DS-A1M w/ Mount Pipe | C | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 3.5559 | 3.2406 | 0.03 |
| | | | 0.00 | | | 1/2" Ice | 3.9559 | 3.9135 | 0.06 |
| | | | 1.00 | | | 1" Ice | 4.3492 | 4.5638 | 0.10 |
| DB-B1-6C-12AB-0Z | B | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 3.3636 | 2.1921 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 3.5972 | 2.3950 | 0.05 |
| | | | 1.00 | | | 1" Ice | 3.8383 | 2.6056 | 0.08 |
| RRH2X40-AWS | A | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 2.1614 | 1.4199 | 0.04 |
| | | | 0.00 | | | 1/2" Ice | 2.3597 | 1.5903 | 0.06 |
| | | | 2.00 | | | 1" Ice | 2.5655 | 1.7676 | 0.08 |
| RRH2X40-AWS | B | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 2.1614 | 1.4199 | 0.04 |

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| Description | Face or Leg | Offset Type | Offsets: Horz Lateral Vert<br>ft ft ft | Azimuth Adjustment<br>° | Placement<br>ft | | $C_AA_A$ Front<br>$ft^2$ | $C_AA_A$ Side<br>$ft^2$ | Weight<br>K |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.00 | | | 1/2" Ice | 2.3597 | 1.5903 | 0.06 |
| | | | 1.00 | | | 1" Ice | 2.5655 | 1.7676 | 0.08 |
| RRH2X40-AWS | C | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 2.1614 | 1.4199 | 0.04 |
| | | | 0.00 | | | 1/2" Ice | 2.3597 | 1.5903 | 0.06 |
| | | | 1.00 | | | 1" Ice | 2.5655 | 1.7676 | 0.08 |
| 6' x 2" Horiz. Pipe | A | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 0.5938 | 0.5938 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 1.1977 | 1.1977 | 0.17 |
| | | | 0.00 | | | 1" Ice | 1.5738 | 1.5738 | 0.32 |
| 6' x 2" Horiz. Pipe | B | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 0.5938 | 0.5938 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 1.1977 | 1.1977 | 0.17 |
| | | | 0.00 | | | 1" Ice | 1.5738 | 1.5738 | 0.32 |
| 6' x 2" Horiz. Pipe | C | From Leg | 4.0000 | 0.0000 | 149.0000 | No Ice | 0.5938 | 0.5938 | 0.02 |
| | | | 0.00 | | | 1/2" Ice | 1.1977 | 1.1977 | 0.17 |
| | | | 0.00 | | | 1" Ice | 1.5738 | 1.5738 | 0.32 |
| Platform Mount [LP 1201-1] | C | None | | 0.0000 | 149.0000 | No Ice | 23.1000 | 23.1000 | 2.10 |
| | | | | | | 1/2" Ice | 26.8000 | 26.8000 | 2.50 |
| | | | | | | 1" Ice | 30.5000 | 30.5000 | 2.90 |
| Miscellaneous [NA 510-1] | C | None | | 0.0000 | 149.0000 | No Ice | 6.0000 | 6.0000 | 0.26 |
| | | | | | | 1/2" Ice | 8.5000 | 8.5000 | 0.34 |
| | | | | | | 1" Ice | 8.6000 | 8.6000 | 0.34 |
| **134** | | | | | | | | | |
| AM-X-CD-17-65-00T-RET | A | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 11.5486 | 8.9375 | 0.09 |
| w/ Mount Pipe | | | 0.00 | | | 1/2" Ice | 12.2673 | 10.4499 | 0.18 |
| | | | 1.00 | | | 1" Ice | 12.9953 | 11.9863 | 0.27 |
| AM-X-CD-17-65-00T-RET | B | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 11.5486 | 8.9375 | 0.09 |
| w/ Mount Pipe | | | 0.00 | | | 1/2" Ice | 12.2673 | 10.4499 | 0.18 |
| | | | 1.00 | | | 1" Ice | 12.9953 | 11.9863 | 0.27 |
| AM-X-CD-17-65-00T-RET | C | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 11.5486 | 8.9375 | 0.09 |
| w/ Mount Pipe | | | 0.00 | | | 1/2" Ice | 12.2673 | 10.4499 | 0.18 |
| | | | 1.00 | | | 1" Ice | 12.9953 | 11.9863 | 0.27 |
| (2) BSA-185065/10CF w/ | A | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 4.1491 | 3.1012 | 0.03 |
| Mount Pipe | | | 0.00 | | | 1/2" Ice | 4.6143 | 4.1051 | 0.07 |
| | | | 1.00 | | | 1" Ice | 5.0646 | 4.8407 | 0.11 |
| (2) BSA-185065/10CF w/ | B | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 4.1491 | 3.1012 | 0.03 |
| Mount Pipe | | | 0.00 | | | 1/2" Ice | 4.6143 | 4.1051 | 0.07 |
| | | | 1.00 | | | 1" Ice | 5.0646 | 4.8407 | 0.11 |
| (2) BSA-185065/10CF w/ | C | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 4.1491 | 3.1012 | 0.03 |
| Mount Pipe | | | 0.00 | | | 1/2" Ice | 4.6143 | 4.1051 | 0.07 |
| | | | 1.00 | | | 1" Ice | 5.0646 | 4.8407 | 0.11 |
| KRC 115 032/2 | A | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 0.1633 | 0.1176 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.2176 | 0.1664 | 0.00 |
| | | | 1.00 | | | 1" Ice | 0.2793 | 0.2226 | 0.01 |
| KRC 115 032/2 | B | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 0.1633 | 0.1176 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.2176 | 0.1664 | 0.00 |
| | | | 1.00 | | | 1" Ice | 0.2793 | 0.2226 | 0.01 |
| KRC 115 032/2 | C | From Leg | 4.0000 | 0.0000 | 134.0000 | No Ice | 0.1633 | 0.1176 | 0.00 |
| | | | 0.00 | | | 1/2" Ice | 0.2176 | 0.1664 | 0.00 |
| | | | 1.00 | | | 1" Ice | 0.2793 | 0.2226 | 0.01 |
| Platform Mount [LP 403-1] | C | None | | 0.0000 | 134.0000 | No Ice | 18.8500 | 18.8500 | 1.50 |
| | | | | | | 1/2" Ice | 24.3000 | 24.3000 | 1.80 |
| | | | | | | 1" Ice | 29.7500 | 29.7500 | 2.09 |
| **124** | | | | | | | | | |
| *** | | | | | | | | | |

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# Load Combinations

| Comb. No. | Description |
|---|---|
| 1 | Dead Only |
| 2 | 1.2 Dead+1.6 Wind 0 deg - No Ice |
| 3 | 0.9 Dead+1.6 Wind 0 deg - No Ice |
| 4 | 1.2 Dead+1.6 Wind 30 deg - No Ice |
| 5 | 0.9 Dead+1.6 Wind 30 deg - No Ice |
| 6 | 1.2 Dead+1.6 Wind 60 deg - No Ice |
| 7 | 0.9 Dead+1.6 Wind 60 deg - No Ice |
| 8 | 1.2 Dead+1.6 Wind 90 deg - No Ice |
| 9 | 0.9 Dead+1.6 Wind 90 deg - No Ice |
| 10 | 1.2 Dead+1.6 Wind 120 deg - No Ice |
| 11 | 0.9 Dead+1.6 Wind 120 deg - No Ice |
| 12 | 1.2 Dead+1.6 Wind 150 deg - No Ice |
| 13 | 0.9 Dead+1.6 Wind 150 deg - No Ice |
| 14 | 1.2 Dead+1.6 Wind 180 deg - No Ice |
| 15 | 0.9 Dead+1.6 Wind 180 deg - No Ice |
| 16 | 1.2 Dead+1.6 Wind 210 deg - No Ice |
| 17 | 0.9 Dead+1.6 Wind 210 deg - No Ice |
| 18 | 1.2 Dead+1.6 Wind 240 deg - No Ice |
| 19 | 0.9 Dead+1.6 Wind 240 deg - No Ice |
| 20 | 1.2 Dead+1.6 Wind 270 deg - No Ice |
| 21 | 0.9 Dead+1.6 Wind 270 deg - No Ice |
| 22 | 1.2 Dead+1.6 Wind 300 deg - No Ice |
| 23 | 0.9 Dead+1.6 Wind 300 deg - No Ice |
| 24 | 1.2 Dead+1.6 Wind 330 deg - No Ice |
| 25 | 0.9 Dead+1.6 Wind 330 deg - No Ice |
| 26 | 1.2 Dead+1.0 Ice+1.0 Temp |
| 27 | 1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp |
| 28 | 1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp |
| 29 | 1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp |
| 30 | 1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp |
| 31 | 1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp |
| 32 | 1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp |
| 33 | 1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp |
| 34 | 1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp |
| 35 | 1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp |
| 36 | 1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp |
| 37 | 1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp |
| 38 | 1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp |
| 39 | Dead+Wind 0 deg - Service |
| 40 | Dead+Wind 30 deg - Service |
| 41 | Dead+Wind 60 deg - Service |
| 42 | Dead+Wind 90 deg - Service |
| 43 | Dead+Wind 120 deg - Service |
| 44 | Dead+Wind 150 deg - Service |
| 45 | Dead+Wind 180 deg - Service |
| 46 | Dead+Wind 210 deg - Service |
| 47 | Dead+Wind 240 deg - Service |
| 48 | Dead+Wind 270 deg - Service |
| 49 | Dead+Wind 300 deg - Service |
| 50 | Dead+Wind 330 deg - Service |

# Maximum Member Forces

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| Section No. | Elevation ft | Component Type | Condition | Gov. Load Comb. | Axial K | Major Axis Moment kip-ft | Minor Axis Moment kip-ft |
|---|---|---|---|---|---|---|---|
| L1 | 178 - 140 | Pole | Max Tension | 1 | 0.00 | 0.00 | 0.00 |
| | | | Max. Compression | 26 | -48.20 | -0.12 | -5.81 |
| | | | Max. Mx | 20 | -16.59 | 501.04 | 2.27 |
| | | | Max. My | 14 | -16.61 | -2.50 | -496.41 |
| | | | Max. Vy | 20 | -22.44 | 501.04 | 2.27 |
| | | | Max. Vx | 14 | 22.26 | -2.50 | -496.41 |
| | | | Max. Torque | 8 | | | -3.27 |
| L2 | 140 - 100 | Pole | Max Tension | 1 | 0.00 | 0.00 | 0.00 |
| | | | Max. Compression | 26 | -72.02 | 0.05 | -7.66 |
| | | | Max. Mx | 20 | -30.78 | 1613.52 | 6.61 |
| | | | Max. My | 14 | -30.80 | -7.03 | -1601.56 |
| | | | Max. Vy | 20 | -30.27 | 1613.52 | 6.61 |
| | | | Max. Vx | 14 | 30.09 | -7.03 | -1601.56 |
| | | | Max. Torque | 8 | | | -3.27 |
| L3 | 100 - 60 | Pole | Max Tension | 1 | 0.00 | 0.00 | 0.00 |
| | | | Max. Compression | 26 | -96.35 | 0.30 | -9.60 |
| | | | Max. Mx | 20 | -48.99 | 2927.28 | 10.85 |
| | | | Max. My | 14 | -49.00 | -11.43 | -2908.02 |
| | | | Max. Vy | 20 | -35.21 | 2927.28 | 10.85 |
| | | | Max. Vx | 14 | 35.02 | -11.43 | -2908.02 |
| | | | Max. Torque | 8 | | | -3.26 |
| L4 | 60 - 20 | Pole | Max Tension | 1 | 0.00 | 0.00 | 0.00 |
| | | | Max. Compression | 26 | -122.72 | 0.60 | -11.33 |
| | | | Max. Mx | 20 | -69.38 | 4422.25 | 14.98 |
| | | | Max. My | 14 | -69.38 | -15.71 | -4395.81 |
| | | | Max. Vy | 20 | -39.24 | 4422.25 | 14.98 |
| | | | Max. Vx | 14 | 39.06 | -15.71 | -4395.81 |
| | | | Max. Torque | 8 | | | -3.26 |
| L5 | 20 - 0 | Pole | Max Tension | 1 | 0.00 | 0.00 | 0.00 |
| | | | Max. Compression | 26 | -136.58 | 0.68 | -12.02 |
| | | | Max. Mx | 20 | -80.56 | 5222.43 | 17.02 |
| | | | Max. My | 14 | -80.56 | -17.82 | -5192.50 |
| | | | Max. Vy | 20 | -40.76 | 5222.43 | 17.02 |
| | | | Max. Vx | 14 | 40.58 | -17.82 | -5192.50 |
| | | | Max. Torque | 8 | | | -3.26 |

## Maximum Reactions

| Location | Condition | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|---|---|---|---|---|---|
| Pole | Max. Vert | 26 | 136.58 | 0.00 | -0.00 |
| | Max. $H_x$ | 21 | 60.43 | 40.74 | 0.12 |
| | Max. $H_z$ | 2 | 80.57 | 0.12 | 40.56 |
| | Max. $M_x$ | 2 | 5184.79 | 0.12 | 40.56 |
| | Max. $M_z$ | 8 | 5216.37 | -40.74 | -0.12 |
| | Max. Torsion | 20 | 3.23 | 40.74 | 0.12 |
| | Min. Vert | 5 | 60.43 | -20.27 | 35.07 |
| | Min. $H_x$ | 9 | 60.43 | -40.74 | -0.12 |
| | Min. $H_z$ | 14 | 80.57 | -0.12 | -40.56 |
| | Min. $M_x$ | 14 | -5192.50 | -0.12 | -40.56 |
| | Min. $M_z$ | 20 | -5222.43 | 40.74 | 0.12 |
| | Min. Torsion | 8 | -3.25 | -40.74 | -0.12 |

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# Tower Mast Reaction Summary

| Load Combination | Vertical<br>K | $Shear_x$<br>K | $Shear_z$<br>K | Overturning Moment, $M_x$<br>kip-ft | Overturning Moment, $M_z$<br>kip-ft | Torque<br>kip-ft |
|---|---|---|---|---|---|---|
| Dead Only | 67.14 | 0.00 | 0.00 | 3.08 | 2.42 | 0.00 |
| 1.2 Dead+1.6 Wind 0 deg - No Ice | 80.57 | -0.12 | -40.56 | -5184.79 | 23.90 | -0.30 |
| 0.9 Dead+1.6 Wind 0 deg - No Ice | 60.43 | -0.12 | -40.56 | -5132.85 | 22.86 | -0.27 |
| 1.2 Dead+1.6 Wind 30 deg - No Ice | 80.57 | 20.27 | -35.07 | -4479.26 | -2588.64 | 1.37 |
| 0.9 Dead+1.6 Wind 30 deg - No Ice | 60.43 | 20.27 | -35.07 | -4434.52 | -2562.98 | 1.39 |
| 1.2 Dead+1.6 Wind 60 deg - No Ice | 80.57 | 35.22 | -20.18 | -2572.42 | -4506.71 | 2.68 |
| 0.9 Dead+1.6 Wind 60 deg - No Ice | 60.43 | 35.22 | -20.18 | -2547.16 | -4461.45 | 2.68 |
| 1.2 Dead+1.6 Wind 90 deg - No Ice | 80.57 | 40.74 | 0.12 | 24.70 | -5216.37 | 3.25 |
| 0.9 Dead+1.6 Wind 90 deg - No Ice | 60.43 | 40.74 | 0.12 | 23.45 | -5163.83 | 3.24 |
| 1.2 Dead+1.6 Wind 120 deg - No Ice | 80.57 | 35.34 | 20.38 | 2616.19 | -4527.51 | 2.95 |
| 0.9 Dead+1.6 Wind 120 deg - No Ice | 60.43 | 35.34 | 20.38 | 2588.50 | -4482.00 | 2.93 |
| 1.2 Dead+1.6 Wind 150 deg - No Ice | 80.57 | 20.47 | 35.19 | 4507.75 | -2624.74 | 1.86 |
| 0.9 Dead+1.6 Wind 150 deg - No Ice | 60.43 | 20.47 | 35.19 | 4460.75 | -2598.66 | 1.83 |
| 1.2 Dead+1.6 Wind 180 deg - No Ice | 80.57 | 0.12 | 40.56 | 5192.50 | -17.82 | 0.28 |
| 0.9 Dead+1.6 Wind 180 deg - No Ice | 60.43 | 0.12 | 40.56 | 5138.54 | -18.37 | 0.25 |
| 1.2 Dead+1.6 Wind 210 deg - No Ice | 80.57 | -20.27 | 35.07 | 4486.95 | 2594.72 | -1.37 |
| 0.9 Dead+1.6 Wind 210 deg - No Ice | 60.43 | -20.27 | 35.07 | 4440.20 | 2567.48 | -1.39 |
| 1.2 Dead+1.6 Wind 240 deg - No Ice | 80.57 | -35.22 | 20.18 | 2580.10 | 4512.79 | -2.66 |
| 0.9 Dead+1.6 Wind 240 deg - No Ice | 60.43 | -35.22 | 20.18 | 2552.83 | 4465.94 | -2.66 |
| 1.2 Dead+1.6 Wind 270 deg - No Ice | 80.57 | -40.74 | -0.12 | -17.02 | 5222.43 | -3.23 |
| 0.9 Dead+1.6 Wind 270 deg - No Ice | 60.43 | -40.74 | -0.12 | -17.78 | 5168.31 | -3.22 |
| 1.2 Dead+1.6 Wind 300 deg - No Ice | 80.57 | -35.34 | -20.38 | -2608.51 | 4533.57 | -2.95 |
| 0.9 Dead+1.6 Wind 300 deg - No Ice | 60.43 | -35.34 | -20.38 | -2582.82 | 4486.48 | -2.93 |
| 1.2 Dead+1.6 Wind 330 deg - No Ice | 80.57 | -20.47 | -35.19 | -4500.04 | 2630.80 | -1.88 |
| 0.9 Dead+1.6 Wind 330 deg - No Ice | 60.43 | -20.47 | -35.19 | -4455.06 | 2603.14 | -1.85 |
| 1.2 Dead+1.0 Ice+1.0 Temp | 136.58 | -0.00 | 0.00 | 12.02 | 0.68 | 0.00 |
| 1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp | 136.58 | -0.01 | -8.04 | -1043.89 | 2.99 | -0.19 |
| 1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp | 136.58 | 4.01 | -6.95 | -901.23 | -526.58 | 0.12 |
| 1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp | 136.58 | 6.96 | -4.01 | -513.76 | -914.88 | 0.40 |
| 1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp | 136.58 | 8.05 | 0.01 | 14.69 | -1057.84 | 0.57 |

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| Load Combination | Vertical K | $Shear_x$ K | $Shear_z$ K | Overturning Moment, $M_x$ kip-ft | Overturning Moment, $M_z$ kip-ft | Torque kip-ft |
|---|---|---|---|---|---|---|
| 1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp | 136.58 | 6.98 | 4.03 | 542.52 | -917.17 | 0.59 |
| 1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp | 136.58 | 4.03 | 6.97 | 928.31 | -530.56 | 0.45 |
| 1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp | 136.58 | 0.01 | 8.04 | 1068.67 | -1.60 | 0.19 |
| 1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp | 136.58 | -4.01 | 6.95 | 926.01 | 527.98 | -0.12 |
| 1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp | 136.58 | -6.96 | 4.01 | 538.55 | 916.28 | -0.40 |
| 1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp | 136.58 | -8.05 | -0.01 | 10.10 | 1059.24 | -0.57 |
| 1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp | 136.58 | -6.98 | -4.03 | -517.74 | 918.57 | -0.59 |
| 1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp | 136.58 | -4.03 | -6.97 | -903.52 | 531.96 | -0.45 |
| Dead+Wind 0 deg - Service | 67.14 | -0.02 | -8.17 | -1035.12 | 6.68 | -0.05 |
| Dead+Wind 30 deg - Service | 67.14 | 4.08 | -7.06 | -893.93 | -516.11 | 0.28 |
| Dead+Wind 60 deg - Service | 67.14 | 7.09 | -4.06 | -512.35 | -899.94 | 0.54 |
| Dead+Wind 90 deg - Service | 67.14 | 8.20 | 0.02 | 7.36 | -1041.96 | 0.66 |
| Dead+Wind 120 deg - Service | 67.14 | 7.11 | 4.10 | 525.96 | -904.11 | 0.60 |
| Dead+Wind 150 deg - Service | 67.14 | 4.12 | 7.08 | 904.48 | -523.34 | 0.37 |
| Dead+Wind 180 deg - Service | 67.14 | 0.02 | 8.17 | 1041.50 | -1.66 | 0.05 |
| Dead+Wind 210 deg - Service | 67.14 | -4.08 | 7.06 | 900.31 | 521.13 | -0.28 |
| Dead+Wind 240 deg - Service | 67.14 | -7.09 | 4.06 | 518.73 | 904.96 | -0.54 |
| Dead+Wind 270 deg - Service | 67.14 | -8.20 | -0.02 | -0.98 | 1046.98 | -0.66 |
| Dead+Wind 300 deg - Service | 67.14 | -7.11 | -4.10 | -519.58 | 909.13 | -0.60 |
| Dead+Wind 330 deg - Service | 67.14 | -4.12 | -7.08 | -898.10 | 528.36 | -0.38 |

## Solution Summary

| | Sum of Applied Forces | | | Sum of Reactions | | | |
|---|---|---|---|---|---|---|---|
| Load Comb. | PX K | PY K | PZ K | PX K | PY K | PZ K | % Error |
| 1 | 0.00 | -67.14 | 0.00 | 0.00 | 67.14 | 0.00 | 0.000% |
| 2 | -0.12 | -80.57 | -40.56 | 0.12 | 80.57 | 40.56 | 0.000% |
| 3 | -0.12 | -60.43 | -40.56 | 0.12 | 60.43 | 40.56 | 0.000% |
| 4 | 20.27 | -80.57 | -35.07 | -20.27 | 80.57 | 35.07 | 0.000% |
| 5 | 20.27 | -60.43 | -35.07 | -20.27 | 60.43 | 35.07 | 0.000% |
| 6 | 35.22 | -80.57 | -20.18 | -35.22 | 80.57 | 20.18 | 0.000% |
| 7 | 35.22 | -60.43 | -20.18 | -35.22 | 60.43 | 20.18 | 0.000% |
| 8 | 40.74 | -80.57 | 0.12 | -40.74 | 80.57 | -0.12 | 0.000% |
| 9 | 40.74 | -60.43 | 0.12 | -40.74 | 60.43 | -0.12 | 0.000% |
| 10 | 35.34 | -80.57 | 20.38 | -35.34 | 80.57 | -20.38 | 0.000% |
| 11 | 35.34 | -60.43 | 20.38 | -35.34 | 60.43 | -20.38 | 0.000% |
| 12 | 20.47 | -80.57 | 35.19 | -20.47 | 80.57 | -35.19 | 0.000% |
| 13 | 20.47 | -60.43 | 35.19 | -20.47 | 60.43 | -35.19 | 0.000% |
| 14 | 0.12 | -80.57 | 40.56 | -0.12 | 80.57 | -40.56 | 0.000% |
| 15 | 0.12 | -60.43 | 40.56 | -0.12 | 60.43 | -40.56 | 0.000% |
| 16 | -20.27 | -80.57 | 35.07 | 20.27 | 80.57 | -35.07 | 0.000% |
| 17 | -20.27 | -60.43 | 35.07 | 20.27 | 60.43 | -35.07 | 0.000% |
| 18 | -35.22 | -80.57 | 20.18 | 35.22 | 80.57 | -20.18 | 0.000% |
| 19 | -35.22 | -60.43 | 20.18 | 35.22 | 60.43 | -20.18 | 0.000% |
| 20 | -40.74 | -80.57 | -0.12 | 40.74 | 80.57 | 0.12 | 0.000% |
| 21 | -40.74 | -60.43 | -0.12 | 40.74 | 60.43 | 0.12 | 0.000% |
| 22 | -35.34 | -80.57 | -20.38 | 35.34 | 80.57 | 20.38 | 0.000% |
| 23 | -35.34 | -60.43 | -20.38 | 35.34 | 60.43 | 20.38 | 0.000% |
| 24 | -20.47 | -80.57 | -35.19 | 20.47 | 80.57 | 35.19 | 0.000% |

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| Load Comb. | Sum of Applied Forces PX K | PY K | PZ K | Sum of Reactions PX K | PY K | PZ K | % Error |
|---|---|---|---|---|---|---|---|
| 25 | -20.47 | -60.43 | -35.19 | 20.47 | 60.43 | 35.19 | 0.000% |
| 26 | 0.00 | -136.58 | 0.00 | 0.00 | 136.58 | -0.00 | 0.000% |
| 27 | -0.01 | -136.58 | -8.04 | 0.01 | 136.58 | 8.04 | 0.000% |
| 28 | 4.01 | -136.58 | -6.95 | -4.01 | 136.58 | 6.95 | 0.000% |
| 29 | 6.96 | -136.58 | -4.01 | -6.96 | 136.58 | 4.01 | 0.000% |
| 30 | 8.05 | -136.58 | 0.01 | -8.05 | 136.58 | -0.01 | 0.000% |
| 31 | 6.97 | -136.58 | 4.03 | -6.98 | 136.58 | -4.03 | 0.000% |
| 32 | 4.03 | -136.58 | 6.96 | -4.03 | 136.58 | -6.97 | 0.000% |
| 33 | 0.01 | -136.58 | 8.04 | -0.01 | 136.58 | -8.04 | 0.000% |
| 34 | -4.01 | -136.58 | 6.95 | 4.01 | 136.58 | -6.95 | 0.000% |
| 35 | -6.96 | -136.58 | 4.01 | 6.96 | 136.58 | -4.01 | 0.000% |
| 36 | -8.05 | -136.58 | -0.01 | 8.05 | 136.58 | 0.01 | 0.000% |
| 37 | -6.97 | -136.58 | -4.03 | 6.98 | 136.58 | 4.03 | 0.000% |
| 38 | -4.03 | -136.58 | -6.96 | 4.03 | 136.58 | 6.97 | 0.000% |
| 39 | -0.02 | -67.14 | -8.17 | 0.02 | 67.14 | 8.17 | 0.000% |
| 40 | 4.08 | -67.14 | -7.06 | -4.08 | 67.14 | 7.06 | 0.000% |
| 41 | 7.09 | -67.14 | -4.06 | -7.09 | 67.14 | 4.06 | 0.000% |
| 42 | 8.20 | -67.14 | 0.02 | -8.20 | 67.14 | -0.02 | 0.000% |
| 43 | 7.11 | -67.14 | 4.10 | -7.11 | 67.14 | -4.10 | 0.000% |
| 44 | 4.12 | -67.14 | 7.08 | -4.12 | 67.14 | -7.08 | 0.000% |
| 45 | 0.02 | -67.14 | 8.17 | -0.02 | 67.14 | -8.17 | 0.000% |
| 46 | -4.08 | -67.14 | 7.06 | 4.08 | 67.14 | -7.06 | 0.000% |
| 47 | -7.09 | -67.14 | 4.06 | 7.09 | 67.14 | -4.06 | 0.000% |
| 48 | -8.20 | -67.14 | -0.02 | 8.20 | 67.14 | 0.02 | 0.000% |
| 49 | -7.11 | -67.14 | -4.10 | 7.11 | 67.14 | 4.10 | 0.000% |
| 50 | -4.12 | -67.14 | -7.08 | 4.12 | 67.14 | 7.08 | 0.000% |

## Non-Linear Convergence Results

| Load Combination | Converged? | Number of Cycles | Displacement Tolerance | Force Tolerance |
|---|---|---|---|---|
| 1 | Yes | 4 | 0.00000001 | 0.00000001 |
| 2 | Yes | 4 | 0.00000001 | 0.00042523 |
| 3 | Yes | 4 | 0.00000001 | 0.00023008 |
| 4 | Yes | 5 | 0.00000001 | 0.00060006 |
| 5 | Yes | 5 | 0.00000001 | 0.00028325 |
| 6 | Yes | 5 | 0.00000001 | 0.00056897 |
| 7 | Yes | 5 | 0.00000001 | 0.00026725 |
| 8 | Yes | 5 | 0.00000001 | 0.00006230 |
| 9 | Yes | 4 | 0.00000001 | 0.00086306 |
| 10 | Yes | 5 | 0.00000001 | 0.00063438 |
| 11 | Yes | 5 | 0.00000001 | 0.00029857 |
| 12 | Yes | 5 | 0.00000001 | 0.00059066 |
| 13 | Yes | 5 | 0.00000001 | 0.00027691 |
| 14 | Yes | 4 | 0.00000001 | 0.00031686 |
| 15 | Yes | 4 | 0.00000001 | 0.00014650 |
| 16 | Yes | 5 | 0.00000001 | 0.00058290 |
| 17 | Yes | 5 | 0.00000001 | 0.00027355 |
| 18 | Yes | 5 | 0.00000001 | 0.00061899 |
| 19 | Yes | 5 | 0.00000001 | 0.00029175 |
| 20 | Yes | 5 | 0.00000001 | 0.00004934 |
| 21 | Yes | 4 | 0.00000001 | 0.00068375 |
| 22 | Yes | 5 | 0.00000001 | 0.00058340 |
| 23 | Yes | 5 | 0.00000001 | 0.00027315 |
| 24 | Yes | 5 | 0.00000001 | 0.00062216 |
| 25 | Yes | 5 | 0.00000001 | 0.00029264 |

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| | | | | |
|---|---|---|---|---|
| 26 | Yes | 4 | 0.00000001 | 0.00006530 |
| 27 | Yes | 5 | 0.00000001 | 0.00042093 |
| 28 | Yes | 5 | 0.00000001 | 0.00044750 |
| 29 | Yes | 5 | 0.00000001 | 0.00044968 |
| 30 | Yes | 5 | 0.00000001 | 0.00043094 |
| 31 | Yes | 5 | 0.00000001 | 0.00046593 |
| 32 | Yes | 5 | 0.00000001 | 0.00046596 |
| 33 | Yes | 5 | 0.00000001 | 0.00043818 |
| 34 | Yes | 5 | 0.00000001 | 0.00046418 |
| 35 | Yes | 5 | 0.00000001 | 0.00046344 |
| 36 | Yes | 5 | 0.00000001 | 0.00043137 |
| 37 | Yes | 5 | 0.00000001 | 0.00045255 |
| 38 | Yes | 5 | 0.00000001 | 0.00045101 |
| 39 | Yes | 4 | 0.00000001 | 0.00004540 |
| 40 | Yes | 4 | 0.00000001 | 0.00014005 |
| 41 | Yes | 4 | 0.00000001 | 0.00012091 |
| 42 | Yes | 4 | 0.00000001 | 0.00006720 |
| 43 | Yes | 4 | 0.00000001 | 0.00016030 |
| 44 | Yes | 4 | 0.00000001 | 0.00012839 |
| 45 | Yes | 4 | 0.00000001 | 0.00004552 |
| 46 | Yes | 4 | 0.00000001 | 0.00012905 |
| 47 | Yes | 4 | 0.00000001 | 0.00015599 |
| 48 | Yes | 4 | 0.00000001 | 0.00006595 |
| 49 | Yes | 4 | 0.00000001 | 0.00012542 |
| 50 | Yes | 4 | 0.00000001 | 0.00014996 |

## Maximum Tower Deflections - Service Wind

| Section No. | Elevation ft | Horz. Deflection in | Gov. Load Comb. | Tilt ° | Twist ° |
|---|---|---|---|---|---|
| L1 | 178 - 140 | 18.789 | 48 | 0.9542 | 0.0043 |
| L2 | 140 - 100 | 11.548 | 48 | 0.7963 | 0.0018 |
| L3 | 100 - 60 | 5.800 | 49 | 0.5274 | 0.0007 |
| L4 | 60 - 20 | 2.127 | 49 | 0.3306 | 0.0004 |
| L5 | 20 - 0 | 0.230 | 49 | 0.1070 | 0.0001 |

## Critical Deflections and Radius of Curvature - Service Wind

| Elevation ft | Appurtenance | Gov. Load Comb. | Deflection in | Tilt ° | Twist ° | Radius of Curvature ft |
|---|---|---|---|---|---|---|
| 179.0000 | Top Hat 2' 3" x 31.83" | 48 | 18.789 | 0.9542 | 0.0044 | 156373 |
| 178.0000 | Lighting Rod 5/8" x 8' | 48 | 18.789 | 0.9542 | 0.0044 | 156373 |
| 168.0000 | APX16DWV-16DWV-S-E-A20 w/Mount Pipe | 48 | 16.798 | 0.9202 | 0.0036 | 31274 |
| 160.0000 | HPA-65R-BUU-H6 w/ Mount Pipe | 48 | 15.230 | 0.8907 | 0.0030 | 17374 |
| 149.0000 | (2) LNX-6514DS-VTM w/ Mount Pipe | 48 | 13.151 | 0.8435 | 0.0023 | 10784 |
| 134.0000 | AM-X-CD-17-65-00T-RET w/ Mount Pipe | 48 | 10.542 | 0.7595 | 0.0015 | 8331 |

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## Maximum Tower Deflections - Design Wind

| Section No. | Elevation ft | Horz. Deflection in | Gov. Load Comb. | Tilt ° | Twist ° |
|---|---|---|---|---|---|
| L1 | 178 - 140 | 93.779 | 22 | 4.7551 | 0.0212 |
| L2 | 140 - 100 | 57.700 | 22 | 3.9803 | 0.0089 |
| L3 | 100 - 60 | 28.992 | 22 | 2.6372 | 0.0036 |
| L4 | 60 - 20 | 10.630 | 22 | 1.6527 | 0.0017 |
| L5 | 20 - 0 | 1.151 | 22 | 0.5346 | 0.0005 |

## Critical Deflections and Radius of Curvature - Design Wind

| Elevation ft | Appurtenance | Gov. Load Comb. | Deflection in | Tilt ° | Twist ° | Radius of Curvature ft |
|---|---|---|---|---|---|---|
| 179.0000 | Top Hat 2' 3" x 31.83" | 22 | 93.779 | 4.7551 | 0.0218 | 31999 |
| 178.0000 | Lighting Rod 5/8" x 8' | 22 | 93.779 | 4.7551 | 0.0218 | 31999 |
| 168.0000 | APX16DWV-16DWV-S-E-A20 w/Mount Pipe | 22 | 83.861 | 4.5898 | 0.0180 | 6399 |
| 160.0000 | HPA-65R-BUU-H6 w/ Mount Pipe | 22 | 76.053 | 4.4460 | 0.0151 | 3553 |
| 149.0000 | (2) LNX-6514DS-VTM w/ Mount Pipe | 22 | 65.693 | 4.2141 | 0.0115 | 2203 |
| 134.0000 | AM-X-CD-17-65-00T-RET w/ Mount Pipe | 22 | 52.679 | 3.7975 | 0.0077 | 1697 |

## *Compression Checks*

## Pole Design Data

| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| L1 | 178 - 176.1 | P24x1/2 | 38.0000 | 0.0000 | 0.0 | 36.9137 | -3.52 | 1162.78 | 0.003 |
| | 176.1 - 174.2 | | | | | 36.9137 | -3.86 | 1162.78 | 0.003 |
| | 174.2 - 172.3 | | | | | 36.9137 | -4.21 | 1162.78 | 0.004 |
| | 172.3 - 170.4 | | | | | 36.9137 | -4.55 | 1162.78 | 0.004 |
| | 170.4 - 168.5 | | | | | 36.9137 | -4.89 | 1162.78 | 0.004 |
| | 168.5 - 166.6 | | | | | 36.9137 | -6.76 | 1162.78 | 0.006 |
| | 166.6 - 164.7 | | | | | 36.9137 | -7.09 | 1162.78 | 0.006 |
| | 164.7 - 162.8 | | | | | 36.9137 | -7.44 | 1162.78 | 0.006 |
| | 162.8 - 160.9 | | | | | 36.9137 | -7.78 | 1162.78 | 0.007 |
| | 160.9 - 159 | | | | | 36.9137 | -9.65 | 1162.78 | 0.008 |
| | 159 - 157.1 | | | | | 36.9137 | -10.00 | 1162.78 | 0.009 |
| | 157.1 - 155.2 | | | | | 36.9137 | -10.35 | 1162.78 | 0.009 |
| | 155.2 - 153.3 | | | | | 36.9137 | -10.70 | 1162.78 | 0.009 |
| | 153.3 - 151.4 | | | | | 36.9137 | -11.06 | 1162.78 | 0.010 |
| | 151.4 - 149.5 | | | | | 36.9137 | -11.41 | 1162.78 | 0.010 |
| | 149.5 - 147.6 | | | | | 36.9137 | -15.08 | 1162.78 | 0.013 |
| | 147.6 - 145.7 | | | | | 36.9137 | -15.45 | 1162.78 | 0.013 |
| | 145.7 - 143.8 | | | | | 36.9137 | -15.82 | 1162.78 | 0.014 |
| | 143.8 - 141.9 | | | | | 36.9137 | -16.20 | 1162.78 | 0.014 |

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| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| | 141.9 - 140 | | | | | 36.9137 | -16.58 | 1162.78 | 0.014 |
| L2 | 140 - 138 | P36x1/2 | 40.0000 | 0.0000 | 0.0 | 55.7633 | -17.18 | 1756.54 | 0.010 |
| | | 4.8.2 (1.04 CR) - 2/19 | | | | | | | |
| | 138 - 136 | | | | | 55.7633 | -17.76 | 1756.54 | 0.010 |
| | | 4.8.2 (1.04 CR) - 2/18 | | | | | | | |
| | 136 - 134 | | | | | 55.7633 | -18.35 | 1756.54 | 0.010 |
| | | 4.8.2 (1.04 CR) - 2/17 | | | | | | | |
| | 134 - 132 | | | | | 55.7633 | -21.04 | 1756.54 | 0.012 |
| | | 4.8.2 (1.04 CR) - 2/16 | | | | | | | |
| | 132 - 130 | | | | | 55.7633 | -21.63 | 1756.54 | 0.012 |
| | | 4.8.2 (1.04 CR) - 2/15 | | | | | | | |
| | 130 - 128 | | | | | 55.7633 | -22.22 | 1756.54 | 0.013 |
| | | 4.8.2 (1.04 CR) - 2/14 | | | | | | | |
| | 128 - 126 | | | | | 55.7633 | -22.82 | 1756.54 | 0.013 |
| | | 4.8.2 (1.04 CR) - 2/13 | | | | | | | |
| | 126 - 124 | | | | | 55.7633 | -23.42 | 1756.54 | 0.013 |
| | | 4.8.2 (1.04 CR) - 2/12 | | | | | | | |
| | 124 - 122 | | | | | 55.7633 | -24.02 | 1756.54 | 0.014 |
| | | 4.8.2 (1.04 CR) - 2/11 | | | | | | | |
| | 122 - 120 | | | | | 55.7633 | -24.62 | 1756.54 | 0.014 |
| | | 4.8.2 (1.04 CR) - 2/10 | | | | | | | |
| | 120 - 118 | | | | | 55.7633 | -25.22 | 1756.54 | 0.014 |
| | | 4.8.2 (1.04 CR) - 2/9 | | | | | | | |
| | 118 - 116 | | | | | 55.7633 | -25.83 | 1756.54 | 0.015 |
| | | 4.8.2 (1.04 CR) - 2/8 | | | | | | | |
| | 116 - 114 | | | | | 55.7633 | -26.44 | 1756.54 | 0.015 |
| | | 4.8.2 (1.04 CR) - 2/7 | | | | | | | |
| | 114 - 112 | | | | | 55.7633 | -27.05 | 1756.54 | 0.015 |
| | | 4.8.2 (1.04 CR) - 2/6 | | | | | | | |
| | 112 - 110 | | | | | 55.7633 | -27.67 | 1756.54 | 0.016 |
| | | 4.8.2 (1.04 CR) - 2/5 | | | | | | | |
| | 110 - 108 | | | | | 55.7633 | -28.28 | 1756.54 | 0.016 |
| | | 4.8.2 (1.04 CR) - 2/4 | | | | | | | |
| | 108 - 106 | | | | | 55.7633 | -28.90 | 1756.54 | 0.016 |
| | | 4.8.2 (1.04 CR) - 2/3 | | | | | | | |
| | 106 - 104 | | | | | 55.7633 | -29.53 | 1756.54 | 0.017 |
| | | 4.8.2 (1.04 CR) - 2/2 | | | | | | | |
| | 104 - 102 | | | | | 55.7633 | -30.15 | 1756.54 | 0.017 |
| | | 4.8.2 (1.04 CR) - 2 | | | | | | | |
| | 102 - 100 | | | | | 55.7633 | -30.78 | 1756.54 | 0.018 |
| | | 4.8.2 (1.04 CR) - 2 | | | | | | | |
| L3 | 100 - 98 | P48x5/8 | 40.0000 | 0.0000 | 0.0 | 93.0206 | -31.70 | 2930.15 | 0.011 |
| | 98 - 96 | | | | | 93.0206 | -32.59 | 2930.15 | 0.011 |
| | 96 - 94 | | | | | 93.0206 | -33.49 | 2930.15 | 0.011 |
| | 94 - 92 | | | | | 93.0206 | -34.40 | 2930.15 | 0.012 |
| | 92 - 90 | | | | | 93.0206 | -35.30 | 2930.15 | 0.012 |
| | 90 - 88 | | | | | 93.0206 | -36.20 | 2930.15 | 0.012 |
| | 88 - 86 | | | | | 93.0206 | -37.11 | 2930.15 | 0.013 |
| | 86 - 84 | | | | | 93.0206 | -38.01 | 2930.15 | 0.013 |
| | 84 - 82 | | | | | 93.0206 | -38.92 | 2930.15 | 0.013 |
| | 82 - 80 | | | | | 93.0206 | -39.83 | 2930.15 | 0.014 |
| | 80 - 78 | | | | | 93.0206 | -40.74 | 2930.15 | 0.014 |
| | 78 - 76 | | | | | 93.0206 | -41.65 | 2930.15 | 0.014 |
| | 76 - 74 | | | | | 93.0206 | -42.56 | 2930.15 | 0.015 |
| | 74 - 72 | | | | | 93.0206 | -43.48 | 2930.15 | 0.015 |
| | 72 - 70 | | | | | 93.0206 | -44.39 | 2930.15 | 0.015 |
| | 70 - 68 | | | | | 93.0206 | -45.31 | 2930.15 | 0.015 |
| | 68 - 66 | | | | | 93.0206 | -46.23 | 2930.15 | 0.016 |
| | 66 - 64 | | | | | 93.0206 | -47.14 | 2930.15 | 0.016 |
| | 64 - 62 | | | | | 93.0206 | -48.07 | 2930.15 | 0.016 |

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| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| | 62 - 60 | | | | | 93.0206 | -48.99 | 2930.15 | 0.017 |
| L4 | 60 - 58 | P54x5/8 | 40.0000 | 0.0000 | 0.0 | 104.8020 | -50.00 | 3301.25 | 0.015 |
| | 58 - 56 | 4.8.2 (1.04 CR) - 4/19 | | | | 104.8020 | -51.01 | 3301.25 | 0.015 |
| | 56 - 54 | 4.8.2 (1.04 CR) - 4/18 | | | | 104.8020 | -52.02 | 3301.25 | 0.016 |
| | 54 - 52 | 4.8.2 (1.04 CR) - 4/17 | | | | 104.8020 | -53.03 | 3301.25 | 0.016 |
| | 52 - 50 | 4.8.2 (1.04 CR) - 4/16 | | | | 104.8020 | -54.04 | 3301.25 | 0.016 |
| | 50 - 48 | 4.8.2 (1.04 CR) - 4/15 | | | | 104.8020 | -55.06 | 3301.25 | 0.017 |
| | 48 - 46 | 4.8.2 (1.04 CR) - 4/14 | | | | 104.8020 | -56.07 | 3301.25 | 0.017 |
| | 46 - 44 | 4.8.2 (1.04 CR) - 4/13 | | | | 104.8020 | -57.09 | 3301.25 | 0.017 |
| | 44 - 42 | 4.8.2 (1.04 CR) - 4/12 | | | | 104.8020 | -58.11 | 3301.25 | 0.018 |
| | 42 - 40 | 4.8.2 (1.04 CR) - 4/11 | | | | 104.8020 | -59.12 | 3301.25 | 0.018 |
| | 40 - 38 | 4.8.2 (1.04 CR) - 4/10 | | | | 104.8020 | -60.14 | 3301.25 | 0.018 |
| | 38 - 36 | 4.8.2 (1.04 CR) - 4/9 | | | | 104.8020 | -61.16 | 3301.25 | 0.019 |
| | 36 - 34 | 4.8.2 (1.04 CR) - 4/8 | | | | 104.8020 | -62.19 | 3301.25 | 0.019 |
| | 34 - 32 | 4.8.2 (1.04 CR) - 4/7 | | | | 104.8020 | -63.21 | 3301.25 | 0.019 |
| | 32 - 30 | 4.8.2 (1.04 CR) - 4/6 | | | | 104.8020 | -64.23 | 3301.25 | 0.019 |
| | 30 - 28 | 4.8.2 (1.04 CR) - 4/5 | | | | 104.8020 | -65.26 | 3301.25 | 0.020 |
| | 28 - 26 | 4.8.2 (1.04 CR) - 4/4 | | | | 104.8020 | -66.29 | 3301.25 | 0.020 |
| | 26 - 24 | 4.8.2 (1.04 CR) - 4/3 | | | | 104.8020 | -67.32 | 3301.25 | 0.020 |
| | 24 - 22 | 4.8.2 (1.04 CR) - 4/2 | | | | 104.8020 | -68.35 | 3301.25 | 0.021 |
| | 22 - 20 | 4.8.2 (1.04 CR) - 4 | | | | 104.8020 | -69.38 | 3301.25 | 0.021 |

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| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| L5 | 20 - 19 | 4.8.2 (1.04 CR) - 4 P60x5/8 | 20.0000 | 0.0000 | 0.0 | 116.5830 | -69.95 | 3649.51 | 0.019 |
| | 19 - 18 | 4.8.2 (1.01 CR) - 5/19 | | | | 116.5830 | -70.50 | 3649.51 | 0.019 |
| | 18 - 17 | 4.8.2 (1.01 CR) - 5/18 | | | | 116.5830 | -71.06 | 3649.51 | 0.019 |
| | 17 - 16 | 4.8.2 (1.01 CR) - 5/17 | | | | 116.5830 | -71.62 | 3649.51 | 0.020 |
| | 16 - 15 | 4.8.2 (1.01 CR) - 5/16 | | | | 116.5830 | -72.18 | 3649.51 | 0.020 |
| | 15 - 14 | 4.8.2 (1.01 CR) - 5/15 | | | | 116.5830 | -72.73 | 3649.51 | 0.020 |
| | 14 - 13 | 4.8.2 (1.01 CR) - 5/14 | | | | 116.5830 | -73.29 | 3649.51 | 0.020 |
| | 13 - 12 | 4.8.2 (1.01 CR) - 5/13 | | | | 116.5830 | -73.85 | 3649.51 | 0.020 |
| | 12 - 11 | 4.8.2 (1.01 CR) - 5/12 | | | | 116.5830 | -74.41 | 3649.51 | 0.020 |
| | 11 - 10 | 4.8.2 (1.01 CR) - 5/11 | | | | 116.5830 | -74.97 | 3649.51 | 0.021 |
| | 10 - 9 | 4.8.2 (1.01 CR) - 5/10 | | | | 116.5830 | -75.52 | 3649.51 | 0.021 |
| | 9 - 8 | 4.8.2 (1.01 CR) - 5/9 | | | | 116.5830 | -76.08 | 3649.51 | 0.021 |
| | 8 - 7 | 4.8.2 (1.01 CR) - 5/8 | | | | 116.5830 | -76.64 | 3649.51 | 0.021 |
| | 7 - 6 | 4.8.2 (1.01 CR) - 5/7 | | | | 116.5830 | -77.20 | 3649.51 | 0.021 |
| | 6 - 5 | 4.8.2 (1.01 CR) - 5/6 | | | | 116.5830 | -77.76 | 3649.51 | 0.021 |
| | 5 - 4 | 4.8.2 (1.01 CR) - 5/5 | | | | 116.5830 | -78.32 | 3649.51 | 0.021 |
| | 4 - 3 | 4.8.2 (1.01 CR) - 5/4 | | | | 116.5830 | -78.88 | 3649.51 | 0.022 |
| | 3 - 2 | 4.8.2 (1.01 CR) - 5/3 | | | | 116.5830 | -79.44 | 3649.51 | 0.022 |
| | 2 - 1 | 4.8.2 (1.01 CR) - 5/2 | | | | 116.5830 | -80.00 | 3649.51 | 0.022 |
| | 1 - 0 | 4.8.2 (1.01 CR) - 5 | | | | 116.5830 | -80.56 | 3649.51 | 0.022 |

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| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | 4.8.2 (1.01 CR) - 5 | | | | | | | |

## Pole Bending Design Data

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| L1 | 178 - 176.1 | P24x1/2 | 13.62 | 724.94 | 0.019 | 0.00 | 724.94 | 0.000 |
| | 176.1 - 174.2 | | 21.86 | 724.94 | 0.030 | 0.00 | 724.94 | 0.000 |
| | 174.2 - 172.3 | | 30.41 | 724.94 | 0.042 | 0.00 | 724.94 | 0.000 |
| | 172.3 - 170.4 | | 39.28 | 724.94 | 0.054 | 0.00 | 724.94 | 0.000 |
| | 170.4 - 168.5 | | 48.47 | 724.94 | 0.067 | 0.00 | 724.94 | 0.000 |
| | 168.5 - 166.6 | | 68.29 | 724.94 | 0.094 | 0.00 | 724.94 | 0.000 |
| | 166.6 - 164.7 | | 84.84 | 724.94 | 0.117 | 0.00 | 724.94 | 0.000 |
| | 164.7 - 162.8 | | 101.75 | 724.94 | 0.140 | 0.00 | 724.94 | 0.000 |
| | 162.8 - 160.9 | | 118.98 | 724.94 | 0.164 | 0.00 | 724.94 | 0.000 |
| | 160.9 - 159 | | 141.94 | 724.94 | 0.196 | 0.00 | 724.94 | 0.000 |
| | 159 - 157.1 | | 170.83 | 724.94 | 0.236 | 0.00 | 724.94 | 0.000 |
| | 157.1 - 155.2 | | 200.01 | 724.94 | 0.276 | 0.00 | 724.94 | 0.000 |
| | 155.2 - 153.3 | | 229.50 | 724.94 | 0.317 | 0.00 | 724.94 | 0.000 |
| | 153.3 - 151.4 | | 259.27 | 724.94 | 0.358 | 0.00 | 724.94 | 0.000 |
| | 151.4 - 149.5 | | 289.33 | 724.94 | 0.399 | 0.00 | 724.94 | 0.000 |
| | 149.5 - 147.6 | | 333.14 | 724.94 | 0.460 | 0.00 | 724.94 | 0.000 |
| | 147.6 - 145.7 | | 374.98 | 724.94 | 0.517 | 0.00 | 724.94 | 0.000 |
| | 145.7 - 143.8 | | 417.07 | 724.94 | 0.575 | 0.00 | 724.94 | 0.000 |
| | 143.8 - 141.9 | | 459.43 | 724.94 | 0.634 | 0.00 | 724.94 | 0.000 |
| | 141.9 - 140 | | 502.03 | 724.94 | 0.693 | 0.00 | 724.94 | 0.000 |
| L2 | 140 - 138 | P36x1/2 | 547.25 | 1586.55 | 0.345 | 0.00 | 1586.55 | 0.000 |
| | 138 - 136 | | 592.93 | 1586.55 | 0.374 | 0.00 | 1586.55 | 0.000 |
| | 136 - 134 | | 639.09 | 1586.55 | 0.403 | 0.00 | 1586.55 | 0.000 |
| | 134 - 132 | | 695.50 | 1586.55 | 0.438 | 0.00 | 1586.55 | 0.000 |
| | 132 - 130 | | 749.93 | 1586.55 | 0.473 | 0.00 | 1586.55 | 0.000 |
| | 130 - 128 | | 804.81 | 1586.55 | 0.507 | 0.00 | 1586.55 | 0.000 |
| | 128 - 126 | | 860.13 | 1586.55 | 0.542 | 0.00 | 1586.55 | 0.000 |
| | 126 - 124 | | 915.89 | 1586.55 | 0.577 | 0.00 | 1586.55 | 0.000 |
| | 124 - 122 | | 972.08 | 1586.55 | 0.613 | 0.00 | 1586.55 | 0.000 |
| | 122 - 120 | | 1028.70 | 1586.55 | 0.648 | 0.00 | 1586.55 | 0.000 |
| | 120 - 118 | | 1085.73 | 1586.55 | 0.684 | 0.00 | 1586.55 | 0.000 |
| | 118 - 116 | | 1143.18 | 1586.55 | 0.721 | 0.00 | 1586.55 | 0.000 |
| | 116 - 114 | | 1201.03 | 1586.55 | 0.757 | 0.00 | 1586.55 | 0.000 |
| | 114 - 112 | | 1259.28 | 1586.55 | 0.794 | 0.00 | 1586.55 | 0.000 |
| | 112 - 110 | | 1317.92 | 1586.55 | 0.831 | 0.00 | 1586.55 | 0.000 |
| | 110 - 108 | | 1376.93 | 1586.55 | 0.868 | 0.00 | 1586.55 | 0.000 |
| | 108 - 106 | | 1436.32 | 1586.55 | 0.905 | 0.00 | 1586.55 | 0.000 |
| | 106 - 104 | | 1496.07 | 1586.55 | 0.943 | 0.00 | 1586.55 | 0.000 |
| | 104 - 102 | | 1556.18 | 1586.55 | 0.981 | 0.00 | 1586.55 | 0.000 |
| | 102 - 100 | | 1616.63 | 1586.55 | 1.019 | 0.00 | 1586.55 | 0.000 |
| L3 | 100 - 98 | P48x5/8 | 1677.53 | 3492.39 | 0.480 | 0.00 | 3492.39 | 0.000 |
| | 98 - 96 | | 1738.97 | 3492.39 | 0.498 | 0.00 | 3492.39 | 0.000 |
| | 96 - 94 | | 1800.97 | 3492.39 | 0.516 | 0.00 | 3492.39 | 0.000 |
| | 94 - 92 | | 1863.51 | 3492.39 | 0.534 | 0.00 | 3492.39 | 0.000 |
| | 92 - 90 | | 1926.58 | 3492.39 | 0.552 | 0.00 | 3492.39 | 0.000 |
| | 90 - 88 | | 1990.19 | 3492.39 | 0.570 | 0.00 | 3492.39 | 0.000 |
| | 88 - 86 | | 2054.32 | 3492.39 | 0.588 | 0.00 | 3492.39 | 0.000 |
| | 86 - 84 | | 2118.97 | 3492.39 | 0.607 | 0.00 | 3492.39 | 0.000 |
| | 84 - 82 | | 2184.12 | 3492.39 | 0.625 | 0.00 | 3492.39 | 0.000 |

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| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| | 82 - 80 | | 2249.78 | 3492.39 | 0.644 | 0.00 | 3492.39 | 0.000 |
| | 80 - 78 | | 2315.93 | 3492.39 | 0.663 | 0.00 | 3492.39 | 0.000 |
| | 78 - 76 | | 2382.57 | 3492.39 | 0.682 | 0.00 | 3492.39 | 0.000 |
| | 76 - 74 | | 2449.69 | 3492.39 | 0.701 | 0.00 | 3492.39 | 0.000 |
| | 74 - 72 | | 2517.28 | 3492.39 | 0.721 | 0.00 | 3492.39 | 0.000 |
| | 72 - 70 | | 2585.35 | 3492.39 | 0.740 | 0.00 | 3492.39 | 0.000 |
| | 70 - 68 | | 2653.88 | 3492.39 | 0.760 | 0.00 | 3492.39 | 0.000 |
| | 68 - 66 | | 2722.85 | 3492.39 | 0.780 | 0.00 | 3492.39 | 0.000 |
| | 66 - 64 | | 2792.27 | 3492.39 | 0.800 | 0.00 | 3492.39 | 0.000 |
| | 64 - 62 | | 2862.12 | 3492.39 | 0.820 | 0.00 | 3492.39 | 0.000 |
| | 62 - 60 | | 2932.39 | 3492.39 | 0.840 | 0.00 | 3492.39 | 0.000 |
| L4 | 60 - 58 | P54x5/8 | 3003.13 | 4349.32 | 0.690 | 0.00 | 4349.32 | 0.000 |
| | 58 - 56 | | 3074.35 | 4349.32 | 0.707 | 0.00 | 4349.32 | 0.000 |
| | 56 - 54 | | 3146.06 | 4349.32 | 0.723 | 0.00 | 4349.32 | 0.000 |
| | 54 - 52 | | 3218.24 | 4349.32 | 0.740 | 0.00 | 4349.32 | 0.000 |
| | 52 - 50 | | 3290.88 | 4349.32 | 0.757 | 0.00 | 4349.32 | 0.000 |
| | 50 - 48 | | 3363.97 | 4349.32 | 0.773 | 0.00 | 4349.32 | 0.000 |
| | 48 - 46 | | 3437.52 | 4349.32 | 0.790 | 0.00 | 4349.32 | 0.000 |
| | 46 - 44 | | 3511.49 | 4349.32 | 0.807 | 0.00 | 4349.32 | 0.000 |
| | 44 - 42 | | 3585.88 | 4349.32 | 0.824 | 0.00 | 4349.32 | 0.000 |
| | 42 - 40 | | 3660.69 | 4349.32 | 0.842 | 0.00 | 4349.32 | 0.000 |
| | 40 - 38 | | 3735.91 | 4349.32 | 0.859 | 0.00 | 4349.32 | 0.000 |
| | 38 - 36 | | 3811.52 | 4349.32 | 0.876 | 0.00 | 4349.32 | 0.000 |
| | 36 - 34 | | 3887.51 | 4349.32 | 0.894 | 0.00 | 4349.32 | 0.000 |
| | 34 - 32 | | 3963.88 | 4349.32 | 0.911 | 0.00 | 4349.32 | 0.000 |
| | 32 - 30 | | 4040.61 | 4349.32 | 0.929 | 0.00 | 4349.32 | 0.000 |
| | 30 - 28 | | 4117.69 | 4349.32 | 0.947 | 0.00 | 4349.32 | 0.000 |
| | 28 - 26 | | 4195.11 | 4349.32 | 0.965 | 0.00 | 4349.32 | 0.000 |
| | 26 - 24 | | 4272.86 | 4349.32 | 0.982 | 0.00 | 4349.32 | 0.000 |
| | 24 - 22 | | 4350.93 | 4349.32 | 1.000 | 0.00 | 4349.32 | 0.000 |
| | 22 - 20 | | 4429.31 | 4349.32 | 1.018 | 0.00 | 4349.32 | 0.000 |
| L5 | 20 - 19 | P60x5/8 | 4468.62 | 5299.02 | 0.843 | 0.00 | 5299.02 | 0.000 |
| | 19 - 18 | | 4508.00 | 5299.02 | 0.851 | 0.00 | 5299.02 | 0.000 |
| | 18 - 17 | | 4547.48 | 5299.02 | 0.858 | 0.00 | 5299.02 | 0.000 |
| | 17 - 16 | | 4587.03 | 5299.02 | 0.866 | 0.00 | 5299.02 | 0.000 |
| | 16 - 15 | | 4626.67 | 5299.02 | 0.873 | 0.00 | 5299.02 | 0.000 |
| | 15 - 14 | | 4666.38 | 5299.02 | 0.881 | 0.00 | 5299.02 | 0.000 |
| | 14 - 13 | | 4706.18 | 5299.02 | 0.888 | 0.00 | 5299.02 | 0.000 |
| | 13 - 12 | | 4746.05 | 5299.02 | 0.896 | 0.00 | 5299.02 | 0.000 |
| | 12 - 11 | | 4786.01 | 5299.02 | 0.903 | 0.00 | 5299.02 | 0.000 |
| | 11 - 10 | | 4826.04 | 5299.02 | 0.911 | 0.00 | 5299.02 | 0.000 |
| | 10 - 9 | | 4866.15 | 5299.02 | 0.918 | 0.00 | 5299.02 | 0.000 |
| | 9 - 8 | | 4906.33 | 5299.02 | 0.926 | 0.00 | 5299.02 | 0.000 |
| | 8 - 7 | | 4946.59 | 5299.02 | 0.933 | 0.00 | 5299.02 | 0.000 |
| | 7 - 6 | | 4986.93 | 5299.02 | 0.941 | 0.00 | 5299.02 | 0.000 |
| | 6 - 5 | | 5027.33 | 5299.02 | 0.949 | 0.00 | 5299.02 | 0.000 |
| | 5 - 4 | | 5067.82 | 5299.02 | 0.956 | 0.00 | 5299.02 | 0.000 |
| | 4 - 3 | | 5108.37 | 5299.02 | 0.964 | 0.00 | 5299.02 | 0.000 |
| | 3 - 2 | | 5148.99 | 5299.02 | 0.972 | 0.00 | 5299.02 | 0.000 |
| | 2 - 1 | | 5189.68 | 5299.02 | 0.979 | 0.00 | 5299.02 | 0.000 |
| | 1 - 0 | | 5230.44 | 5299.02 | 0.987 | 0.00 | 5299.02 | 0.000 |

## Pole Shear Design Data

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| Section No. | Elevation<br>ft | Size | Actual $V_u$<br>K | $\phi V_n$<br>K | Ratio $\frac{V_u}{\phi V_n}$ | Actual $T_u$<br>kip-ft | $\phi T_n$<br>kip-ft | Ratio $\frac{T_u}{\phi T_n}$ |
|---|---|---|---|---|---|---|---|---|
| L1 | 178 - 176.1 | P24x1/2 | 4.25 | 581.39 | 0.007 | 1.46 | 1115.34 | 0.001 |
| | 176.1 - 174.2 | | 4.41 | 581.39 | 0.008 | 1.46 | 1115.34 | 0.001 |
| | 174.2 - 172.3 | | 4.58 | 581.39 | 0.008 | 1.46 | 1115.34 | 0.001 |
| | 172.3 - 170.4 | | 4.75 | 581.39 | 0.008 | 1.46 | 1115.34 | 0.001 |
| | 170.4 - 168.5 | | 4.91 | 581.39 | 0.008 | 1.46 | 1115.34 | 0.001 |
| | 168.5 - 166.6 | | 8.61 | 581.39 | 0.015 | 1.46 | 1115.34 | 0.001 |
| | 166.6 - 164.7 | | 8.82 | 581.39 | 0.015 | 1.73 | 1115.34 | 0.002 |
| | 164.7 - 162.8 | | 8.99 | 581.39 | 0.015 | 1.73 | 1115.34 | 0.002 |
| | 162.8 - 160.9 | | 9.15 | 581.39 | 0.016 | 1.73 | 1115.34 | 0.002 |
| | 160.9 - 159 | | 15.13 | 581.39 | 0.026 | 3.00 | 1115.34 | 0.003 |
| | 159 - 157.1 | | 15.29 | 581.39 | 0.026 | 3.00 | 1115.34 | 0.003 |
| | 157.1 - 155.2 | | 15.44 | 581.39 | 0.027 | 3.00 | 1115.34 | 0.003 |
| | 155.2 - 153.3 | | 15.60 | 581.39 | 0.027 | 3.00 | 1115.34 | 0.003 |
| | 153.3 - 151.4 | | 15.75 | 581.39 | 0.027 | 3.00 | 1115.34 | 0.003 |
| | 151.4 - 149.5 | | 15.90 | 581.39 | 0.027 | 3.00 | 1115.34 | 0.003 |
| | 149.5 - 147.6 | | 21.96 | 581.39 | 0.038 | 3.00 | 1115.34 | 0.003 |
| | 147.6 - 145.7 | | 22.10 | 581.39 | 0.038 | 2.97 | 1115.34 | 0.003 |
| | 145.7 - 143.8 | | 22.24 | 581.39 | 0.038 | 2.97 | 1115.34 | 0.003 |
| | 143.8 - 141.9 | | 22.37 | 581.39 | 0.038 | 2.97 | 1115.34 | 0.003 |
| | 141.9 - 140 | | 22.50 | 581.39 | 0.039 | 2.97 | 1115.34 | 0.003 |
| L2 | 140 - 138 | P36x1/2 | 22.73 | 878.27 | 0.026 | 2.97 | 2562.64 | 0.001 |
| | 138 - 136 | | 22.97 | 878.27 | 0.026 | 2.97 | 2562.64 | 0.001 |
| | 136 - 134 | | 23.20 | 878.27 | 0.026 | 2.97 | 2562.64 | 0.001 |
| | 134 - 132 | | 27.11 | 878.27 | 0.031 | 2.96 | 2562.64 | 0.001 |
| | 132 - 130 | | 27.34 | 878.27 | 0.031 | 2.96 | 2562.64 | 0.001 |
| | 130 - 128 | | 27.56 | 878.27 | 0.031 | 2.96 | 2562.64 | 0.001 |
| | 128 - 126 | | 27.78 | 878.27 | 0.032 | 2.96 | 2562.64 | 0.001 |
| | 126 - 124 | | 28.00 | 878.27 | 0.032 | 2.96 | 2562.64 | 0.001 |
| | 124 - 122 | | 28.22 | 878.27 | 0.032 | 2.96 | 2562.64 | 0.001 |
| | 122 - 120 | | 28.43 | 878.27 | 0.032 | 2.96 | 2562.64 | 0.001 |
| | 120 - 118 | | 28.64 | 878.27 | 0.033 | 2.96 | 2562.64 | 0.001 |
| | 118 - 116 | | 28.84 | 878.27 | 0.033 | 2.96 | 2562.64 | 0.001 |
| | 116 - 114 | | 29.04 | 878.27 | 0.033 | 2.96 | 2562.64 | 0.001 |
| | 114 - 112 | | 29.24 | 878.27 | 0.033 | 2.96 | 2562.64 | 0.001 |
| | 112 - 110 | | 29.43 | 878.27 | 0.034 | 2.96 | 2562.64 | 0.001 |
| | 110 - 108 | | 29.62 | 878.27 | 0.034 | 2.96 | 2562.64 | 0.001 |
| | 108 - 106 | | 29.81 | 878.27 | 0.034 | 2.96 | 2562.64 | 0.001 |
| | 106 - 104 | | 29.99 | 878.27 | 0.034 | 2.96 | 2562.64 | 0.001 |
| | 104 - 102 | | 30.16 | 878.27 | 0.034 | 2.96 | 2562.64 | 0.001 |
| | 102 - 100 | | 30.34 | 878.27 | 0.035 | 2.96 | 2562.64 | 0.001 |
| L3 | 100 - 98 | P48x5/8 | 30.60 | 1465.07 | 0.021 | 2.96 | 5709.67 | 0.001 |
| | 98 - 96 | | 30.87 | 1465.07 | 0.021 | 2.96 | 5709.67 | 0.001 |
| | 96 - 94 | | 31.15 | 1465.07 | 0.021 | 2.96 | 5709.67 | 0.001 |
| | 94 - 92 | | 31.42 | 1465.07 | 0.021 | 2.96 | 5709.67 | 0.001 |
| | 92 - 90 | | 31.68 | 1465.07 | 0.022 | 2.96 | 5709.67 | 0.001 |
| | 90 - 88 | | 31.95 | 1465.07 | 0.022 | 2.96 | 5709.67 | 0.001 |
| | 88 - 86 | | 32.21 | 1465.07 | 0.022 | 2.96 | 5709.67 | 0.001 |
| | 86 - 84 | | 32.46 | 1465.07 | 0.022 | 2.96 | 5709.67 | 0.001 |
| | 84 - 82 | | 32.72 | 1465.07 | 0.022 | 2.96 | 5709.67 | 0.001 |
| | 82 - 80 | | 32.97 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 80 - 78 | | 33.22 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 78 - 76 | | 33.46 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 76 - 74 | | 33.70 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 74 - 72 | | 33.93 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 72 - 70 | | 34.17 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 70 - 68 | | 34.40 | 1465.07 | 0.023 | 2.96 | 5709.67 | 0.001 |
| | 68 - 66 | | 34.62 | 1465.07 | 0.024 | 2.96 | 5709.67 | 0.001 |
| | 66 - 64 | | 34.84 | 1465.07 | 0.024 | 2.96 | 5709.67 | 0.001 |
| | 64 - 62 | | 35.06 | 1465.07 | 0.024 | 2.96 | 5709.67 | 0.001 |
| | 62 - 60 | | 35.27 | 1465.07 | 0.024 | 2.96 | 5709.67 | 0.001 |

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| Section No. | Elevation ft | Size | Actual $V_u$ K | $\phi V_n$ K | Ratio $\frac{V_u}{\phi V_n}$ | Actual $T_u$ kip-ft | $\phi T_n$ kip-ft | Ratio $\frac{T_u}{\phi T_n}$ |
|---|---|---|---|---|---|---|---|---|
| L4 | 60 - 58 | P54x5/8 | 35.51 | 1650.62 | 0.022 | 2.96 | 7257.86 | 0.000 |
| | 58 - 56 | | 35.75 | 1650.62 | 0.022 | 2.96 | 7257.86 | 0.000 |
| | 56 - 54 | | 35.99 | 1650.62 | 0.022 | 2.96 | 7257.86 | 0.000 |
| | 54 - 52 | | 36.23 | 1650.62 | 0.022 | 2.96 | 7257.86 | 0.000 |
| | 52 - 50 | | 36.46 | 1650.62 | 0.022 | 2.96 | 7257.86 | 0.000 |
| | 50 - 48 | | 36.68 | 1650.62 | 0.022 | 2.96 | 7257.86 | 0.000 |
| | 48 - 46 | | 36.90 | 1650.62 | 0.022 | 2.95 | 7257.86 | 0.000 |
| | 46 - 44 | | 37.12 | 1650.62 | 0.022 | 2.95 | 7257.86 | 0.000 |
| | 44 - 42 | | 37.33 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 42 - 40 | | 37.53 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 40 - 38 | | 37.73 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 38 - 36 | | 37.93 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 36 - 34 | | 38.12 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 34 - 32 | | 38.30 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 32 - 30 | | 38.48 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 30 - 28 | | 38.66 | 1650.62 | 0.023 | 2.95 | 7257.86 | 0.000 |
| | 28 - 26 | | 38.83 | 1650.62 | 0.024 | 2.95 | 7257.86 | 0.000 |
| | 26 - 24 | | 38.99 | 1650.62 | 0.024 | 2.95 | 7257.86 | 0.000 |
| | 24 - 22 | | 39.15 | 1650.62 | 0.024 | 2.95 | 7257.86 | 0.000 |
| | 22 - 20 | | 39.30 | 1650.62 | 0.024 | 2.95 | 7257.86 | 0.000 |
| L5 | 20 - 19 | P60x5/8 | 39.36 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 19 - 18 | | 39.44 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 18 - 17 | | 39.53 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 17 - 16 | | 39.61 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 16 - 15 | | 39.69 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 15 - 14 | | 39.77 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 14 - 13 | | 39.85 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 13 - 12 | | 39.93 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 12 - 11 | | 40.01 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 11 - 10 | | 40.08 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 10 - 9 | | 40.16 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 9 - 8 | | 40.24 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 8 - 7 | | 40.31 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 7 - 6 | | 40.39 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 6 - 5 | | 40.46 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 5 - 4 | | 40.53 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 4 - 3 | | 40.60 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 3 - 2 | | 40.68 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 2 - 1 | | 40.75 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |
| | 1 - 0 | | 40.81 | 1824.75 | 0.022 | 2.95 | 8935.67 | 0.000 |

## Pole Interaction Design Data

| Section No. | Elevation ft | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Ratio $\frac{V_u}{\phi V_n}$ | Ratio $\frac{T_u}{\phi T_n}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| L1 | 178 - 176.1 | 0.003 | 0.019 | 0.000 | 0.007 | 0.001 | 0.022 ✔ | 1.000 | 4.8.2 ✔ |
| | 176.1 - 174.2 | 0.003 | 0.030 | 0.000 | 0.008 | 0.001 | 0.034 ✔ | 1.000 | 4.8.2 ✔ |
| | 174.2 - 172.3 | 0.004 | 0.042 | 0.000 | 0.008 | 0.001 | 0.046 ✔ | 1.000 | 4.8.2 ✔ |
| | 172.3 - 170.4 | 0.004 | 0.054 | 0.000 | 0.008 | 0.001 | 0.058 ✔ | 1.000 | 4.8.2 ✔ |

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| Section No. | Elevation ft | Ratio $P_u/\phi P_n$ | Ratio $M_{ux}/\phi M_{nx}$ | Ratio $M_{uy}/\phi M_{ny}$ | Ratio $V_u/\phi V_n$ | Ratio $T_u/\phi T_n$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| | 170.4 - 168.5 | 0.004 | 0.067 | 0.000 | 0.008 | 0.001 | 0.071 ✔ | 1.000 | 4.8.2 ✔ |
| | 168.5 - 166.6 | 0.006 | 0.094 | 0.000 | 0.015 | 0.001 | 0.100 ✔ | 1.000 | 4.8.2 ✔ |
| | 166.6 - 164.7 | 0.006 | 0.117 | 0.000 | 0.015 | 0.002 | 0.123 ✔ | 1.000 | 4.8.2 ✔ |
| | 164.7 - 162.8 | 0.006 | 0.140 | 0.000 | 0.015 | 0.002 | 0.147 ✔ | 1.000 | 4.8.2 ✔ |
| | 162.8 - 160.9 | 0.007 | 0.164 | 0.000 | 0.016 | 0.002 | 0.171 ✔ | 1.000 | 4.8.2 ✔ |
| | 160.9 - 159 | 0.008 | 0.196 | 0.000 | 0.026 | 0.003 | 0.205 ✔ | 1.000 | 4.8.2 ✔ |
| | 159 - 157.1 | 0.009 | 0.236 | 0.000 | 0.026 | 0.003 | 0.245 ✔ | 1.000 | 4.8.2 ✔ |
| | 157.1 - 155.2 | 0.009 | 0.276 | 0.000 | 0.027 | 0.003 | 0.286 ✔ | 1.000 | 4.8.2 ✔ |
| | 155.2 - 153.3 | 0.009 | 0.317 | 0.000 | 0.027 | 0.003 | 0.327 ✔ | 1.000 | 4.8.2 ✔ |
| | 153.3 - 151.4 | 0.010 | 0.358 | 0.000 | 0.027 | 0.003 | 0.368 ✔ | 1.000 | 4.8.2 ✔ |
| | 151.4 - 149.5 | 0.010 | 0.399 | 0.000 | 0.027 | 0.003 | 0.410 ✔ | 1.000 | 4.8.2 ✔ |
| | 149.5 - 147.6 | 0.013 | 0.460 | 0.000 | 0.038 | 0.003 | 0.474 ✔ | 1.000 | 4.8.2 ✔ |
| | 147.6 - 145.7 | 0.013 | 0.517 | 0.000 | 0.038 | 0.003 | 0.532 ✔ | 1.000 | 4.8.2 ✔ |
| | 145.7 - 143.8 | 0.014 | 0.575 | 0.000 | 0.038 | 0.003 | 0.591 ✔ | 1.000 | 4.8.2 ✔ |
| | 143.8 - 141.9 | 0.014 | 0.634 | 0.000 | 0.038 | 0.003 | 0.649 ✔ | 1.000 | 4.8.2 ✔ |
| | 141.9 - 140 | 0.014 | 0.693 | 0.000 | 0.039 | 0.003 | 0.708 ✔ | 1.000 | 4.8.2 ✔ |
| L2 | 140 - 138 | 0.010 | 0.345 | 0.000 | 0.026 | 0.001 | 0.355 ✔ | 1.000 | 4.8.2 ✔ |
| | 138 - 136 | 0.010 | 0.374 | 0.000 | 0.026 | 0.001 | 0.385 ✔ | 1.000 | 4.8.2 ✔ |
| | 136 - 134 | 0.010 | 0.403 | 0.000 | 0.026 | 0.001 | 0.414 ✔ | 1.000 | 4.8.2 ✔ |
| | 134 - 132 | 0.012 | 0.438 | 0.000 | 0.031 | 0.001 | 0.451 ✔ | 1.000 | 4.8.2 ✔ |
| | 132 - 130 | 0.012 | 0.473 | 0.000 | 0.031 | 0.001 | 0.486 ✔ | 1.000 | 4.8.2 ✔ |
| | 130 - 128 | 0.013 | 0.507 | 0.000 | 0.031 | 0.001 | 0.521 ✔ | 1.000 | 4.8.2 ✔ |
| | 128 - 126 | 0.013 | 0.542 | 0.000 | 0.032 | 0.001 | 0.556 ✔ | 1.000 | 4.8.2 ✔ |
| | 126 - 124 | 0.013 | 0.577 | 0.000 | 0.032 | 0.001 | 0.592 ✔ | 1.000 | 4.8.2 ✔ |
| | 124 - 122 | 0.014 | 0.613 | 0.000 | 0.032 | 0.001 | 0.627 ✔ | 1.000 | 4.8.2 ✔ |
| | 122 - 120 | 0.014 | 0.648 | 0.000 | 0.032 | 0.001 | 0.664 ✔ | 1.000 | 4.8.2 ✔ |

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| Section No. | Elevation ft | Ratio $P_u / \phi P_n$ | Ratio $M_{ux} / \phi M_{nx}$ | Ratio $M_{uy} / \phi M_{ny}$ | Ratio $V_u / \phi V_n$ | Ratio $T_u / \phi T_n$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| | 120 - 118 | 0.014 | 0.684 | 0.000 | 0.033 | 0.001 | 0.700 ✔ | 1.000 | 4.8.2 ✔ |
| | 118 - 116 | 0.015 | 0.721 | 0.000 | 0.033 | 0.001 | 0.736 ✔ | 1.000 | 4.8.2 ✔ |
| | 116 - 114 | 0.015 | 0.757 | 0.000 | 0.033 | 0.001 | 0.773 ✔ | 1.000 | 4.8.2 ✔ |
| | 114 - 112 | 0.015 | 0.794 | 0.000 | 0.033 | 0.001 | 0.810 ✔ | 1.000 | 4.8.2 ✔ |
| | 112 - 110 | 0.016 | 0.831 | 0.000 | 0.034 | 0.001 | 0.848 ✔ | 1.000 | 4.8.2 ✔ |
| | 110 - 108 | 0.016 | 0.868 | 0.000 | 0.034 | 0.001 | 0.885 ✔ | 1.000 | 4.8.2 ✔ |
| | 108 - 106 | 0.016 | 0.905 | 0.000 | 0.034 | 0.001 | 0.923 ✔ | 1.000 | 4.8.2 ✔ |
| | 106 - 104 | 0.017 | 0.943 | 0.000 | 0.034 | 0.001 | 0.961 ✔ | 1.000 | 4.8.2 ✔ |
| | 104 - 102 | 0.017 | 0.981 | 0.000 | 0.034 | 0.001 | 0.999 ✔ | 1.000 | 4.8.2 ✔ |
| | 102 - 100 | 0.018 | 1.019 | 0.000 | 0.035 | 0.001 | **1.038** | 1.000 | 4.8.2 |
| L3 | 100 - 98 | 0.011 | 0.480 | 0.000 | 0.021 | 0.001 | 0.492 ✔ | 1.000 | 4.8.2 ✔ |
| | 98 - 96 | 0.011 | 0.498 | 0.000 | 0.021 | 0.001 | 0.510 ✔ | 1.000 | 4.8.2 ✔ |
| | 96 - 94 | 0.011 | 0.516 | 0.000 | 0.021 | 0.001 | 0.528 ✔ | 1.000 | 4.8.2 ✔ |
| | 94 - 92 | 0.012 | 0.534 | 0.000 | 0.021 | 0.001 | 0.546 ✔ | 1.000 | 4.8.2 ✔ |
| | 92 - 90 | 0.012 | 0.552 | 0.000 | 0.022 | 0.001 | 0.564 ✔ | 1.000 | 4.8.2 ✔ |
| | 90 - 88 | 0.012 | 0.570 | 0.000 | 0.022 | 0.001 | 0.583 ✔ | 1.000 | 4.8.2 ✔ |
| | 88 - 86 | 0.013 | 0.588 | 0.000 | 0.022 | 0.001 | 0.601 ✔ | 1.000 | 4.8.2 ✔ |
| | 86 - 84 | 0.013 | 0.607 | 0.000 | 0.022 | 0.001 | 0.620 ✔ | 1.000 | 4.8.2 ✔ |
| | 84 - 82 | 0.013 | 0.625 | 0.000 | 0.022 | 0.001 | 0.639 ✔ | 1.000 | 4.8.2 ✔ |
| | 82 - 80 | 0.014 | 0.644 | 0.000 | 0.023 | 0.001 | 0.658 ✔ | 1.000 | 4.8.2 ✔ |
| | 80 - 78 | 0.014 | 0.663 | 0.000 | 0.023 | 0.001 | 0.678 ✔ | 1.000 | 4.8.2 ✔ |
| | 78 - 76 | 0.014 | 0.682 | 0.000 | 0.023 | 0.001 | 0.697 ✔ | 1.000 | 4.8.2 ✔ |
| | 76 - 74 | 0.015 | 0.701 | 0.000 | 0.023 | 0.001 | 0.717 ✔ | 1.000 | 4.8.2 ✔ |
| | 74 - 72 | 0.015 | 0.721 | 0.000 | 0.023 | 0.001 | 0.736 ✔ | 1.000 | 4.8.2 ✔ |
| | 72 - 70 | 0.015 | 0.740 | 0.000 | 0.023 | 0.001 | 0.756 ✔ | 1.000 | 4.8.2 ✔ |
| | 70 - 68 | 0.015 | 0.760 | 0.000 | 0.023 | 0.001 | 0.776 ✔ | 1.000 | 4.8.2 ✔ |
| | 68 - 66 | 0.016 | 0.780 | 0.000 | 0.024 | 0.001 | 0.796 | 1.000 | 4.8.2 ✔ |

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| Section No. | Elevation ft | Ratio $P_u / \phi P_n$ | Ratio $M_{ux} / \phi M_{nx}$ | Ratio $M_{uy} / \phi M_{ny}$ | Ratio $V_u / \phi V_n$ | Ratio $T_u / \phi T_n$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| | 66 - 64 | 0.016 | 0.800 | 0.000 | 0.024 | 0.001 | 0.816 | 1.000 | 4.8.2 |
| | 64 - 62 | 0.016 | 0.820 | 0.000 | 0.024 | 0.001 | 0.837 | 1.000 | 4.8.2 |
| | 62 - 60 | 0.017 | 0.840 | 0.000 | 0.024 | 0.001 | 0.857 | 1.000 | 4.8.2 |
| L4 | 60 - 58 | 0.015 | 0.690 | 0.000 | 0.022 | 0.000 | 0.706 | 1.000 | 4.8.2 |
| | 58 - 56 | 0.015 | 0.707 | 0.000 | 0.022 | 0.000 | 0.723 | 1.000 | 4.8.2 |
| | 56 - 54 | 0.016 | 0.723 | 0.000 | 0.022 | 0.000 | 0.740 | 1.000 | 4.8.2 |
| | 54 - 52 | 0.016 | 0.740 | 0.000 | 0.022 | 0.000 | 0.757 | 1.000 | 4.8.2 |
| | 52 - 50 | 0.016 | 0.757 | 0.000 | 0.022 | 0.000 | 0.774 | 1.000 | 4.8.2 |
| | 50 - 48 | 0.017 | 0.773 | 0.000 | 0.022 | 0.000 | 0.791 | 1.000 | 4.8.2 |
| | 48 - 46 | 0.017 | 0.790 | 0.000 | 0.022 | 0.000 | 0.808 | 1.000 | 4.8.2 |
| | 46 - 44 | 0.017 | 0.807 | 0.000 | 0.022 | 0.000 | 0.825 | 1.000 | 4.8.2 |
| | 44 - 42 | 0.018 | 0.824 | 0.000 | 0.023 | 0.000 | 0.843 | 1.000 | 4.8.2 |
| | 42 - 40 | 0.018 | 0.842 | 0.000 | 0.023 | 0.000 | 0.860 | 1.000 | 4.8.2 |
| | 40 - 38 | 0.018 | 0.859 | 0.000 | 0.023 | 0.000 | 0.878 | 1.000 | 4.8.2 |
| | 38 - 36 | 0.019 | 0.876 | 0.000 | 0.023 | 0.000 | 0.895 | 1.000 | 4.8.2 |
| | 36 - 34 | 0.019 | 0.894 | 0.000 | 0.023 | 0.000 | 0.913 | 1.000 | 4.8.2 |
| | 34 - 32 | 0.019 | 0.911 | 0.000 | 0.023 | 0.000 | 0.931 | 1.000 | 4.8.2 |
| | 32 - 30 | 0.019 | 0.929 | 0.000 | 0.023 | 0.000 | 0.949 | 1.000 | 4.8.2 |
| | 30 - 28 | 0.020 | 0.947 | 0.000 | 0.023 | 0.000 | 0.967 | 1.000 | 4.8.2 |
| | 28 - 26 | 0.020 | 0.965 | 0.000 | 0.024 | 0.000 | 0.985 | 1.000 | 4.8.2 |
| | 26 - 24 | 0.020 | 0.982 | 0.000 | 0.024 | 0.000 | **1.003** | 1.000 | 4.8.2 |
| | 24 - 22 | 0.021 | 1.000 | 0.000 | 0.024 | 0.000 | **1.022** | 1.000 | 4.8.2 |
| | 22 - 20 | 0.021 | 1.018 | 0.000 | 0.024 | 0.000 | **1.040** | 1.000 | 4.8.2 |
| L5 | 20 - 19 | 0.019 | 0.843 | 0.000 | 0.022 | 0.000 | 0.863 | 1.000 | 4.8.2 |
| | 19 - 18 | 0.019 | 0.851 | 0.000 | 0.022 | 0.000 | 0.871 | 1.000 | 4.8.2 |
| | 18 - 17 | 0.019 | 0.858 | 0.000 | 0.022 | 0.000 | 0.878 | 1.000 | 4.8.2 |
| | 17 - 16 | 0.020 | 0.866 | 0.000 | 0.022 | 0.000 | 0.886 | 1.000 | 4.8.2 |

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| Section No. | Elevation ft | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Ratio $\frac{V_u}{\phi V_n}$ | Ratio $\frac{T_u}{\phi T_n}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| | 16 - 15 | 0.020 | 0.873 | 0.000 | 0.022 | 0.000 | 0.893 ✔ | 1.000 | 4.8.2 ✔ |
| | 15 - 14 | 0.020 | 0.881 | 0.000 | 0.022 | 0.000 | 0.901 ✔ | 1.000 | 4.8.2 ✔ |
| | 14 - 13 | 0.020 | 0.888 | 0.000 | 0.022 | 0.000 | 0.909 ✔ | 1.000 | 4.8.2 ✔ |
| | 13 - 12 | 0.020 | 0.896 | 0.000 | 0.022 | 0.000 | 0.916 ✔ | 1.000 | 4.8.2 ✔ |
| | 12 - 11 | 0.020 | 0.903 | 0.000 | 0.022 | 0.000 | 0.924 ✔ | 1.000 | 4.8.2 ✔ |
| | 11 - 10 | 0.021 | 0.911 | 0.000 | 0.022 | 0.000 | 0.932 ✔ | 1.000 | 4.8.2 ✔ |
| | 10 - 9 | 0.021 | 0.918 | 0.000 | 0.022 | 0.000 | 0.940 ✔ | 1.000 | 4.8.2 ✔ |
| | 9 - 8 | 0.021 | 0.926 | 0.000 | 0.022 | 0.000 | 0.947 ✔ | 1.000 | 4.8.2 ✔ |
| | 8 - 7 | 0.021 | 0.933 | 0.000 | 0.022 | 0.000 | 0.955 ✔ | 1.000 | 4.8.2 ✔ |
| | 7 - 6 | 0.021 | 0.941 | 0.000 | 0.022 | 0.000 | 0.963 ✔ | 1.000 | 4.8.2 ✔ |
| | 6 - 5 | 0.021 | 0.949 | 0.000 | 0.022 | 0.000 | 0.971 ✔ | 1.000 | 4.8.2 ✔ |
| | 5 - 4 | 0.021 | 0.956 | 0.000 | 0.022 | 0.000 | 0.978 ✔ | 1.000 | 4.8.2 ✔ |
| | 4 - 3 | 0.022 | 0.964 | 0.000 | 0.022 | 0.000 | 0.986 ✔ | 1.000 | 4.8.2 ✔ |
| | 3 - 2 | 0.022 | 0.972 | 0.000 | 0.022 | 0.000 | 0.994 ✔ | 1.000 | 4.8.2 ✔ |
| | 2 - 1 | 0.022 | 0.979 | 0.000 | 0.022 | 0.000 | **1.002** | 1.000 | 4.8.2 |
| | 1 - 0 | 0.022 | 0.987 | 0.000 | 0.022 | 0.000 | **1.010** | 1.000 | 4.8.2 |

## Section Capacity Table

| Section No. | Elevation ft | Component Type | Size | Critical Element | P K | $\phi P_{allow}$ K | % Capacity | Pass Fail |
|---|---|---|---|---|---|---|---|---|
| L1 | 178 - 140 | Pole | P24x1/2 | 1 | -16.58 | 1162.78 | 70.8 | Pass |
| L2 | 140 - 100 | Pole | P36x1/2 | 2 | -30.78 | 1756.54 | 103.8 | Pass[2] |
| L3 | 100 - 60 | Pole | P48x5/8 | 3 | -48.99 | 2930.15 | 85.7 | Pass |
| L4 | 60 - 20 | Pole | P54x5/8 | 4 | -69.38 | 3301.25 | 104.0 | Pass[2] |
| L5 | 20 - 0 | Pole | P60x5/8 | 5 | -80.56 | 3649.51 | 101.0 | Pass[2] |
| | | | | | | | Summary | |
| | | | | | | Pole (L4) | 104.0 | Pass[2] |
| | | | | | | **RATING =** | **104.0** | **Pass[2]** |

RESURGAM CITY OF PORTLAND, MAINE
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

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Inspections Division
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# APPENDIX B

# BASE LEVEL DRAWING

RESURGAM, MAINE
CITY OF PORTLAND
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

BUSINESS UNIT: 878783 TOWER ID: C_BASELEVEL

CROWN REGION ADDRESS

USA

| | | | |
|---|---|---|---|
| 16/03/16 | UPDATED PER WORK ORDER 1208711 | AMM |
| 16/03/16 | UPDATED PER WORK ORDER 1208821 | AMM |
| 30/03/16 | UPDATED PER WORK ORDER 1216094 | BMH |
| 11/05/16 | UPDATED PER WORK ORDER 1233111 | GS |
| 17/06/16 | UPDATED PER WORK ORDER 1265535 | SS |
| 11/07/16 | UPDATED PER WORK ORDER 1287913 | SAT |
| 03/12/16 | UPDATED PER WORK ORDER 1323445 | MR |
| 19/12/16 | UPDATED PER WORK ORDER 1339501 | JHM |
| 02/02/17 | UPDATED PER WORK ORDER 1357765 | JHP |

DRAWN BY: DJA
CHECKED BY: BBF
DRAWING DATE: 13/08/07

SITE NUMBER:
SITE NAME:

SITE NAME

PORTLAND NORTH

BUSINESS UNIT NUMBER

878783

SITE ADDRESS

527 PERSUMPSCOT
PORTLAND, ME 04101
CUMBERLAND COUNTY
USA

SHEET TITLE

**BASE LEVEL**

SHEET NUMBER

**A1-0**

**BASE LEVEL DRAWING**

SCALE: 1" = 1'-0" | 1

PLOT DATE: 10/13/2016 FILE NAME: 878783_BASELEVEL.DWG
Xref R:\TEMPLATES\TYPICAL BLOCKS FOR TEMPLATES\TITLE BLOCK STD-VER 5.1.dwg

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# APPENDIX C

# ADDITIONAL CALCULATIONS

Reviewed for Code Compliance
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# Stiffened or Unstiffened, Ungrouted, Circular Base Plate - Any Rod Material

**TIA Rev G** Assumption: Clear space between bottom of leveling nut and top of concrete **not** exceeding (1)*(Rod Diameter)

**Site Data**

| | |
|---|---|
| BU#: | *878783* |
| Site Name: | *PORTLAND NORTH* |
| App #: | *364306 Rev 0* |
| Pole Manufacturer: | *Other* |

| Reactions | | |
|---|---|---|
| Mu: | 4650 | ft-kips |
| Axial, Pu: | 81 | kips |
| Shear, Vu: | 41 | kips |
| Eta Factor, η | 0.55 | TIA G (Fig. 4-4) |

| Anchor Rod Data | | |
|---|---|---|
| Qty: | 32 | |
| Diam: | 2 | in |
| Rod Material: | A615-5 | |
| Strength (Fu): | 58 | ksi |
| Yield (Fy): | 36 | ksi |
| Bolt Circle: | 66 | in |

If No stiffeners, Criteria: AISC LRFD <-Only Applcable to Unstiffened Cases

**Anchor Rod Results**

| | | | |
|---|---|---|---|
| Max Rod (Cu+ Vu/ń): | 110.5 | Kips | Rigid |
| Allowable Axial, Φ*Fu*Anet: | 116.0 | Kips | AISC LRFD |
| Anchor Rod Stress Ratio: | 95.3% | **Pass** | φ*Tn |

| Plate Data | | |
|---|---|---|
| Diam: | 72 | in |
| Thick: | 3.25 | in |
| Grade: | 36 | ksi |
| Single-Rod B-eff: | 5.89 | in |

**Base Plate Results** Flexural Check

| | | | |
|---|---|---|---|
| Base Plate Stress: | 12.9 | ksi | Rigid |
| Allowable Plate Stress: | 32.4 | ksi | AISC LRFD |
| Base Plate Stress Ratio: | 39.9% | **Pass** | φ*Fy |
| | | | Y.L. Length: 27.50 |

| Stiffener Data (Welding at both sides) | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

n/a

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

| | |
|---|---|
| Pole Punching Shear Check: | n/a |

| Pole Data | | |
|---|---|---|
| Diam: | 60 | in |
| Thick: | 0.625 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |
| Reinf. Fillet Weld | 0 | "0" if None |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

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Date: 05/05/17

# Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

| Reactions | | |
|---|---|---|
| Mu | 4429.31 | ft-kips |
| Axial, Pu: | 69.38 | kips |
| Shear, Vu: | 39.30 | kips |
| **Elevation:** | 20 | feet |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 43.05 |

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| Pole Manufacturer: | Other |
|---|---|

| If No stiffeners, Criteria: | TIA G |
|---|---|

<-Only Applcable to Unstiffened Cases

| Rigid |
|---|
| φ*Tn |
| φTn[(1-(Vu/φVn)^2]^0.5 |

**Bolt Data**

| | | | |
|---|---|---|---|
| Qty: | 60 | | |
| Diameter (in.): | 1.125 | Bolt Fu: | 105 |
| Bolt Material: | A325 | Bolt Fy: | 81 |
| N/A: | 100 | <-- Disregard | |
| N/A: | 75 | <-- Disregard | |
| Circle (in.): | 56.375 | | |

**Plate Data**

| | | |
|---|---|---|
| Diam: | 58.5 | in |
| Thick, t: | 3.125 | in |
| Grade (Fy): | 36 | ksi |
| Strength, Fu: | 58 | ksi |
| Single-Rod B-eff: | 2.83 | in |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

**Pole Data**

| | | |
|---|---|---|
| Diam: | 54 | in |
| Thick: | 0.625 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |
| Reinf. Fillet Weld | 0 | "0" if None |

**Flange Bolt Results**

| | | | |
|---|---|---|---|
| Bolt Tension Capacity, φ*Tn,**B1**: | 60.09 | kips | |
| Adjusted φ*Tn (due to Vu=Vu/Qty), **B**: | 60.08 | kips | |
| Max Bolt directly applied Tu: | 61.70 | Kips | |
| Min. PL "tc" for **B** cap. **w/o** Pry: Tu>B | N/A | in | |
| Min PL "treq" for actual **T w/ Pry:** | 1.022 | in | |
| Min PL "t1" for actual **T w/o Pry:** Tu>B | N/A | in | |
| T allowable w/o Prying: | 60.09 | kips | |
| Prying Force, q: | 0.00 | kips | T>B Case |
| Total Bolt Tension=Tu+q: | 61.70 | kips | |
| Non-Prying Bolt Stress Ratio, Tu/B: | 102.7% | **Pass** | |

**Exterior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Compression Side Plate Stress: | 7.7 | ksi |
| Allowable Plate Stress: | 32.4 | ksi |
| Compression Plate Stress Ratio: | 23.8% | **Pass** |
| **No Prying Check for Tu>B** | | |
| Tension Side Stress Ratio, (treq/t)^2: | 10.7% | **Pass** |

| Rigid |
|---|
| TIA G |
| φ*Fy |
| Comp. Y.L. Length: |
| 16.19 |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

| | |
|---|---|
| Pole Punching Shear Check: | n/a |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| | |
|---|---|
| Manufacturer: | Other |

**Reactions**

| | | |
|---|---|---|
| Moment: | 4429.31 | ft-kips |
| Axial: | 69.38 | kips |
| Shear: | 39.30 | kips |
| Exterior Flange Run, T+q: | 61.70 | kips |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 43.05 |

**Elevation:** 20 feet

**Bolt Data**

| | | | |
|---|---|---|---|
| Qty: | 60 | | |
| Diam: | 1.125 | Bolt Fu: | 105 |
| Bolt Material: | A325 | Bolt Fy: | 81 |
| N/A: | 100 | <-- Disregard | |
| N/A: | 75 | <-- Disregard | |
| Circle: | 56.375 | in | |

**Interior Flange Bolt Results**

| | | |
|---|---|---|
| Maximum Bolt Tension, Tu: | 61.7 | Kips, Ext. Tu=Interior Tu |
| Adjusted φ*Tn (due to Vu=Vu/Qty) | 60.1 | Kips |
| Bolt Stress Ratio: | 102.7% | **Pass** |

**Plate Data**

| | | |
|---|---|---|
| Plate Outer Diam: | 58.75 | in |
| Plate Inner Diam: | 54.25 | in (Hole @ Ctr) |
| Thick: | 3.125 | in |
| Grade: | 36 | ksi |
| **Effective Width:** | 3.08 | in |

**Interior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Controlling Bolt Axial Force: | 64.0 | Kips, Ext. Cu=Interior Cu |
| Plate Stress: | 10.1 | ksi |
| Allowable Plate Stress, φ*Fy: | 32.4 | ksi |
| Plate Stress Ratio: | 31.2% | **Pass** |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

Pole Punching Shear Check: n/a

**Pole Data**

| | | |
|---|---|---|
| Pole OuterDiam: | 60 | in |
| Thick: | 0.625 | in |
| Pole Inner Diam: | 58.75 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

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Inspections Division
Approved with Conditions
Date: 05/05/17

# Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

| Reactions | | |
|---|---|---|
| Mu | 2932.39 | ft-kips |
| Axial, Pu: | 48.99 | kips |
| Shear, Vu: | 35.27 | kips |
| **Elevation:** | 60 | feet |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 38.88 |

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| Pole Manufacturer: | Other |
|---|---|

| If No stiffeners, Criteria: | TIA G |
|---|---|

<-Only Applcable to Unstiffened Cases

| Rigid |
|---|
| φ*Tn |
| φTn[(1-(Vu/φVn)^2]^0.5 |

**Bolt Data**

| | | | |
|---|---|---|---|
| Qty: | 56 | | |
| Diameter (in.): | 1 | Bolt Fu: | 120 |
| Bolt Material: | A325 | Bolt Fy: | 92 |
| N/A: | 100 | <-- Disregard | |
| N/A: | 75 | <-- Disregard | |
| Circle (in.): | 50.375 | | |

**Flange Bolt Results**

| | | |
|---|---|---|
| Bolt Tension Capacity, φ*Tn,**B1**: | 54.54 | kips |
| Adjusted φ*Tn (due to Vu=Vu/Qty), **B**: | 54.53 | kips |
| Max Bolt directly applied Tu: | 49.02 | Kips |
| Min. PL "tc" for **B** cap. **w/o** Pry: | 1.032 | in |
| Min PL "treq" for actual **T w/ Pry**: | 0.845 | in |
| Min PL "t1" for actual **T w/o Pry**: | 0.979 | in |
| T allowable w/o Prying: | 54.54 | kips |
| Prying Force, q: | 0.00 | kips |
| Total Bolt Tension=Tu+q: | 49.02 | kips |
| Non-Prying Bolt Stress Ratio, Tu/B: | 89.9% | Pass |

α'<0 case

**Plate Data**

| | | |
|---|---|---|
| Diam: | 52.5 | in |
| Thick, t: | 2.75 | in |
| Grade (Fy): | 36 | ksi |
| Strength, Fu: | 58 | ksi |
| Single-Rod B-eff: | 2.69 | in |

**Exterior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Compression Side Plate Stress: | 8.2 | ksi |
| Allowable Plate Stress: | 32.4 | ksi |
| Compression Plate Stress Ratio: | 25.3% | Pass |
| **No Prying** | | |
| Tension Side Stress Ratio, (treq/t)^2: | 9.4% | Pass |

| Rigid |
|---|
| TIA G |
| φ*Fy |
| Comp. Y.L. Length: |
| 15.29 |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

n/a

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

| | |
|---|---|
| Pole Punching Shear Check: | n/a |

**Pole Data**

| | | |
|---|---|---|
| Diam: | 48 | in |
| Thick: | 0.625 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |
| Reinf. Fillet Weld | 0 | "0" if None |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| | |
|---|---|
| Manufacturer: | Other |

**Reactions**

| | | |
|---|---|---|
| Moment: | 2932.39 | ft-kips |
| Axial: | 48.99 | kips |
| Shear: | 35.27 | kips |
| Exterior Flange Run, T+q: | 49.02 | kips |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 38.88 |

**Elevation:** 60 feet

**Bolt Data**

| | | | |
|---|---|---|---|
| Qty: | 56 | | |
| Diam: | 1 | Bolt Fu: | 120 |
| Bolt Material: | A325 | Bolt Fy: | 92 |
| N/A: | 100 | <-- Disregard | |
| N/A: | 75 | <-- Disregard | |
| Circle: | 50.375 | in | |

**Interior Flange Bolt Results**

| | | |
|---|---|---|
| Maximum Bolt Tension, Tu: | 49.0 | Kips, Ext. Tu=Interior Tu |
| Adjusted φ*Tn (due to Vu=Vu/Qty) | 54.5 | Kips |
| Bolt Stress Ratio: | 89.9% | **Pass** |

**Plate Data**

| | | |
|---|---|---|
| Plate Outer Diam: | 52.75 | in |
| Plate Inner Diam: | 48.25 | in (Hole @ Ctr) |
| Thick: | 2.75 | in |
| Grade: | 36 | ksi |
| **Effective Width:** | 2.96 | in |

**Interior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Controlling Bolt Axial Force: | 50.8 | Kips, Ext. Cu=Interior Cu |
| Plate Stress: | 10.8 | ksi |
| Allowable Plate Stress, φ*Fy: | 32.4 | ksi |
| Plate Stress Ratio: | 33.3% | **Pass** |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

Pole Punching Shear Check: n/a

**Pole Data**

| | | |
|---|---|---|
| Pole OuterDiam: | 54 | in |
| Thick: | 0.625 | in |
| Pole Inner Diam: | 52.75 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

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# Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

| Reactions | | |
|---|---|---|
| Mu | 1616.62 | ft-kips |
| Axial, Pu: | 30.78 | kips |
| Shear, Vu: | 30.34 | kips |
| **Elevation:** | 100 | feet |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 27.34 |

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| Pole Manufacturer: | Other |
|---|---|

| If No stiffeners, Criteria: | TIA G |
|---|---|

<-Only Applcable to Unstiffened Cases

**Bolt Data**

| | | | | |
|---|---|---|---|---|
| Qty: | 52 | | | |
| Diameter (in.): | 0.75 | | Bolt Fu: | 150 |
| Bolt Material: | Other | | Bolt Fy: | 130 |
| Strength (Fu): | 150 | ksi | | |
| Yield (Fy): | 130 | ksi | | |
| Circle (in.): | 41.375 | | | |

**Plate Data**

| | | |
|---|---|---|
| Diam: | 46.5 | in |
| Thick, t: | 2.5 | in |
| Grade (Fy): | 36 | ksi |
| Strength, Fu: | 58 | ksi |
| Single-Rod B-eff: | 2.17 | in |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

**Pole Data**

| | | |
|---|---|---|
| Diam: | 36 | in |
| Thick: | 0.5 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |
| Reinf. Fillet Weld | 0 | "0" if None |

**Flange Bolt Results**

| | | | |
|---|---|---|---|
| Bolt Tension Capacity, φ*Tn,**B1**: | 37.58 | kips | |
| Adjusted φ*Tn (due to Vu=Vu/Qty), **B**: | 37.57 | kips | |
| Max Bolt directly applied Tu: | 35.47 | Kips | |
| Min. PL "tc" for **B** cap. **w/o** Pry: | 1.749 | in | |
| Min PL "treq" for actual **T w/ Pry**: | 1.634 | in | |
| Min PL "t1" for actual **T w/o Pry**: | 1.699 | in | |
| T allowable w/o Prying: | 37.58 | kips | α'<0 case |
| Prying Force, q: | 0.00 | kips | |
| Total Bolt Tension=Tu+q: | 35.47 | kips | |
| Non-Prying Bolt Stress Ratio, Tu/B: | 94.4% | **Pass** | |

| Rigid |
|---|
| φ*Tn |
| φTn[(1-(Vu/φVn)^2]^0.5 |

**Exterior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Compression Side Plate Stress: | 15.9 | ksi |
| Allowable Plate Stress: | 32.4 | ksi |
| Compression Plate Stress Ratio: | 49.1% | **Pass** |
| **No Prying** | | |
| Tension Side Stress Ratio, (treq/t)^2: | 42.7% | **Pass** |

| Rigid |
|---|
| TIA G |
| φ*Fy |
| Comp. Y.L. Length: |
| 20.39 |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

Pole Punching Shear Check: n/a

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| | |
|---|---|
| Manufacturer: | Other |

**Reactions**

| | | |
|---|---|---|
| Moment: | 1616.62 | ft-kips |
| Axial: | 30.78 | kips |
| Shear: | 30.34 | kips |
| Exterior Flange Run, T+q: | 35.47 | kips |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 27.34 |

**Elevation:** 100 feet

**Bolt Data**

| | | | | |
|---|---|---|---|---|
| Qty: | 52 | | | |
| Diam: | 0.75 | | Bolt Fu: | 150 |
| Bolt Material: | Other | | Bolt Fy: | 130 |
| Strength (Fu): | 150 | ksi | | |
| Yield (Fy): | 130 | ksi | | |
| Circle: | 41.375 | in | | |

**Interior Flange Bolt Results**

| | | |
|---|---|---|
| Maximum Bolt Tension, Tu: | 35.5 | Kips, Ext. Tu=Interior Tu |
| Adjusted φ*Tn (due to Vu=Vu/Qty) | 37.6 | Kips |
| Bolt Stress Ratio: | 94.4% | **Pass** |

**Plate Data**

| | | |
|---|---|---|
| Plate Outer Diam: | 46.75 | in |
| Plate Inner Diam: | 36.25 | in (Hole @ Ctr) |
| Thick: | 2.5 | in |
| Grade: | 36 | ksi |
| **Effective Width:** | 2.82 | in |

**Interior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Controlling Bolt Axial Force: | 36.7 | Kips, Ext. Cu=Interior Cu |
| Plate Stress: | 22.3 | ksi |
| Allowable Plate Stress, φ*Fy: | 32.4 | ksi |
| Plate Stress Ratio: | 68.9% | **Pass** |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

Pole Punching Shear Check: n/a

**Pole Data**

| | | |
|---|---|---|
| Pole OuterDiam: | 48 | in |
| Thick: | 0.625 | in |
| Pole Inner Diam: | 46.75 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

| Reactions | | |
|---|---|---|
| Mu | 502.03 | ft-kips |
| Axial, Pu: | 16.58 | kips |
| Shear, Vu: | 22.50 | kips |
| **Elevation:** | 140 | feet |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 27.34 |

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| Pole Manufacturer: | Other |
|---|---|

| If No stiffeners, Criteria: | TIA G |
|---|---|

<-Only Applcable to Unstiffened Cases

| Bolt Data | | | | |
|---|---|---|---|---|
| Qty: | 24 | | | |
| Diameter (in.): | 0.75 | | Bolt Fu: | 150 |
| Bolt Material: | Other | | Bolt Fy: | 130 |
| Strength (Fu): | 150 | ksi | | |
| Yield (Fy): | 130 | ksi | | |
| Circle (in.): | 29.5 | | | |

| Plate Data | | |
|---|---|---|
| Diam: | 34.75 | in |
| Thick, t: | 1.875 | in |
| Grade (Fy): | 36 | ksi |
| Strength, Fu: | 58 | ksi |
| Single-Rod B-eff: | 3.14 | in |

| Stiffener Data (Welding at Both Sides) | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

| Pole Data | | |
|---|---|---|
| Diam: | 24 | in |
| Thick: | 0.5 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |
| Reinf. Fillet Weld | 0 | "0" if None |

**Flange Bolt Results**

| | | | |
|---|---|---|---|
| Bolt Tension Capacity, φ*Tn,**B1**: | 37.58 | kips | |
| Adjusted φ*Tn (due to Vu=Vu/Qty), **B**: | 37.55 | kips | |
| Max Bolt directly applied Tu: | 33.35 | Kips | |
| Min. PL "tc" for **B** cap. **w/o** Pry: | 1.474 | in | |
| Min PL "treq" for actual **T w/ Pry**: | 1.274 | in | |
| Min PL "t1" for actual **T w/o Pry**: | 1.389 | in | |
| T allowable w/o Prying: | 37.58 | kips | α'<0 case |
| Prying Force, q: | 0.00 | kips | |
| Total Bolt Tension=Tu+q: | 33.35 | kips | |
| Non-Prying Bolt Stress Ratio, Tu/B: | 88.8% | **Pass** | |

| Rigid |
|---|
| φ*Tn |
| φTn[(1-(Vu/φVn)^2]^0.5 |

**Exterior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Compression Side Plate Stress: | 16.4 | ksi |
| Allowable Plate Stress: | 32.4 | ksi |
| Compression Plate Stress Ratio: | 50.7% | **Pass** |
| **No Prying** | | |
| Tension Side Stress Ratio, (treq/t)^2: | 46.1% | **Pass** |

| Rigid |
|---|
| TIA G |
| φ*Fy |
| Comp. Y.L. Length: |
| 17.15 |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

Pole Punching Shear Check: n/a

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

**Site Data**

BU#: *878783*
Site Name: *PORTLAND NORTH*
App #: *364306 Rev 0*

| | |
|---|---|
| Manufacturer: | Other |

**Reactions**

| | | |
|---|---|---|
| Moment: | 502.03 | ft-kips |
| Axial: | 16.58 | kips |
| Shear: | 22.50 | kips |
| Exterior Flange Run, T+q: | 33.35 | kips |

| Bolt Threads: |
|---|
| X-Excluded |
| φVn=φ(0.55*Ab*Fu) |
| φ=0.75, φ*Vn (kips): |
| 27.34 |

**Elevation:** 140 feet

**Bolt Data**

| | | | | |
|---|---|---|---|---|
| Qty: | 24 | | | |
| Diam: | 0.75 | | Bolt Fu: | 150 |
| Bolt Material: | Other | | Bolt Fy: | 130 |
| Strength (Fu): | 150 | ksi | | |
| Yield (Fy): | 130 | ksi | | |
| Circle: | 29.5 | in | | |

**Interior Flange Bolt Results**

| | | |
|---|---|---|
| Maximum Bolt Tension, Tu: | 33.3 | Kips, Ext. Tu=Interior Tu |
| Adjusted φ*Tn (due to Vu=Vu/Qty) | 37.6 | Kips |
| Bolt Stress Ratio: | 88.8% | **Pass** |

**Plate Data**

| | | |
|---|---|---|
| Plate Outer Diam: | 35 | in |
| Plate Inner Diam: | 24.25 | in (Hole @ Ctr) |
| Thick: | 1.875 | in |
| Grade: | 36 | ksi |
| **Effective Width:** | 4.58 | in |

**Interior Flange Plate Results** Flexural Check

| | | |
|---|---|---|
| Controlling Bolt Axial Force: | 34.7 | Kips, Ext. Cu=Interior Cu |
| Plate Stress: | 23.7 | ksi |
| Allowable Plate Stress, φ*Fy: | 32.4 | ksi |
| Plate Stress Ratio: | 73.2% | **Pass** |

**Stiffener Data** (Welding at Both Sides)

| | | |
|---|---|---|
| Config: | 0 | * |
| Weld Type: | | |
| Groove Depth: | | <-- Disregard |
| Groove Angle: | | <-- Disregard |
| Fillet H. Weld: | | in |
| Fillet V. Weld: | | in |
| Width: | | in |
| Height: | | in |
| Thick: | | in |
| Notch: | | in |
| Grade: | | ksi |
| Weld str.: | | ksi |

**n/a**

**Stiffener Results**

| | |
|---|---|
| Horizontal Weld : | n/a |
| Vertical Weld: | n/a |
| Plate Flex+Shear, fb/Fb+(fv/Fv)^2: | n/a |
| Plate Tension+Shear, ft/Ft+(fv/Fv)^2: | n/a |
| Plate Comp. (AISC Bracket): | n/a |

**Pole Results**

Pole Punching Shear Check: n/a

**Pole Data**

| | | |
|---|---|---|
| Pole OuterDiam: | 36 | in |
| Thick: | 0.5 | in |
| Pole Inner Diam: | 35 | in |
| Grade: | 35 | ksi |
| # of Sides: | 0 | "0" IF Round |
| Fu | 63 | ksi |

* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

| | | | |
|---|---|---|---|
| Project Name: | Portland North | JACOBS® Jacobs Engineering Group, Inc. | Created On: 6/17/2 |
| Project Number: | BU#878783 | | Checked By: SMR |
| Job Number: | WO#1367448 | | Revised On: 9/16/2016 |
| Date: | 2/22/2017 | | Revision No.: 2.5 |

# Monopole Additional Anchor Rod and Bracket Checks

| | | |
|---|---|---|
| **New Design?** | No | |
| **Code:** | G | |
| **Moment (M)** | 5230 | kip-ft |
| **Axial (P)** | 81 | kips |
| **Shear (V)** | 41 | kips |

| **Existing Rods** | | |
|---|---|---|
| Number of Rods | 32 | |
| Rod Circle | 66 | in |
| y | 33 | in |
| Moment of Inertia (I) | 43560 | $in^4$ |
| Rod Grade | A36 | |
| Thread Type | Non-Upset | |
| Diameter (d) | 2 | in |
| Ag | 3.14 | $in^2$ |
| Ae | 2.5 | $in^2$ |
| Fy | 36 | ksi |
| Fu | 58 | ksi |
| Tension per Rod | 110.51 | kips |
| Shear per Rod | 1.28 | kips |
| Allowable | 116.0 | kips |
| % Capacity | 95.3% | % |
| | Pass | |

| **New Rods** | | |
|---|---|---|
| Number of Rods | 3 | |
| Rod Circle | 77 | in |
| y | 38.5 | in |
| Moment of Inertia (I) | 5,558 | $in^4$ |
| Rod Grade | A615-75 | |
| Thread Type | Non-Upset | |
| Diameter (d) | 2 | |
| Ag | 3.14 | $in^2$ |
| Ae | 2.50 | $in^2$ |
| Fy | 75 | ksi |
| Fu | 100 | ksi |
| Tension per Rod | 122.98 | kips |
| Shear per Rod | 0.00 | kips |
| Allowable | 200.0 | kips |
| % Capacity | 61.5% | % |
| | Pass | |

| | | |
|---|---|---|
| Total Moment of Inertia | 49118.44 | $in^4$ |

| **Horizontal and Vertical Weld to Pole Checks** | | |
|---|---|---|
| Pole Grade | | |
| Fy | 35 | ksi |
| Fu | 60 | ksi |
| Base Plate Grade | | |
| Fy | 36 | ksi |
| Fu | 58 | ksi |
| Bracket Plate Grade | | |
| Fy | 65 | ksi |
| Fu | 80 | ksi |
| Bracket plate thickness | 1.25 | in |
| Bracket Plate width | 6.875 | in |
| Height of vertical weld from base plate | 18 | in |
| Notch | 0.75 | in |
| Gap between Base Plate and Pipe | 0.875 | in |
| Vertical fillet weld size (bracket to pole) | 8 | x/16 in |
| Weld Material Grade | 70 | ksi |

| **Pipe/HSS Checks** | | |
|---|---|---|
| Pipe/HSS | Pipe | |
| Diameter Pipe/Width HSS | 3.5 | in |
| thickness of pipe | 0.6 | in |
| inner diameter of pipe | 2.3 | in |
| Pipe Fy | 50 | ksi |
| Length of Pipe | 26 | in |
| Pipe Area | 5.17 | $in^2$ |
| MOI of pipe | 5.79 | in^4 |
| r pipe | 1.06 | in |
| Allowable Bearing | 348.98 | k |
| % Capacity | 35.2% | % |
| | Pass | |
| Fa | 27.80 | ksi |
| Fe | 474.2 | ksi |
| kl/r | 24.57 | |
| 4.71*√(E/Fy) | 113.43 | |
| Fcr | 47.84 | ksi |
| øPn | 232.65 | k |
| % Capacity | 52.9% | % |
| | Pass | |

**Case 1: Vertical Fillet Weld Controls**

**Case 2: Vertical Fillet Base Material Controls**

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Inspections Division
Approved with Conditions
Date: 05/05/17

| Check extreme fiber 1 | | |
|---|---|---|
| ra1 | 15.56 | ksi |
| Rnweld | 31.50 | ksi |
| Cap1 | 49.4% | % |
| | Pass | |
| Check extreme fiber 2 | | |
| ra2 | 14.60 | ksi |
| Fu | 58.00 | ksi |
| Rnplate | 26.10 | ksi |
| Cap2 | 55.9% | % |
| | Pass | |

| Check extreme fiber 1 | | |
|---|---|---|
| ra1 | 12.33 | ksi |
| Rnweld | 27.00 | ksi |
| Cap3 | 45.7% | % |
| | Pass | |
| Check extreme fiber 2 | | |
| ra2 | 12.56 | ksi |
| Fu | 58.00 | ksi |
| Rnplate | 26.10 | ksi |
| Cap4 | 48.1% | % |
| | Pass | |

| Vertical Weld to Pipe Checks | | |
|---|---|---|
| length of vertical weld to pipe | 18 | in |
| Vertical fillet weld size (bracket to pipe) | 6 | x/16 in |
| Weld Material Grade | 70 | ksi |
| C1 | 1 | |
| ex | 1.75 | in |
| a | 0.10 | |
| C | 3.72 | |
| Allowable | 301.30 | k |
| % Capacity | 40.8% | % |
| | Pass | |

| Bracket Plate Check | | |
|---|---|---|
| ΦFv | 35.1 | ksi |
| ΦVn | 789.75 | k |
| Vn | 123.0 | k |
| bracket plate welded to base plate? | No | |
| Elastic Section Modulus | 67.5 | $in^3$ |
| Plastic Section Modulus | 101.3 | $in^3$ |
| ΦMn | 5923.1 | k-in |
| $M_u$ | 1060.7 | k-in |
| % Capacity | 17.9% | % |
| | Pass | |

| | | | |
|---|---|---|---|
| Project Name: | PORTLAND NORTH | JACOBS® Jacobs Engineering Group, Inc. | Created On: 9/ |
| Project Number: | BU#878783 | | Checked By: JT |
| Job Number: | WO#1367448 | | Revised On: 10/ |
| Date: | 2/22/2017 | | Revision No.: 1.5 |

CITY OF PORTLAND, MAINE — RESURGAM
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Single Pad Stability Checks

| Foundation Properties | | |
|---|---|---|
| Foundation Type: | Single Pad | |
| Length (Short Side): | 25 | ft |
| Width (Long Side): | 28 | ft |
| Thickness: | 5 | ft |
| Bearing Depth: | 4.5 | ft |

| Reactions | |
|---|---|
| Code: | G |
| Axial: | 81 |
| Shear: | 41 |
| Moment: | 5230 |

| Factored Loads | |
|---|---|
| 0.9 Axial: | 60.75 |
| 1.2 Axial: | 81 |
| Shear: | 41 |
| Moment: | 5230 |

| Soil Properties | | |
|---|---|---|
| Unit Weight: | 105 | pcf |
| Friction Angle: | 28 | |
| Cohesion: | 0 | psf |
| Friction Coefficient (μ): | 0.3 | |
| Ultimate Bearing Strength: | 7 | ksf |
| Water Table: | 99 | ft |

Calculate Bearing Length

| Sliding Resistance: | | |
|---|---|---|
| $K_p$: | 2.76983 | |
| Friction Resistance: | 159.98 | kip |
| Passive Resistance: | 82.45 | kip |
| Total Resistance: | 242.43 | kip |
| Sliding Capacity: | 16.9% | Pass |

| Overturning Check | | |
|---|---|---|
| *Orthogonal Direction* | | |
| Eccentricity: | 10.69 | ft |
| Allowable Moment: | 5554.9 | kip-ft |
| Moment Capacity: | 94.2% | Pass |
| *Diagonal Direction:* | | |
| Eccentricity: | 9.0 | ft |
| Allowable Moment: | 6306.1 | kip-ft |
| Moment Capacity: | 82.9% | Pass |

| Bearing Check | | |
|---|---|---|
| *Orthogonal Direction* | | |
| Compressive Force: | 711.0 | kip |
| Eccentricity: | 7.56 | ft |
| $q_{max}$: | 3.425 | ksf |
| Bearing Capacity: | 65.2% | Pass |
| *Diagonal Direction* | | |
| Compressive Force: | 711.0 | kip |
| Eccentricity: | 5.64 | ft |
| $q_{max}$: | 3.097 | ksf |
| Bearing Capacity: | 59.0% | Pass |

| | | | |
|---|---|---|---|
| Project Name: | PORTLAND NORTH | JACOBS® Jacobs Engineering Group, Inc. | Created On: 9/ |
| Project Number: | BU#878783 | | Checked By: JT |
| Job Number: | WO#1367448 | | Revised On: 10/ |
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Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 05/05/17

# Single Pad Structural Checks

| Structural Properties | | |
|---|---|---|
| $f'_c$: | 4000 | psi |
| Concrete Density: | 150 | pcf |
| Clear Cover: | 3 | in |
| Flexual Rebar Strength: | 60 | ksi |
| Tie Strength: | 40 | ksi |

| Pad Reinforcement: | | |
|---|---|---|
| Rebar Size: | 10 | |
| Rebar Quantity: | 22 | |

| Anchor Bolt Properties | | |
|---|---|---|
| Anchor Bolt Circle | 66 | in |

| Factored Pad Reactions | | |
|---|---|---|
| Max Shear: | 204.5 | kip |
| Max Moment: | 402.0 | kip-ft |

| Pad Beam Shear | | |
|---|---|---|
| $d_{pad}$: | 55.095 | in |
| $V_c$: | 2090.7 | kip |
| $\varphi V_n$: | 1568.0 | kip |
| Beam Shear Capacity: | 13.0% | Pass |

| Punching Shear | | |
|---|---|---|
| $q_{comp}$: | 1.016 | ksf |
| Punching Force: | 629.8 | kip |
| $b_o$: | 380.4 | in |
| Vc: | 5302.5 | kip |
| $\varphi V_n$: | 3976.9 | kip |
| Punching Shear Capacity: | 15.8% | Pass |

| Pad Flexural Strength | | |
|---|---|---|
| $\beta_1$: | 0.85 | |
| c: | 1.934 | in |
| a: | 1.644 | in |
| $M_n$: | 7582.0 | kip-ft |
| $\varphi M_n$: | 6823.8 | kip-ft |
| Flexural Capacity: | 5.9% | Pass |