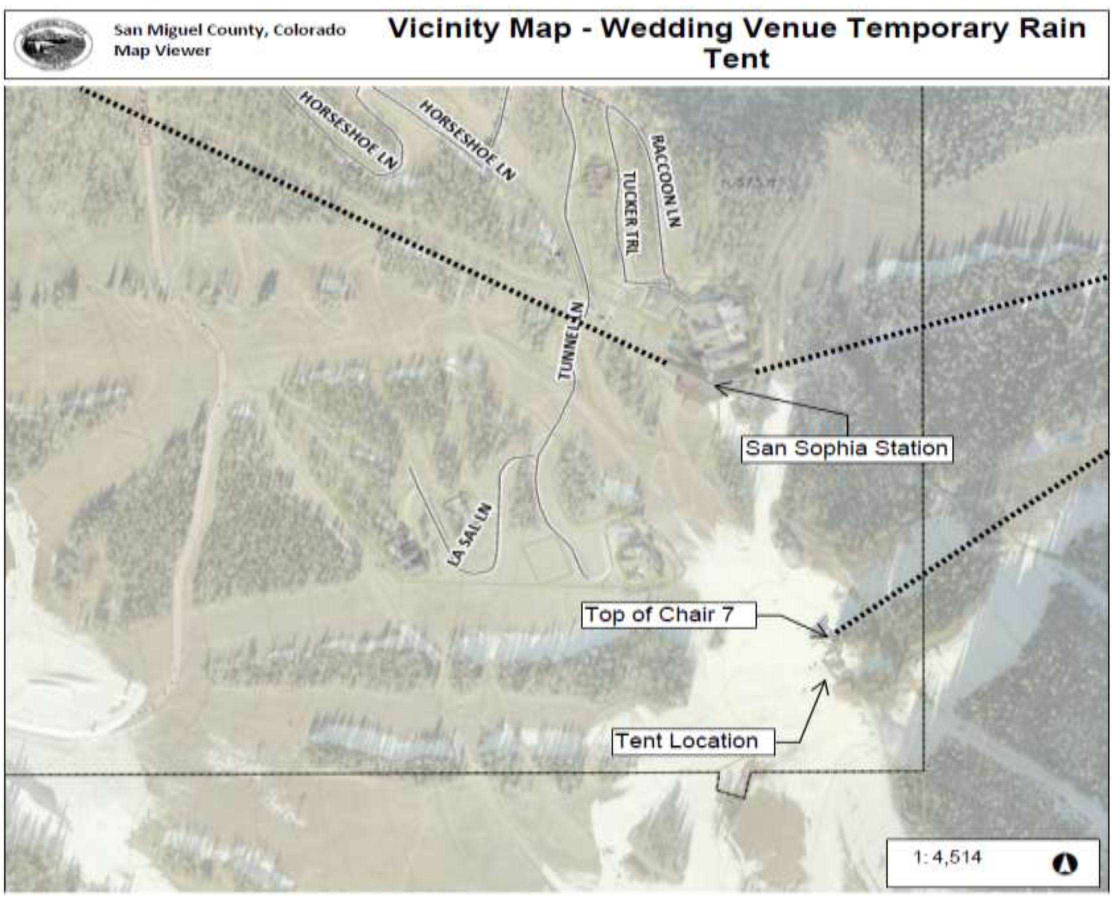
The following document contains drawings and plan sets that are not accessible to screen readers. For assistance in accessing and interpreting these documents, please email cd@mtnvillage.org or call (970) 728-8000

JOHN MILLER
Telluride Ski & Golf Resort
565 Mountain Village Blvd
Mountain Village, CO 81435
(970) 708-2366
jmiller@tellurideskiresort.com

Date: 6.20.2025

TO:
Planning Department Staff
Town of Mountain Village
455 Mountain Village Blvd
Mountain Village, CO 81435

RE: Conditional Use Permit Narrative
Project: Temporary Rain Tent Placement – Chair 7, San Sophia Wedding Site
Parcel Information: OSP 49R, Active Open Space



Dear Planning Staff,

On behalf of Telluride Ski & Golf Resort, please accept this narrative in support of our application for a **Conditional Use Permit (CUP)** to allow for the **temporary placement of a 20’ x 20’ x 10’ rain tent** near the existing yurt structure at the **top of Chair 7**, a designated wedding venue.

The purpose of the tent is to provide a weather contingency space for guests and staff during wedding ceremonies and receptions held at this scenic, high-alpine site. The structure will be in place **only during the summer event season** and will be fully **removed at the conclusion of the season**, returning the site to its current condition. The installation is reversible, and no permanent grading, utility connections, or foundation work is proposed.

Compliance with Community Development Code (CDC)

This temporary use complies with the applicable provisions of the Town of Mountain Village CDC, including but not limited to:

§17.4.12 – Conditional Use Permit Review Standards

A. Consistency with the Comprehensive Plan
The proposed use supports the goals and policies of the Mountain Village Comprehensive Plan, which encourages sustainable, year-round resort operations, tourism-supporting amenities, and preservation of community character. This temporary structure ensures continuity of wedding services in inclement weather without requiring permanent development at a visually and environmentally sensitive location.

B. Compatibility with Surrounding Uses
The tent will be used solely to support events already permitted at this location. It is visually and functionally compatible with the adjacent yurt, ski lift infrastructure, and open alpine environment. It will not result in intensification of use, expansion of operating hours, or conflict with nearby resort or trail operations.

C. Adequate Infrastructure
No new infrastructure is required. Access is provided via existing mountain roads and trails used for wedding logistics and ski operations. The tent will not require utilities or impact existing infrastructure capacity.

D. Design Minimizes Adverse Impacts
The tent is temporary, fabric-based, and designed for quick assembly and removal. Its placement adjacent to the existing yurt minimizes visual disruption and concentrates human activity within an area already designated for event use. There will be no clearing of vegetation or permanent alterations to the site. Noise levels will remain consistent with permitted wedding events.

E. Compliance with Other Applicable Provisions
This temporary use does not violate any applicable zoning standards or environmental protections. There are no known wetlands or slopes in excess of 30% within the tent footprint. The structure complies with all fire and building safety standards relevant to temporary tents and will be permitted and inspected as required.

F. Duration of Use
This is a **seasonal and temporary installation**. The tent will be installed at the beginning of the summer wedding season and fully removed by the end of the season. No winter or year-round use is proposed. The tent is currently operating under a short term special use permit, but this application would request that the conditional use permit be granted seasonally for a period of 3 years unless council determines a longer time period for seasonal use is appropriate.

Photo of Temporary Tent

Summary

Telluride Ski & Golf respectfully requests approval of this CUP to temporarily place a rain tent near the existing Chair 7 yurt for summer weddings. The proposed use aligns with the intent of the CDC and Mountain Village Comprehensive Plan by supporting resort activities in a minimal-impact, reversible manner. We appreciate your consideration and welcome the opportunity to provide additional information or clarification during the review process.

Sincerely,
John Miller
Telluride Ski & Golf Resort


Cross cable Bracing
Cables blocking access on
Sidewall Bay

Proposal

LOSBERGER DE BOER

Offer No.
Version #: 1
PO#
Cust #:

Bill To: Telluride Ski & Golf Resort
565 Mountain Village Blvd
Telluride CO 81435

A/P Contact:
Phone:
Email:

Date: April 25, 2025

Contact: Piper Greenwood
Phone: (406) 249-8017
E-Mail: pgreenwood@tellurideskiresort.com

Ship To: #N/A
#N/A

Delivery Contact: #N/A
Phone: #N/A
Email: #N/A

In-Hands:

Delivery

Terms of Payment: 50% Deposit, Balance due 30 days. Deposit required for delivery.
This proposal is valid as shown above for 15 days from the date of this proposal.

QTY	Part #	SAP #	Description	Unit Price		Total
1			Multiflex Plus P7 Losberger frame: 6m wide x 6m long x 3m leg height (20' x 20' x 10'), complete with 1m long shouldered steel tent stakes, two side "X" bracing bays and 3m/10' bay spacing. Beam profile: 120mm x 48mm (4 3/4" x 2"). Rafter beams are 1 piece 3m.	$9,829.00		$9,829.00
2	732698		P7 6m x 3m White blockout, coated vinyl roof cover	$784.00	10%	$1,411.20
2	732699		P7 6m White blockout, coated vinyl gable cover, with zipper closure	$454.00	10%	$817.20
8	735892		3m x 3m Clear vinyl 2pc sidewall panel with zipper closure	$689.00	10%	$4,960.80
1	IT612p7		P8/P7 6m-12m Install/removal tools: (3) 15m pull ropes, (3) spring hook, (2) MF purlin fork, (2) 30/24 combo wrench, (2) 8mm Allan wrench	$469.20		$469.20
			Deposit Due at Signing: $8,743.70 Deposit required for delivery.			
					Sub Total	**$17,487.40**
					Estimated freight charges:	**TBD**
					TOTAL:	**$17,487.40**

Additional Specifications: Complete framing includes all cabling, bracing, roof tensioning system and ground anchors. Anchors for this installation are: stakes
Fabric is white blockout vinyl, coated fabric, unless noted above.
Fabric sidewalls are 2 piece sections with centered vertical separations for easy deployment, unless noted above.

Not included, unless line itemed above: Fabric Sidewall tension ground rails are not included, unless noted above.
Storage bags for roof and gable fabric sections and for fabric wall sections are not included, unless noted above.
Site and foundation engineering is the responsibility of the customer
All permitting with fire marshal and building code officials is the sole responsibility of the customer.
This structure is not snow loaded, unless noted above.
Installation of this equipment is the responsibility of others

Shipment: FOB Frederick, MD. Final freight charges estimated above will be pre-paid by Losberger US and added to your invoice, including duties and taxes

Required in hands date: 0-Jan-00

Other Conditions of Sale: **Any price discounts are earned ONLY if full payment is made in accordance with the terms of payment noted above. Interest in the amount of 1.5% per month (18% per annum) will be assessed, due and payable to Losberger US by the customer on all unpaid balances outstanding beyond the payment due date. Credit cards only accepted if payment is made in accordance with the Terms of Payment see payment section in Terms & Conditions Page 3.**

Payment: **Unless otherwise provided on the face of this form, payment is due within 15 days after the date of invoice. Buyer shall pay to Seller a $50.00 handling fee if any of buyer's checks is returned to Seller as a result of insufficient funds. Credit Card Payments: Visa, Master Card, Discover Card and American Express only. Credit cards will be accepted only on orders under $50,000. Credit cards are only accepted when paid within 30 days of delivery. Credit cards are not accepted on over due accounts. Multiple credit card payments on large invoices are not permitted.**

Terms and Conditions of Sale on the last page:

Prices are subject to change without prior notice, this proposal is valid as shown above for 15 days from the date of this proposal.

The scope of work in this proposal by Losberger US, LLC. is limited to the details outlined above.

This proposal prepared by:
Mike Morse
Losberger US, LLC.
285 Bucheimer Rd. Suite A
Frederick, MD 21701
607.220.7113
mike.morse@losbergerdeboer.com

Above pricing, Terms & Conditions accepted by (signature): ____________
Print name: ____________
Title: ____________
Date: ____________

Terms and Conditions of Sale

Governing Provisions:

Cancellation:
No order may not be cancelled or altered by buyer except upon terms and conditions acceptable to Seller, as evidenced by Seller's written consent. No products ordered may be returned without Seller's written permission, and in compliance with the terms of any such permission. Seller may return to buyer, freight collect, any products returned without out sellers permission. All returns accepted by Seller may be subjected to a 15% restocking fee.

Clerical Errors:
Seller reserves the right to correct all clerical errors in any quotation, order acknowledgement or invoice.

Delivery & Delay:
All quoted delivery dates and/or periods are approximate. Delivery periods shall commence when buyer shall have provided complete specifications and/or applicable documents required to effect shipment. Unless otherwise provided on the face page of this form, all products shall be shipped freight collect. Title and risk of loss or damage in transit shall pass to buyer upon delivery of goods to a carrier at Seller's premises.

Seller reserves the right to make delivery in installments; and all such installments, when separately invoiced, shall be paid for when due, without regard to subsequent deliveries. Delay in delivery of any installment shall not relieve buyer of its obligations to accept remaining deliveries.

Seller shall not be liable for any damage as a result of any delay due to any cause beyond Seller's reasonable control, including but not limited to any act of God, act of Buyer, embargo or other government act, regulation or request, fire, accident, strike, slow-down, riot, shortage, delay in transportation, or delayed delivery by suppliers. In the event of any such delay, the time for delivery shall be extended for a period equal to the time lost by reason of the delay.

Claims for shortages or other errors must be made in writing to Seller within ten (10) days after receipt of shipment; and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by buyer.

Shortage:
If Buyer requests that shipment of products be delayed for a period of more than fifteen (15) days, Seller may store such products at the buyer's risk in a warehouse or yard or upon Seller's premises; and the buyer shall pay handling, transportation and storage charges at the prevailing commercial rates upon submission of invoices therefor.

Payment:
Unless otherwise provided on the face of this form, payment is due within 15 days after the date of invoice. Buyer shall pay to Seller a $50.00 handling fee if any of buyer's checks is returned to Seller as a result of insufficient funds. Credit Card Payments: Visa, Master Card, Discover Card and American Express only. Credit cards will be accepted only on orders under $50,000
Credit cards are only accepted when paid within 30 days of delivery.
Credit cards are not accepted on over due accounts.
Multiple credit card payments on large invoices are not permitted.

Warranties:
All warranties for the products are set forth in the documents accompanying the products. If no such documents accompany the products, then Seller warrants that the product manufactured by it and supplied hereunder shall be free from defects in materials and workmanship under normal use and service for a period of one (1) year from the date of shipment. If within such period any such product shall be proved to Seller's satisfaction to be defective, such product shall be repaired or replaced at Seller's option. Seller's warranty obligations shall be limited to such repair or replacement, shall be buyer's exclusive remedy hereunder, and shall be conditioned upon Seller's receiving written notice of any alleged defect within ten (10) days after its discover and, at Seller's option, return of such products to Seller, F.O.B. its factory. This exclusive remedy shall not be deemed to have failed its essential purpose so long as the Seller is willing and able to replace defective products or issue a credit to buyer within a reasonable time after buyer proves to Seller that a defect exists. This warranty shall not apply to products which shall have been subjected to negligence, accident, damage by circumstance beyond Seller's control, or improper use, operation, maintenance or storage.

Warning:
The buyer/ installation company is solely responsible for the proper and safe installation of these product listed in this document. Users and installers shall indemnify and hold harmless Losberger US LLC for any claims resulting from the improper installation and/or maintenance of these products.

Multiflex P7 Frame Structure

6m-12m x 2.5m-3.0m Leg
15m x 2.5m Leg

Structural evaluation of the Losberger Multiflex P7 structure
in accordance with FBC 2017, IBC 2015 and ASCE 7-10

For use in regions with 105 mph basic wind speed, 3-second gust
Exposure Category B (urban and suburban terrain)
Temporary Structure
Risk Category = II

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Table of Contents

Revision Log

Rev	Rev. Date	Description
0	16 Jul 19	- Original Issue

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1. Summary and Recommendations

This document, based on technical background information as provided by Losberger U.S., LLC, covers the structural evaluation of the Multiflex aluminum frame style structure in accordance with U.S. Building Code requirements. The specifications outlined in the Structural Engineering Institute / American Society of Civil Engineers (SEI/ASCE 7) "Minimum Design Loads for Buildings and Other Structures" were followed in determining the integrity of the structure. This document is intended to serve as a basis for the acceptability of this temporary, stand-alone, enclosed structure under standard design wind loads at varying levels of exposure (terrain and wind velocities).

Lightweight Design Inc. compiled this document based on the existing frame tent system with reference to the applicable building codes in the U.S. This report includes the load cases and combinations used in the analysis and gives an indication as to the wind exposure for which the structure is suitable. Certification of this document only shows that the Professional Engineer of that particular state is in agreement with the report's contents. It does not, however, imply that the structure is generally suitable for use within that state, or that every installation is covered by this report.

As this document was compiled based on design information as provided by Losberger, the summary and recommendations for this structure and contained within this document can only be valid if the structure is erected with original Losberger parts and components.

Computer-aided structural frame analysis were involved in the course of the investigation. Different load combinations were considered to identify the critical aspects of the design. Member and detail checks were established to derive the conclusions for the entire report.

As such, we have arrived at the following conclusions and recommendations:

1.1 Wind Speed Rating

- Wind Speed — 105 mph, 3-second gust
- Exposure — Category B (urban or suburban terrain)
- Mean Recurrence Interval — 2 years
- Building Risk Category — II
- Velocity Pressure — $q_h = 7.77 \cdot psf$ at mean roof height, $h = 12.65 \cdot ft$

For the above mentioned wind speed, exposure and risk categories, and return period (or mean recurrence interval, MRI), the structure satisfies the requirements of the "American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE 7), as well as the International Building Code (IBC).

Exposure Categories

1609.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

Exposure B. Exposure B shall apply where the ground surface roughness condition, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exception: For buildings whose mean roof height is less than or equal to 30 feet (9144 mm), the upwind distance is permitted to be reduced to 1,500 feet (457 m).

Exposure C. Exposure C shall apply for all cases where Exposures B or D do not apply.

Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall extend inland from the shoreline for a distance of 600 feet (183 m) or 20 times the height of the building, whichever is greater.

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Surface Roughness Categories

1609.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, grasslands, and all water surfaces in hurricane-prone regions.

Surface Roughness D. Flat, unobstructed areas and water surfaces outside hurricane-prone regions. This category includes smooth mud flats, salt flats and unbroken ice.

Additional Exposure and Wind Speed Combinations :

The structure is suitable for up to a 105 mph Category B design wind load. For other exposures and wind speed combinations, refer to the following table, where the stricken values indicate unsuitable pressures and exposures for the structure.

ASCE 7-10 Wind Pressure, q_h in psf				
Exposure	90 mph	95 mph	100 mph	105 mph
Category B	5.71	6.36	7.05	7.77
Category C	7.73	~~8.61~~	~~9.54~~	~~10.52~~
Category D	~~8.99~~	~~10.02~~	~~11.10~~	~~12.24~~

1.2 Hanging Dead Loads

The electrical and mechanical fixtures (lighting, HVAC, suspended items, etc.) totaling 400 lbs per frame and suspended symmetrically on the structure are accounted for. These hanging loads have been assumed to be 100 lbf at the center of each rafter and 200 lbf at the ridge of each rafter for this analysis.

1.3 Live Loads

Due to the temporary nature of the structure and its seasonal installation, snow loading is neglected in the load considerations and is beyond the scope of this structure report. It is not recommended to install this structure in locations prone to snow and during times where snow events are expected to occur. If a snow event is likely while the structure is erected, then measures must be provided to ensure snow removal or melting during the event. Furthermore, the prescribed gradient of the roof fabric should be maintained to allow for smooth drainage and to prevent the potential for ponding.

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1.4 Base Reactions

The maximum reactions at the foundations/supports due to the rated load and exposure category are given in the table below, per base plate, per frame.

	15Mx250 Multiflex	
	Arch Frame	Gable End Wall Posts
Max Vertical Downward	1.3 kips	0.1 kips
Max Vertical Uplift	1.2 kips[1]	0.0 kips
Max Shear	0.9 kips	0.4 kips

[1]Add'l uplift at cross-braced frames = 0.5 kips
[1]Add'l shear at cross-braced frames = 0.4 kips

The structural components of this structure can be reassembled into narrower, 6m, 9m and 12m structures. The stresses applied in the narrower structures are less than those applied in this structure, therefore it can be certified that the smaller structures will withstand the same loading conditions as this structure.

The maximum reactions at the foundations/supports for the narrower structures are included here for completeness. Like the larger structure, they are due to the rated load and exposure category and are per base plate, per frame.

	12M Multiflex		9M Multiflex		6M Multiflex	
	x 300	x 250	x 300	x 250	x 300	x 250
Max Vertical Downward	1.2 kips	1.1 kips	1.0 kips	1.0 kips	0.7 kips	0.7 kips
Max Vertical Uplift	0.9 kips[1]	0.9 kips[1]	0.6 kips[1]	0.6 kips[1]	0.4 kips[1]	0.4 kips[1]
Max Shear	0.7 kips[1]	0.7 kips[1]	0.5 kips[1]	0.4 kips[1]	0.5 kips[1]	0.4 kips[1]
[1]Add'l uplift =	0.5 kips	0.4 kips	0.3 kips	0.2 kips	0.2 kips	0.1 kips
[1]Add'l shear =	0.4 kips	0.3 kips	0.2 kips	0.2 kips	0.2 kips	0.1 kips

NOTE: Foundations, by others, are required to support column loads. The structure should be set on firm and unyielding ground. This ground should sufficiently contain the bearing pressures of the base plates as well as the tractive forces of the anchors. A foundations engineer must verify ground conditions on a site-by-site basis and provide appropriate bearing plate sizes to accommodate column loads:

1.5 Installation Requirements

It is understood that the responsibility of proper installation according to the plans rests upon the installation contractor. This includes, but is not limited to, ensuring the following:

- that the cables are always held taut,
- that the fabric is stretched tight enough to prevent the development of pockets and to maintain the prescribed roof gradient,
- that purlins are installed securely against rafters to resist calculated loads,
- that base plates are secured to their foundations using anchors. The manufacturer provides a base plate and anchoring plan for the structure as a base starting point for average soil conditions. It is the installers responsibility to ensure that the anchorage provided will resist the reaction loads as indicated in the tables found in this document.

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2. Project Parameters

The Losberger Multiflex structure consists of a series of pin-supported interior and end frames made up of custom-designed hollow profiles of structural aluminum alloy spanning the tent hall width.

These tents are classified as temporary structures. Their installation and use are restricted to certain seasons and environmental conditions. As such, snow loads are neglected. If such occurs, acceptable means of snow melting or removal, and interior heating shall be immediately employed. Further, the tent should be maintained closed at all unused times to prevent the possibility of an internal pressure build-up which is not considered in the succeeding stability calculations of this document.

The technical background information, design drawings, and material properties were made available by Losberger to facilitate the evaluation of the structure according to U.S. building code requirements. The ASCE 7 Standard is utilized for this purpose because of its particular coverage regarding the United States.

Building Geometry

The interior and gable end aluminum frames with their corresponding dimensions for the 15M, 12M, 9M, and 6M versions of this structure are included in Appendix A of this report. It is understood that the length of the structure may be extended when necessary. At hall lengths of over 40M, additional wind bracing bays are to be arranged so that there would be 6 bracing-free bays (30M) at most between the wall bracings.

The schematic elevations show the presence of steel struts and pinned connections at the strut, eaves, and base support joints. The roof and walls are clad in non-prestressed fabric skin connected to the aluminum frames by edge ropes slid through the aluminum extrusions. Since this fabric is not attached to the purlins, it transmits the effects of suction pressures directly to the supporting frames. Moreover, the structure is attached to base plates anchored securely to the ground against uplift. The fabric is considered too elastic to provide lateral support to the frame, so the frame is designed as stand-alone.

The longitudinal stability, high strength cross bracing cables and steel struts are utilized for the roof and column braces. In addition, the purlins, ridge, and eaves beams transmit longitudinal forces to the intermediate frames of the structure.

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3. Determination of Loads

Dead Load :

The structure dead loads consist of the self weight of the structure's components with addition of uniform distributed loads for fabric roofing, side wall materials, and minor components. Calculated weight of the fabric is shown below for reference and use in the static computer model analysis.

Roof and Side fabric : $AreaWt_{fabric} = 24.00 \cdot oz\ per\ sq\ yard$ $UnitWt_{fabric} = 0.137 \cdot pli$

The electrical and mechanical fixtures (lighting, HVAC, suspended items, etc.) totaling 400 lbs per frame and suspended symmetrically on the structure are accounted for. These hanging loads have been assumed to be 100 lbf at the center of each rafter and 200 lbf at the ridge of each rafter for this analysis.

Intermediate Load hanging midway down rafter : $P_{rafter} = 100 \cdot lbf$

Ridge Load hanged at peak : $P_{peak} = 200 \cdot lbf$

The structure is designed to support the loads shown in this calculations. It may, or may not, be capable of supporting additional collateral loads. The owner of the structure shall not hand, or otherwise affix, additional loads to this structure without a review by an engineer qualified to make said review. Additionally, prior to adding load to this structure, the owner shall get a written confirmation by the qualified engieer as to the magnitude and location of the load, or loads, being applied.

Live Load :

Due to the temporary nature of the structure and its seasonal installation, snow loading is neglected in the load considerations and is beyond the scope of this structure report. It is not recommended to install this structure in locations prone to snow and during times where snow events are expected to occur. If a snow event is likely while the structure is erected, then measures must be provided to ensure snow removal or melting during the event. Furthermore, the prescribed gradient of the roof fabric should be maintained to allow for smooth drainage and to prevent to potential for ponding.

Live loads loads produced by the use and occupancy of the building are found on Table 1607.1. In the case of this structure, their are no additional live loads.

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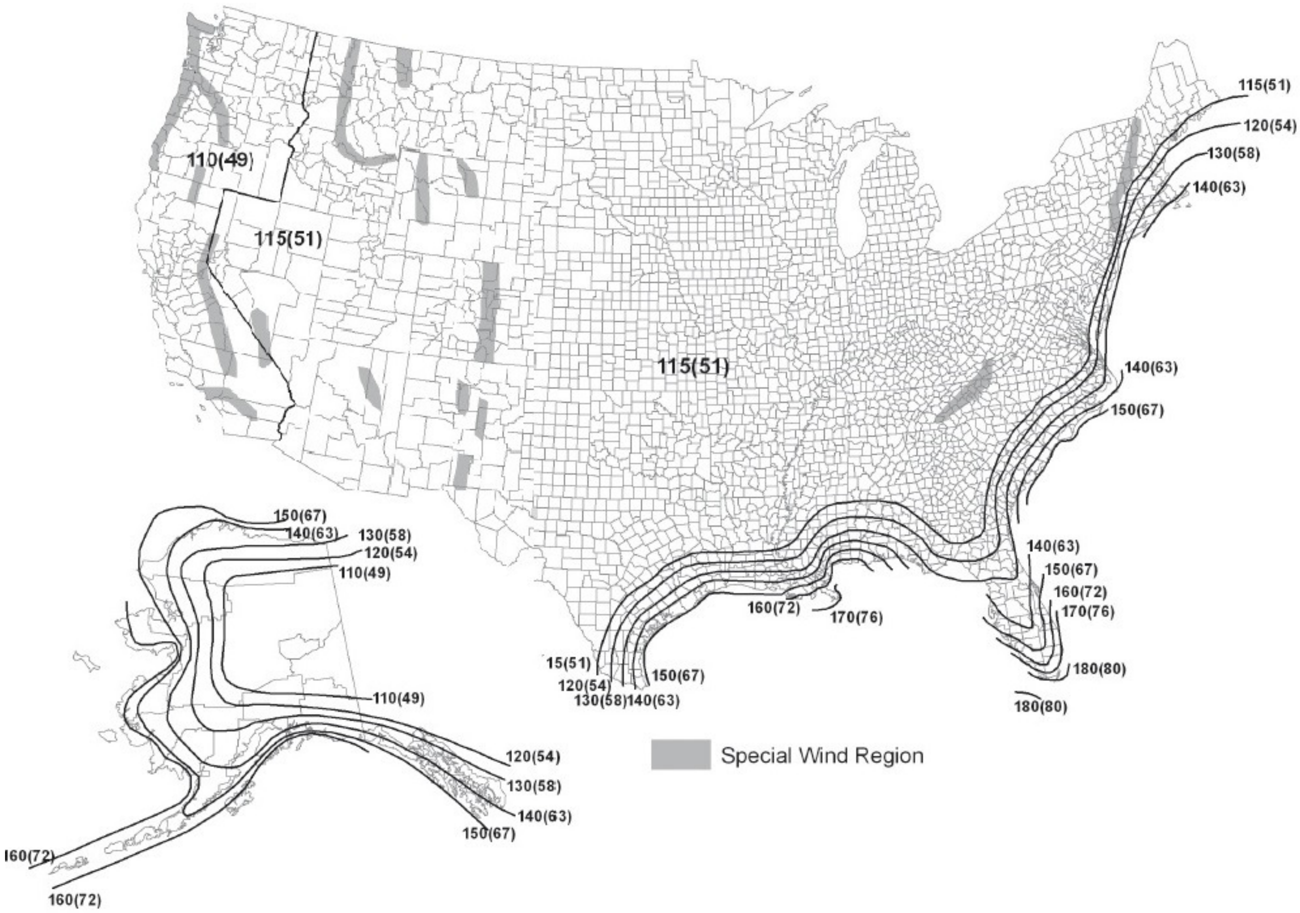
Wind Loads.



General Requirements

Risk Category:	Cat = "II"	*[Table 1.5-1]*

Use of Building = "All building and other structure except those listed in Risk Categories I, III, and IV"

Basic wind speed:	$V = 105 \cdot mph$	*[Section 26.5.1]*
Wind directionality factor:	$K_d = 0.85$	*[Section 26.6]*
Exposure category:	Exposure = "B"	*[Section 26.7]*
Topographic factor:	$K_{zt} = 1$	*[Section 26.8]*
Gust effect factor:	$G = 0.85$	*[Section 26.9]*
Mean recurrence interval:	$MRI = 2 \cdot yr$	
Reduction factor for 'other' MRI:	$R_n = 0.68$	*[Table C6-3]*
Effective wind speed:	$V_r = 71.4 \cdot mph$	

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Envelope Procedure

ASCE 7-10 Envelope Procedure for low-rise buildings as specified in Chapter 28 is used in this evaluation.

No reduction to the velocity pressure is taken due to apparent shielding. *[Section 28.1.4]*

Velocity pressure : *[Section 28.3.1]*

$$q_z = 0.00256\cdot\frac{psf}{mph^2}\cdot K_z\cdot K_{zt}\cdot K_d\cdot V_r^2$$ where : *[Equation 28.3-1]*

$K_d = 0.85$ wind directionality factor *[Section 26.6, Table 26.6-1]*

$K_{zt} = 1$ topographic factor *[Section 26.8, Fig. 26.8-1]*

$K_z = 2.01\cdot\left(\frac{z}{z_g}\right)^{\frac{2}{\alpha}}$ for $15ft \le z \le z_g$ $\quad$ $K_z = 2.01\cdot\left(\frac{15ft}{z_g}\right)^{\frac{2}{\alpha}}$ for $z \le 15ft$ *[Table 28.3-1]*

$K_z = 0.7$ velocity pressure exposure coefficient

$V_r = 71.4\cdot mph$ basic wind speed

$q_z = 7.77\cdot psf$ velocity pressure evaluated at peak height, z

$q_h = 7.77\cdot psf$ velocity pressure evaluated at mean roof height, h

The wind load to be used in the design of the MWFRS for an enclosed or partially enclosed building shall not be less than 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. *[Section 28.4.4]*

$\text{Wall Case}_{windward} = 6.56\cdot pli$ $\quad$ $\text{Wall Case}_{leeward} = 6.56\cdot pli$

$\text{Roof Case}_{windward} = 3.28\cdot pli$ $\quad$ $\text{Roof Case}_{leeward} = 3.28\cdot pli$

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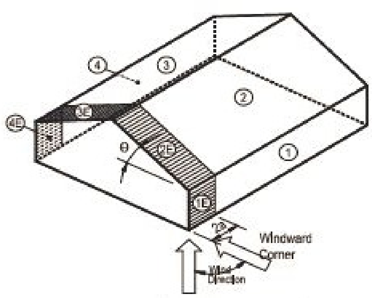
Internal Pressure Coefficients (GC_{pi})

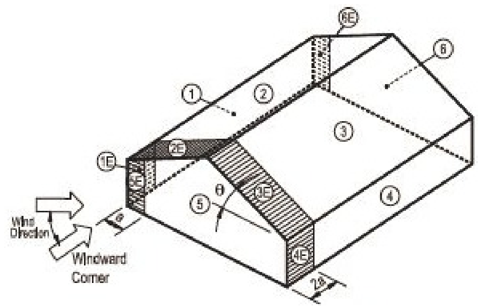
Openings are considered to be equally distributed around the building. The building qualifies as an enclosed building (see Section 26.10). The value can be both positive (overpressure), and negative (underpressure)

$$GC_{pi} = \begin{pmatrix} 0.18 \\ -0.18 \end{pmatrix}$$ *[Section 26.11]*

External Pressure Coefficients (GC_{pf})



Load Case A
(wind on side)



Load Case B
(wind on end)

$$2 \cdot a = 9.89 \cdot ft$$

$$\frac{2 \cdot a}{L_{bay}} = 100.47 \cdot \%$$

ASCE 7-10 Figure 28.4-1 : External Pressure coefficients (GC_{pf})

Roof Angle θ (degrees)	LOAD CASE A Building Surface							
	1	2	3	4	1E	2E	3E	4E
0-5	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
20	0.53	-0.69	-0.48	-0.43	0.80	-1.07	-0.69	-0.64
30-45	0.56	0.21	-0.43	-0.37	0.69	0.27	-0.53	-0.48
90	0.56	0.56	-0.37	-0.37	0.69	0.69	-0.48	-0.48

Roof Angle θ (degrees)	LOAD CASE B Building Surface											
	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
0-90	-0.45	-0.69	-0.37	-0.45	0.40	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

$GC_{pf.A} =$

"1"	"2"	"3"	"4"	"1E"	"2E"	"3E"	"4E"
0.53	-0.69	-0.48	-0.43	0.8	-1.07	-0.69	-0.64

(interpolated to the roof slope; $\theta_t = 20 \cdot deg$)

$GC_{pf.B} =$

"1"	"2"	"3"	"4"	"5"	"6"	"1E"	"2E"	"3E"	"4E"	"5E"	"6E"
-0.45	-0.69	-0.37	-0.45	0.4	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

Application of Pressures on Building Suraces 2 and 3

Per note 8 in ASCE 7-10 Fig. 28.4-1, the roof pressure coefficient (GCpf), when negative in Zone 2 and 2E, shall be applied in Zone 2/2E for a distance from the edge of the roof equal to 0.5*horizontal dimension of the building parallel to the direction of the MWFRS being designed or 2.5* the eave height at the windward wall, whichever is less; the remainder of Zone 2/2E extending to the ridge line shall use the pressure coefficeint (GCpf) for Zone 3/3E.

$$\text{Zone 2/2E distance}_{CaseA} = 20.38 \cdot ft$$

$$\text{Zone 2/2E distance}_{CaseB} = 20.38 \cdot ft$$

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Design Wind Pressures

$p = q_h \cdot \left[\left(GC_{pf} \right) - \left(GC_{pi} \right) \right]$ *[Equation 28.4-1]*

$p_A =$ (psf)

"1"	"2"	"3"	"4"	"1E"	"2E"	"3E"	"4E"
2.72	-6.76	-5.13	-4.74	4.82	-9.71	-6.76	-6.37
5.52	-3.96	-2.33	-1.94	7.62	-6.91	-3.96	-3.57

$p_B =$ (psf)

"1"	"2"	"3"	"4"	"5"	"6"	"1E"	"2E"	"3E"	"4E"	"5E"	"6E"
-4.9	-6.76	-4.27	-4.9	1.71	-3.65	-5.13	-9.71	-5.52	-5.13	3.34	-4.74
-2.1	-3.96	-1.48	-2.1	4.51	-0.85	-2.33	-6.92	-2.72	-2.33	6.14	-1.94

top line = overpressure, bottom line = underpressure

Design Wind Loads

The wind pressure on one bay must be supported by one arch. The total wind load per arch equals :

$WL = p \cdot L_{bay}$

$WL_A =$ (pli)

"1"	"2"	"3"	"4"	"1E"	"2E"	"3E"	"4E"
2.23	-5.54	-4.21	-3.89	3.95	-7.97	-5.55	-5.23
4.53	-3.25	-1.91	-1.59	6.25	-5.67	-3.25	-2.93

$WL_B =$ (pli)

"1"	"2"	"3"	"4"	"5"	"6"	"1E"	"2E"	"3E"	"4E"	"5E"	"6E"
-4.02	-5.55	-3.51	-4.02	1.4	-3	-4.21	-7.97	-4.53	-4.21	2.74	-3.89
-1.72	-3.25	-1.21	-1.72	3.7	-0.7	-1.91	-5.67	-2.23	-1.91	5.04	-1.59

top line = overpressure, bottom line = underpressure

Design Wind Loads - First Arch on End with applied load

$WL_{A1} =$ (pli)

"1/1E"	"2/2E"	"3/3E"	"4/4E"
1.98	-3.98	-2.77	-2.61
3.12	-2.84	-1.63	-1.47

$WL_{B1} =$ (pli)

"1/1E"	"2/2E"	"3/3E"	"4/4E"	"5"	"6"
-2.10	-3.98	-2.26	-2.10	1.37	-1.94
-0.96	-2.84	-1.12	-0.96	2.52	-0.80

Design Wind Loads - Second Arch from End with applied load

$WL_{A2} =$ (pli)

"1/1E"	"2/2E"	"3/3E"	"4/4E"
3.10	-6.77	-4.88	-4.56
5.39	-4.47	-2.59	-2.27

$WL_{B2} =$ (pli)

"1/1E"	"2/2E"	"3/3E"	"4/4E"	"5"	"6"
-4.11	-6.77	-4.02	-4.11	2.08	-3.45
-1.82	-4.47	-1.73	-1.82	4.37	-1.15

Design Wind Loads - All Other Arches

$WL_{A3} =$ (pli)

"1"	"2"	"3"	"4"
2.23	-5.54	-4.21	-3.89
4.53	-3.25	-1.91	-1.59

$WL_{B3} =$ (pli)

"1"	"2"	"3"	"4"	"5"	"6"
-4.02	-5.55	-3.51	-4.02	1.4	-3
-1.72	-3.25	-1.21	-1.72	3.7	-0.7

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4. LRFD Load Combinations :

ASCE Section 2.2 : SYMBOLS AND NOTATION

D = dead load
Di = weight of ice
E = earthquake load
F = load due to fluids with well-defined pressures and maximum heights
Fa = flood load
H = load due to lateral earth pressure, ground water pressure, or pressure of bulk materials
L = live load
Lr = roof live load
R = rain load
S = snow load
T = self-straining force
W = wind load
Wi = wind-on-ice determined in accordance with Chapter 10

ASCE Section 2.3 : COMBINING FACTORED LOADS USING STRENGTH DESIGN

Section 2.3.2 : Basic Combinations. Structures, components, and foundations shall be designed so that their design strength equals or exceeds the effects of the factored loads in the following combinations:

1. 1.4(D + F)
2. 1.2(D + F + T) + 1.6(L + H) + 0.5(Lr or S or R)
3. 1.2D + 1.6(Lr or S or R) + (L or 0.5W)
4. 1.2D + 1.0W + L + 0.5(Lr or S or R)
5. 1.2D + 1.0E + L + 0.2S
6. 0.9D + 1.0W + 1.6H
7. 0.9D + 1.0E + 1.6H

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Symbols as used in calculations

D_1 = dead load;
L_f = live load;
L_r = roof live load;
S_1 = balanced snow
S_2 = unbalanced snow

W_1 = lateral wind (perpendicular to ridge line with overpressure)
W_2 = lateral wind (perpendicular to ridge line with overpressure)
W_3 = longitudinal wind (parallel to ridge line with underrpressure)
W_4 = longitudinal wind (parallel to ridge line with underpressure)

Combinations as applied in calculations :

1 a. $1.4D_1$

2 a. $1.2D_1 + 1.6L_f + 0.5L_r$
b. $1.2D_1 + 1.6L_f + 0.5S_1$
c. $1.2D_1 + 1.6L_f + 0.5S_2$

3 a. $1.2D_1 + 1.6L_r + 1.0L_f$
b. $1.2D_1 + 1.6L_r + 0.5W_1$
c. $1.2D_1 + 1.6L_r + 0.5W_2$
d. $1.2D_1 + 1.6L_r + 0.5W_3$
e. $1.2D_1 + 1.6L_r + 0.5W_4$
f. $1.2D_1 + 1.6S_1 + 1.0L_f$
g. $1.2D_1 + 1.6S_1 + 0.5W_1$
h. $1.2D_1 + 1.6S_1 + 0.5W_2$
i. $1.2D_1 + 1.6S_1 + 0.5W_3$
j. $1.2D_1 + 1.6S_1 + 0.5W_4$
k. $1.2D_1 + 1.6S_2 + 1.0L_f$
l. $1.2D_1 + 1.6S_2 + 0.5W_1$
m. $1.2D_1 + 1.6S_2 + 0.5W_2$
n. $1.2D_1 + 1.6S_2 + 0.5W_3$
o. $1.2D_1 + 1.6S_2 + 0.5W_4$

4 a. $1.2D_1 + 1.0L_f + 0.5L_r + 1.0W_1$
b. $1.2D_1 + 1.0L_f + 0.5L_r + 1.0W_2$
c. $1.2D_1 + 1.0L_f + 0.5L_r + 1.0W_3$
d. $1.2D_1 + 1.0L_f + 0.5L_r + 1.0W_4$
e. $1.2D_1 + 1.0L_f + 0.5S_1 + 1.0W_1$
f. $1.2D_1 + 1.0L_f + 0.5S_1 + 1.0W_2$
g. $1.2D_1 + 1.0L_f + 0.5S_1 + 1.0W_3$
h. $1.2D_1 + 1.0L_f + 0.5S_1 + 1.0W_4$
i. $1.2D_1 + 1.0L_f + 0.5S_2 + 1.0W_1$
j. $1.2D_1 + 1.0L_f + 0.5S_2 + 1.0W_2$
k. $1.2D_1 + 1.0L_f + 0.5S_2 + 1.0W_3$
l. $1.2D_1 + 1.0L_f + 0.5S_2 + 1.0W_4$

6 a. $0.9D_1 + 1.0W_1$
b. $0.9D_1 + 1.0W_2$
c. $0.9D_1 + 1.0W_3$
d. $0.9D_1 + 1.0W_4$

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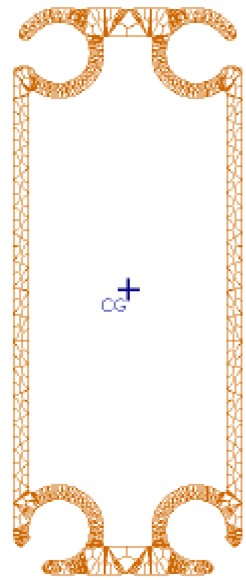
5. Main Profile Design

Section Properties :



$E = 10100 \cdot ksi$ Table 3.3-1

$n_u = 1.95$ Table 3.4-1

$A_g = 1.953 \cdot in^2$ Cross-sectional area of Shape

$b_w = 4.724 \cdot in$ Web length of Shape

$t_w = 0.118 \cdot in$ Web thickness

$b_f = 1.890 \cdot in$ Flat flange

$t_f = 0.236 \cdot in$ Flange thickness

$I_x = 5.65 \cdot in^4$ $I_y = 0.96 \cdot in^4$ Moment of inertia

$S_x = 2.39 \cdot in^3$ $S_y = 1.02 \cdot in^3$ Section Modulus

$r_x = 1.7 \cdot in$ $r_y = 0.70 \cdot in$ Radius of Gyration

$J = 2.83 \cdot in^4$ Torsional constant

$K_x := 1.0$ For strong axis buckling

$L_x = 127.6 \cdot in$ Length between Inflection Points for strong axis buckling

$K_y := 0.7$ For weak axis buckling

$L_y = 127.6 \cdot in$ Length for weak axis buckling

$L_b := L_y$ Length between Bracing Points (compression flange restrained from twisting or moving laterally)

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The following allowable stresses are based on values from the "2005 Aluminum Design Manual"

Allowable Axial Stress:

Specification 3.4.1 - Tension, axial:
Any tension member.

$F_{3.4.1} = 36.1 \cdot ksi$

Specification 3.4.7 - Compression in Columns:
All columns.

$F_{3.4.7x} = 13.9 \cdot ksi$

$F_{3.4.7y} = 5.7 \cdot ksi$

Specification 3.4.9 - Compression in Column Elements:
Flat elements supported on both edges.

$F_{3.4.9} = 21.25 \cdot ksi$

Allowable Axial Stress:

$F_a = 5.7 \cdot ksi$ Use in Eq. 4.1.1-1

$F_{ao} = 21.25 \cdot ksi$ Use in Eq. 4.1.1-2

$F_{ex} = 13.9 \cdot ksi$ $F_{ey} = 5.7 \cdot ksi$

Allowable Bending Stress:

Specification 3.4.2 - Tension in Beams, extreme fibre, net section:
Flat elements in uniform tension (flanges).

$F_{3.4.2} = 36.1 \cdot ksi$

Specification 3.4.14 - Compression in Beams, gross section.:
Tubular shapes.

$F_{3.4.14} = 29.18 \cdot ksi$

Specification 3.4.16 - Compression in Beams, gross section:
Flat elements supported on both edges.

$F_{3.4.16} = 36.1 \cdot ksi$

Specification 3.4.19 - Compression in Beams, elements:
Flat elements supported on both edges with longitudinal stiffening.

$F_{3.4.19} = 46.93 \cdot ksi$

Allowable Bending Stress:

$F_{bx} = 29.18 \cdot ksi$ Use in Eq. 4.1.1-1

$F_{by} = 29.18 \cdot ksi$ & Eq. 4.1.1-2

Allowable Shear Stress:

Specification 3.4.20 - Shear in Elements, gross section:
Unstiffened flat elements supported on both edges.

$F_{3.4.20} = 18.86 \cdot ksi$

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Actual Stress:

Member ID = "ms112"

Load Case = "1b - 1.4D1 + 1.4D2 Second Order"

Cmx := 0.85 Cmy := 0.85

$M_x = -67.28 \cdot kip \cdot in$ $M_y = 0 \cdot kip \cdot in$ $C = -1.07 \cdot kip$

$f_{bx} := \left|\frac{M_x}{S_x}\right|$ $f_{by} := \frac{M_y}{S_y}$ $f_{ac} := \left|\frac{C}{A_g}\right|$

$f_{bx} = 28.1 \cdot ksi$ $f_{by} = 0.0 \cdot ksi$ $f_{ac} = 0.5 \cdot ksi$

Eq. 4.1.1-1 :

$$Eq1 := \frac{f_{ac}}{F_a} + \frac{Cmx \cdot f_{bx}}{\left(1 - \frac{f_{ac}}{F_{ex}}\right) \cdot F_{bx}} + \frac{Cmy \cdot f_{by}}{\left(1 - \frac{f_{ac}}{F_{ey}}\right) \cdot F_{by}} = 0.95$$

Eq1 is less than or equal to 1.0 = "OK"

Eq. 4.1.1-2 :

$$Eq2 := \frac{f_{ac}}{F_{ao}} + \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}} = 0.99$$

Eq2 is less than or equal to 1.0 = "OK"

Member ID = "ms102"

Load Case = "6a - 0.9D1 + 1.0W1 Second Order"

$M_x = 65.38 \cdot kip \cdot in$ $M_y = 0 \cdot kip \cdot in$ $T = 1.29 \cdot kip$

$f_{bx} := \frac{M_x}{S_x}$ $f_{by} := \frac{M_y}{S_y}$ $f_{at} := \frac{T}{A_g}$

$f_{bx} = 27.3 \cdot ksi$ $f_{by} = 0 \cdot ksi$ $f_{at} = 0.7 \cdot ksi$

Eq. 4.1.2-1 :

$$Eq3 := \frac{f_{at}}{F_{3.4.1}} + \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}} = 0.95$$

Eq3 is less than or equal to 1.0 = "OK"

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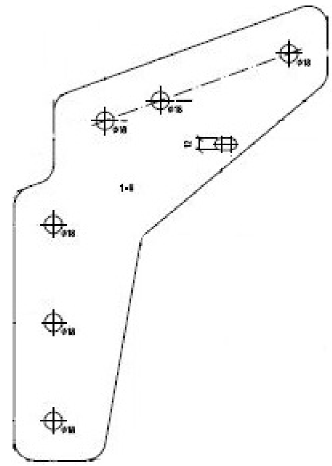
6. Splice Design

Eave Splice Design :

Section Properties :



Splice Section

Number of splice plates : $n = 2$

Web length of Shape $b_w = 4.252 \cdot in$

Web thickness $t_w = 0.315 \cdot in$

Cross-sectional area $A_g = 2.678 \cdot in^2$

Plastic Modulus about strong axis $Z_x = 2.85 \cdot in^3$

Section Modulus about strong axis $S_x = 1.9 \cdot in^3$

Compressive Strength :

Flexural Buckling :

$$F_{cr} := \left(0.658^{\frac{F_{y_{S355}}}{E_{stl}}}\right) \cdot F_{y_{S355}} = 51.45 \cdot ksi$$

$$P_{n1} := F_{cr} \cdot A_g = 137804 \cdot lbf$$

Allowable :

$$P_{allowable} := \phi_c \cdot P_{n1} = 117134 \cdot lbf$$

Flexural Strength :

Yielding :

$$M_{n1} := \min\left(F_{y_{S355}} \cdot Z_x, 1.6 \cdot F_{y_{S355}} \cdot S_x\right) = 146.59 \cdot kip \cdot in$$

Lateral-Torsional Buckling :

$L_b = 120 \cdot mm$ $\quad C_b := 1$

$$F_{cr} := \frac{1.9 \cdot E_{stl} \cdot C_b}{\frac{L_b \cdot b_w}{t_w^2}} = 272.1 \cdot ksi \qquad ratio := \frac{L_b \cdot b_w}{t_w^2} = 202.5$$

$$M_{n2} := if\left[ratio > \frac{1.9 \cdot E_{stl}}{F_{y_{S355}}}, F_{cr} \cdot S_x, C_b \cdot \left[1.52 - 0.274 \cdot (ratio) \cdot \frac{F_{y_{S355}}}{E_{stl}}\right] \cdot F_{y_{S355}} \cdot S_x\right] = 138.92 \cdot kip \cdot in$$

Allowable :

$$M_{allowable} := \phi_b \cdot \min\left(M_{n1}, M_{n2}\right) = 118.08 \cdot kip \cdot in$$

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Stresses in Splice :

The connection splice is considered to carry the entire moment where the roof and column profiles meet.

Member ID = "mr103" $\quad Mx = 72.7 \cdot kip \cdot in \quad V = 0.59 \cdot kip \quad C = 1.3 \cdot kip$

Load Case = "6a - 0.9D1 + 1.0W1 Second Order"

Stress interaction on the splice : $IE := \frac{|C|}{P_{allowable}} + \frac{|Mx|}{M_{allowable}} = 0.63$

IE is less than or equal to 1.0 = "OK"

Bolts : M20

Bolt Area : $A_{M16} = 201 \cdot mm^2 \quad A_{M16} = 0.31 \cdot in^2$

Yield Stress : $Fy_{M16} = 640 \cdot \frac{N}{mm^2} \quad Fy_{M16} = 92.8 \cdot ksi$

Tensile Strength : $Fut_{M16} = 800 \cdot \frac{N}{mm^2}$

$Fut_{M16} = 116 \cdot ksi \quad d1 := \sqrt{(53 \cdot mm)^2 + (106 \cdot mm)^2} \quad d1 = 119 \cdot mm \quad d1 = 4.7 \cdot in$

Allowable Shear Stress in bolt :

$F_v := (0.22) \cdot Fut_{M16} \quad F_v = 176 \cdot \frac{N}{mm^2} \quad F_v = 25.5 \cdot ksi$

Actual Shear Stress in bolt :

Member ID = "mr103"

Load Case = "6a - 0.9D1 + 1.0W1 Second Or $Mx = 72.7 \cdot kip \cdot in \quad V = 0.59 \cdot kip \quad A = 1.3 \cdot kip$

Considering only the 4 bolts in the middle to resist the full moment and forces,
the resulting force on 1 bolt is :

$F_T := \frac{A}{4} = 0.33 \cdot kip \quad F_V := \frac{V}{4} = 0.15 \cdot kip \quad F_{B1} := \frac{Mx \cdot d1}{4 \cdot d1^2} = 3.9 \cdot kip$

$F_{res} := F_{B1} + \sqrt{F_T^2 + F_V^2} \quad F_{res} = 4.3 \cdot kip$

Shear Stress on Bolt taking Double Shear into account :

$f_{res} := \frac{F_{res}}{(2) \cdot A_{M16}} \quad f_{res} = 6.82 \cdot ksi$

f_{res} is less than or equal to F_v = "OK"

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Bearing on Splice and Profile from the Bolts :

Splice :

Wall thickness : $t_{splice} = 8 \cdot mm$

Diameter in Splice : $d_{splice} = 18 \cdot mm$

Allowable Bearing Pressure : $F_p := 1.2 \cdot F_{tu_{alu}}$ $F_p = 54 \cdot ksi$

Actual Bearing Pressure : $f_p := \dfrac{F_{res}}{(2) \cdot d_{splice} \cdot t_{splice}}$ $f_p = 9.53 \cdot ksi$

f_p is less than or equal to F_p = "OK"

Profile :

Wall thickness : $t_{w1} = 4 \cdot mm$

Diameter in Profile : $d_{profile} = 22 \cdot mm$

Allowable Bearing Pressure : $F_p := 1.2 \cdot F_{tu_{alu}}$

Actual Bearing Pressure : $f_p := \dfrac{F_{res}}{(2) \cdot d_{profile} \cdot t_{w1}}$ $f_p = 15.59 \cdot ksi$

f_p is less than or equal to F_p = "OK"

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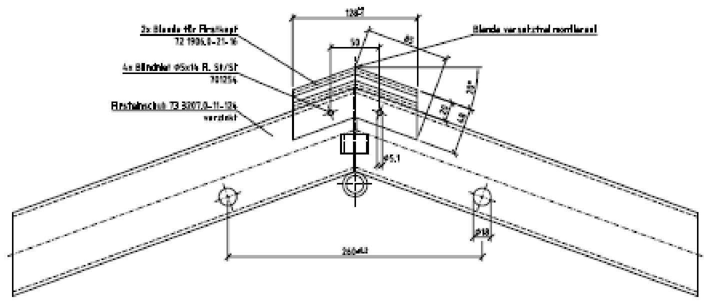
Peak Splice Design :

Section Properties :

$E_{alu} = 10100 \cdot ksi$ Table 3.3-1



	Main Section	Splice Section
Cross-sectional area	$A_{g1} = 1.953 \cdot in^2$	$A_{g2} = 1.648 \cdot in^2$
Moment of inertia about strong axis	$I_{x1} = 5.65 \cdot in^4$	$I_{x2} = 2 \cdot in^4$
Moment of inertia about weak axis	$I_{y1} = 0.96 \cdot in^4$	$I_{y2} = 0.6 \cdot in^4$
Section Modulus about strong axis	$S_{x1} = 2.39 \cdot in^3$	$S_{x2} = 1.27 \cdot in^3$
Section Modulus about weak axis	$S_{y1} = 1.02 \cdot in^3$	$S_{y2} = 0.76 \cdot in^3$
Radius of Gyration abt stong axis	$r_{x1} = 1.7 \cdot in$	$r_{x2} = 1.1 \cdot in$
Radius of Gyration abt weak axis	$r_{y1} = 0.70 \cdot in$	$r_{y2} = 0.62 \cdot in$

Stresses in Splice :

The connection splice is considered to carry the entire moment where the main profiles meet.

Member ID = "mr109" $Mx = 24.04 \cdot kip \cdot in$ $V = 0.11 \cdot kip$ $C = -0.76 \cdot kip$

Load Case = "1b - 1.4D1 + 1.4D2 Second Order"

Stress on the connection splice : $\sigma := \frac{|C|}{A_{g2}} + \frac{|V|}{A_{g2}} + \frac{|Mx|}{S_{x2}}$ $\sigma = 19.5 \cdot ksi$ OK by inspection

Member ID = "mr109" $Mx = 26.02 \cdot kip \cdot in$ $V = -0.27 \cdot kip$ $T = 0.89 \cdot kip$

Load Case = "4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3 Second Order"

Stress at the connection splice : $\sigma := \frac{T}{A_{g2}} + \frac{|V|}{A_{g2}} + \frac{|Mx|}{S_{x1}}$ $\sigma = 11.6 \cdot ksi$ OK by inspection

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Bolts : M16

Bolt Area : $A_{M16} = 0.31 \cdot in^2$

Yield Stress : $Fy_{M16} = 92.8 \cdot ksi$

Tensile Strength : $Fut_{M16} = 116 \cdot ksi$

$d1 := 240mm$

Allowable Shear Stress in bolt :

$F_v := (0.22) \cdot Fut_{M16}$ $\quad F_v = 176 \cdot \frac{N}{mm^2}$ $\quad F_v = 25.5 \cdot ksi$

Actual Shear Stress in bolt :

Member ID = "mr109"

Load Case = "4g - 1.2D1 + 1.2D2 + Lf + 0.5I Mx = 26.02·kip·in Order" $\quad V = 0.27 \cdot kip$ $\quad A = 0.89 \cdot kip$

Considering only the 1 bolt on either side of splice resist the full forces, the resulting force on 1 bolt is :

$F_T := A$ $\quad F_T = 0.89 \cdot kip$

$F_V := V$ $\quad F_V = 0.27 \cdot kip$

$F_{B1} := \frac{Mx \cdot d1}{d1^2}$ $\quad F_{B1} = 5.1 \cdot kip$

$F_{res} := F_{B1} + \sqrt{F_T^2 + F_V^2}$ $\quad F_{res} = 6 \cdot kip$

Shear Stress on Bolt taking Double Shear into account :

$f_{res} := \frac{F_{res}}{(2) \cdot A_{M16}}$ $\quad f_{res} = 9.64 \cdot ksi$

f_{res} is less than or equal to F_v = "OK"

Bearing on Splice and Profile from the Bolts :

The splice fits the profile so that the splice will bear on the profile before the bolts will bear on the bolt holes, therefore the bearing is okay by inspection.

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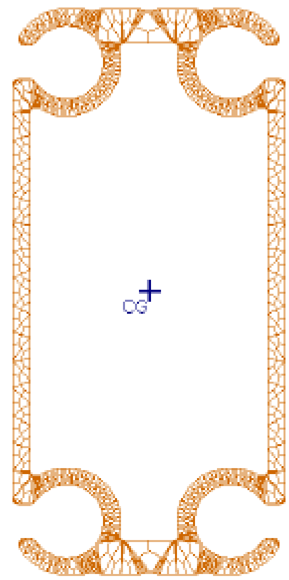
7. Gable End Upright Design

Gable Uprights :

The uprights are connected to the gable end arch by means of a hinge. They are also connected to the upright baseplate by means of a hinge.



$E = 10100 \cdot ksi$ — Table 3.3-1

$n_u = 1.95$ — Table 3.4-1

$A_g = 1.775 \cdot in^2$		Cross-sectional area of Shape
$b_w = 3.937 \cdot in$	$t_w = 0.118 \cdot in$	Web dimensions
$b_f = 1.890 \cdot in$	$t_f = 0.236 \cdot in$	Flange dimensions
$I_x = 3.58 \cdot in^4$	$I_y = 0.79 \cdot in^4$	Moment of inertia
$S_x = 1.82 \cdot in^3$	$S_y = 0.84 \cdot in^3$	Section Modulus
$r_x = 1.42 \cdot in$	$r_y = 0.67 \cdot in$	Radius of Gyration
$J = 1.41 \cdot in^4$		Torsional constant
$K_x := 1.0$	$K_y := 0.7$	Factor for buckling
$L_x = 177.29 \cdot in$	$L_y = 97.83 \cdot in$	Length for buckling
$L_b = 97.83 \cdot in$		Length restrained from twisting or moving laterally

The following allowable stresses are based on values from the "2005 Aluminum Design Manual"

Allowable Bending Stress:

<u>Specification 3.4.2 - Tension in Beams, extreme fibre, net section</u>:
Flat elements in uniform tension (flanges). $F_{3.4.2} = 36.1 \cdot ksi$

<u>Specification 3.4.14 - Compression in Beams, gross section.</u>:
Tubular shapes. $F_{3.4.14} = 29.52 \cdot ksi$

<u>Specification 3.4.16 - Compression in Beams, gross section</u>:
Flat elements supported on both edges. $F_{3.4.16} = 36.1 \cdot ksi$

<u>Specification 3.4.19 - Compression in Beams, elements</u>:
Flat elements supported on both edges with longitudinal stiffening. $F_{3.4.19} = 46.93 \cdot ksi$

<u>Allowable Bending Stress</u>:
$F_{bx} = 29.52 \cdot ksi$
$F_{by} = 29.52 \cdot ksi$
Use in Eq. 4.1.1-1 & Eq. 4.1.1-2

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Actual Stress:

Upright #1 :

Gable Length : $L = 3.41\ m$ $L = 11.2 \cdot ft$

Longitudinal Wind Pressure : $q = \begin{pmatrix} 215.83 \\ -174.89 \end{pmatrix} Pa$ $q = \begin{pmatrix} 4.51 \\ -3.65 \end{pmatrix} \cdot psf$

Width of loaded area: $W = 3.02\ m$ $W = 9.9 \cdot ft$

Uniform Load on Gable : $Q := q \cdot W$ $Q = \begin{pmatrix} 44.6 \\ -36.2 \end{pmatrix} \cdot plf$

Moment on Gable : $M_j := \frac{\left|Q_j\right| \cdot L^2}{8}$ $M = \begin{pmatrix} 8.4 \\ 6.8 \end{pmatrix} \cdot kip \cdot in$

Bending Stress on Gable : $\sigma := \frac{M}{S_x}$ $\sigma = \begin{pmatrix} 4.6 \\ 3.7 \end{pmatrix} \cdot ksi$

σ_j is less than or equal to $F_{bx} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

Upright #2 :

Gable Length : $L = 4.5\ m$ $L = 14.8 \cdot ft$

Longitudinal Wind Pressure : $q = \begin{pmatrix} 215.83 \\ -174.89 \end{pmatrix} Pa$ $q = \begin{pmatrix} 4.51 \\ -3.65 \end{pmatrix} \cdot psf$

Width of loaded area: $W = 3\ m$ $W = 9.84 \cdot ft$

Uniform Load on Gable : $Q := q \cdot W$ $Q = \begin{pmatrix} 44.4 \\ -36 \end{pmatrix} \cdot plf$

Moment on Gable : $M_j := \frac{\left|Q_j\right| \cdot L^2}{8}$ $M = \begin{pmatrix} 14.5 \\ 11.8 \end{pmatrix} \cdot kip \cdot in$

Bending Stress on Gable : $\sigma := \frac{M}{S_x}$ $\sigma = \begin{pmatrix} 8 \\ 6.5 \end{pmatrix} \cdot ksi$

σ_j is less than or equal to $F_{bx} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \end{pmatrix}$

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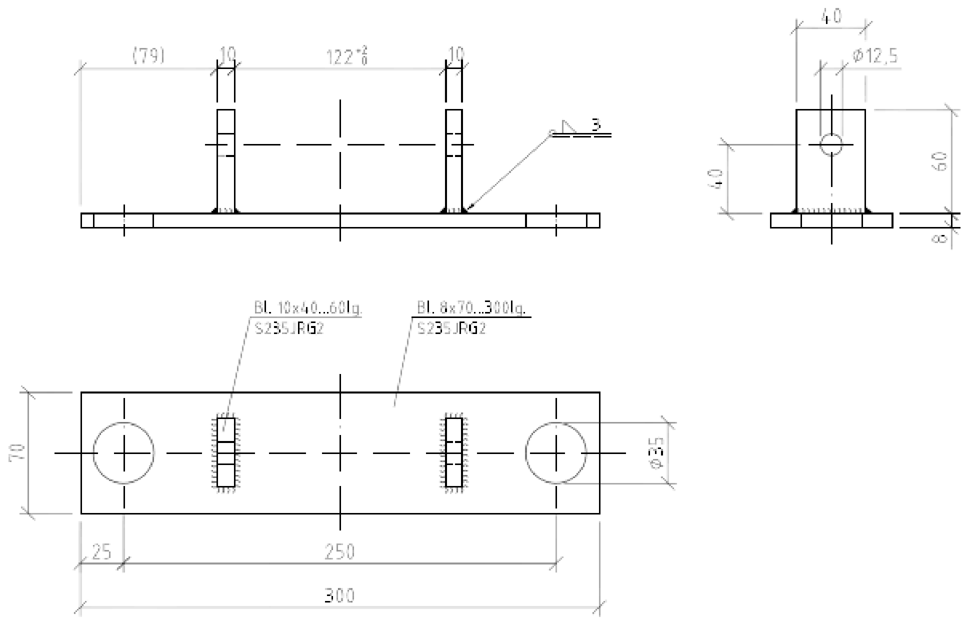
8. Base plate Design



Material : S235	$Fy_{AE235} = 34.08 \cdot ksi$	$Fut_{AE235} = 49.31 \cdot ksi$	$E_{AE235} = 30457.92 \cdot ksi$
Vertical Plates :	$b_v = 40 \cdot mm$	$t_v = 10 \cdot mm$	$d_v = 60 \cdot mm$
Base Plate :	$b_b = 70 \cdot mm$	$t_b = 8 \cdot mm$	$d_b = 300 \cdot mm$
Base Plate to Bolt :	$d_B = 48 \cdot mm$		

Vertical plates :

Section Properties (single vertical plate) :

$$A_v := b_v \cdot t_v = 0.62 \cdot in^2 \qquad S_{vx} := \frac{t_v \cdot b_v^{\,2}}{6} = 0.16 \cdot in^3 \qquad S_{vy} := \frac{b_v \cdot t_v^{\,2}}{6} = 0.04 \cdot in^3$$

Allowable Stress :

$$\sigma_{allowable} := (0.6) \cdot Fy_{AE235} = 20.45 \cdot ksi$$

Actual Stress :

Moment arm above Section : $d_B = 1.89 \cdot in$

$LoadCase_0$ = "1b - 1.4D1 + 1.4D2 Second Order" $H_0 = 0.76 \cdot kip$ $V_0 = 1.32 \cdot kip$

$$\sigma := \left| \frac{V_0}{2 \cdot A_v} + \frac{0.5 \cdot H_0 \cdot d_B}{2 \cdot S_{vy}} \right| = 9.84 \cdot ksi$$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

$LoadCase_1$ = "1b - 1.4D1 + 1.4D2 Second Order" $H_1 = -0.76 \cdot kip$ $V_1 = 1.32 \cdot kip$

$$\sigma := \left| \frac{V_1}{(2) \cdot A_v} - \frac{0.5 \cdot H_1 \cdot d_B}{2 \cdot S_{vy}} \right| = 9.84 \cdot ksi$$

σ is less than or equal to $\sigma_{allowable}$ = "OK"

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Bending of Plate :

The Base Plate has the following dimensions.

Length : $L = 250 \cdot mm$ (measured between stake holes)

Width : $W = 70 \cdot mm$

Thickness : $T = 8 \cdot mm$

Surface area : $A := L \cdot W = 27.13 \cdot in^2$

The reaction forces act on a distance "d" above the bottom side of plate: $d = 48 \cdot mm$

$LoadCase_0$ = "1b - 1.4D1 + 1.4D2 Second Order" $H_0 = 0.76 \cdot kip$ $V_0 = 1.32 \cdot kip$

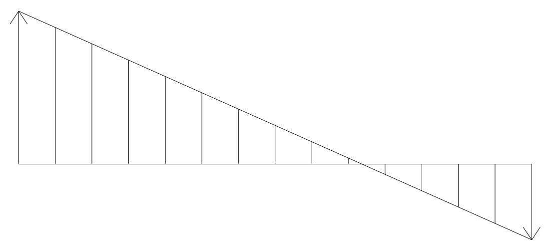
These forces result in the following pressure under the baseplate:

$$f_{max} := \frac{V_0}{A} + \frac{H_0 \cdot d \cdot (6)}{L \cdot W^2} \qquad f_{max} = 1125.12 \cdot \frac{kN}{m^2}$$

$$f_{max} = 0.163 \cdot ksi$$

$$f_{min} := \frac{V_0}{A} - \frac{H_0 \cdot d \cdot (6)}{L \cdot W^2} \qquad f_{min} = -456.11 \cdot \frac{kN}{m^2}$$

$$f_{min} = -0.066 \cdot ksi$$



Pressure under the BasePlate

The pressure f_A equals: $f_A := f_{max} - \left(\left|f_{max}\right| + \left|f_{min}\right|\right) \cdot \frac{54 \cdot mm}{250 \cdot mm}$ $f_A = 783.6 \cdot \frac{kN}{m^2}$ $f_A = 0.11 \cdot ksi$

The moment resulting from the pressure under the plate equals :

$$M_A := \left(\frac{f_{max} + f_A}{2}\right) \cdot 54mm \cdot \left(\frac{54 \cdot mm}{2} \cdot 250 \cdot mm\right) \qquad M_A = 0.35 \cdot kN \cdot m \qquad M_A = 3.1 \cdot kip \cdot in$$

The actual stress equals : $\sigma_A := \frac{M_A \cdot 6}{L \cdot T^2}$ $\sigma_A = 130.4 \cdot \frac{N}{mm^2}$ $\sigma_A = 18.9 \cdot ksi$

σ_A is less than or equal to $\sigma_{allowable}$ = "OK"

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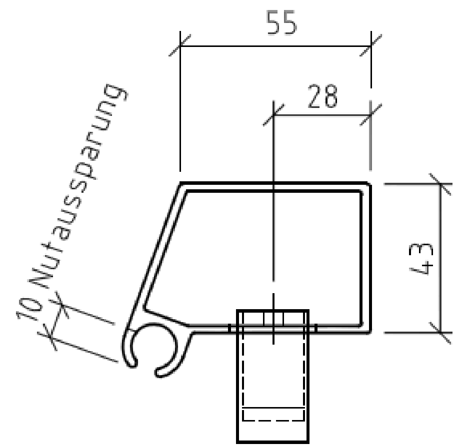
9. Purlin Design

Eave Purlins :



Web of seciton: $b_w = 55 \cdot mm$ $t_w = 2.5 \cdot mm$

Flange of section $b_f = 43 \cdot mm$ $t_f = 2.5 \cdot mm$

Cross-sectional area: $A_g = 0.84 \cdot in^2$

Moment of Inertial: $I_x = 0.35 \cdot in^4$ $I_y = 0.88 \cdot in^4$

Section modulus: $S_x = 0.29 \cdot in^3$ $S_y = 0.51 \cdot in^3$

Radius of gyration: $r_x = 0.65 \cdot in$ $r_y = 1.03 \cdot in$

Slenderness ratio: $K_x = 1.0$ $K_y = 1$

$L = 9.06 \cdot ft$ (unbraced length of purlin)

The following allowable stresses are based on values from the "2005 Aluminum Design Manual"

Allowable Axial Stress :

<u>Specification 3.4.1 - Tension, axial</u>: $F_{3.4.1} = 36.1 \cdot ksi$
Any tension member.

<u>Specification 3.4.7 - Compression in Columns</u>: $F_{3.4.7x} = 3.34 \cdot ksi$
All columns.
$F_{3.4.7y} = 7.75 \cdot ksi$

<u>Specification 3.4.9 - Compression in Column Elements</u>: $F_{3.4.9} = 31.55 \cdot ksi$
Flat elements supported on both edges.

<u>Allowable Axial Stress</u>: $F_a = 3.34 \cdot ksi$ Use in Eq. 4.1.1-1

$F_{ao} = 31.55 \cdot ksi$ Use in Eq. 4.1.1-2

$F_{ex} = 3.34 \cdot ksi$ $F_{ey} = 7.75 \cdot ksi$

Actual Stress:

Maximum Axial Compression Force due to Fabric and/or Wind loading: $P_c = 2615 \cdot lbf$

$f_{ac} := \frac{P_c}{A_g} = 3.12 \cdot ksi$ f_{ac} is less than or equal to F_a = "OK"

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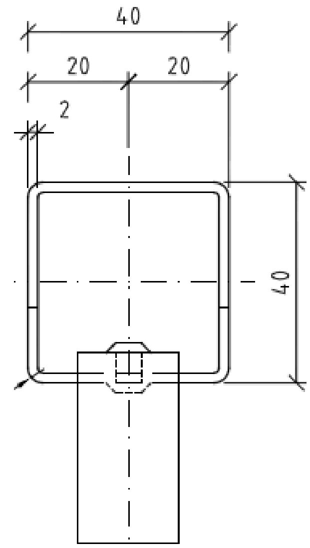
Intermediate Purlin:



Web of seciton: $b_w = 40 \cdot mm$ $t_w = 2 \cdot mm$

Flange of section $b_f = 40 \cdot mm$ $t_f = 2 \cdot mm$

Cross-sectional area: $A_g = 0.45 \cdot in^2$

Moment of Inertial: $I_x = 0.17 \cdot in^4$ $I_y = 0.17 \cdot in^4$

Radius of gyration: $r_x = 0.61 \cdot in$ $r_y = 0.61 \cdot in$

Slenderness ratio: $K_x = 1.0$ $K_y = 1$

$L = 9.06 \cdot ft$ (unbraced length of purlin)

The following allowable stresses are based on values from the "2005 Aluminum Design Manual" For Alloy: 6082-T6

Allowable Axial Stress :

<u>Specification 3.4.1 - Tension, axial</u>: $F_{3.4.1} = 36.1 \cdot ksi$
Any tension member.

<u>Specification 3.4.7 - Compression in Columns</u>: $F_{3.4.7x} = 2.95 \cdot ksi$
All columns. $F_{3.4.7y} = 2.95 \cdot ksi$

<u>Specification 3.4.9 - Compression in Column Elements</u>: $F_{3.4.9} = 32.48 \cdot ksi$
Flat elements supported on both edges.

<u>Allowable Axial Stress</u>: $F_a = 2.95 \cdot ksi$ Use in Eq. 4.1.1-1

$F_{ao} = 32.48 \cdot ksi$ Use in Eq. 4.1.1-2

$F_{ex} = 2.95 \cdot ksi$ $F_{ey} = 2.95 \cdot ksi$

Actual Stress:

Maximum Axial Compression Force due to Fabric and/or Wind loading: $P_c = 1195 \cdot lbf$

$$f_{ac} := \frac{P_c}{A_g} = 2.66 \cdot ksi$$

f_{ac} is less than or equal to F_a = "OK"

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10. Bracing Cable Assemblies

- The bracing cables are constructed of 8mm 6x19 Galvanized steel wire rope.
- The length of the cable is adjusted by means of a ½x12 turnbuckle (Built-in Safety factor of 5.0).

Nominal Strength of Cable : $\text{Cable Capacity} = 7823 \cdot \text{lbf}$

Working Load of Turnbuckle : $\text{Turnbuckle Capacity} = 3979 \cdot \text{lbf}$

Recommended Safety Factor is : $\text{Safety Factor} = 2$

The max force in a single side wall wind brace is $T_{max} = 593 \cdot \text{lbf}$.

$$\text{Bracing Cable} := \text{if}\left[\frac{0.9(\text{Cable Capacity})}{\text{Safety Factor}} > T_{max}, \text{"is OK"}, \text{"is not OK"}\right] \qquad \text{Bracing Cable} = \text{"is OK"}$$

$$\text{Turnbuckle} := \text{if}\left(\text{Turnbuckle Capacity} > T_{max}, \text{"is OK"}, \text{"is not OK"}\right) \qquad \text{Turnbuckle} = \text{"is OK"}$$

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APPENDIX A

FIGURES AND SKETCHES

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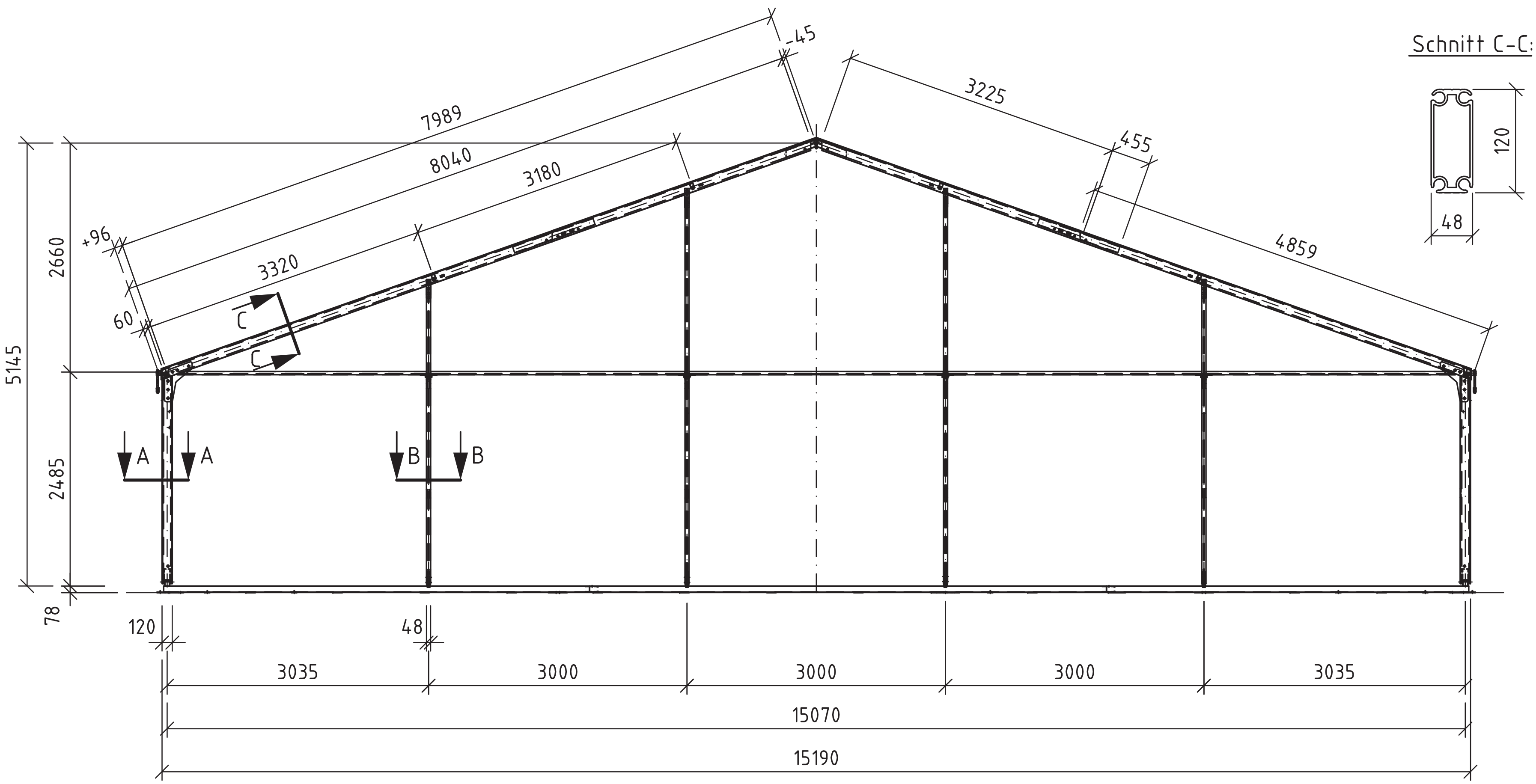
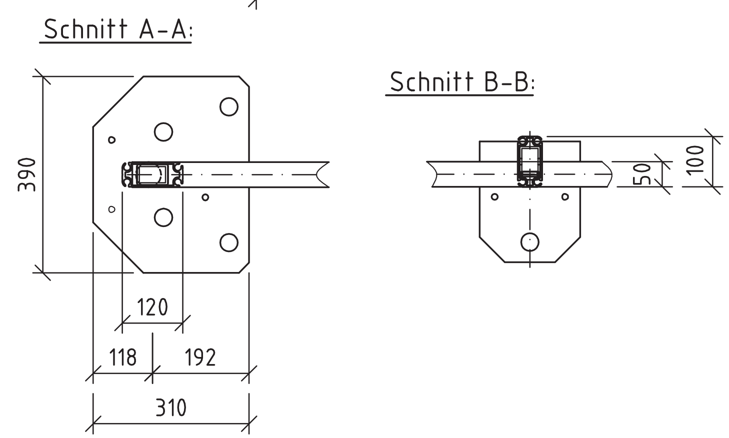




LOSBERGER

Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)

	Datum:	Name:
Bearb.	17.03.10	BKo
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Ersatz für:

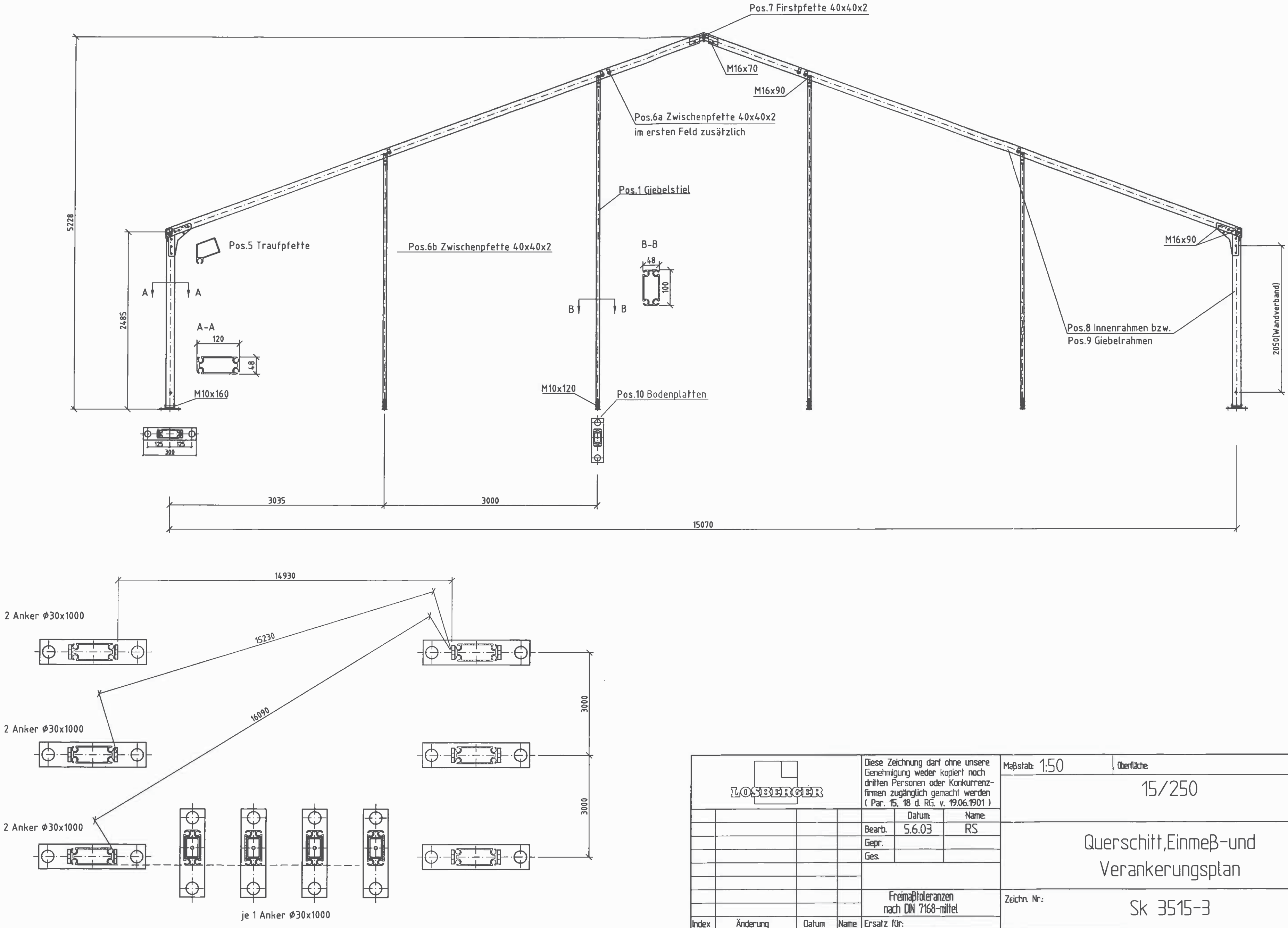
Index	Änderung	Datum	Name

Maßstab: 1:50, 1:10, 1:5 Oberfläche:

multiflex plus P7 15/250

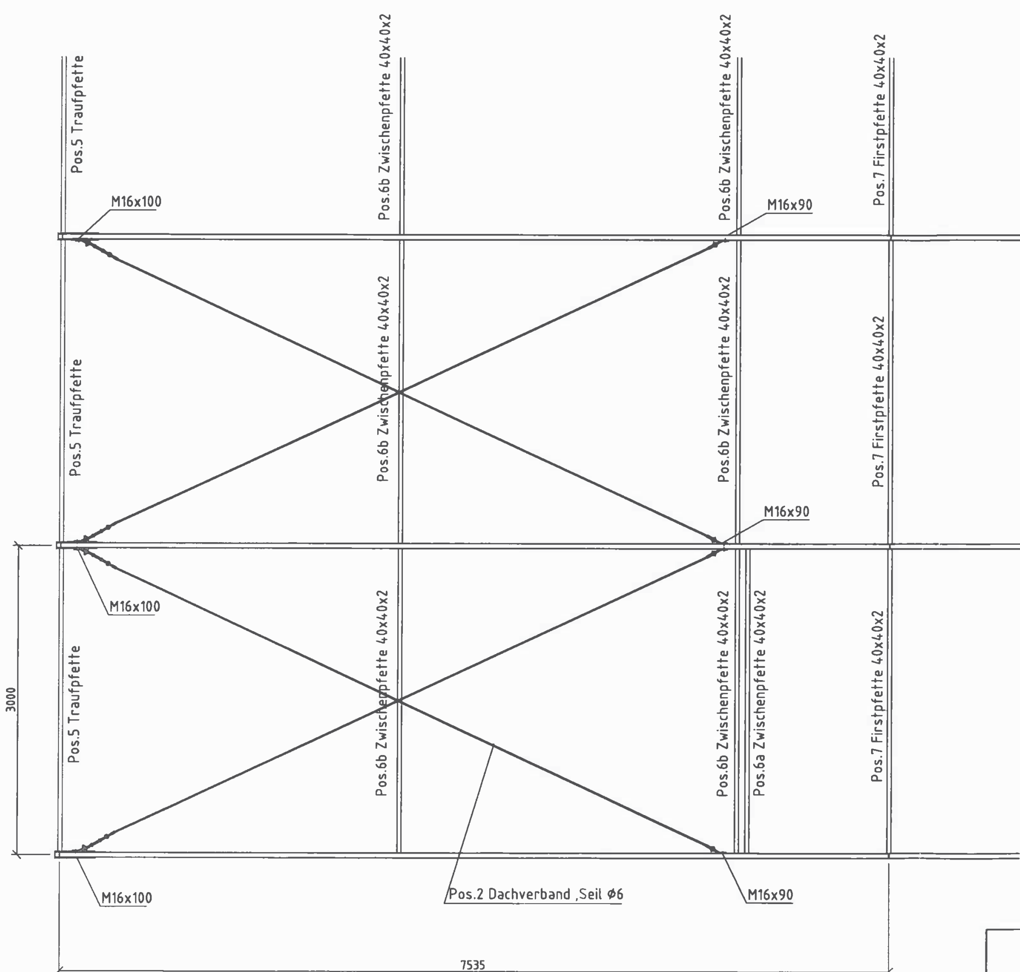
Querschitt Giebel 15/250
mit geteilten Riegeln

Zeichn. Nr.: SK 3630



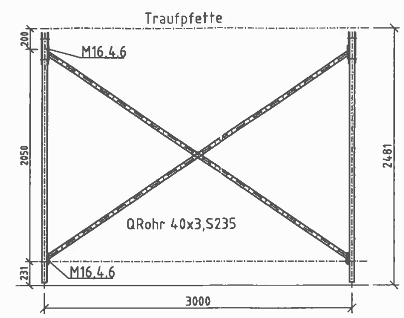
LOSBERGER	Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)	Maßstab: 1:50	Oberfläche: 15/250
	Datum: 5.6.03 / Name: RS		
	Bearb. 5.6.03 RS	Querschitt,Einmeß-und Verankerungsplan	
	Gepr.		
	Ges.		
	Freimaßtoleranzen nach DIN 7168-mittel	Zeichn. Nr.: Sk 3515-3	
Index / Änderung / Datum / Name	Ersatz für:		

Pos.2 Dachverband

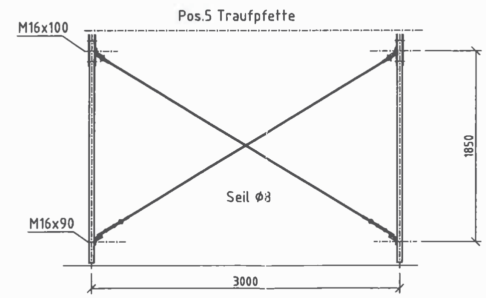


Pos.3 Vertikalverband

Stebenverband bis 2,5m Traufhöhe



Seilverband bis max.2,3m Traufhöhe



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	Datum:	Name:
Bearb.	5.6.03	RS
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Index	Änderung	Datum	Name

Ersatz für:

Maßstab: 1:50

Oberfläche: 15/250

Dach-und Wandverband

Zeichn. Nr.: Sk 3515-4

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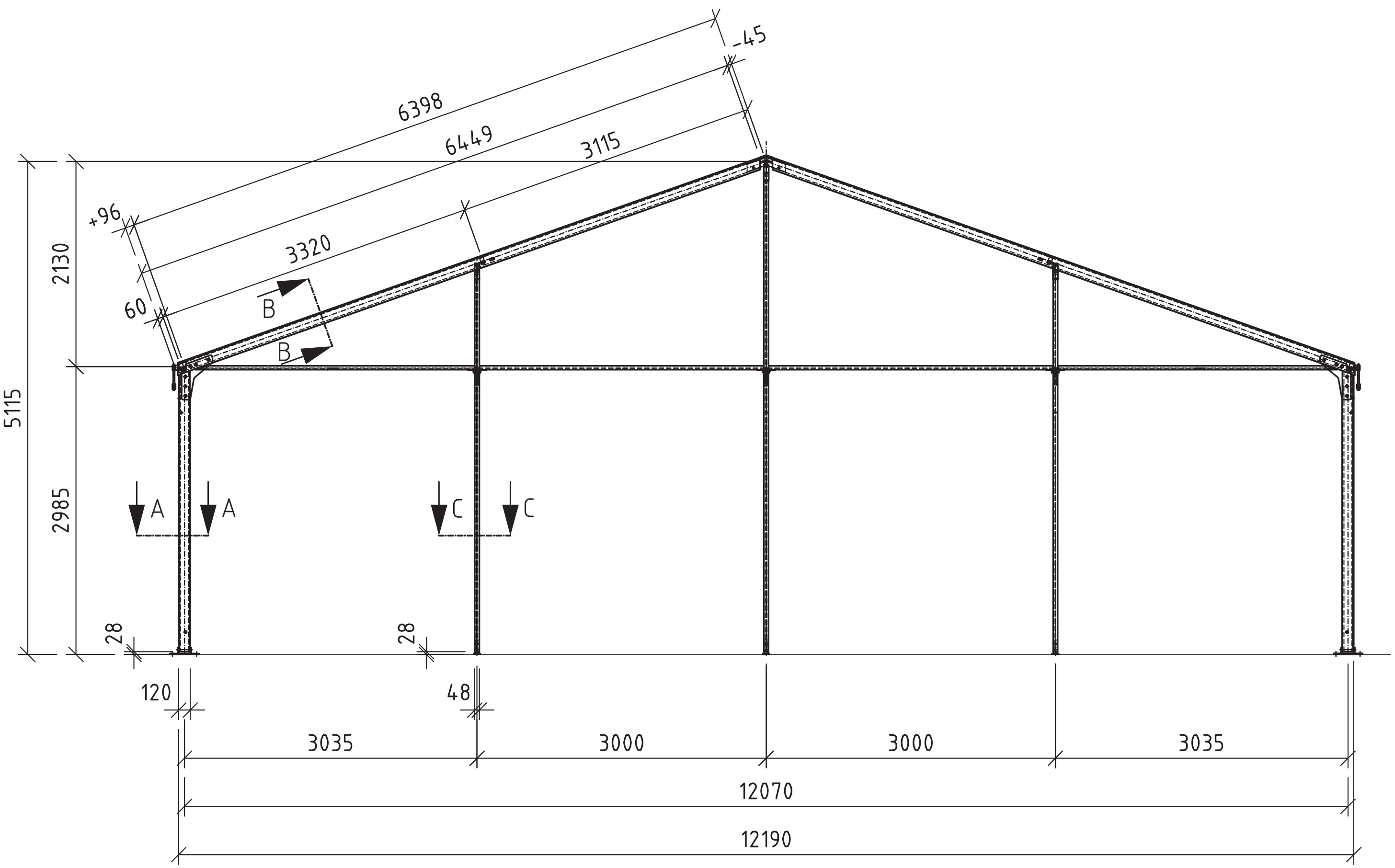
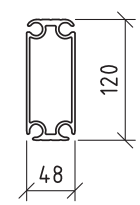
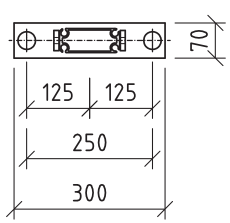


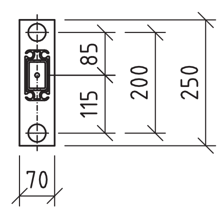
Schnitt B-B:



Schnitt A-A:



Schnitt C-C:



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	Datum:	Name:
Bearb.	01.04.04	BKo
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Index	Änderung	Datum	Name

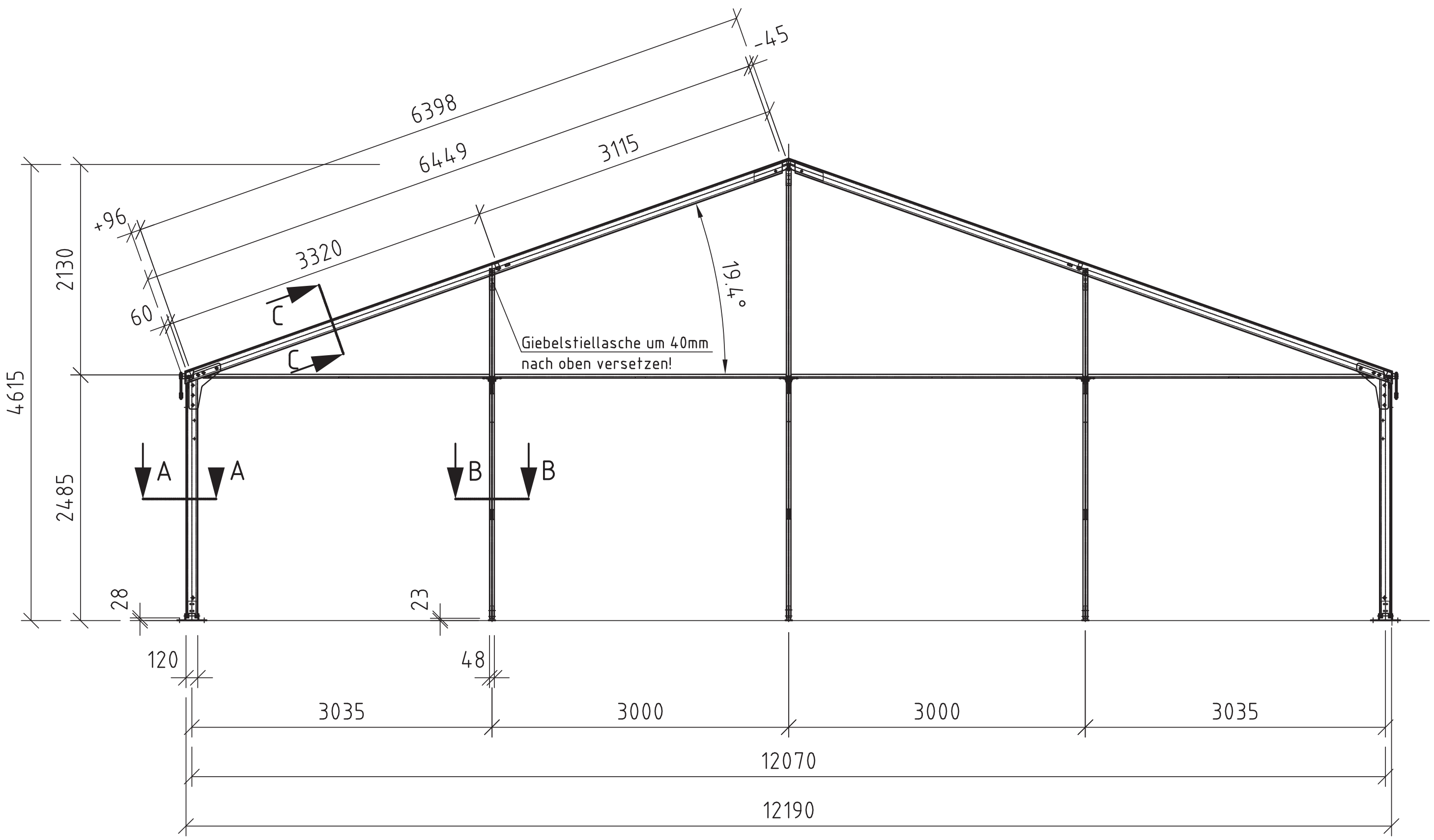
Ersatz für:

Maßstab: 1:50,1:10,1:5 Oberfläche:

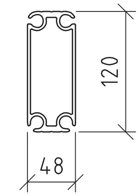
multiflex P7 plus 12/300
Aztec Party & Tent Rentals

Giebelbinder 12/300

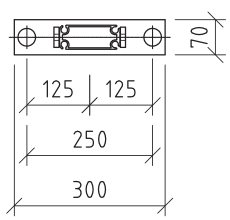
Zeichn. Nr.: SK 3606



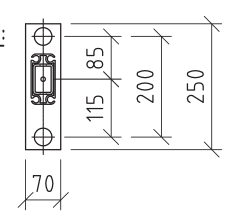
Schnitt C-C:



Schnitt A-A:



Schnitt B-B:



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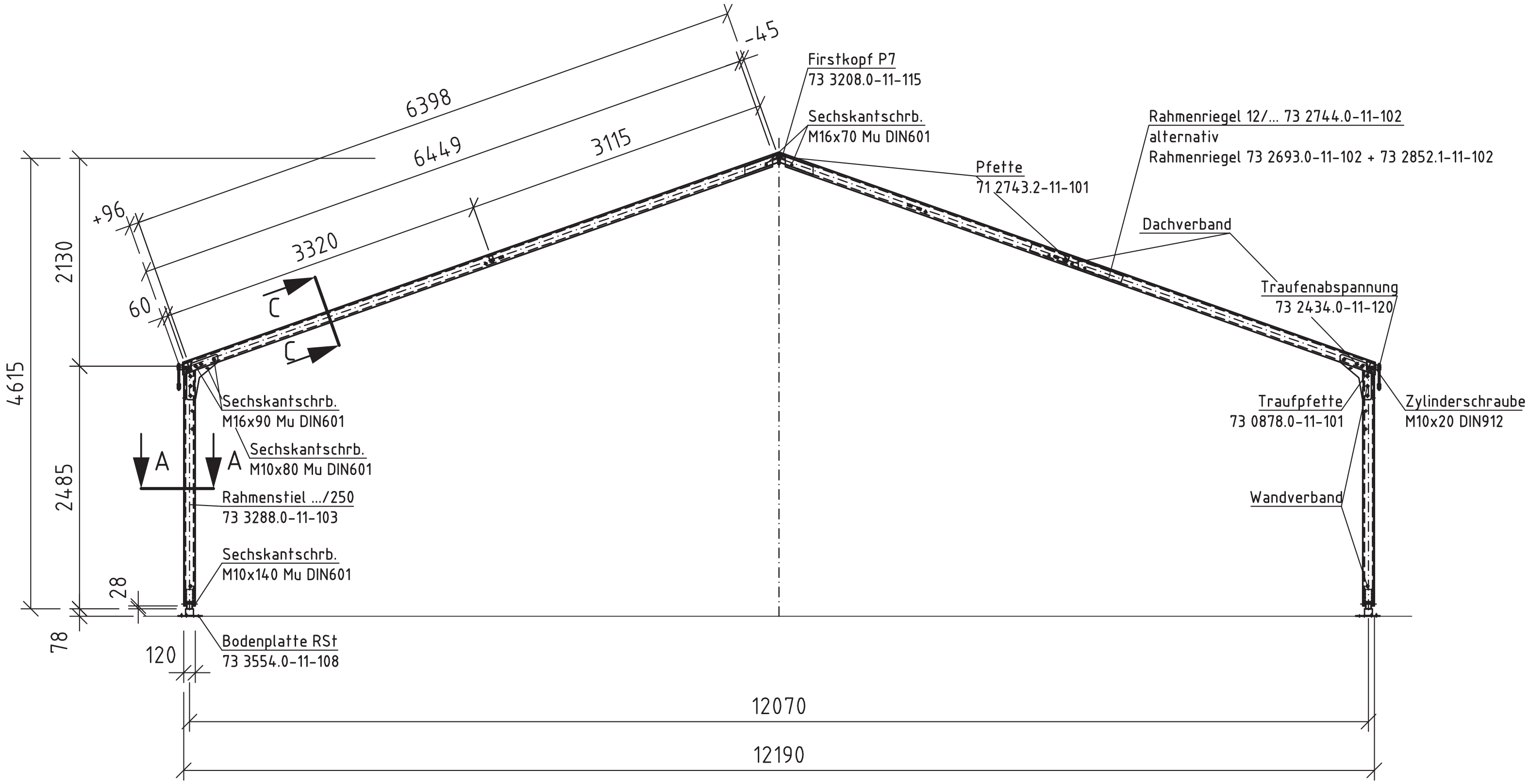
	Datum: 23.05.2003 Name: BKo (Bearb.)	multiflex P7 plus 12/250 System 3035+3000+3000+3035 =12070
	Gepr.	Querschnitt 12/250
	Ges.	
Index / Änderung / Datum / Name	Freimaßtoleranzen nach DIN 7168-mittel Ersatz für:	Zeichn. Nr.: SK 3558



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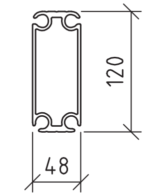
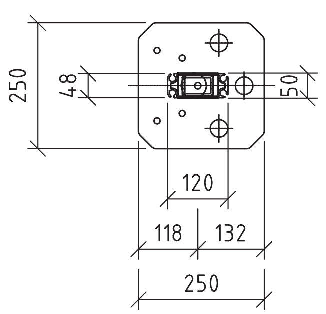
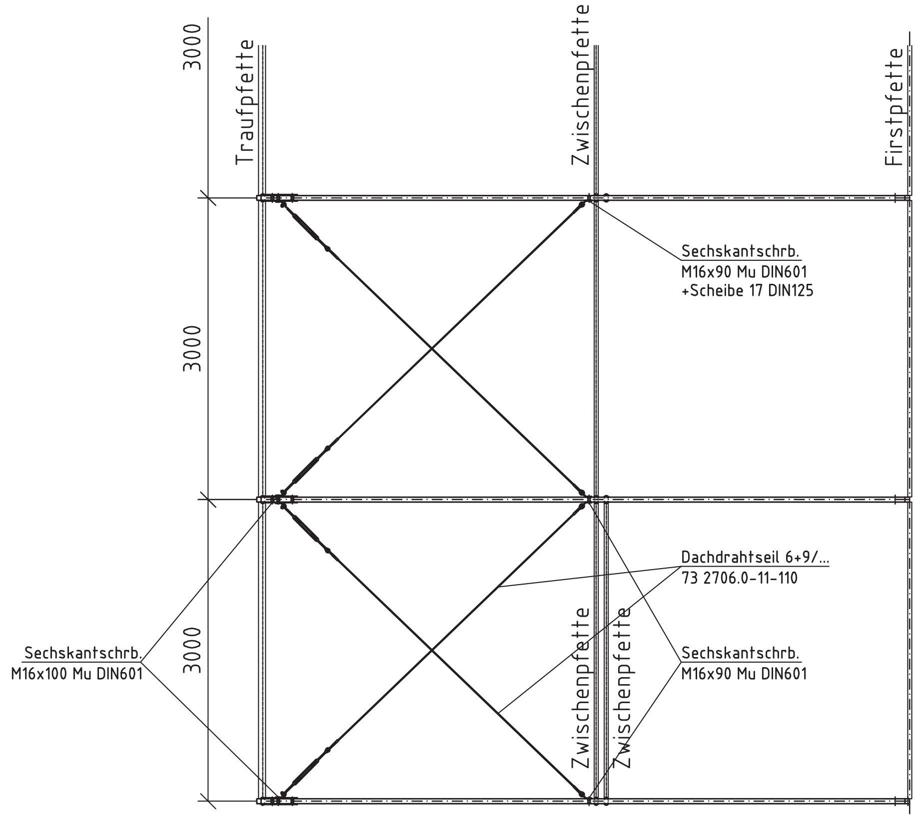


Schnitt A-A:

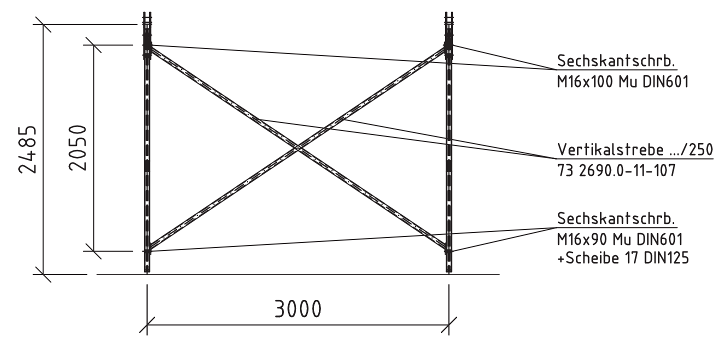


LOSBERGER	Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)			Maßstab: 1:50, 1:10, 1:5 Oberfläche: multiflex plus P7 12/250
		Datum:	Name:	
	Bearb.	08.11.04	BKo	Querschitt Binder 12/250 vorber. für Systemwand
	Gepr.			
	Ges.			
.1 / 30.08.05 / BKo	Freimaßtoleranzen nach DIN 7168-mittel			Zeichn. Nr.: SK 3630.1
Index / Änderung / Datum / Name	Ersatz für:			

Dachverband:



Vertikalverband: Streben



Verteilung der Bodenanker bei Aufstellung ohne Fußboden:

Giebelrahmenstiel	je 2 Anker Ø30x1000
Innenrahmenstiel	je 2 Anker Ø30x1000
Giebelstiel	je 1 Anker Ø30x1000

LOSBERGER

	Datum:	Name:
Bearb.	08.11.04	BKo
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Ersatz für:

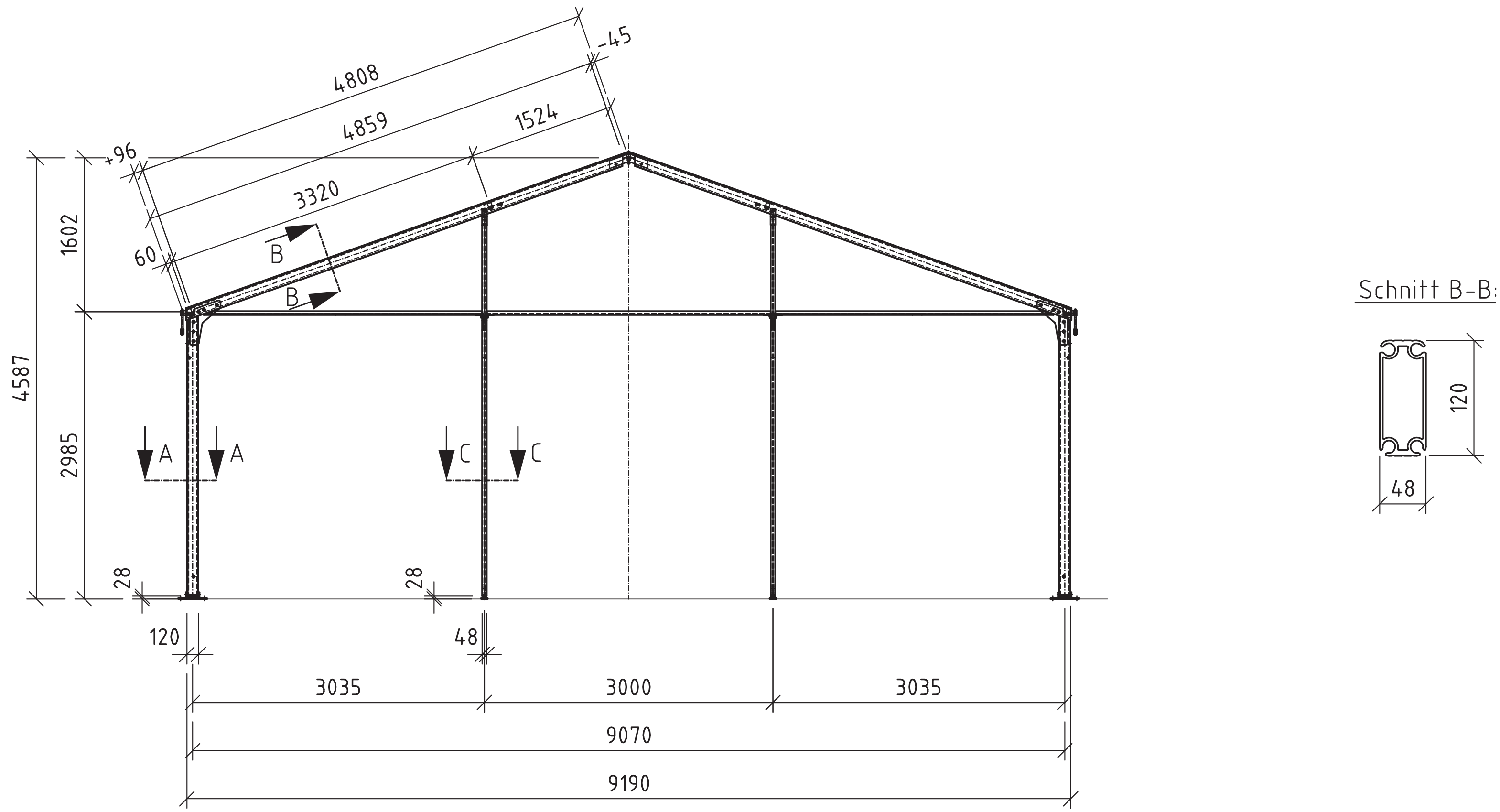
Index	Änderung	Datum	Name

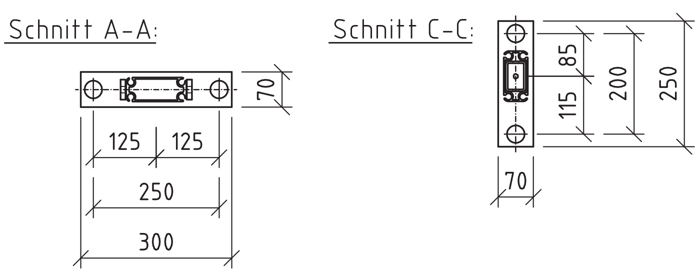
Maßstab: 1:50 Oberfläche:

multiflex P7 12/250

Verbände 12/250

Zeichn. Nr.: SK 3630





LOSBERGER

Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)

	Datum:	Name:
Bearb.	31.03.04	BKo
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Index	Änderung	Datum	Name

Ersatz für:

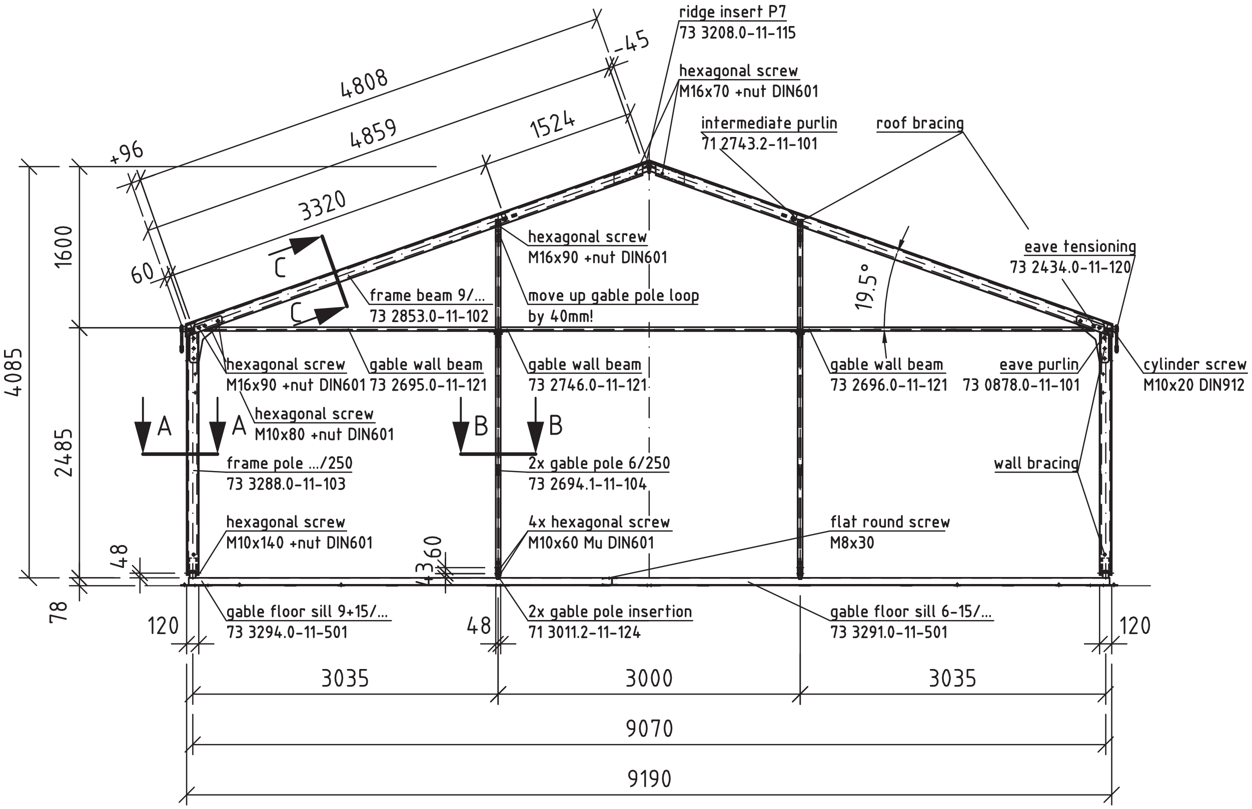
Maßstab: 1:50,1:10,1:5 Oberfläche:

multiflex P7 plus 9/300

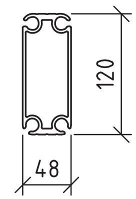
Aztec Party & Tent Rentals

Giebelbinder 9/300

Zeichn. Nr.: SK 3606



Schnitt C-C:



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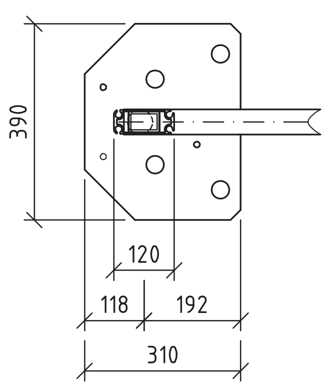
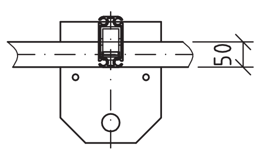


section B-B:



LOSBERGER

Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)

	Datum:	Name:
Bearb.	11.05.09	BKo
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Ersatz für:

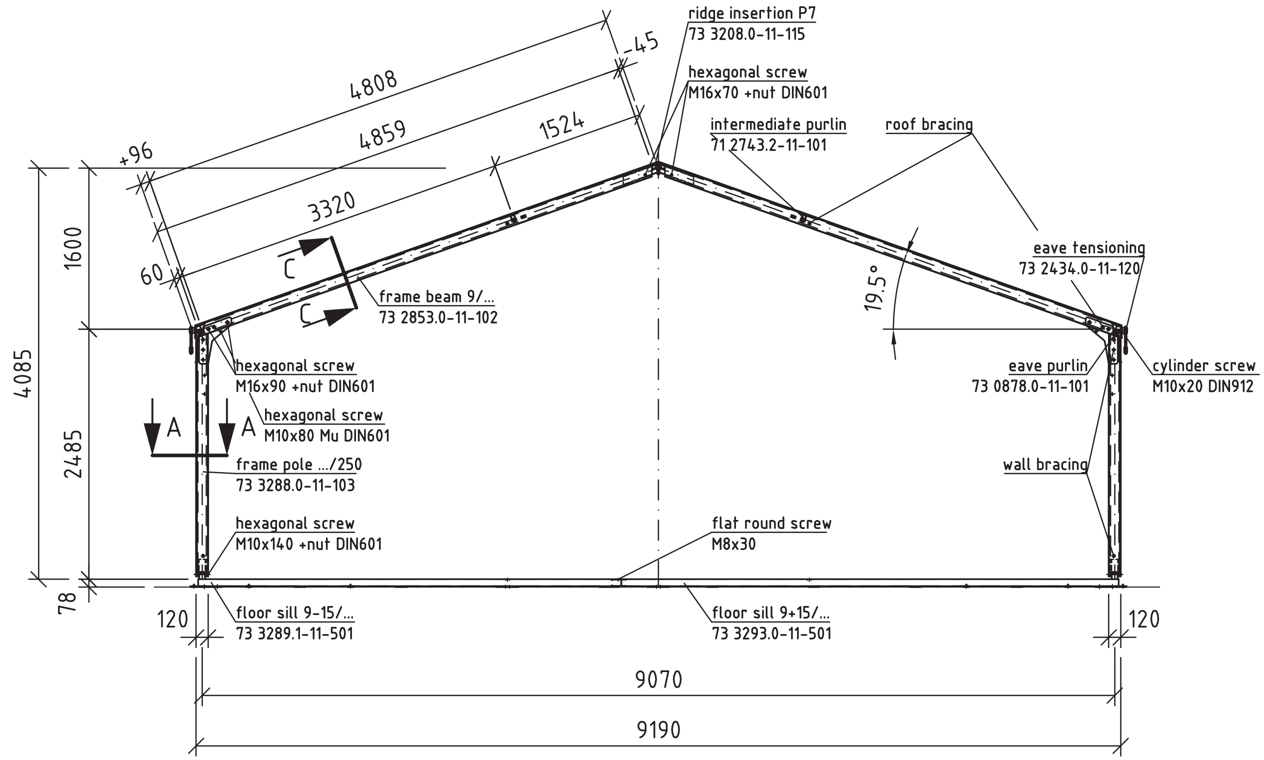
Index	Änderung	Datum	Name

Maßstab: 1:50, 1:10, 1:5 Oberfläche:

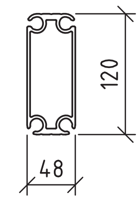
multiflex plus P7 9/250

gable 9/250
mit Fußboden

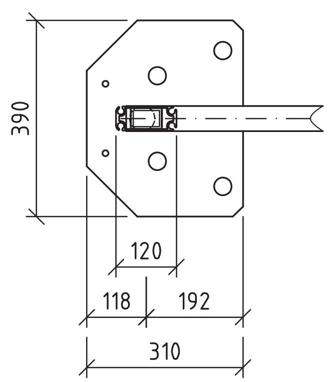
Zeichn. Nr.: SK 3630-E



section C-C:



section A-A:



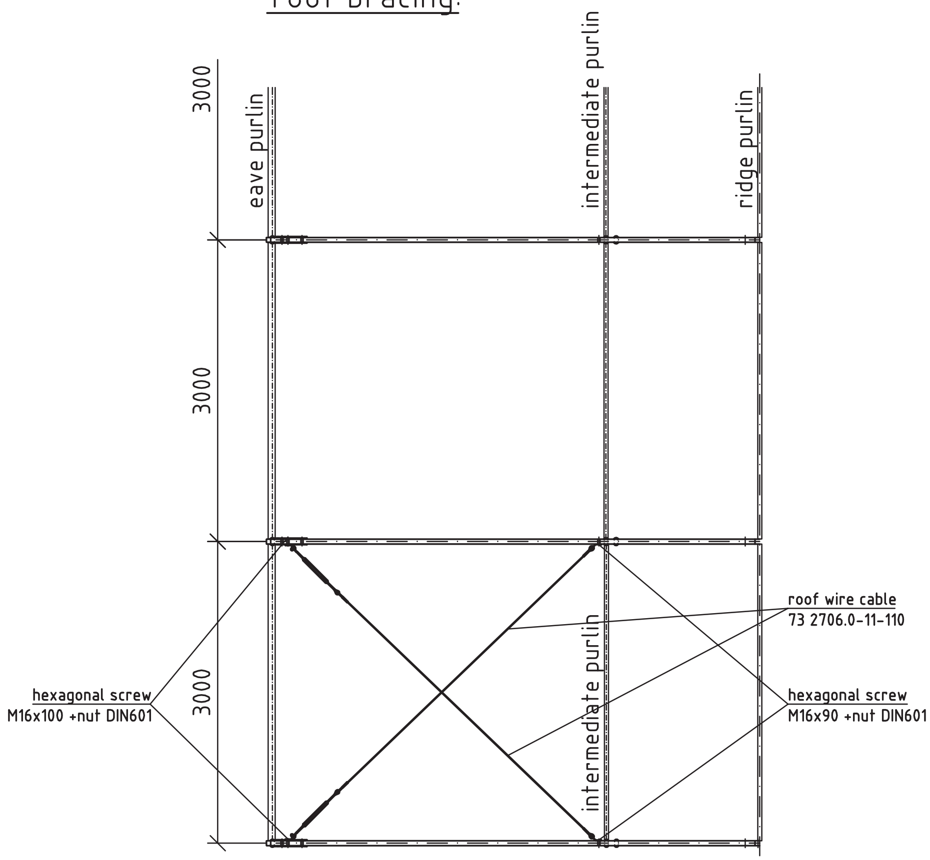
LOSBERGER	Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)
Maßstab:	1:50, 1:10, 1:5
Oberfläche:	
	multiflex plus P7 9/250
	truss 9/250
Zeichn. Nr.:	SK 3630-E

	Datum:	Name:
Bearb.	11.05.09	BKo
Gepr.		
Ges.		

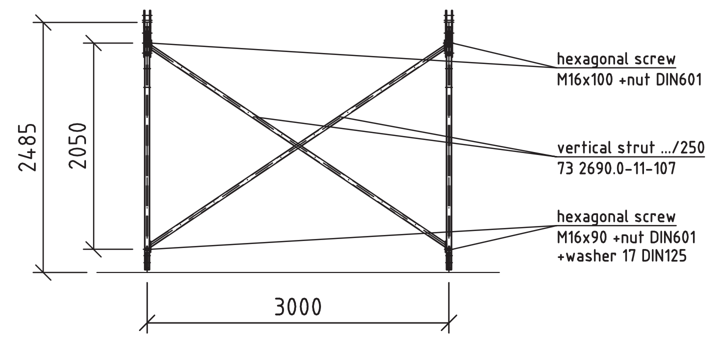
Freimaßtoleranzen nach DIN 7168-mittel

Index	Änderung	Datum	Name	Ersatz für:

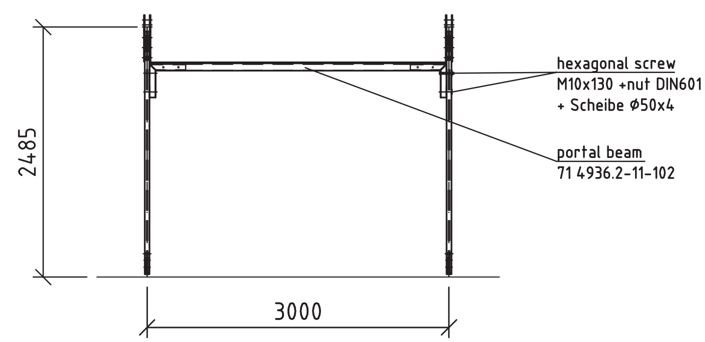
roof bracing:



vertical bracing with strut:



vertical bracing with portal:



anchoring configuration without flooring:

per gable frame pole	1 anchor Ø30x1000
per intermediate frame pole	1 anchor Ø30x1000
per gable pole	1 anchor Ø30x1000

LOSBERGER

	Datum:	Name:
Bearb.	11.05.09	BKo
Gepr.		
Ges.		

Freimaßtoleranzen nach DIN 7168-mittel

Ersatz für:

Index	Änderung	Datum	Name

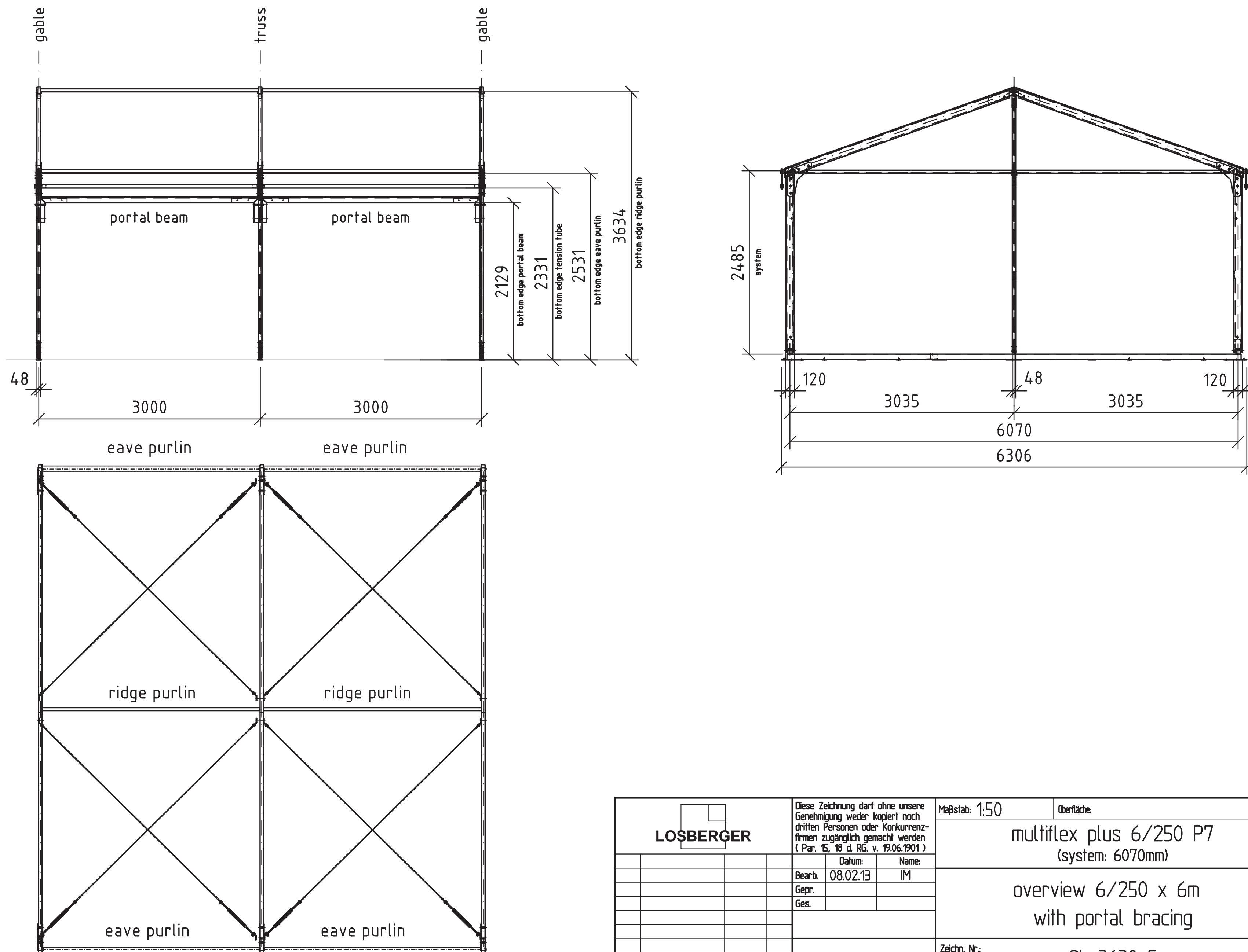
Maßstab: 1:50

Oberfläche:

multiflex P7 9/250

bracing configuration 9/250

Zeichn. Nr.: SK 3630-E



LOSBERGER

Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)

	Datum:	Name:
Bearb.	08.02.13	IM
Gepr.		
Ges.		

Maßstab: 1:50

Oberfläche:

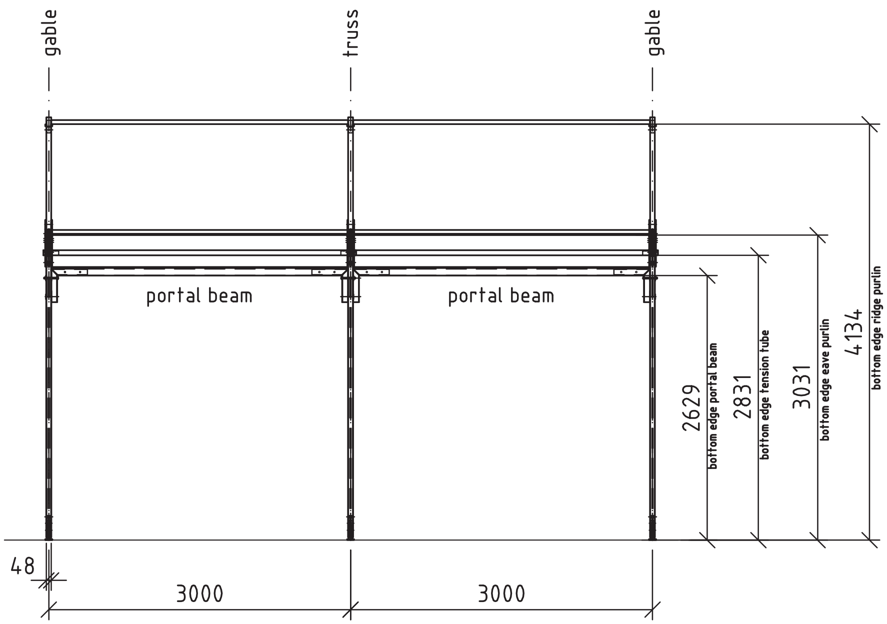
multiflex plus 6/250 P7
(system: 6070mm)

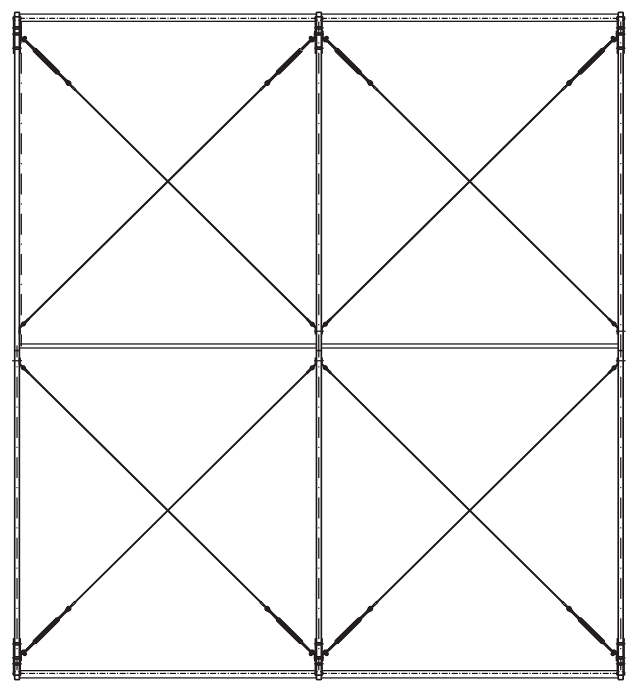
overview 6/250 x 6m
with portal bracing

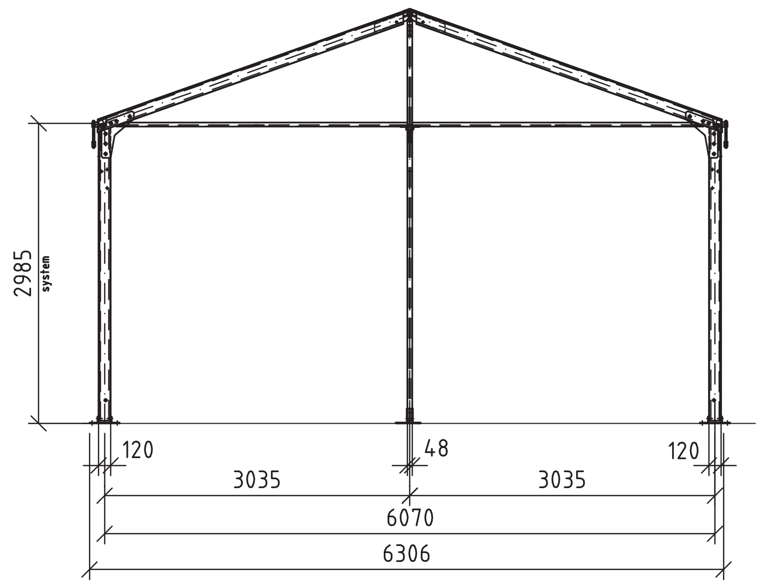
Zeichn. Nr.: Sk 3630-E

Index	Änderung	Datum	Name

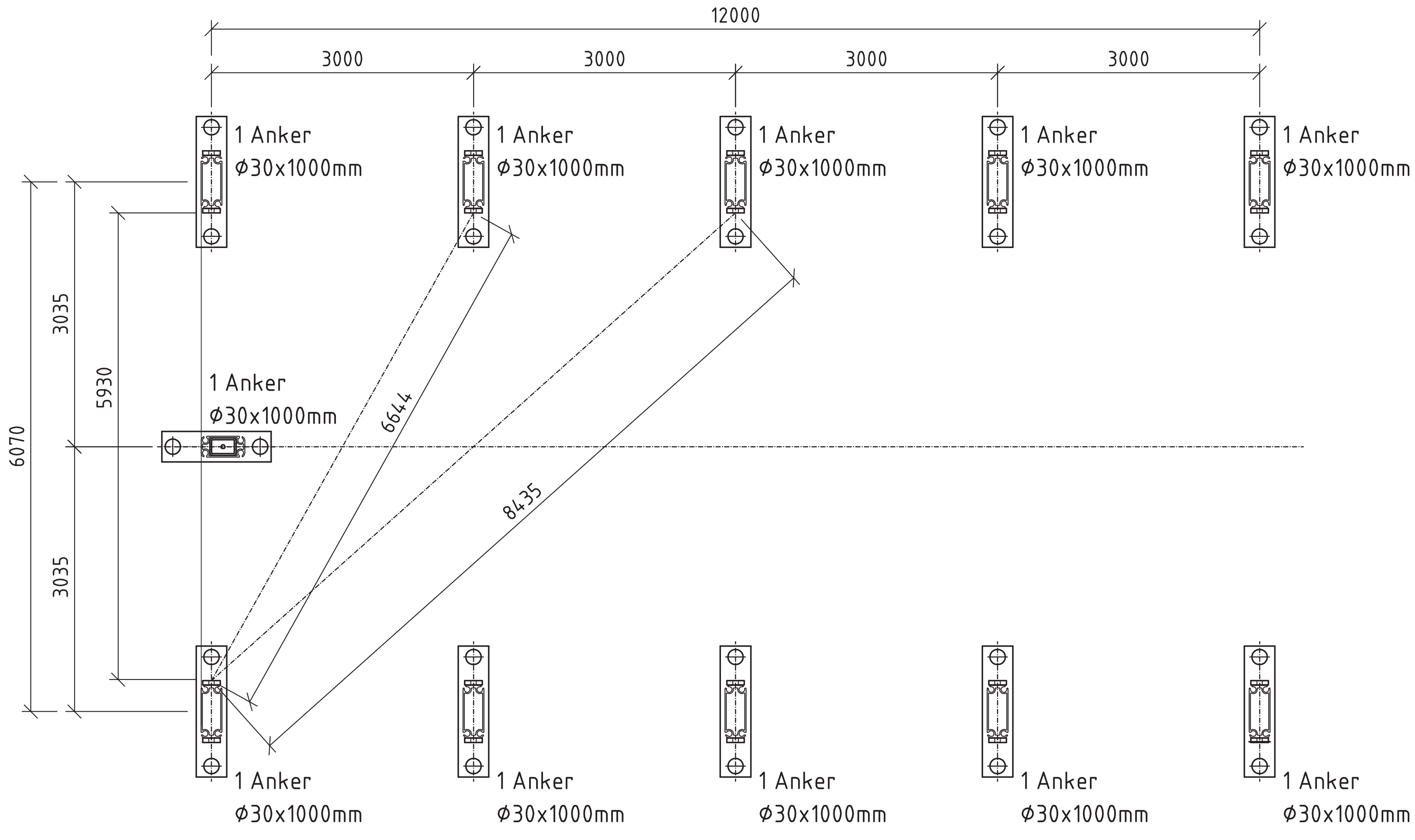
Ersatz für:







LOSBERGER	Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)		Maßstab: 1:50	Oberfläche:
			multiflex plus 6/300 P7 (system: 6070mm)	
		Datum:	Name:	
	Bearb.	08.02.13	IM	overview 6/300 x 6m with portal bracing
	Gepr.			
	Ges.			
Index / Änderung / Datum / Name	Ersatz für:		Zeichn. Nr.:	Sk 3630-E



LOSBERGER	Diese Zeichnung darf ohne unsere Genehmigung weder kopiert noch dritten Personen oder Konkurrenzfirmen zugänglich gemacht werden (Par. 15, 18 d. RG. v. 19.06.1901)	Maßstab: 1:50, 1:10, 1:5 Oberfläche:
		multiflex P7 plus 6/… System 3035+3035 =6070
	Datum: 23.11.04 / Name: BKo — Bearb. / Gepr. / Ges.	Bodenplattenplan 6/…
Index / Änderung / Datum / Name	Freimaßtoleranzen nach DIN 7168-mittel; Ersatz für:	Zeichn. Nr.: SK 3606

Losberger U.S., LLC
285 Bucheimer Rd, Suite A
Frederick, MD 21701
(800) 964-8368

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Losberger U.S., LLC
285 Bucheimer Rd, Suite A
Frederick, MD 21701
(800) 964-8368

APPENDIX B

COMPUTER MODEL INPUT

Losberger U.S., LLC
285 Bucheimer Rd, Suite A
Frederick, MD 21701
(800) 964-8368

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Project: Multiflex 15-250

Table of Contents

Model Summary

Structure Type: Plane Frame
17 Nodes, and 47 Degrees of Freedom
16 Member Elements
The model is linear.
The model will have 47 unique mode shapes.
The size of the model is:
593.3 in, in the X direction
205.8 in, in the Y direction

Nodes

Node	X	Y	Fix DX	Fix DY	Fix RZ
	in	in			
101	-296.654	0.000	Yes	Yes	No
102	-296.654	52.756	No	No	No
103	-296.654	85.866	No	No	No
104	-296.654	97.835	No	No	No
105	-177.165	141.339	No	No	No
106	-59.055	184.331	No	No	No
107	0.000	205.827	No	No	No
108	59.055	184.331	No	No	No
109	177.165	141.339	No	No	No
110	296.654	97.835	No	No	No
111	296.654	85.866	No	No	No
112	296.654	52.756	No	No	No
113	296.654	0.000	Yes	Yes	No
N001	-7.795	202.992	No	No	No
N002	7.795	202.992	No	No	No
N003	-287.756	101.063	No	No	No
N004	287.756	101.063	No	No	No

Material Properties

Material	Strength	Elasticity	Poisson	Density	Therm. Coeff.
	psi	psi		lb/in^3	in/in/deg-F
ASTM A992 Grade 50	50000.000	29000000.000	0.290000	0.284	6.389e-006

Nodal Supports

Node	Fix DX	Fix DY	Fix RZ
101	Yes	Yes	No
113	Yes	Yes	No

Service Load Cases

Load Case	Self Weight
D1 - Dead Load	Standard
D2 - Collateral Load	None
W1 - Wind Lateral (+)	None
W2 - Wind Lateral (-)	None
W3 - Wind Longitudinal (+)	None

W4 - Wind Longitudinal (-)	None

Load Cases

Load Case
(1)D1 - Dead Load
(2)D2 - Collateral Load
(9)W1 - Wind Lateral (+)
(10)W2 - Wind Lateral (-)
(11)W3 - Wind Longitudinal (+)
(12)W4 - Wind Longitudinal (-)
(13)1a - 1.4D1
(14)1b - 1.4D1 + 1.4D2
(15)2a - 1.2D1 + 1.6Lf + 0.5Lr
(16)2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr
(17)3a - 1.2D1 + Lf + 1.6Lr
(18)3b - 1.2D1 + 1.6Lr + 0.5W1
(19)3c - 1.2D1 + 1.6Lr + 0.5W2
(20)3d - 1.2D1 + 1.6Lr + 0.5W3
(21)3e - 1.2D1 + 1.6Lr + 0.5W4
(22)3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr
(23)3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1
(24)3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2
(25)3j - 1.2D1 + 1.2D2 + Lr + 0.5W3
(26)3k - 1.2D1 + 1.2D2 + Lr + 0.5W4
(27)4a - 1.2D1 + Lf + 0.5Lr + 1.0W1
(28)4b - 1.2D1 + Lf + 0.5Lr + 1.0W2
(29)4c - 1.2D1 + Lf + 0.5Lr + 1.0W3
(30)4d - 1.2D1 + Lf + 0.5Lr + 1.0W4
(31)4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1
(32)4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2
(33)4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3
(34)4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4
(35)6a - 0.9D1 + 1.0W1
(36)6b - 0.9D1 + 1.0W2
(37)6c - 0.9D1 + 1.0W3
(38)6e - 0.9D1 + 0.9D2 + 1.0W1
(39)6d - 0.9D1 + 1.0W4
(40)6f - 0.9D1 + 0.9D2 + 1.0W2
(41)6g - 0.9D1 + 0.9D2 + 1.0W3
(42)6h - 0.9D1 + 0.9D2 + 1.0W4

Load Combination Summary

Factored Combination: 1a - 1.4D1
Scale factor = 1.00

Factor : Service Case

1.40 x D1 - Dead Load

Factored Combination: 1b - 1.4D1 + 1.4D2
Scale factor = 1.00

Factor : Service Case

1.40 x D1 - Dead Load
1.40 x D2 - Collateral Load

Factored Combination: 2a - 1.2D1 + 1.6Lf + 0.5Lr
Scale factor = 1.00

Factor : Service Case

1.20 x D1 - Dead Load
1.60 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof

Factored Combination: 2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr
Scale factor = 1.00

Factor : Service Case

1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.60 x Lf - Live Load Floor
1.60 x Lr - Live Load Roof

Factored Combination: 3a - 1.2D1 + Lf + 1.6Lr
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.00 x Lf - Live Load Floor
1.60 x Lr - Live Load Roof

Factored Combination: 3b - 1.2D1 + 1.6Lr + 0.5W1
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.60 x Lr - Live Load Roof
0.50 x W1 - Wind Lateral (+)

Factored Combination: 3c - 1.2D1 + 1.6Lr + 0.5W2
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.60 x Lr - Live Load Roof
0.50 x W2 - Wind Lateral (-)

Factored Combination: 3d - 1.2D1 + 1.6Lr + 0.5W3
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.60 x Lr - Live Load Roof
0.50 x W3 - Wind Longitudinal (+)

Factored Combination: 3e - 1.2D1 + 1.6Lr + 0.5W4
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.60 x Lr - Live Load Roof
0.50 x W4 - Wind Longitudinal (-)

Factored Combination: 3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.00 x Lf - Live Load Floor
1.60 x Lr - Live Load Roof

Factored Combination: 3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.60 x Lr - Live Load Roof
0.50 x W1 - Wind Lateral (+)

Factored Combination: 3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.60 x Lr - Live Load Roof
0.50 x W2 - Wind Lateral (-)

Factored Combination: 3j - 1.2D1 + 1.2D2 + Lr + 0.5W3
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.00 x Lr - Live Load Roof
0.50 x W3 - Wind Longitudinal (+)

Factored Combination: 3k - 1.2D1 + 1.2D2 + Lr + 0.5W4
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.00 x Lr - Live Load Roof
0.50 x W4 - Wind Longitudinal (-)

Factored Combination: 4a - 1.2D1 + Lf + 0.5Lr + 1.0W1
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W1 - Wind Lateral (+)

Factored Combination: 4b - 1.2D1 + Lf + 0.5Lr + 1.0W2
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W2 - Wind Lateral (-)

Factored Combination: 4c - 1.2D1 + Lf + 0.5Lr + 1.0W3
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W3 - Wind Longitudinal (+)

Factored Combination: 4d - 1.2D1 + Lf + 0.5Lr + 1.0W4
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W4 - Wind Longitudinal (-)

Factored Combination: 4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
0.50 x Lr - Live Load Roof
1.00 x W1 - Wind Lateral (+)
1.00 x Lf - Live Load Floor

Factored Combination: 4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W2 - Wind Lateral (-)

Factored Combination: 4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3
Scale factor = 1.00
Factor : Service Case
1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W3 - Wind Longitudinal (+)

Factored Combination: 4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4
Scale factor = 1.00
Factor : Service Case

1.20 x D1 - Dead Load
1.20 x D2 - Collateral Load
1.00 x Lf - Live Load Floor
0.50 x Lr - Live Load Roof
1.00 x W4 - Wind Longitudinal (-)

Factored Combination: 6a - 0.9D1 + 1.0W1
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
1.00 x W1 - Wind Lateral (+)

Factored Combination: 6b - 0.9D1 + 1.0W2
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
1.00 x W2 - Wind Lateral (-)

Factored Combination: 6c - 0.9D1 + 1.0W3
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
1.00 x W3 - Wind Longitudinal (+)

Factored Combination: 6e - 0.9D1 + 0.9D2 + 1.0W1
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
0.90 x D2 - Collateral Load
1.00 x W1 - Wind Lateral (+)

Factored Combination: 6d - 0.9D1 + 1.0W4
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
1.00 x W4 - Wind Longitudinal (-)

Factored Combination: 6f - 0.9D1 + 0.9D2 + 1.0W2
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
0.90 x D2 - Collateral Load
1.00 x W2 - Wind Lateral (-)

Factored Combination: 6g - 0.9D1 + 0.9D2 + 1.0W3
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
0.90 x D2 - Collateral Load
1.00 x W3 - Wind Longitudinal (+)

Factored Combination: 6h - 0.9D1 + 0.9D2 + 1.0W4
Scale factor = 1.00
Factor : Service Case
0.90 x D1 - Dead Load
0.90 x D2 - Collateral Load
1.00 x W4 - Wind Longitudinal (-)

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APPENDIX C

COMPUTER MODEL OUTPUT

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Project: Multiflex 15-250

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Load Cases

Load Case
(1)D1 - Dead Load
(2)D2 - Collateral Load
(9)W1 - Wind Lateral (+)
(10)W2 - Wind Lateral (-)
(11)W3 - Wind Longitudinal (+)
(12)W4 - Wind Longitudinal (-)
(13)1a - 1.4D1
(14)1b - 1.4D1 + 1.4D2
(15)2a - 1.2D1 + 1.6Lf + 0.5Lr
(16)2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr
(17)3a - 1.2D1 + Lf + 1.6Lr
(18)3b - 1.2D1 + 1.6Lr + 0.5W1
(19)3c - 1.2D1 + 1.6Lr + 0.5W2
(20)3d - 1.2D1 + 1.6Lr + 0.5W3
(21)3e - 1.2D1 + 1.6Lr + 0.5W4
(22)3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr
(23)3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1
(24)3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2
(25)3j - 1.2D1 + 1.2D2 + Lr + 0.5W3
(26)3k - 1.2D1 + 1.2D2 + Lr + 0.5W4
(27)4a - 1.2D1 + Lf + 0.5Lr + 1.0W1
(28)4b - 1.2D1 + Lf + 0.5Lr + 1.0W2
(29)4c - 1.2D1 + Lf + 0.5Lr + 1.0W3
(30)4d - 1.2D1 + Lf + 0.5Lr + 1.0W4
(31)4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1
(32)4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2
(33)4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3
(34)4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4
(35)6a - 0.9D1 + 1.0W1
(36)6b - 0.9D1 + 1.0W2
(37)6c - 0.9D1 + 1.0W3
(38)6e - 0.9D1 + 0.9D2 + 1.0W1
(39)6d - 0.9D1 + 1.0W4
(40)6f - 0.9D1 + 0.9D2 + 1.0W2
(41)6g - 0.9D1 + 0.9D2 + 1.0W3
(42)6h - 0.9D1 + 0.9D2 + 1.0W4

Member Extreme Results

Member	Fx (lc)	Vy (lc)	Mz (lc)
	lb	lb	lb-in
mr103	-1126 (14)	-756 (14)	-74225 (14)
mr103	1830 (9)	971 (9)	**106211 (9)**
mr104	-1074 (14)	**-1402 (9)**	-74225 (14)
mr104	1502 (9)	743 (14)	106211 (9)
mr108	-771 (14)	-164 (13)	-7047 (9)
mr108	1504 (9)	714 (11)	26057 (33)
mr109	-771 (14)	-492 (9)	-6002 (9)
mr109	1550 (9)	164 (13)	26057 (33)
mr113	-1074 (14)	-743 (14)	-74225 (14)
mr113	1548 (9)	1050 (9)	91715 (11)
mr114	-1126 (14)	-1138 (11)	**-74225 (14)**

mr114	1515 (9)	756 (14)	91715 (11)
ms101	-1316 (14)	-756 (14)	-40073 (14)
ms101	1830 (9)	**1237 (9)**	60959 (9)
ms102	-1199 (14)	-756 (14)	-65169 (14)
ms102	**1830 (9)**	1074 (9)	94810 (9)
ms105	-1068 (14)	-1336 (9)	-67285 (14)
ms105	1504 (9)	722 (14)	93249 (9)
ms106	-919 (14)	-539 (9)	-47026 (11)
ms106	1504 (9)	507 (33)	26863 (14)
ms107	-812 (14)	-147 (13)	-31327 (9)
ms107	1504 (9)	681 (11)	26963 (14)
ms110	-812 (14)	-452 (9)	-23413 (9)
ms110	1549 (9)	147 (13)	26963 (14)
ms111	-919 (14)	-314 (14)	-26957 (9)
ms111	1549 (9)	428 (9)	26863 (14)
ms112	-1068 (14)	-722 (14)	-67285 (14)
ms112	1549 (9)	1002 (9)	83292 (11)
ms115	-1199 (14)	-1089 (11)	-65169 (14)
ms115	1515 (9)	756 (14)	78383 (11)
ms116	**-1316 (14)**	-953 (11)	-40073 (14)
ms116	1515 (9)	756 (14)	44569 (11)

Nodal Reactions

Node	Result Case Name	FX	FY	MZ
		lb	lb	lb-in
101	1a - 1.4D1	528	1036	-NA-
101	1a - 1.4D1 Second Order	528	1036	-NA-
101	1b - 1.4D1 + 1.4D2	756	1316	-NA-
101	1b - 1.4D1 + 1.4D2 Second Order	**756**	1316	-NA-
101	2a - 1.2D1 + 1.6Lf + 0.5Lr	453	888	-NA-
101	2a - 1.2D1 + 1.6Lf + 0.5Lr Second Order	453	888	-NA-
101	2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr	648	1128	-NA-
101	2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr Second Order	648	1128	-NA-
101	3a - 1.2D1 + Lf + 1.6Lr	453	888	-NA-
101	3a - 1.2D1 + Lf + 1.6Lr Second Order	453	888	-NA-
101	3b - 1.2D1 + 1.6Lr + 0.5W1	-166	-27	-NA-
101	3b - 1.2D1 + 1.6Lr + 0.5W1 Second Order	-166	-27	-NA-
101	3c - 1.2D1 + 1.6Lr + 0.5W2	-36	313	-NA-
101	3c - 1.2D1 + 1.6Lr + 0.5W2 Second Order	-36	313	-NA-
101	3d - 1.2D1 + 1.6Lr + 0.5W3	204	58	-NA-
101	3d - 1.2D1 + 1.6Lr + 0.5W3 Second Order	204	58	-NA-
101	3e - 1.2D1 + 1.6Lr + 0.5W4	334	399	-NA-
101	3e - 1.2D1 + 1.6Lr + 0.5W4 Second Order	334	399	-NA-
101	3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr	648	1128	-NA-
101	3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr Second Order	648	1128	-NA-
101	3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1	29	213	-NA-
101	3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1 Second Order	29	213	-NA-
101	3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2	159	553	-NA-
101	3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2 Second Order	159	553	-NA-
101	3j - 1.2D1 + 1.2D2 + Lr + 0.5W3	398	298	-NA-
101	3j - 1.2D1 + 1.2D2 + Lr + 0.5W3 Second Order	398	299	-NA-
101	3k - 1.2D1 + 1.2D2 + Lr + 0.5W4	528	639	-NA-
101	3k - 1.2D1 + 1.2D2 + Lr + 0.5W4 Second Order	529	639	-NA-
101	4a - 1.2D1 + Lf + 0.5Lr + 1.0W1	-784	-942	-NA-
101	4a - 1.2D1 + Lf + 0.5Lr + 1.0W1 Second Order	-784	-942	-NA-
101	4b - 1.2D1 + Lf + 0.5Lr + 1.0W2	-524	-261	-NA-
101	4b - 1.2D1 + Lf + 0.5Lr + 1.0W2 Second Order	-524	-261	-NA-
101	4c - 1.2D1 + Lf + 0.5Lr + 1.0W3	-46	-771	-NA-
101	4c - 1.2D1 + Lf + 0.5Lr + 1.0W3 Second Order	-45	-771	-NA-
101	4d - 1.2D1 + Lf + 0.5Lr + 1.0W4	214	-90	-NA-
101	4d - 1.2D1 + Lf + 0.5Lr + 1.0W4 Second Order	215	-90	-NA-

101	4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1	-590	-702	-NA-
101	4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1 Second Order	-589	-702	-NA-
101	4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2	-329	-21	-NA-
101	4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2 Second Order	-330	-21	-NA-
101	4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3	149	-531	-NA-
101	4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3 Second Order	149	-531	-NA-
101	4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4	409	150	-NA-
101	4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4 Second Order	409	150	-NA-
101	6a - 0.9D1 + 1.0W1	-898	-1164	-NA-
101	6a - 0.9D1 + 1.0W1 Second Order	-897	-1164	-NA-
101	6b - 0.9D1 + 1.0W2	-638	-483	-NA-
101	6b - 0.9D1 + 1.0W2 Second Order	-637	-483	-NA-
101	6c - 0.9D1 + 1.0W3	-159	-993	-NA-
101	6c - 0.9D1 + 1.0W3 Second Order	-158	-993	-NA-
101	6d - 0.9D1 + 1.0W4	101	-312	-NA-
101	6d - 0.9D1 + 1.0W4 Second Order	101	-312	-NA-
101	6e - 0.9D1 + 0.9D2 + 1.0W1	-752	-984	-NA-
101	6e - 0.9D1 + 0.9D2 + 1.0W1 Second Order	-751	-984	-NA-
101	6f - 0.9D1 + 0.9D2 + 1.0W2	-491	-303	-NA-
101	6f - 0.9D1 + 0.9D2 + 1.0W2 Second Order	-491	-303	-NA-
101	6g - 0.9D1 + 0.9D2 + 1.0W3	-13	-813	-NA-
101	6g - 0.9D1 + 0.9D2 + 1.0W3 Second Order	-12	-813	-NA-
101	6h - 0.9D1 + 0.9D2 + 1.0W4	247	-132	-NA-
101	6h - 0.9D1 + 0.9D2 + 1.0W4 Second Order	247	-132	-NA-
101	D1 - Dead Load	377	740	**-NA-**
101	D1 - Dead Load Second Order	377	740	-NA-
101	D2 - Collateral Load	162	200	-NA-
101	D2 - Collateral Load Second Order	162	200	-NA-
101	W1 - Wind Lateral (+)	**-1237**	**-1830**	-NA-
101	W1 - Wind Lateral (+) Second Order	-1236	-1829	-NA-
101	W2 - Wind Lateral (-)	-977	-1149	-NA-
101	W2 - Wind Lateral (-) Second Order	-977	-1148	-NA-
101	W3 - Wind Longitudinal (+)	-499	-1659	-NA-
101	W3 - Wind Longitudinal (+) Second Order	-497	-1660	-NA-
101	W4 - Wind Longitudinal (-)	-238	-978	-NA-
101	W4 - Wind Longitudinal (-) Second Order	-238	-978	-NA-
113	1a - 1.4D1	-528	1036	-NA-
113	1a - 1.4D1 Second Order	-528	1036	-NA-
113	1b - 1.4D1 + 1.4D2	-756	**1316**	-NA-
113	1b - 1.4D1 + 1.4D2 Second Order	-756	1316	-NA-
113	2a - 1.2D1 + 1.6Lf + 0.5Lr	-453	888	-NA-
113	2a - 1.2D1 + 1.6Lf + 0.5Lr Second Order	-453	888	-NA-
113	2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr	-648	1128	-NA-
113	2b - 1.2D1 + 1.2D2 + 1.6Lf + 1.6Lr Second Order	-648	1128	-NA-
113	3a - 1.2D1 + Lf + 1.6Lr	-453	888	-NA-
113	3a - 1.2D1 + Lf + 1.6Lr Second Order	-453	888	-NA-
113	3b - 1.2D1 + 1.6Lr + 0.5W1	-127	130	-NA-
113	3b - 1.2D1 + 1.6Lr + 0.5W1 Second Order	-127	130	-NA-
113	3c - 1.2D1 + 1.6Lr + 0.5W2	-258	470	-NA-
113	3c - 1.2D1 + 1.6Lr + 0.5W2 Second Order	-258	470	-NA-
113	3d - 1.2D1 + 1.6Lr + 0.5W3	-85	198	-NA-
113	3d - 1.2D1 + 1.6Lr + 0.5W3 Second Order	-85	198	-NA-
113	3e - 1.2D1 + 1.6Lr + 0.5W4	-215	538	-NA-
113	3e - 1.2D1 + 1.6Lr + 0.5W4 Second Order	-215	538	-NA-
113	3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr	-648	1128	-NA-
113	3g - 1.2D1 + 1.2D2 + Lf + 1.6Lr Second Order	-648	1128	-NA-
113	3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1	-322	370	-NA-
113	3h - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W1 Second Order	-322	370	-NA-
113	3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2	-452	710	-NA-
113	3i - 1.2D1 + 1.2D2 + 1.6Lr + 0.5W2 Second Order	-453	710	-NA-
113	3j - 1.2D1 + 1.2D2 + Lr + 0.5W3	-279	438	-NA-

113	3j - 1.2D1 + 1.2D2 + Lr + 0.5W3 Second Order	-279	438	-NA-
113	3k - 1.2D1 + 1.2D2 + Lr + 0.5W4	-410	778	-NA-
113	3k - 1.2D1 + 1.2D2 + Lr + 0.5W4 Second Order	-410	778	-NA-
113	4a - 1.2D1 + Lf + 0.5Lr + 1.0W1	199	-627	-NA-
113	4a - 1.2D1 + Lf + 0.5Lr + 1.0W1 Second Order	198	-627	-NA-
113	4b - 1.2D1 + Lf + 0.5Lr + 1.0W2	-62	53	-NA-
113	4b - 1.2D1 + Lf + 0.5Lr + 1.0W2 Second Order	-63	53	-NA-
113	4c - 1.2D1 + Lf + 0.5Lr + 1.0W3	284	-492	-NA-
113	4c - 1.2D1 + Lf + 0.5Lr + 1.0W3 Second Order	283	-492	-NA-
113	4d - 1.2D1 + Lf + 0.5Lr + 1.0W4	23	188	-NA-
113	4d - 1.2D1 + Lf + 0.5Lr + 1.0W4 Second Order	22	188	-NA-
113	4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1	4	-387	-NA-
113	4e - 1.2D1 + 1.2D2 + Lr + 0.5Lr + 1.0W1 Second Order	3	-387	-NA-
113	4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2	-257	293	-NA-
113	4f - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W2 Second Order	-257	293	-NA-
113	4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3	89	-252	-NA-
113	4g - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W3 Second Order	88	-252	-NA-
113	4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4	-172	428	-NA-
113	4h - 1.2D1 + 1.2D2 + Lf + 0.5Lr + 1.0W4 Second Order	-172	428	-NA-
113	6a - 0.9D1 + 1.0W1	312	-849	-NA-
113	6a - 0.9D1 + 1.0W1 Second Order	311	-849	-NA-
113	6b - 0.9D1 + 1.0W2	51	-169	-NA-
113	6b - 0.9D1 + 1.0W2 Second Order	51	-169	-NA-
113	6c - 0.9D1 + 1.0W3	397	-714	-NA-
113	6c - 0.9D1 + 1.0W3 Second Order	396	-714	-NA-
113	6d - 0.9D1 + 1.0W4	136	-34	-NA-
113	6d - 0.9D1 + 1.0W4 Second Order	136	-34	-NA-
113	6e - 0.9D1 + 0.9D2 + 1.0W1	166	-669	-NA-
113	6e - 0.9D1 + 0.9D2 + 1.0W1 Second Order	165	-669	-NA-
113	6f - 0.9D1 + 0.9D2 + 1.0W2	-95	11	-NA-
113	6f - 0.9D1 + 0.9D2 + 1.0W2 Second Order	-95	11	-NA-
113	6g - 0.9D1 + 0.9D2 + 1.0W3	251	-534	-NA-
113	6g - 0.9D1 + 0.9D2 + 1.0W3 Second Order	250	-534	-NA-
113	6h - 0.9D1 + 0.9D2 + 1.0W4	-10	146	-NA-
113	6h - 0.9D1 + 0.9D2 + 1.0W4 Second Order	-10	146	-NA-
113	D1 - Dead Load	-377	740	-NA-
113	D1 - Dead Load Second Order	-377	740	-NA-
113	D2 - Collateral Load	-162	200	-NA-
113	D2 - Collateral Load Second Order	-162	200	-NA-
113	W1 - Wind Lateral (+)	651	-1515	-NA-
113	W1 - Wind Lateral (+) Second Order	650	-1515	-NA-
113	W2 - Wind Lateral (-)	390	-835	-NA-
113	W2 - Wind Lateral (-) Second Order	390	-835	-NA-
113	W3 - Wind Longitudinal (+)	736	-1380	-NA-
113	W3 - Wind Longitudinal (+) Second Order	735	-1379	-NA-
113	W4 - Wind Longitudinal (-)	475	-700	-NA-
113	W4 - Wind Longitudinal (-) Second Order	475	-699	-NA-

Nodal Extreme Displacements

Node	DX	DY
	in	in
101	-NA-	-NA-
101	-NA-	-NA-
102	-0.198 (34)	-0.000 (14)
102	0.192 (9)	0.001 (9)
103	-0.304 (34)	-0.001 (14)
103	0.253 (9)	0.001 (9)
104	-0.336 (34)	-0.001 (14)
104	**0.256 (9)**	0.001 (9)
105	-0.375 (34)	-0.251 (14)
105	0.126 (9)	0.444 (11)

106	-0.298 (34)	-0.533 (14)
106	0.031 (9)	**0.628 (9)**
107	-0.252 (11)	**-0.570 (14)**
107	0.034 (32)	0.623 (9)
108	-0.289 (11)	-0.533 (14)
108	0.033 (32)	0.581 (9)
109	-0.386 (11)	-0.251 (14)
109	0.115 (14)	0.302 (9)
110	-0.422 (11)	-0.001 (14)
110	0.205 (14)	0.001 (9)
111	-0.392 (11)	-0.001 (14)
111	0.199 (14)	0.001 (9)
112	-0.268 (11)	-0.000 (14)
112	0.146 (14)	0.001 (9)
113	-NA-	-NA-
113	-NA-	-NA-
N001	-0.257 (33)	-0.570 (14)
N001	0.033 (10)	0.626 (9)
N002	-0.257 (11)	-0.570 (14)
N002	0.033 (32)	0.619 (9)
N003	-0.344 (34)	-0.002 (14)
N003	0.254 (9)	0.025 (11)
N004	**-0.428 (11)**	-0.018 (34)
N004	0.205 (14)	0.005 (9)