DATE ISSUED: 6/25/21
BID DATE: 6/29/21
PROJECT: Hail Damage Repair – Billings Parmly Library
ADDRESS: 510 North Broadway, Billings, MT

ADDENDUM #4:

Bauer Group Architects PLLC
P O Box 20939
Billings, Montana 59104

GENERAL:

1. This addendum shall be considered a part of the Contract Documents and shall take precedence over previous requirements for the work. Bidders are required to acknowledge receipt of addendum on the proposal form; failure to do so may result in disqualification.
2. Work not specifically changed or modified by this addendum shall be as originally indicated on the drawings and/or specification.

CLARIFICATION(S):

1. Attached are submittal documents for the stainless steel scrim panels and the skylight installations for reference use.

END OF ADDENDUM #4

ATTACHMENTS:
Submittal – Scrim
Submittal - Skylight

O2A
O² ARCHITECTS

208 N. Broadway - Suite 350 Billings, Montana 59101 TEL (406) 259-7123 FAX (406) 256-7123 dono@o2architects.net

TRANSMITTAL LETTER

To: **Jackson Contractor Group**
Mike Chase

Date: 3/27/2013

CC: **WB+P**

Project Name: **Parmly Billings Library**

Project Number: **1101**

We transmit:

(x) Herewith
( ) In accordance with your request
( ) Under separate cover via:

For Your

( ) Approval	( ) Information	(X) Distribution to Others
( ) Review & Comment	( ) Record	( ) ________________

The following:

( ) Drawings	(X) Shop Drawings	(x) See Below
( ) Specifications	(X) Product Literature	( ) Digital Files

Copies	Date:	Description:		
1	1/21/2013	05 7000	Metal SS Scrim	**Approved**

Remarks

Jackson CONTRACTOR GROUP, INC.
P.O. Box 967, Missoula, MT 59806
406-542-9150 | FAX 542-3515

Submittal Packages

Summary with Register Items & Stamp

Parmly Billings Library
510 N. Broadway
Billings, MT 59101

Project # 2012.35

Jackson Contractor Group Inc.
Tel: 406-542-9150 Fax: 406-542-3515

Item No	Register No	Rev	Spec Section	Sub Section	Description	Responsible	Supplier	Rec'd On	Action
0070 - 05 7000 - 0					**Ornamental Metalwork - Scrim Channels w/ LEED**				
1	00073	0	05 70 00	1.03.A	Ornament. Mtlwork - Drawings	Rollfab Metal Products, LLC	Rollfab Metal Products, LLC	1/16/2013	Submitted
2	00074	0	05 70 00	1.03.B	Ornament. Mtlwork - Prod. Data	Rollfab Metal Products, LLC	Rollfab Metal Products, LLC	1/16/2013	Submitted
3	00075	0	05 70 00	1.03.C	Ornament. Mtlwork - Samples	Rollfab Metal Products, LLC	Rollfab Metal Products, LLC	1/16/2013	Submitted

SUBMITTAL REVIEW

✓ REVIEWED, NO EXCEPTIONS TAKEN __REVISE AND RESUBMIT
__NOTE COMMENTS __SEE ATTACHED COMMENTS

Corrections or comments made to the shop drawings during this review do not relieve subcontractor/vendor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The subcontractor/vendor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner.

JACKSON CONTRACTOR GROUP, INC.

BY MIKE CHASE DATE 1.21.13

A/E - is there a desired pattern for fasteners?

SHOP DRAWING I SUBMITTAL REVIEW

☒ APPROVED ☐ APPROVED WITH CHANGES NOTED
☐ REVISE & RESUBMIT ☐ REJECTED ________________

SUBMITTAL WAS REVIEWED FOR DESIGN CONFORMITY AND GENERAL CONFORMANCE TO CONTRACT DOCUMENTS ONLY. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING DIMENSIONS AT JOB SITES FOR TOLERANCES, CLEARANCES, QUANTITIES, FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATION OF THE WORK WITH OTHER TRADES AND FULL COMPLIANCE WITH THE CONTRACT DOCUMENTS.

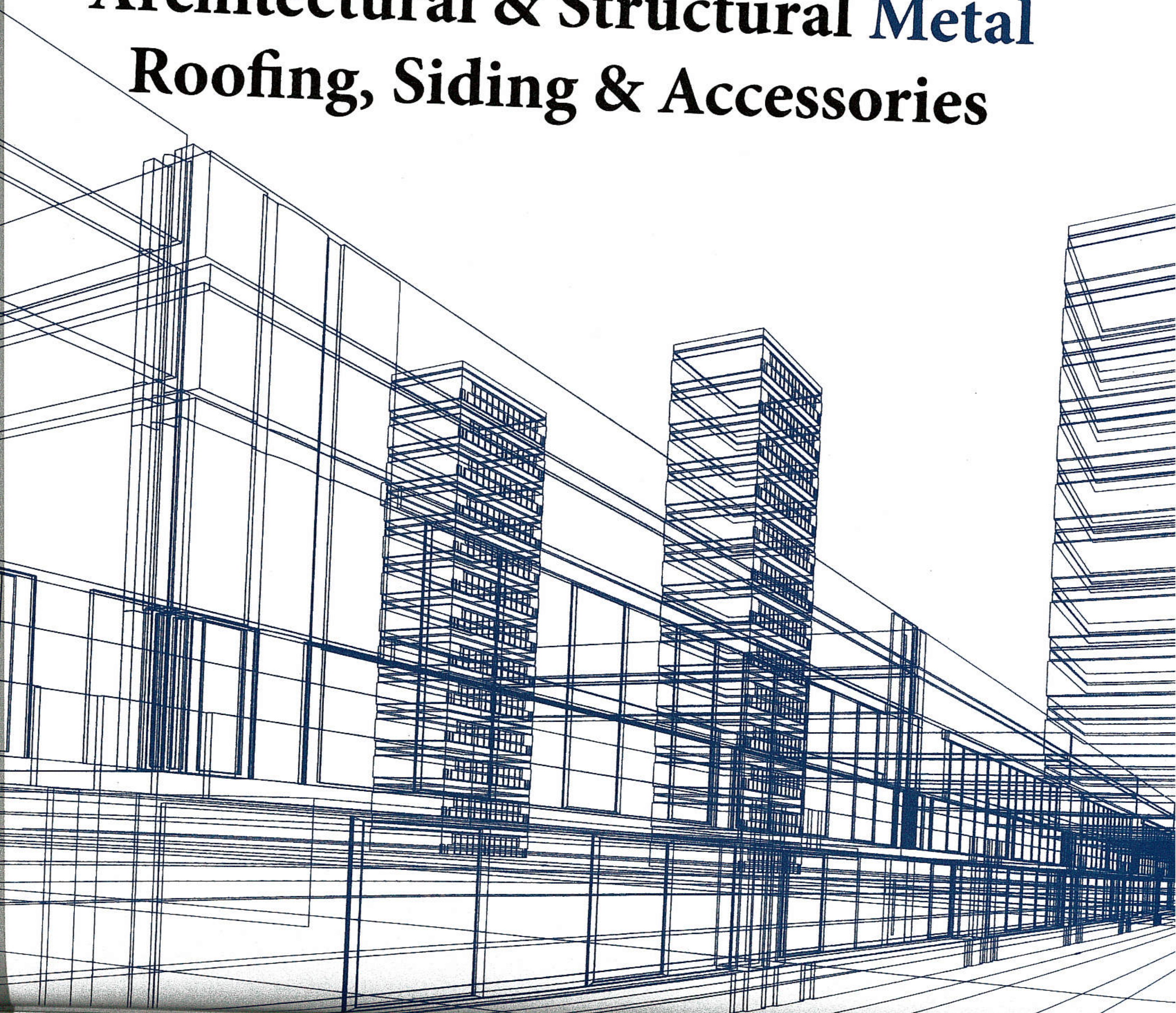
will bruderarchitects *kent mcclure 03.26.13*
4200 North Central Avenue Phoenix, Arizona 85012 **602.277.5211** f 602.277.5202

RMP

ROLLFAB

METAL PRODUCTS

Architectural & Structural Metal Roofing, Siding & Accessories



MANUFACTURER'S QUALIFICATION STATEMENT

Rollfab Metal Products was established in 1997 by George Shafer, a veteran manufacturer of prefinished metal roofing and siding in the industry since 1986.

The combined staff of Rollfab has over 50 years of experience in sheet metal fabrication.

Rollfab offers a large selection of architectural metal roofing, metal siding, and custom flashing products for usage on commercial, industrial, and residential projects. These can be provided in various metal types, textures, gauges, finishes, and colors.

Rollfab's 32,000 SF facility located in the heart of Phoenix features "State of the Art" computer controlled manufacturing equipment to achieve the highest quality and consistency for large and small orders. The facility's layout is engineered to minimize the handling of the material and maximize the productive efficiency of the work force. This allows them to produce over a million square feet of product annually.

Rollfab's standing seam roof product offerings are produced on portable roll-forming equipment. This service allows you the design flexibility and construction practicality of having Rollfab "Jobsite Roll-form" panels in excess of shippable lengths. This provides continuous "eave to ridge", or "eave to eave in the case of barrel vault roofs", panel lengths; thus eliminating the need for problematic panel end laps.

Rollfab's technical staff is always ready, available, and willing to render assistance to you in the design, selection, and application of the products you're considering using.

Projects of similar size and complexity to Dine College Archival Building:

Chandler Performing Arts Center, Chandler, AZ
Franciscan Winery in Napa Valley, CA
U of A Student Housing Center in Tucson
Fountain Hills Elementary School, Fountain Hills, AZ
NAU Business Administration Bldg., Flagstaff, AZ
Phoenix Fire Station #16, Phoenix, AZ
Arizona Bank & Trust, Phoenix, AZ
Cocopah Casino in Yuma, AZ
Showlow Junior High School, Showlow, AZ
Sanctuary on Camelback, Phoenix, AZ
The Vale, Tempe, AZ
Sells Recreation Facility, Sells, AZ
U.S. Bank @ Desert Ridge, Phoenix, AZ
Arizona Bank & Trust Chandler, AZ
Command and Control Facility Headquarter Fort Bliss, El Paso, TX
Apache Junction Magistrate Facility, Apache Junction, AZ
Paradise Valley Country Club, Paradise Valley, AZ

Contact: Steven Tetreault
Rollfab Metal Building Products
602-275-1676

Steven Tetreault
Rollfab Metal Building Products
602-275-1676

CHOOSING AND USING "DESIGNER" METAL ROOFING PANELS

By Steven Tetreault*

Picture these scenarios: A commercial client calls to tell you that he wants the look of a copper verdigris roof for a new project… but his budget can't handle the high cost of copper. Another client calls looking for an unusual profile that you can't find in the standard product lines offered by your panel manufacturing sources. Or, a client asks if you can order and install an S-shaped canopy made of curved metal panels.

Would you know how to advise your customers in these situations? The fact is, in recent years, the metal roofing market has grown quite sophisticated, with many more choices available to contractors, architects and building owners. This article will attempt to update you on some of the latest trends in metal roofing, focusing especially on specialty or "designer" panels. The purpose will be to familiarize you with some of the new types of products now available and the processes that make them possible… so that you'll be able to answer the above questions, and more.

In past decades, metal roofing panels were used primarily on metal buildings and rural structures. Though highly functional and low in cost, these panels (mostly corrugated profiles) perpetuated the belief that metal roofing was a low-end product reserved for industrial and agricultural projects.

Today's "designer" panels are a whole different story. Because of their excellent aesthetics, these panels are ideal for commercial and residential applications where corrugated roofing would not have been an option. The result: Your clients can enjoy the high performance and life cycle cost benefits of metal with no compromise in aesthetics.

Fabricating Techniques

Most roofing panels are fabricated using **roll forming** equipment. In this process, sheet metal coil is fed through a machine where it passes under a series of precision rollers that determine the shape of the profile. Every profile requires a different series of rollers; so if a customer wanted to deviate from a standard profile, the cost would usually be prohibitive.

Press forming machinery uses top and bottom dies that stamp the sheet metal coil into the desired profile. A system of programmable stops allows the operator to produce the desired angle bend. Using press forming, many different shapes can be made with a single die by simply adjusting the stops. This technique results in greater design flexibility with no need to change tooling.

Advanced **finishing** techniques have also contributed to the growth of designer panels. Today's standard paint coatings offer low maintenance, excellent durability, and a wide palette of colors. In addition, new techniques have made it possible to achieve special design effects. For example, two-toned paint patterns have a "marbled" appearance that lends a richer, more textured look than a standard paint finish for high-end projects. A two-toned pattern is used on the celebrated new Bellagio hotel in Las Vegas, where it simulates the look of copper verdigris using much less costly galvanized steel. The pattern was first created as a painting, which was later replicated with computer imaging techniques and transferred to the machine that would cut the roll. The coil coater then manipulated the pattern on-line until they achieved the desired texture and finish characteristics. Without advanced technologies, printed patterns like this would not be viable.

Metal curving techniques have become popular for creating attractively curved roofs, mansards, fascias, canopies and more. Probably the most versatile technique is **crimp-curving**, which was introduced to this country in the mid-1980s. Crimp-curving may be used to shape panels into virtually any radius or angle without marring the panel finish, and it is suited to a wide range of profiles from ¾" to 4" deep in 18-26 GA metal. Crimp-curving can actually double the load factor of steel panels. Crimp-curving creates lightweight yet rigid components that require minimal structural support. The technique may also be used to produce mitered corners and multiple-radius curves – including the "S-shaped" canopy mentioned at the beginning of this story.

Stretch-forming is another curving technique that is used on a more limited basis. The stretch-forming equipment pulls the panel around a custom jig or form and stretches it into shape. It provides an alternative in situations where crimp-curving is not viable – for example, when there is a need to bend very deep-ribbed panels. Unlike crimp-curving, the stretching process will decrease the strength of the metal, so a heavier substrate (18-20 GA) is required.

Choosing a Standard Profile

Due to all these advances, for most projects you need look no further than the standard product offerings of today's metal component manufacturers. Before you order a custom panel, check out the following "standard" specialty metal roofing panels:

- Extra-deep profiles (panels with a depth of more than three inches) may be selected to create interesting architectural relief effects. Deep-ribbed panels are particularly suited to large-scale industrial or commercial jobs, where their high strength and long-span capabilities make it possible to reduce structural costs. The deep panel ribs are highly aesthetic and may be varied to create different light and shadow effects.

One project recently used a pan and batten roofing system with panel depth of 11 inches! The result was dramatic, to say the least.

- Exposed fastener panels that simulate the look of more costly concealed fastener systems are also available. Their vertical ribs mimic the look of standing seam or batten seam roofing, while simplifying installation and saving money.

- Special modifications can be made to standard panels with no need for special tooling, using press forming machinery as described above. For example, the manufacturer can vary the width of the reveal and/or the top pan to the specified dimensional requirements, creating shadow lines in almost any location on the panel surface. Profiles may be symmetrical or asymmetrical, and ribs may be fabricated in virtually any angle desired. This high degree of flexibility offers greater freedom and control in new construction projects. It can also allow you to reconstruct difficult-to-match panels for retrofit or renovation jobs.

- Tile facsimile panels are designed to combine the high performance of metal with the popular look of clay tile, at just a fraction of the weight. They can therefore be used for residential and commercial projects where tile appearance is desired but weight is a concern. For best performance, look for a system with long-length panels that install vertically from eave to ridge and are secured with screw fasteners. A system with this design will typically offer the fastest installation and greatest wind resistance. Similar products are also available to simulate the look of shingles or shakes.

- Duotone and other high-tech paint finishes can sometimes be used to mimic the look of more expensive substrates or to give panels a textured appearance, as noted earlier.

Going Custom

After all is said and done, if you still decide to go the custom route, be sure to allow ample lead time for design and fabrication of your special panels. Here are some specific considerations to keep in mind:

- How much material will be needed? Most panels are made from coil stock in modules 36", 42" or 48" wide. Panels should be planned with these modules in mind to minimize costly "drop" or waste (the amount of unused coil that will have to be scrapped). The amount of material required by the panel will also affect cost. A deep profile with heavy ribbing will use more metal per square foot than a shallow, flush-faced panel.

- What substrate will be used? The industry standards – galvanized or zinc aluminum coated steel – are the most economical choices, while special materials such as stainless steel or copper will carry a cost premium.

- How complex is the panel design? This may affect cost in other areas, too. A modified panel produced with an existing die will cost less than one requiring special tooling. A complex design with multiple ribs and angles may be more time-consuming to fabricate than a simpler profile.

- What type of finish will be best? Review the requirements of the project, including climate and environmental conditions, usage, roof slope, etc. Can a standard color be used? Special colors involve a longer lead time (typically 4-8 weeks) and will usually carry minimum order requirements. Should a protective film be applied to protect panels during installation?

- What other fabrication processes will be required? For example, crimp-curving of panels will carry an additional service charge. However, for many applications – such as self-supporting covers or roof decks – the curved panels can actually save money in labor and materials by reducing the amount of structural support needed and allowing you to use a lighter gauge of metal.

- What about code considerations? If the panel is to be used structurally, it must meet load-bearing requirements. If an UL-90 rated panel is modified in any way, its rating will be invalidated. If panels are to be installed over a wood deck, fire codes may be a concern, so check first. Span requirements are generally not a problem.

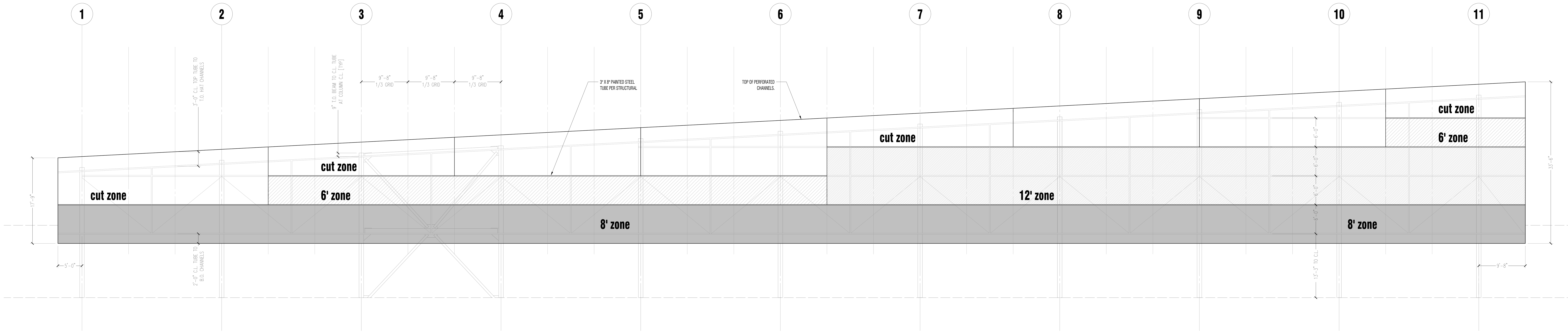
- What are the panel manufacturer's capabilities? When sourcing custom panels, inquire about the supplier's expertise in this area. Be sure to ask:

  -What types of materials, paint finishes and colors are offered?
  -What are the limitations on panel depths, widths and lengths?
  -What tooling is currently available?
  -Is engineering support available (including calculations and shop drawings)?
  -For curved panels, what type of curving process is used? Again, is technical support available for these applications?

Specialty or "designer" metal panels are not for every application. But it's a good idea to keep informed of the latest developments and understand how to choose and use these new profiles – whether standard or customized. By doing so, you have an opportunity to expand your product base; make inroads into the profitable high end market, and differentiate yourself from competitors.

# # #

Steven Tetreault is general sales manager for Rollfab Metal Products, Phoenix, AZ., a manufacturer of metal roofing panels. The author can be reached at (602) 275-1676; email info@rollfabmetal.com; website at www.rollfabmetal.com



1 hat height legend

sheet notes

A. SEE PLAN SHEET A2.2, AND ELEVATION SHEETS A3.1 AND A3.2 FOR VISUAL REPRESENTATION OF SCRIM RHYTHM / SCALE ACROSS ENTIRE ELEVATION.

B. SHADE SCRIM IS COMPRISED OF CUSTOM HAT CHANNEL PROFILES IN 20 GA. STAINLESS STEEL SHEET METAL. SEE PROFILES IN DRAWING 4 BELOW.

C. ALL PROFILES BEGIN AS FLAT SHEET SHEET STRIPS, IN MODULES SHEARED OUT OF STANDARD 4' WIDE SHEET. ORIGINATING WIDTHS ARE 24", 12" & 18".

D. ELEVATION DRAWING DEPICTS ZONES OF HAT CHANNEL HEIGHT. HATCHED AREAS INDICATE ZONES OF TYPICAL HEIGHTS, AS NOTED ON ELEVATION AND IN HAT CHANNEL INVENTORY. NON HATCHED AREAS ARE THOSE ENGAGED WITH THE SLOPING TOP PROFILE OF SCRIM, AND MUST BE TRIMMED TO FIT. TRIM HEIGHTS ARE LISTED IN THE SCHEDULED INVENTORY FOR EACH HAT ACROSS ENTIRE ELEVATION. PANELS SHALL BE TRIMMED TO HEIGHT WHEN FLAT, THEN FORMED TO HAT PROFILE. TOP OF HAT CHANNEL IS TO BE LEVEL, NOT SLOPED. [TOPS OF INSTALLED HAT CHANNELS WILL STEP SLIGHTLY].

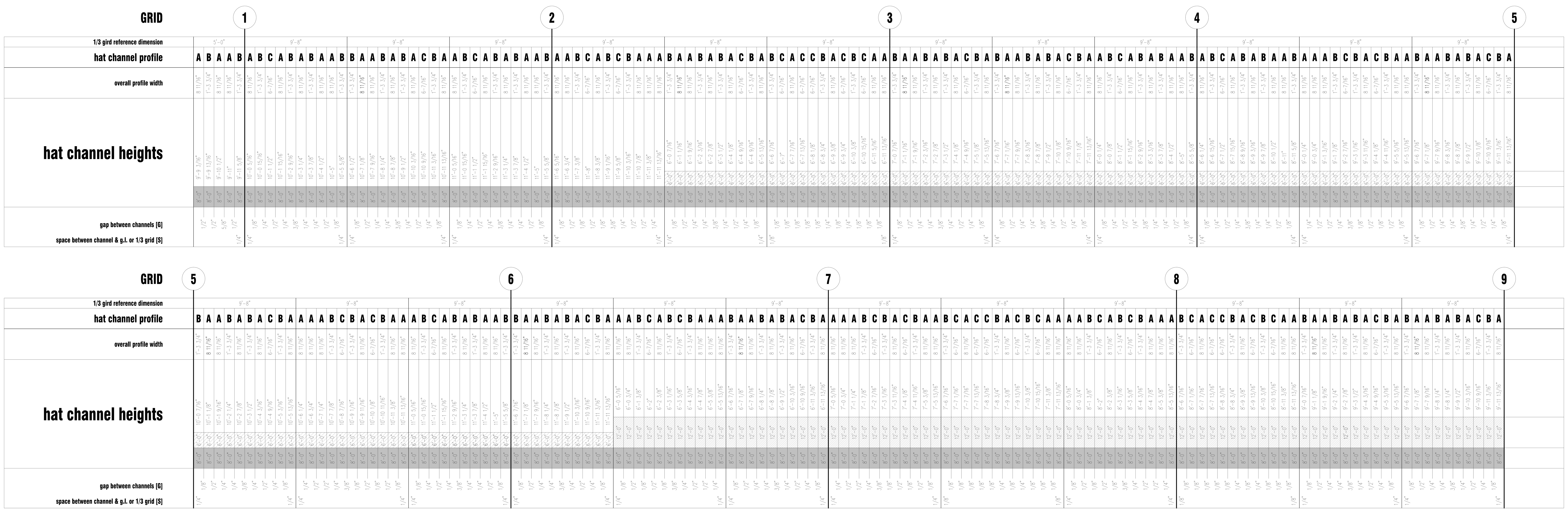
E. HAT CHANNELS INSTALL TO FACE OF 3" X 8" TUBE STEEL HORIZONTALS. FASTENING IS BY POWDER ACTUATED NAILS. ARCHITECT TO APPROVE APPEARANCE / SPACING, ETC. IN MOCK-UP.

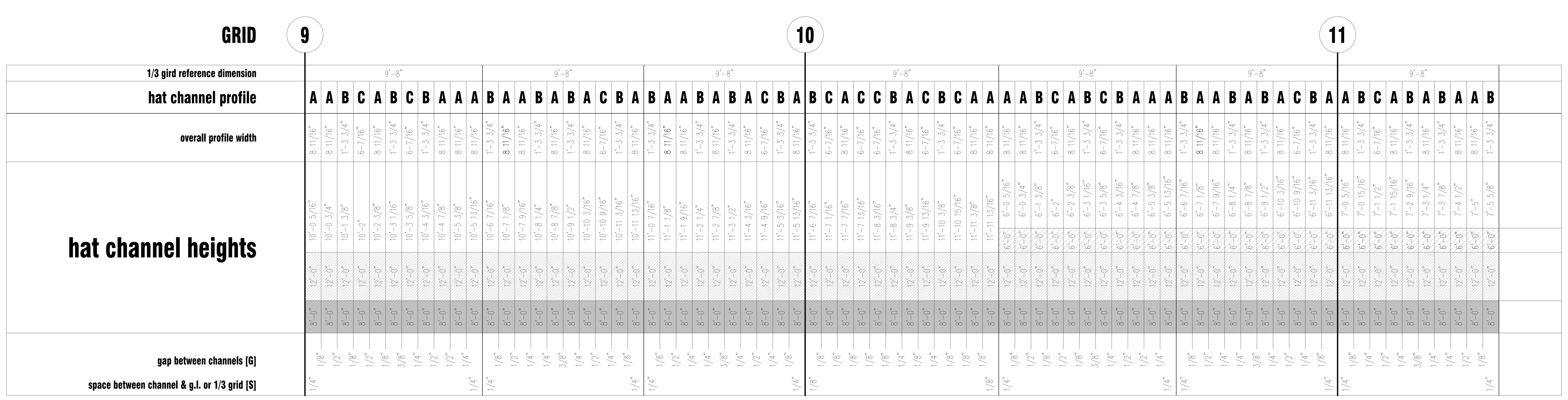
F. HAT CHANNEL INVENTORY GIVES ORDER OF HAT PROFILES ACROSS ELEVATION. GAPS BETWEEN EACH INSTALLED HAT ARE GIVEN IN FRACTIONAL INCHES. AS MUCH AS POSSIBLE, THE GAPS SHOWN IN THE SCHEDULE SHOULD BE MAINTAINED, THOUGH SOME GAPS MAY REQUIRE ADJUSTMENT TO FIT HATS WITHIN 1/3 GRID MODULES. 1/3 GRIDS ARE GIVEN AS CHECK POINTS FOR INSTALLATION, TO INSURE THE COUNT WILL FIT, AND PREVENT THE ORDER FROM "SLIDING" ACROSS THE ENTIRE ELEVATION.

G. SOUTH ELEVATION SHOWN. NORTH ELEVATION IS TO BE MIRROR IMAGE, AND USE THE SAME ORDER / SPACING GIVEN IN THE INVENTORY. SO ALL QUANTITIES DERIVED FROM INVENTORY SHOULD BE MULTIPLIED X 2.

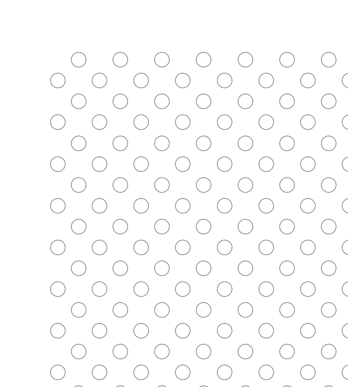
H. GAP AT ABUTTING ENDS IS TO BE DETERMINED. ARCHITECT TO STUDY VISUAL IMPACT OF GAP SIZES AND ADVISE / APPROVE IN FIELD.

I. THE LAST HAT CHANNEL AT EACH END SHOULD HAVE OUTER EDGE OF 1" RETURN FLANGE ALIGNED WITH END OF HORIZONTAL SUPPORT TUBES.



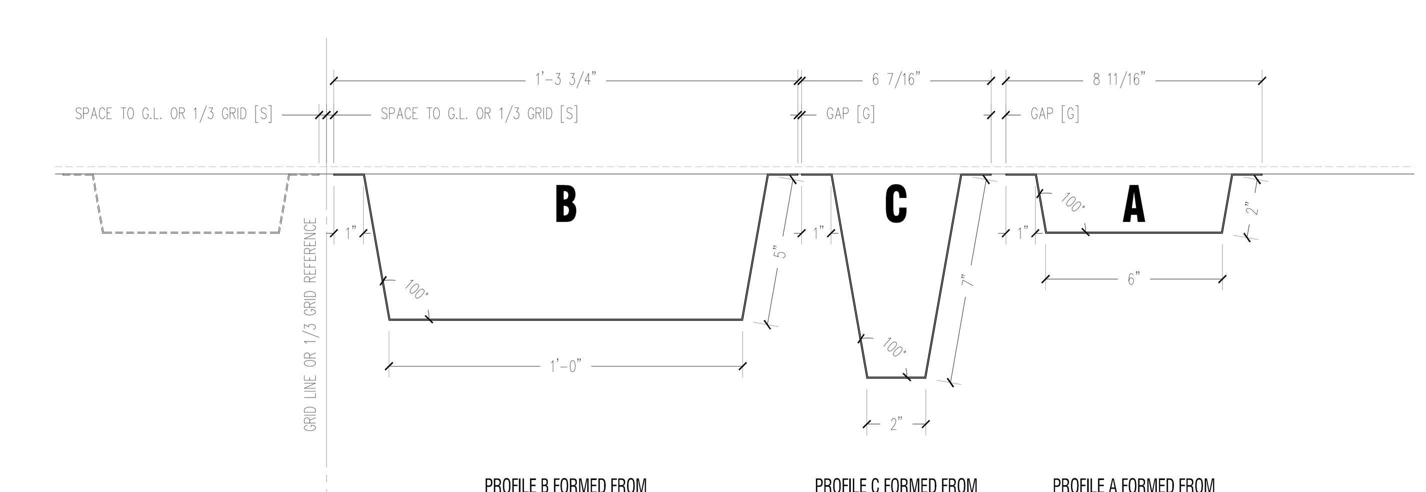


2 hat channel inventory



20 GA PERFORATED STAINLESS STEEL SHEET
1/8" DIAMETER HOLE
1/4" STAGGERED CENTERS
22.7% OPEN

4 perforated pattern



3 hat channel profiles

a3.4

hat channel scrim layout

scale varies

parmly billings library

510 North Broadway
Billings, Montana 59101

will bruder+PARTNERS LTD
2524 North 24th Street
Phoenix, Arizona 85008
602 324 6000
fax 602 324 6001

LICENSED ARCHITECT WILLIAM P. BRUDER 3278 PHOENIX, AZ STATE OF MONTANA

10132

construction documents

30 March 2012

01 May 2012 Bid Package Development 1

30 May 2012 City of Billings Comments 2

25 July 2012 Final Bid Package 3

ROLLFAB PERFORATED HAT CHANNEL "A" CUT LIST

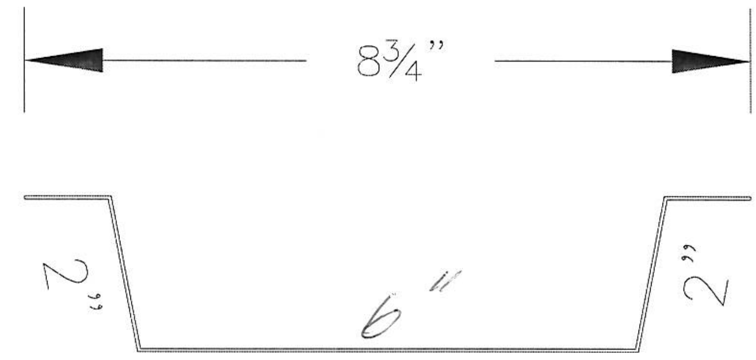
JOB NAME : PARMLEY BILLINGS LIBRARY — CUSTOMER: JACKSON CONTRACTING

JOB NO.: 2202 — DETAILER : SS — VENDOR: RMP — OWNER: RMP

DATE ISSUED : 1/14/13 — DATE REQ'D: TBD — MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED — COLOR : STAINLESS STEEL

MATERIAL DATA	
GAUGE	20

INPUT PANEL DATA	
O.C. SPACING	8.7500
STRETCH OUT	



QUANTITY	LENGTH FEET	LENGTH INCHES	LENGTH (INCHES)	PROFILE SHAPE	GRID NO.	COMMENTS	LINEAL FEET	NET SQ. FT.	WEIGHT	COMPLETED BY:
324	8 ft	0. in	96.000	A			2592.00	1890.00	0.00	
154	6 ft	0. in	72.000	A			924.00	673.75	0.00	
154	12 ft	0. in	144.000	A			1848.00	1347.50	0.00	
2	10 ft	0.313 in	120.313	A			20.05	14.62	0.00	
2	10 ft	0.75 in	120.750	A			20.13	14.67	0.00	
2	10 ft	2.375 in	122.375	A			20.40	14.87	0.00	
2	10 ft	4.875 in	124.875	A			20.81	15.18	0.00	
2	10 ft	5.375 in	125.375	A			20.90	15.24	0.00	
2	10 ft	5.813 in	125.813	A			20.97	15.29	0.00	
2	10 ft	7.125 in	127.125	A			21.19	15.45	0.00	
2	10 ft	7.563 in	127.563	A			21.26	15.50	0.00	
2	10 ft	8.875 in	128.875	A			21.48	15.66	0.00	
2	10 ft	10.188 in	130.188	A			21.70	15.82	0.00	
2	10 ft	11.813 in	131.813	A			21.97	16.02	0.00	
2	11 ft	1.125 in	133.125	A			22.19	16.18	0.00	
2	11 ft	1.563 in	133.563	A			22.26	16.23	0.00	
2	11 ft	2.875 in	134.875	A			22.48	16.39	0.00	
2	11 ft	4.188 in	136.188	A			22.70	16.55	0.00	
2	11 ft	5.813 in	137.813	A			22.97	16.75	0.00	
2	11 ft	7.438 in	139.438	A			23.24	16.95	0.00	

ROLLFAB PERFORATED HAT CHANNEL "A" CUT LIST

JOB NAME : PARMLEY BILLINGS LIBRARY — CUSTOMER: JACKSON CONTRACTING

JOB NO.: 2202 — DETAILER : SS — VENDOR: RMP — OWNER: RMP

DATE ISSUED : 1/14/13 — DATE REQ'D: TBD — MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED — COLOR : STAINLESS STEEL

2	11 ft	9.375 in	141.375	A			23.56	17.18	0.00	
2	11 ft	11.375 in	143.375	A			23.90	17.42	0.00	
2	11 ft	11.813 in	143.813	A			23.97	17.48	0.00	
2	6 ft	0.313 in	72.313	A			12.05	8.79	0.00	
2	6 ft	0.75 in	72.750	A			12.13	8.84	0.00	
2	6 ft	2.375 in	74.375	A			12.40	9.04	0.00	
2	6 ft	4.875 in	76.875	A			12.81	9.34	0.00	
2	6 ft	5.375 in	77.375	A			12.90	9.40	0.00	
2	6 ft	5.813 in	77.813	A			12.97	9.46	0.00	
2	6 ft	7.125 in	79.125	A			13.19	9.62	0.00	
2	6 ft	7.563 in	79.563	A			13.26	9.67	0.00	
2	6 ft	8.875 in	80.875	A			13.48	9.83	0.00	
2	6 ft	10.188 in	82.188	A			13.70	9.99	0.00	
2	6 ft	11.813 in	83.813	A			13.97	10.19	0.00	
2	7 ft	0.313 in	84.313	A			14.05	10.25	0.00	
2	7 ft	1.938 in	85.938	A			14.32	10.44	0.00	
2	7 ft	3.25 in	87.250	A			14.54	10.60	0.00	
2	7 ft	4.5 in	88.500	A			14.75	10.76	0.00	
2	7 ft	5. in	89.000	A			14.83	10.82	0.00	
2	10 ft	1.125 in	121.125	A			20.19	14.72	0.00	
2	10 ft	1.563 in	121.563	A			20.26	14.77	0.00	
2	10 ft	2.875 in	122.875	A			20.48	14.93	0.00	
2	10 ft	4.188 in	124.188	A			20.70	15.09	0.00	
2	10 ft	5.813 in	125.813	A			20.97	15.29	0.00	
2	10 ft	6.25 in	126.250	A			21.04	15.34	0.00	
2	10 ft	6.75 in	126.750	A			21.13	15.40	0.00	
2	10 ft	7.25 in	127.250	A			21.21	15.46	0.00	
2	10 ft	9.688 in	129.688	A			21.61	15.76	0.00	
2	10 ft	11.375 in	131.375	A			21.90	15.97	0.00	
2	10 ft	11.813 in	131.813	A			21.97	16.02	0.00	
2	11 ft	0.313 in	132.313	A			22.05	16.08	0.00	
2	11 ft	1.938 in	133.938	A			22.32	16.28	0.00	

ROLLFAB PERFORATED HAT CHANNEL "A" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	**11 ft**	**3.25 in**	135.250	**A**			22.54	16.44	0.00	
2	**11 ft**	**4.5 in**	136.500	**A**			22.75	16.59	0.00	
2	**11 ft**	**5. in**	137.000	**A**			22.83	16.65	0.00	
2	**11 ft**	**7.125 in**	139.125	**A**			23.19	16.91	0.00	
2	**11 ft**	**7.563 in**	139.563	**A**			23.26	16.96	0.00	
2	**11 ft**	**8.875 in**	140.875	**A**			23.48	17.12	0.00	
2	**11 ft**	**10.188 in**	142.188	**A**			23.70	17.28	0.00	
2	**11 ft**	**11.813 in**	143.813	**A**			23.97	17.48	0.00	
2	**6 ft**	**0.313 in**	72.313	**A**			12.05	8.79	0.00	
2	**6 ft**	**0.75 in**	72.750	**A**			12.13	8.84	0.00	
2	**6 ft**	**2.375 in**	74.375	**A**			12.40	9.04	0.00	
2	**6 ft**	**4.875 in**	76.875	**A**			12.81	9.34	0.00	
2	**6 ft**	**5.375 in**	77.375	**A**			12.90	9.40	0.00	
2	**6 ft**	**5.813 in**	77.813	**A**			12.97	9.46	0.00	
2	**6 ft**	**7.125 in**	79.125	**A**			13.19	9.62	0.00	
2	**6 ft**	**7.563 in**	79.563	**A**			13.26	9.67	0.00	
2	**6 ft**	**8.875 in**	80.875	**A**			13.48	9.83	0.00	
2	**6 ft**	**10.188 in**	82.188	**A**			13.70	9.99	0.00	
2	**6 ft**	**11.813 in**	83.813	**A**			13.97	10.19	0.00	
2	**7 ft**	**0.313 in**	84.313	**A**			14.05	10.25	0.00	
2	**7 ft**	**0.75 in**	84.750	**A**			14.13	10.30	0.00	
2	**7 ft**	**1.25 in**	85.250	**A**			14.21	10.36	0.00	
2	**7 ft**	**3.688 in**	87.688	**A**			14.61	10.66	0.00	
2	**7 ft**	**5.375 in**	89.375	**A**			14.90	10.86	0.00	
2	**7 ft**	**5.813 in**	89.813	**A**			14.97	10.91	0.00	
2	**7 ft**	**7.438 in**	91.438	**A**			15.24	11.11	0.00	
2	**7 ft**	**9.375 in**	93.375	**A**			15.56	11.35	0.00	
2	**7 ft**	**11.375 in**	95.375	**A**			15.90	11.59	0.00	
2	**7 ft**	**11.813 in**	95.813	**A**			15.97	11.64	0.00	
2	**8 ft**	**0.313 in**	96.313	**A**			16.05	11.70	0.00	
2	**8 ft**	**0.75 in**	96.750	**A**			16.13	11.76	0.00	
2	**8 ft**	**2.375 in**	98.375	**A**			16.40	11.96	0.00	

ROLLFAB PERFORATED HAT CHANNEL "A" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	8 ft	4.875 in	100.875	A			16.81	12.26	0.00
2	8 ft	5.375 in	101.375	A			16.90	12.32	0.00
2	8 ft	5.813 in	101.813	A			16.97	12.37	0.00
2	8 ft	7.438 in	103.438	A			17.24	12.57	0.00
2	8 ft	9.375 in	105.375	A			17.56	12.81	0.00
2	8 ft	11.375 in	107.375	A			17.90	13.05	0.00
2	8 ft	11.813 in	107.813	A			17.97	13.10	0.00
2	9 ft	1.125 in	109.125	A			18.19	13.26	0.00
2	9 ft	1.563 in	109.563	A			18.26	13.31	0.00
2	9 ft	2.875 in	110.875	A			18.48	13.47	0.00
2	9 ft	4.188 in	112.188	A			18.70	13.63	0.00
2	9 ft	5.813 in	113.813	A			18.97	13.83	0.00
2	9 ft	7.125 in	115.125	A			19.19	13.99	0.00
2	9 ft	7.563 in	115.563	A			19.26	14.04	0.00
2	9 ft	8.25 in	116.250	A			19.38	14.13	0.00
2	9 ft	10.188 in	118.188	A			19.70	14.36	0.00
2	9 ft	11.813 in	119.813	A			19.97	14.56	0.00
2	9 ft	9.188 in	117.188	A			19.53	14.24	0.00
2	9 ft	10.5 in	118.500	A			19.75	14.40	0.00
2	9 ft	11. in	119.000	A			19.83	14.46	0.00
2	10 ft	0.313 in	120.313	A			20.05	14.62	0.00
2	10 ft	1.938 in	121.938	A			20.32	14.82	0.00
2	10 ft	3.25 in	123.250	A			20.54	14.98	0.00
2	10 ft	4.5 in	124.500	A			20.75	15.13	0.00
2	10 ft	5. in	125.000	A			20.83	15.19	0.00
2	10 ft	7.125 in	127.125	A			21.19	15.45	0.00
2	10 ft	7.563 in	127.563	A			21.26	15.50	0.00
2	10 ft	8.875 in	128.875	A			21.48	15.66	0.00
2	10 ft	10.188 in	130.188	A			21.70	15.82	0.00
2	10 ft	11.813 in	131.813	A			21.97	16.02	0.00
2	11 ft	0.313 in	132.313	A			22.05	16.08	0.00
2	11 ft	1.938 in	133.938	A			22.32	16.28	0.00

ROLLFAB PERFORATED HAT CHANNEL "A" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	11 ft	3.25 in	135.250	A			22.54	16.44	0.00	
2	11 ft	4.5 in	136.500	A			22.75	16.59	0.00	
2	11 ft	5. in	137.000	A			22.83	16.65	0.00	
2	11 ft	6.313 in	138.313	A			23.05	16.81	0.00	
2	11 ft	6.75 in	138.750	A			23.13	16.86	0.00	
2	11 ft	8.375 in	140.375	A			23.40	17.06	0.00	
2	11 ft	10.875 in	142.875	A			23.81	17.36	0.00	
2	11 ft	11.375 in	143.375	A			23.90	17.42	0.00	
2	11 ft	11.813 in	143.813	A			23.97	17.48	0.00	
2	6 ft	1.063 in	73.063	A			12.18	8.88	0.00	
2	6 ft	1.563 in	73.563	A			12.26	8.94	0.00	
2	6 ft	2.875 in	74.875	A			12.48	9.10	0.00	
2	6 ft	4.125 in	76.125	A			12.69	9.25	0.00	
2	6 ft	5.813 in	77.813	A			12.97	9.46	0.00	
2	6 ft	7.438 in	79.438	A			13.24	9.65	0.00	
2	6 ft	9.375 in	81.375	A			13.56	9.89	0.00	
2	6 ft	11.313 in	83.313	A			13.89	10.12	0.00	
2	6 ft	11.813 in	83.813	A			13.97	10.19	0.00	
2	7 ft	1.063 in	85.063	A			14.18	10.34	0.00	
2	7 ft	1.563 in	85.563	A			14.26	10.40	0.00	
2	7 ft	2.875 in	86.875	A			14.48	10.56	0.00	
2	7 ft	4.125 in	88.125	A			14.69	10.71	0.00	
2	7 ft	5.813 in	89.813	A			14.97	10.91	0.00	
2	7 ft	7.063 in	91.063	A			15.18	11.07	0.00	
2	7 ft	7.563 in	91.563	A			15.26	11.13	0.00	
2	7 ft	8.875 in	92.875	A			15.48	11.29	0.00	
2	7 ft	10.125 in	94.125	A			15.69	11.44	0.00	
2	7 ft	11.813 in	95.813	A			15.97	11.64	0.00	
2	8 ft	0.25 in	96.250	A			16.04	11.70	0.00	
2	8 ft	1.938 in	97.938	A			16.32	11.90	0.00	
2	8 ft	3.188 in	99.188	A			16.53	12.05	0.00	
2	8 ft	4.5 in	100.500	A			16.75	12.21	0.00	

ROLLFAB PERFORATED HAT CHANNEL "A" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	8 ft	5. in	101.000	A			16.83	12.27	0.00
2	8 ft	6.25 in	102.250	A			17.04	12.43	0.00
2	8 ft	7.938 in	103.938	A			17.32	12.63	0.00
2	8 ft	9.188 in	105.188	A			17.53	12.78	0.00
2	8 ft	10.5 in	106.500	A			17.75	12.94	0.00
2	8 ft	11. in	107.000	A			17.83	13.00	0.00
2	9 ft	0.25 in	108.250	A			18.04	13.16	0.00
2	9 ft	0.75 in	108.750	A			18.13	13.22	0.00
2	9 ft	1.188 in	109.188	A			18.20	13.27	0.00
2	9 ft	3.688 in	111.688	A			18.61	13.57	0.00
2	9 ft	5.313 in	113.313	A			18.89	13.77	0.00
2	9 ft	5.813 in	113.813	A			18.97	13.83	0.00
2	9 ft	7.125 in	115.125	A			19.19	13.99	0.00
2	9 ft	7.563 in	115.563	A			19.26	14.04	0.00
2	9 ft	8.875 in	116.875	A			19.48	14.20	0.00
2	9 ft	10.125 in	118.125	A			19.69	14.36	0.00
2	9 ft	11.813 in	119.813	A			19.97	14.56	0.00
956							8300.07	6052.14	0.00

NOTE: LENGTHS ARE TO BE IN 1/8" MINIMUM INCREMENTS

ROLLFAB PERFORATED HAT CHANNEL "B" CUT LIST

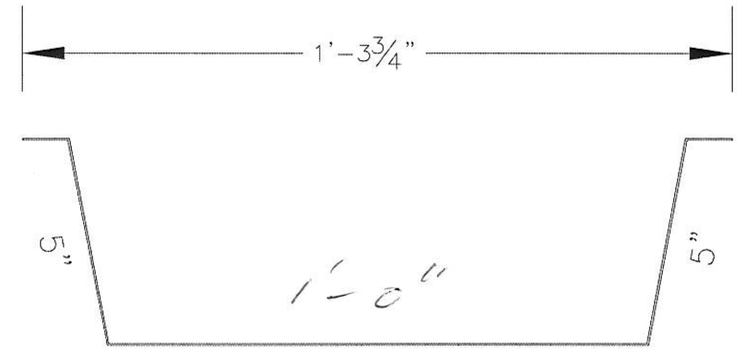
JOB NAME : PARMLEY BILLINGS LIBRARY CUSTOMER: JACKSON CONTRACTING

JOB NO.: 2202 DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : STAINLESS STEEL

MATERIAL DATA	
GAUGE	20

INPUT PANEL DATA	
O.C. SPACING	15.7500
STRETCH OUT	



QUANTITY	LENGTH FEET	LENGTH INCHES	LENGTH (INCHES)	PROFILE SHAPE	GRID NO.	COMMENTS	LINEAL FEET	NET SQ. FT.	WEIGHT	COMPLETED BY:
228	8 ft	0. in	96.000	B			1824.00	2394.00	0.00	
112	6 ft	0. in	72.000	B			672.00	882.00	0.00	
104	12 ft	0. in	144.000	B			1248.00	1638.00	0.00	
2	10 ft	1.375 in	121.375	B			20.23	26.55	0.00	
2	10 ft	3.063 in	123.063	B			20.51	26.92	0.00	
2	10 ft	4.188 in	124.188	B			20.70	27.17	0.00	
2	10 ft	6.438 in	126.438	B			21.07	27.66	0.00	
2	10 ft	8.25 in	128.250	B			21.38	28.05	0.00	
2	10 ft	9.5 in	129.500	B			21.58	28.33	0.00	
2	10 ft	11.188 in	131.188	B			21.86	28.70	0.00	
2	11 ft	2.25 in	134.250	B			22.38	29.37	0.00	
2	11 ft	3.5 in	135.500	B			22.58	29.64	0.00	
2	11 ft	5.188 in	137.188	B			22.86	30.01	0.00	
2	11 ft	6.438 in	138.438	B			23.07	30.28	0.00	
2	11 ft	8.75 in	140.750	B			23.46	30.79	0.00	
2	11 ft	10.375 in	142.375	B			23.73	31.14	0.00	
2	6 ft	1.375 in	73.375	B			12.23	16.05	0.00	
2	6 ft	3.063 in	75.063	B			12.51	16.42	0.00	
2	6 ft	4.188 in	76.188	B			12.70	16.67	0.00	
2	6 ft	6.438 in	78.438	B			13.07	17.16	0.00	

ROLLFAB PERFORATED HAT CHANNEL "B" CUT LIST

JOB NAME : PARMLEY BILLINGS LIBRARY — CUSTOMER: JACKSON CONTRACTING

JOB NO.: 2202 — DETAILER : SS — VENDOR: RMP — OWNER: RMP

DATE ISSUED : 1/14/13 — DATE REQ'D: TBD — MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED — COLOR : STAINLESS STEEL

2	6 ft	8.25 in	80.250	B			13.38	17.55	0.00	
2	6 ft	9.5 in	81.500	B			13.58	17.83	0.00	
2	6 ft	11.188 in	83.188	B			13.86	18.20	0.00	
2	7 ft	0.938 in	84.938	B			14.16	18.58	0.00	
2	7 ft	2.563 in	86.563	B			14.43	18.94	0.00	
2	7 ft	3.875 in	87.875	B			14.65	19.22	0.00	
2	7 ft	5.625 in	89.625	B			14.94	19.61	0.00	
2	11 ft	0.438 in	132.438	B			22.07	28.97	0.00	
2	10 ft	0.438 in	120.438	B			20.07	26.35	0.00	
2	10 ft	2.25 in	122.250	B			20.38	26.74	0.00	
2	10 ft	3.5 in	123.500	B			20.58	27.02	0.00	
2	10 ft	5.188 in	125.188	B			20.86	27.38	0.00	
2	10 ft	7.875 in	127.875	B			21.31	27.97	0.00	
2	10 ft	9.063 in	129.063	B			21.51	28.23	0.00	
2	10 ft	10.688 in	130.688	B			21.78	28.59	0.00	
2	11 ft	0.938 in	132.938	B			22.16	29.08	0.00	
2	11 ft	2.563 in	134.563	B			22.43	29.44	0.00	
2	11 ft	3.875 in	135.875	B			22.65	29.72	0.00	
2	11 ft	5.625 in	137.625	B			22.94	30.11	0.00	
2	11 ft	6.438 in	138.438	B			23.07	30.28	0.00	
2	11 ft	8.25 in	140.250	B			23.38	30.68	0.00	
2	11 ft	9.5 in	141.500	B			23.58	30.95	0.00	
2	11 ft	11.188 in	143.188	B			23.86	31.32	0.00	
2	6 ft	1.375 in	73.375	B			12.23	16.05	0.00	
2	6 ft	3.063 in	75.063	B			12.51	16.42	0.00	
2	6 ft	4.188 in	76.188	B			12.70	16.67	0.00	
2	6 ft	6.438 in	78.438	B			13.07	17.16	0.00	
2	6 ft	8.25 in	80.250	B			13.38	17.55	0.00	
2	6 ft	9.5 in	81.500	B			13.58	17.83	0.00	
2	6 ft	11.188 in	83.188	B			13.86	18.20	0.00	
2	7 ft	1.875 in	85.875	B			14.31	18.79	0.00	
2	7 ft	3.063 in	87.063	B			14.51	19.04	0.00	

ROLLFAB PERFORATED HAT CHANNEL "B" CUT LIST

JOB NAME : PARMLEY BILLINGS LIBRARY — CUSTOMER: JACKSON CONTRACTING

JOB NO.: 2202 — DETAILER : SS — VENDOR: RMP — OWNER: RMP

DATE ISSUED : 1/14/13 — DATE REQ'D: TBD — MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED — COLOR : STAINLESS STEEL

2	7 ft	4.688 in	88.688	B			14.78	19.40	0.00	
2	7 ft	6.438 in	90.438	B			15.07	19.78	0.00	
2	7 ft	8.75 in	92.750	B			15.46	20.29	0.00	
2	7 ft	10.375 in	94.375	B			15.73	20.64	0.00	
2	8 ft	1.375 in	97.375	B			16.23	21.30	0.00	
2	8 ft	3.063 in	99.063	B			16.51	21.67	0.00	
2	8 ft	4.188 in	100.188	B			16.70	21.92	0.00	
2	8 ft	6.438 in	102.438	B			17.07	22.41	0.00	
2	8 ft	8.75 in	104.750	B			17.46	22.91	0.00	
2	8 ft	10.375 in	106.375	B			17.73	23.27	0.00	
2	9 ft	0.438 in	108.438	B			18.07	23.72	0.00	
2	9 ft	2.25 in	110.250	B			18.38	24.12	0.00	
2	9 ft	3.5 in	111.500	B			18.58	24.39	0.00	
2	9 ft	5.188 in	113.188	B			18.86	24.76	0.00	
2	9 ft	6.438 in	114.438	B			19.07	25.03	0.00	
2	9 ft	8.25 in	116.250	B			19.38	25.43	0.00	
2	9 ft	9.5 in	117.500	B			19.58	25.70	0.00	
2	9 ft	11.188 in	119.188	B			19.86	26.07	0.00	
2	9 ft	9.813 in	117.813	B			19.64	25.77	0.00	
2	9 ft	11.625 in	119.625	B			19.94	26.17	0.00	
2	10 ft	0.938 in	120.938	B			20.16	26.46	0.00	
2	10 ft	2.563 in	122.563	B			20.43	26.81	0.00	
2	10 ft	3.875 in	123.875	B			20.65	27.10	0.00	
2	10 ft	5.625 in	125.625	B			20.94	27.48	0.00	
2	10 ft	6.5 in	126.500	B			21.08	27.67	0.00	
2	10 ft	8.25 in	128.250	B			21.38	28.05	0.00	
2	10 ft	9.5 in	129.500	B			21.58	28.33	0.00	
2	10 ft	11.188 in	131.188	B			21.86	28.70	0.00	
2	11 ft	0.938 in	132.938	B			22.16	29.08	0.00	
2	11 ft	2.563 in	134.563	B			22.43	29.44	0.00	
2	11 ft	3.875 in	135.875	B			22.65	29.72	0.00	
2	11 ft	5.625 in	137.625	B			22.94	30.11	0.00	

ROLLFAB PERFORATED HAT CHANNEL "B" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	**11 ft**	**7.375 in**	139.375	**B**			23.23	30.49	0.00	
2	**11 ft**	**9.063 in**	141.063	**B**			23.51	30.86	0.00	
2	**11 ft**	**10.188 in**	142.188	**B**			23.70	31.10	0.00	
2	**6 ft**	**0.438 in**	72.438	**B**			12.07	15.85	0.00	
2	**6 ft**	**2.188 in**	74.188	**B**			12.36	16.23	0.00	
2	**6 ft**	**3.5 in**	75.500	**B**			12.58	16.52	0.00	
2	**6 ft**	**4.563 in**	76.563	**B**			12.76	16.75	0.00	
2	**6 ft**	**6.438 in**	78.438	**B**			13.07	17.16	0.00	
2	**6 ft**	**8.75 in**	80.750	**B**			13.46	17.66	0.00	
2	**6 ft**	**10.375 in**	82.375	**B**			13.73	18.02	0.00	
2	**7 ft**	**0.438 in**	84.438	**B**			14.07	18.47	0.00	
2	**7 ft**	**2.188 in**	86.188	**B**			14.36	18.85	0.00	
2	**7 ft**	**3.5 in**	87.500	**B**			14.58	19.14	0.00	
2	**7 ft**	**5.125 in**	89.125	**B**			14.85	19.50	0.00	
2	**7 ft**	**6.438 in**	90.438	**B**			15.07	19.78	0.00	
2	**7 ft**	**8.188 in**	92.188	**B**			15.36	20.17	0.00	
2	**7 ft**	**9.5 in**	93.500	**B**			15.58	20.45	0.00	
2	**7 ft**	**11.125 in**	95.125	**B**			15.85	20.81	0.00	
2	**8 ft**	**0.875 in**	96.875	**B**			16.15	21.19	0.00	
2	**8 ft**	**2.563 in**	98.563	**B**			16.43	21.56	0.00	
2	**8 ft**	**3.875 in**	99.875	**B**			16.65	21.85	0.00	
2	**8 ft**	**6.938 in**	102.938	**B**			17.16	22.52	0.00	
2	**8 ft**	**8.563 in**	104.563	**B**			17.43	22.87	0.00	
2	**8 ft**	**9.875 in**	105.875	**B**			17.65	23.16	0.00	
2	**8 ft**	**11.625 in**	107.625	**B**			17.94	23.54	0.00	
2	**9 ft**	**1.875 in**	109.875	**B**			18.31	24.04	0.00	
2	**9 ft**	**3.063 in**	111.063	**B**			18.51	24.29	0.00	
2	**9 ft**	**4.688 in**	112.688	**B**			18.78	24.65	0.00	
2	**9 ft**	**6.438 in**	114.438	**B**			19.07	25.03	0.00	
2	**9 ft**	**8.188 in**	116.188	**B**			19.36	25.42	0.00	
2	**9 ft**	**9.5 in**	117.500	**B**			19.58	25.70	0.00	
2	**9 ft**	**11.188 in**	119.188	**B**			19.86	26.07	0.00	

ROLLFAB PERFORATED HAT CHANNEL "B" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	**8 ft**	**5.625 in**	101.625	**B**			16.94	22.23	0.00	
672							**5814.09**	**7631.00**	**0.00**	

NOTE: LENGTHS ARE TO BE IN 1/8" MINIMUM INCREMENTS

ROLLFAB PERFORATED HAT CHANNEL "C" CUT LIST

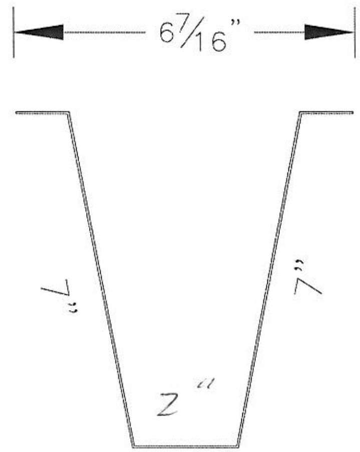
JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

MATERIAL DATA	
GAUGE	20

INPUT PANEL DATA	
O.C. SPACING	6.4380
STRETCH OUT	



QUANTITY	LENGTH FEET	LENGTH INCHES	LENGTH (INCHES)	PROFILE SHAPE	GRID NO.	COMMENTS	LINEAL FEET	NET SQ. FT.	WEIGHT	COMPLETED BY:
110	8 ft	0. in	96.000	C			880.00	472.12	0.00	
44	6 ft	0. in	72.000	C			264.00	141.64	0.00	
64	12 ft	0. in	144.000	C			768.00	412.03	0.00	
2	10 ft	2. in	122.000	C			20.33	10.91	0.00	
2	10 ft	3.625 in	123.625	C			20.60	11.05	0.00	
2	10 ft	10.563 in	130.563	C			21.76	11.67	0.00	
2	11 ft	4.563 in	136.563	C			22.76	12.21	0.00	
2	11 ft	7.063 in	139.063	C			23.18	12.43	0.00	
2	11 ft	7.813 in	139.813	C			23.30	12.50	0.00	
2	11 ft	8.188 in	140.188	C			23.36	12.54	0.00	
2	11 ft	9.813 in	141.813	C			23.64	12.68	0.00	
2	11 ft	10.938 in	142.938	C			23.82	12.78	0.00	
2	6 ft	2. in	74.000	C			12.33	6.62	0.00	
2	6 ft	3.625 in	75.625	C			12.60	6.76	0.00	
2	6 ft	10.563 in	82.563	C			13.76	7.38	0.00	
2	7 ft	1.5 in	85.500	C			14.25	7.65	0.00	
2	10 ft	4.563 in	124.563	C			20.76	11.14	0.00	

ROLLFAB PERFORATED HAT CHANNEL "C" CUT LIST

JOB NAME : PARMLEY BILLINGS LIBRARY   CUSTOMER: JACKSON CONTRACTING

JOB NO.: 2202   DETAILER : SS   VENDOR: RMP   OWNER: RMP

DATE ISSUED : 1/14/13   DATE REQ'D: TBD   MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED   COLOR : STAINLESS STEEL

2	10 ft	8.438 in	128.438	C			21.41	11.48	0.00	
2	10 ft	10.125 in	130.125	C			21.69	11.64	0.00	
2	11 ft	1.5 in	133.500	C			22.25	11.94	0.00	
2	11 ft	10.563 in	142.563	C			23.76	12.75	0.00	
2	6 ft	2. in	74.000	C			12.33	6.62	0.00	
2	6 ft	3.625 in	75.625	C			12.60	6.76	0.00	
2	6 ft	10.563 in	82.563	C			13.76	7.38	0.00	
2	7 ft	2.438 in	86.438	C			14.41	7.73	0.00	
2	7 ft	4.125 in	88.125	C			14.69	7.88	0.00	
2	7 ft	7.063 in	91.063	C			15.18	8.14	0.00	
2	7 ft	7.813 in	91.813	C			15.30	8.21	0.00	
2	7 ft	8.188 in	92.188	C			15.36	8.24	0.00	
2	7 ft	9.813 in	93.813	C			15.64	8.39	0.00	
2	7 ft	10.938 in	94.938	C			15.82	8.49	0.00	
2	8 ft	2. in	98.000	C			16.33	8.76	0.00	
2	8 ft	3.625 in	99.625	C			16.60	8.91	0.00	
2	8 ft	7.063 in	103.063	C			17.18	9.22	0.00	
2	8 ft	7.813 in	103.813	C			17.30	9.28	0.00	
2	8 ft	8.188 in	104.188	C			17.36	9.32	0.00	
2	8 ft	9.813 in	105.813	C			17.64	9.46	0.00	
2	8 ft	10.938 in	106.938	C			17.82	9.56	0.00	
2	9 ft	4.563 in	112.563	C			18.76	10.06	0.00	
2	9 ft	10.563 in	118.563	C			19.76	10.60	0.00	
2	10 ft	1.5 in	121.500	C			20.25	10.86	0.00	
2	10 ft	10.563 in	130.563	C			21.76	11.67	0.00	
2	11 ft	1.5 in	133.500	C			22.25	11.94	0.00	
2	11 ft	8. in	140.000	C			23.33	12.52	0.00	
2	11 ft	9.625 in	141.625	C			23.60	12.66	0.00	
2	6 ft	4.563 in	76.563	C			12.76	6.85	0.00	
2	6 ft	7. in	79.000	C			13.17	7.06	0.00	
2	6 ft	7.813 in	79.813	C			13.30	7.14	0.00	
2	6 ft	8.125 in	80.125	C			13.35	7.16	0.00	

ROLLFAB PERFORATED HAT CHANNEL "C" CUT LIST

JOB NAME : **PARMLEY BILLINGS LIBRARY** CUSTOMER: **JACKSON CONTRACTING**

JOB NO.: **2202** DETAILER : SS VENDOR: RMP OWNER: RMP

DATE ISSUED : 1/14/13 DATE REQ'D: TBD MATERIAL : 304-2B/SS .127RD x .25STG PERFORATED COLOR : **STAINLESS STEEL**

2	6 ft	9.75 in	81.750	C			13.63	7.31	0.00
2	6 ft	10.938 in	82.938	C			13.82	7.42	0.00
2	7 ft	4.563 in	88.563	C			14.76	7.92	0.00
2	7 ft	10.563 in	94.563	C			15.76	8.46	0.00
2	8 ft	1.5 in	97.500	C			16.25	8.72	0.00
2	8 ft	7.5 in	103.500	C			17.25	9.25	0.00
2	9 ft	2.438 in	110.438	C			18.41	9.87	0.00
2	9 ft	4.125 in	112.125	C			18.69	10.03	0.00
2	9 ft	10.563 in	118.563	C			19.76	10.60	0.00
328							2893.53	1552.38	0.00

NOTE: LENGTHS ARE TO BE IN 1/8" MINIMUM INCREMENTS

Construction Fasteners

For Concrete:
Aggre-gator® 300 Series Stainless Anchors
ConFlex® Large Diameter Concrete Anchors
Crete-Flex® SS4 Concrete Anchors
UltraCon® Concrete Anchors
Drill Bits (Carbide-Tipped)
MKT Mechanical Anchors

For Metal – No Washer:
Alumi-Flex™ Stainless Steel Drill Screws
Bi-Flex™ 300 Series Stainless Drill Screws
Dril-Flex® Structural Self-Drilling Screws
Drill Screws, Standard, No Washer
Drilit® Wood-to-Metal Reamers
Fab-Lok® Bolt and Sleeve Fasteners
Low Profile Screws for Roof Clips
AllFlex™ Stainless Steel Tapping Screws
Tap-Flex™ Structural Tapping Screws
N Rivets – *Coming Soon*

For Metal – With Washer:
Drill Screws with Bonded Washers
Flo-Seal® Sealing SDS for Metal
TapFast® Sealing SDS for Metal-to-Wood
Topseal™ Stainless Steel Tapping Screws

For Threaded Rod (Sprinkler/HVAC):
HangerMate® Anchoring Systems

Hurricane Storm Protection
Hurricane Storm Panel Fasteners
Hurricane Storm Protection Accessories
Hurricane Storm Panels

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Bi-Flex 300 Series SS Fasteners: 12-14 x 2", 5/16" Hex Head, #2 Point, Box of 200

#12-14 x 2" bi-metal screws with a 300 series stainless steel head and threads fused to hardened steel lead threads and self-drilling point. Stalgard GB coating provides a galvanic barrier. #2 self-drilling point can drill thicknesses up to .140". 5/16" hex drive.

Bi-Flex fasteners provide unmatched corrosion resistance and high performance in a wide range of demanding applications, including aluminum, and are virtually immune to delayed embrittlement failures.

Product No.: HFAJ240P
OEM: Elco
PRICE: $101.73

Quantity: 1

Add To Shopping Cart

Note: Prices shown are US$. This web site is not currently able to handle international orders. If you are outside the United States, please call us at 281-488-3900 or e-mail us at support@hurripanel.com to place an order.

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Hurripanel Fasteners Inc.
2128 Springwood • Carrollton, TX 75006 support@hurripanel.com
1.972.417.8882 or toll free 1.877.424.7616

Square drive as indicated in spec does not exist

Per Add#4 - Channel to be passivated after cutting to prevent rust spotting

Pro-Finish 500 Color Guide

RMP ROLLFAB METAL PRODUCTS

2529 West Jackson Street
Phoenix, AZ 85009
P: (602) 275-1676 F: (602) 275-1739
www.Rollfabmetal.com

Pro-Finish 500 Cool Primary Selection[1]

Regal White[4]
SR: 0.68 • E: 0.86 • SRI: 82

Sierra Tan[4]
SR: 0.35 • E: 0.86 • SRI: 37

Sandstone[4]
SR: 0.54 • E: 0.86 • SRI: 63

Terra Cotta[4]
SR: 0.35 • E: 0.87 • SRI: 37

Mansard Brown
SR: 0.27 • E: 0.86 • SRI: 26

Medium Bronze[4]
SR: 0.30 • E: 0.87 • SRI: 31

Dark Bronze
SR: 0.26 • E: 0.84 • SRI: 24

L.G. Colonial Red[4]
SR: 0.33 • E: 0.85 • SRI: 35

Patina Green[4]
SR: 0.29 • E: 0.87 • SRI: 29

Evergreen
SR: 0.27 • E: 0.85 • SRI: 26

Pre Weathered Galvalume[2]
SR: 0.30 • E: 0.79 • SRI: 27

Copper Metallic[2, 4]
SR: 0.49 • E: 0.85 • SRI: 55

Silver Metallic[2, 4]
SR: 0.60 • E: 0.77 • SRI: 68

Pro-Finish 500 Cool Accent Selection[1, 3]

Ash Grey[4]
SR: 0.39 • E: 0.84 • SRI: 41

Slate Grey[4]
SR: 0.36 • E: 0.84 • SRI: 37

Charcoal Grey
SR: 0.29 • E: 0.84 • SRI: 28

Hartford Green
SR: 0.27 • E: 0.85 • SRI: 26

Regal Blue
SR: 0.26 • E: 0.85 • SRI: 24

Slate Blue
SR: 0.26• E: 0.85• SRI: 24

Brite Red
SR: 0.42 • E: 0.84• SRI: 45

Additional Colors: Special Inquiry
Hemlock Green • Solar White • Stone White
Regal Red • Champagne Metallic

Note:
Longer lead time and added cost may apply to accent colors

Also Available:
- Zincalume Plus® (acrylic coated Galvalume®)

Custom Colors and Small Quantities:
- Available in quantities to a minimum of 1000 lineal feet

Notes:
1 Energy Star qualified products steep slope
2 Standard mica metallic colors with a modest premium
3 Additional lead-time and cost may apply
4 LEED qualified products

Oil Canning:
All flat metal surfaces can display waviness or "oil canning" due to standard mill tolerances. Inherent variations in the substrate surface may affect appearances.

24 Gauge

WE SELL ENERGY STAR

Manufacturers limited paint warranty available at time of purchase on Fluropon® products.

valspar

RMP ROLLFAB METAL PRODUCTS

Pro-Finish 500 Color Guide

2529 West Jackson Street
Phoenix, AZ 85009
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Performance Specifications

Specular Gloss at 60° ASTM D 523[2]	Typical standard gloss: 20–35 Typical low gloss: 5-15
Pencil Hardness ASTM D 3363	HB to 2H
T-Bend ASTM D 4145[5]	0T to 3T[3] with no loss of adhesion
Cross Hatch Adhesion ASTM D 3359	No loss of adhesion
Reverse Impact ASTM D 2794[5]	Galvalume® or HDG: 2x[3] metal thickness inch-pounds No loss of adhesion Aluminum: 1.5x metal thickness inch-pounds No loss of adhesion
Humidity Resistance **100% RH 2,000 Hours ASTM D 2247** **100% RH 3,000 Hours ASTM D 2247**	Galvalume® or HDG: no field blisters Aluminum: No field blisters
Salt Spray Resistance **1,000 Hours ASTM B 117** **3,000 Hours ASTM B 117**	Galvalume® or HDG: Creep from scribe no more than 1/16" (2mm), no field blisters Aluminum: Creep from scribe no more than 1/16" (2mm), no field blisters
South Florida Exposure **ASTM D 2244** **ASTM D 4214**	Film Integrity: 35 years Color: No more that 5Δ Hunter units in 30 years Chalk: Rating no less than 8 to 30 years
Flame Test ASTM E 84	Class A coating
Water Immersion 500° hours 100 F ASTM D 870	No loss of adhesion
Dew Cycle Weatherometer 1000 hours ASTM D 3361	Color change: No more than 5Δ Hunter units Chalk: Rating no less than 8
Abrasion Resistance ASTM D 968, Method A	65 ± 10 liters
Application Method	Reverse roll coat
Substrate [1]	Aluminum, HDG or Galvalume®
Viscosity ASTM D 4212 (No. 4 Zahn cup)	20 to 35 seconds
VOC (Theoretical) ASTM D 3960	4.4 to 4.8 pounds per gallon[4]
Clean-Up Solvent	Aromatic Ketone blend
Peak Metal Temperature	460° to 490 °F
Flash Point ASTM D 3278	83° F
Contains Lubricant	Yes
MEK Double Rubs ASTM D 5402	100 Plus
Color Side of Panel Dry Film Thickness ASTM D 1005	Primer: 0.20-0.30 mil Top coat: 0.70-0.80 mil Total system: 0.90-1.1 mil
Reverse Side of Panel Dry Film Thickness ASTM D 1005	Primer: 0.20-0.30 mil Top coat: 0.30-0.40 mil Total System: 0.50-0.70
Resin System	Fluoropolymer system comprised of 70% PVDF resins

Description:

Cool Pro-Finish 500 is a premium Fluropon® fluoropolymer coating system containing 70% PVDF proprietary resins. Cool Pro-Finish 500 is a field-proven, high performance exterior finish. It provides outstanding resistance to ultraviolet rays, exceptional color retention and resistance to chalking and chemical degradation.

Notes:

1 All substrates must be properly pretreated.
2 American Society for Testing and Materials.
3 Fluropon is not designed to bridge cracks in the substrate.
4 Varies by color.
5 Fluropon coatings will generally meet the requirements for most post-painted fabrication processes. However, variations in metal quality, thickness or cleaning/pretreatment applications can lead to diminished flexibility.

24 Gauge

RMP ROLLFAB METAL PRODUCTS

www.rollfabmetal.com

LEED Information

Rollfab Metal Products uses recycled metal in our roofing components, which are themselves recyclable at the end of their life.

Our standard colors qualify for one credit for the steep slope (>2:12) LEED-NC Credit 2.2 Credit 7.2 Heat Island Effect: Roof in the Sustainable Sites category. The criteria for the points are that the roof must cover at least 75% (excluding skylights and equipment) of the roof surface and have a minimum SRI of 29.
In addition, our standard color Regal White will satisfy the SRI value for LOW SLOPE

Rollfab Metal Products uses coil manufactured by a basic oxygen furnace with approximately 25% postconsumer recycled content and 6.6% postindustrial content. This can contribute to the material and resources 4.1 LEED credit.

Other credits to consider when using Rollfab Metal products for this project:

- Contributes to MR Credit for 1.1 or 1.2 – Building Reuse
- Contributes to MR Credit 2.1 or 2.2 – Construction Waste management
- Contributes to EA Credit – Optimize Energy Performance

Regards,

Steven P. Tetreault
General Sales Manager
Rollfab Metal Products

Arizona Owned *Arizona Made* *Arizona Jobs*

602-275-1676 Fax 602-275-1739

2529 W Jackson Street, Phoenix, Arizona 85009

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2008 The Inherent Recycled Content of Today's Steel

This paper provides an overview of the methods used to produce steel in North America today, and describes steel's inherent recycled content. Contemporary technologies produce steel in two ways, both of which require old steel to make new.

The basic oxygen furnace (BOF) process uses 25 to 35 percent old steel to make new. It produces products—such as automotive fenders, encasements of refrigerators, and packaging like soup cans, five-gallon pails, and 55-gallon drums—whose major required characteristic is drawability.

The electric arc furnace (EAF) process uses more than 80 percent old steel to make new. It produces products— such as structural beams, steel plates, and reinforcement bars—whose major required characteristic is strength.

Many are surprised to learn that steel is the world's, as well as North America's, most recycled material, and in the United States alone, almost 75 million tons of steel were recycled or exported for recycling in 2008. This is done for economic as well as environmental reasons. It is always cheaper to recycle steel than to mine virgin ore and move it through the process of making new steel. However, it should also be clearly understood that many steel applications are durables, and even though two out of every three pounds of new steel are produced from old steel, the fact that cars, appliances, and bridges last a long time makes it necessary to continue to mine virgin ore to supplement the production of new steel. Economic expansion, domestically and internationally, creates additional demand that cannot be fully met by available scrap supplies.

Unlike other competing industries, recycled content in the steel industry is second nature. The North American steel industry has been recycling steel scrap for over 170 years through the growth of 2,500 scrap processors and some 12,500 auto dismantlers. Many of them have been in the business for more than 100 years. The pre-consumer, post-consumer, and total recycled content of steel products in the United States can be determined for the calendar year 2008 using information from the American Iron and Steel Institute (AISI), the Institute of Scrap Recycling Industries (ISRI), and the U.S. Geological Survey. Additionally, a study prepared for the AISI by William T. Hogan, S.A., and Frank T. Koelble of Fordham University is used to establish pre- and post-consumer fractions of purchased scrap.

Individual company statistics are not applicable or instructive because of the open loop recycling capability that the steel and iron industries enjoy, with available scrap typically going to the closest melting furnace. This open loop recycling allows, for example, an old car to be melted down to produce a new soup can, and then, as the new soup can is recycled, it is melted down to produce a new car, appliance, or perhaps a structural beam used to repair some portion of the Golden Gate Bridge.

Basic Oxygen Furnace

The basic oxygen furnace (BOF) facilities consumed a total of 13,867,000 tons of ferrous scrap in the production of 42,206,000 tons of raw steel during 2008. Based on U.S. Geological Survey statistics, 901,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. In the steel industry, these tons are classified as "home scrap," but are a mix of runaround scrap and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as pre-consumer scrap, equating to 721,000 tons (901,000 x 80%). Additionally, these operations reported that they consumed 26,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

<TURN OVER>

For more information, please contact the Steel Recycling Institute at 1-412-922-2772, or visit us online at www.recycle-steel.org.

The New Steel

Steel Recycling Institute

As a result of the above, based on the total scrap consumed, outside purchases of scrap equate to 12,940,000 tons [13,867,000 - (901,000 + 26,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4 percent, while 16.6 percent of these purchases would be pre-consumer. This equates to 2,148,000 tons of pre-consumer scrap (12,940,000 x 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 42,206,000 tons of raw steel in the BOF is:

13,867,000 / 42,206,000 = 32.9%
(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(12,940,000 - 2,148,000) + 26,000 = 10,818,000
and
10,818,000 / 42,206,000 = 25.6%
(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(721,000 + 2,148,000) / 42,206,000 =
2,869,000 / 42,206,000 = 6.8%
(Pre-Consumer Scrap / Total Tons Raw Steel)

Electric Arc Furnace

The electric arc furnace (EAF) facilities consumed a total of 50,563,000 tons of ferrous scrap in the production of 56,369,000 tons of raw steel during 2008. Based on U.S. Geological Survey adjusted statistics, 16,365,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. Again, in the steel industry, these tons are classified as "home scrap," but are a mix of runaround scrap and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as pre-consumer scrap, equating to 13,092,000 tons (16,365,000 x 80%). Additionally, these operations reported that they consumed 77,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

As a result, based on the total scrap consumed, outside purchases of scrap equate to 34,121,000 tons [50,563,000 - (16,365,000 + 77,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4 percent, while 16.6 percent of these purchases would be pre-consumer. This equates to 5,664,000 tons of pre-consumer scrap (34,121,000 x 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 56,369,000 tons of raw steel in the EAF is:

50,563,000 / 56,369,000= 89.7%
(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(34,121,000 - 5,664,000) + 77,000 = 28,534,000
and
28,534,000 / 56,369,000 = 50.6%
(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(13,092,000 + 5,664,000) / 56,369,000 =
18,756,000 / 56,369,000 = 33.3%
(Pre-Consumer Scrap / Total Tons Raw Steel)

The above discussion and calculations demonstrate conclusively the inherent recycled content of today's steel in North America. To buy steel is to "Buy Recycled."

Understanding the recycled content of BOF and EAF steels, one should not attempt to select one steel producer over another on the basis of a simplistic comparison of relative scrap usage or recycled content. Rather than providing an enhanced environmental benefit, such a selection could prove more costly in terms of total life cycle assessment energy consumption or other variables. Steel does not rely on "recycled content" purchasing to incorporate or drive scrap use. It already happens because of the economics. Recycled content for steel is a function of the steelmaking process itself.

After its useful product life, regardless of its BOF or EAF origin, steel is recycled back into another steel product. Thus steel with more than 80 percent recycled content cannot be described as environmentally superior to steel with 30 percent recycled content. This is not contradictory because they are both complementary parts of the total interlocking infrastructure of steelmaking, product manufacture, scrap generation and recycling. The recycled content of EAF relies on the embodied energy savings of the steel created in the BOF. Steel is truly the most recycled material.

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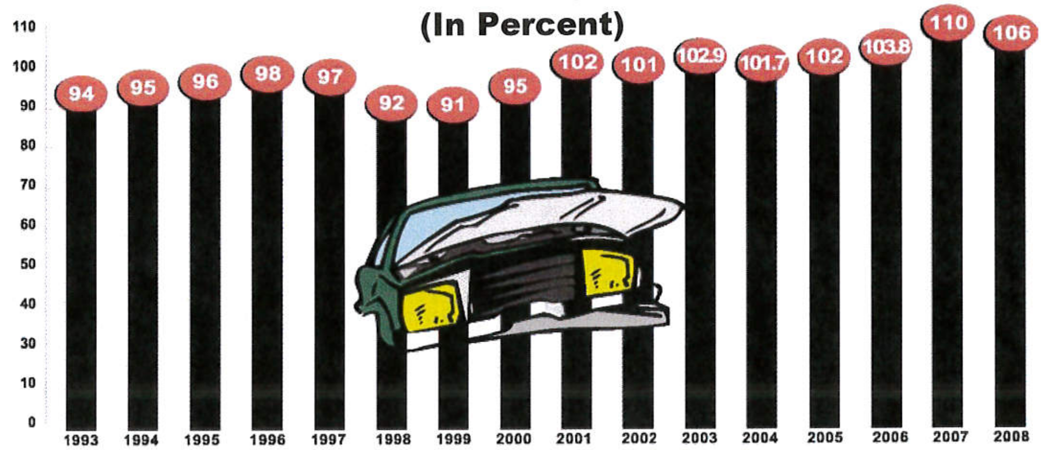
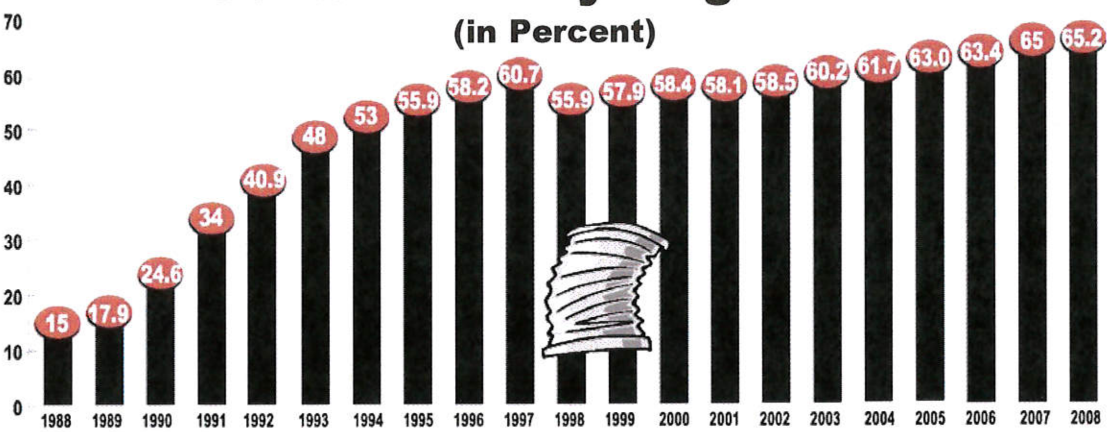
STEEL RECYCLING RATES AT A GLANCE

2008 STEEL RECYCLING RATES

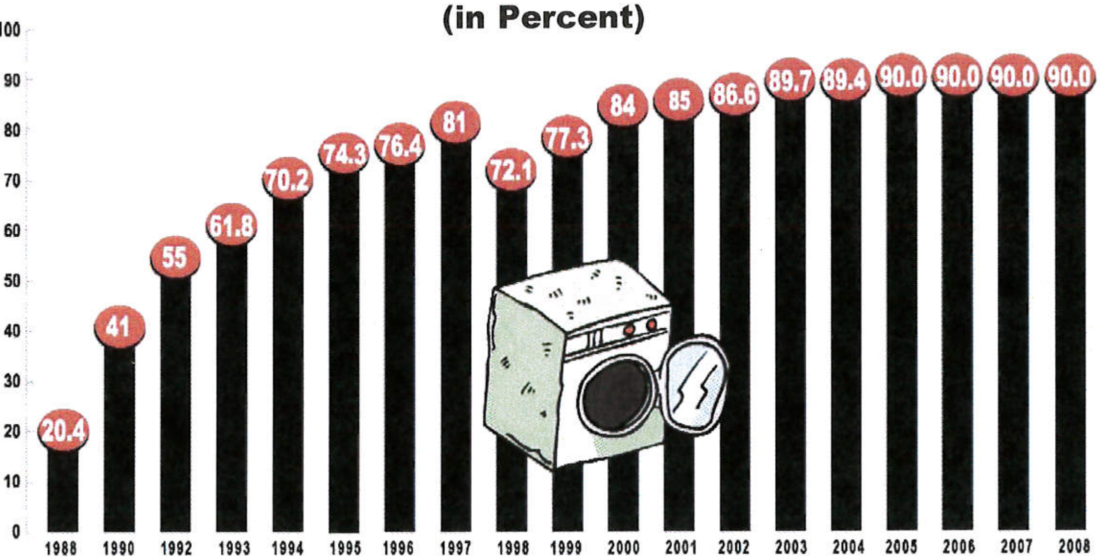
Automotive Recycling Rates



Container Recycling Rates



Appliance Recycling Rates



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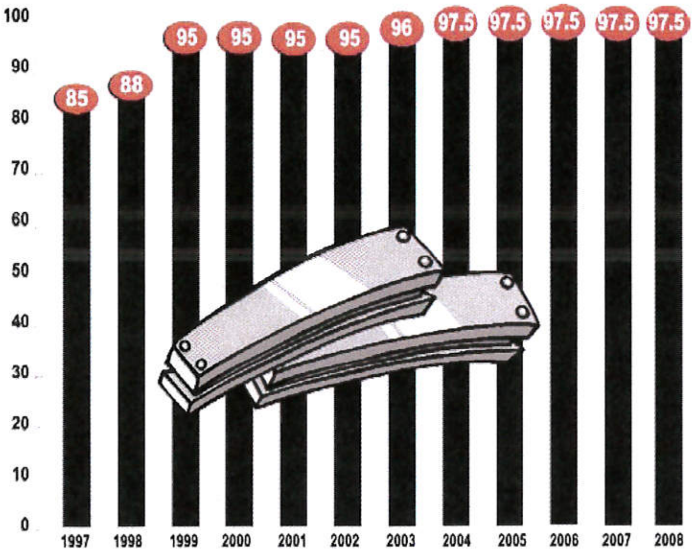
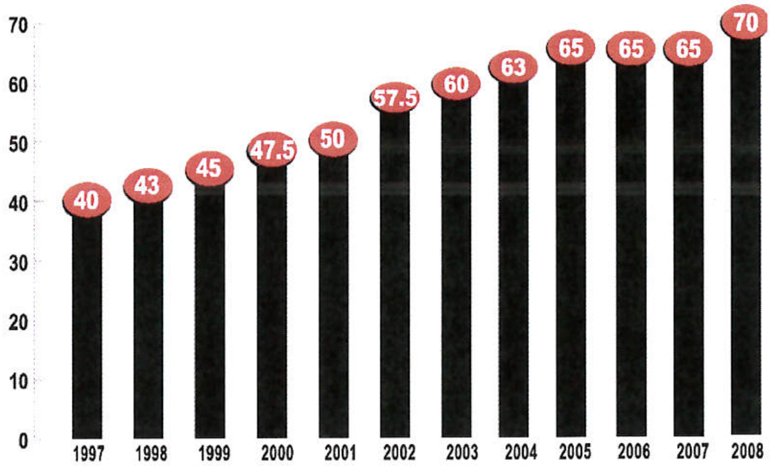
STEEL RECYCLING RATES AT A GLANCE

2008 STEEL RECYCLING RATES

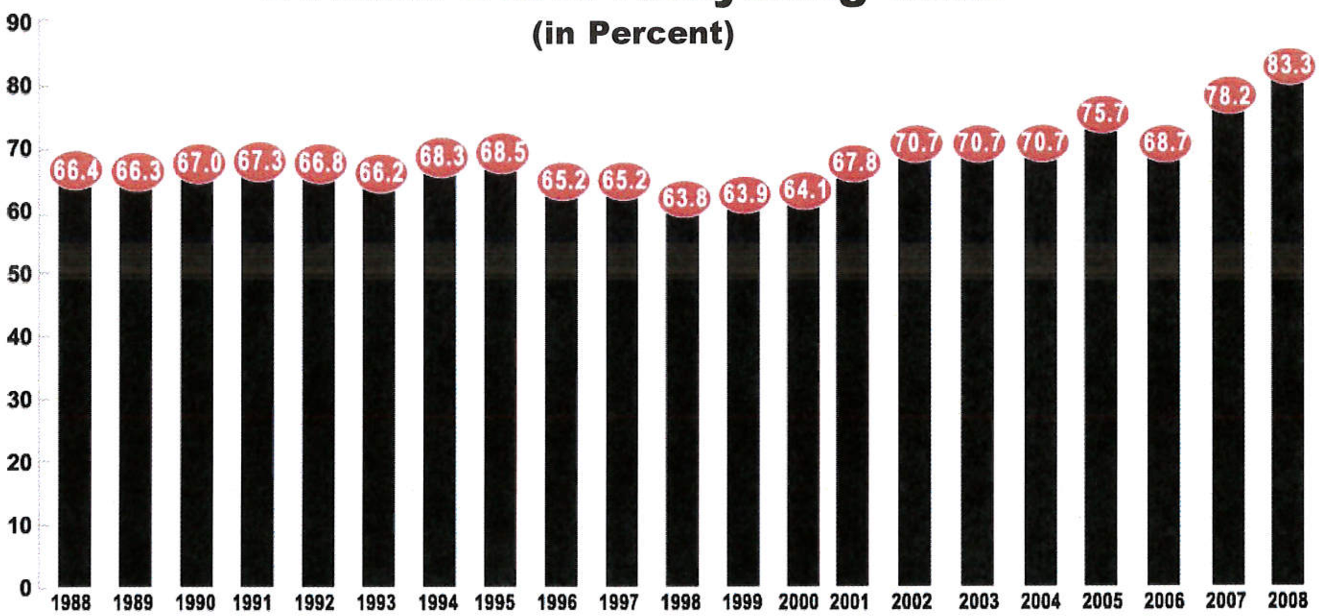
Construction Structural Recycling Rates
(in Percent)



Construction Reinforcement Recycling Rates
(In Percent)



Overall Steel Recycling Rate
(in Percent)



Steel Recycling Institute

The New Steel

The EnviroMetal

steelscape
A BlueScope Steel Company

May 2009

RE: Information regarding the "recycled content" of Steelscape's products

Dear valued Steelscape product user:

Steelscape has made a commitment to continually improving its environmental footprint and the sustainability of its products. To that end, we are pleased to present to you some basic information to help inform and educate you on the recycled content of our products.

For background, "recycled content" means the proportion of our products that are generated from post-consumer or pre-consumer material. "Post-consumer" is material generated by households and businesses, such as tin cans and old car bodies. "Pre-consumer" refers to materials recovered from the manufacturing process before it is sold to consumers, such as scrap from the car industry sold back to the steel industry. Reutilization of materials, such as scrap within the steelmaking process is not considered pre-consumer material, and thus not included in calculating recycled content.

In Steelscape's case, because we purchase steel coils for use in our manufacturing process, the recycled content of our steel products is directly related to the recycled content of the steel coils we use. Currently, our main steel supplier uses a basic oxygen furnace (BOF) process with a recycled content of 15-20%. On average, the "pre-consumer" portion accounts for 10-15% and the "post-consumer" portion accounts for 5%.

In accordance with the U.S. Green Building Council LEED recycled content requirements, Steelscape does have the ability to supply a higher recycle content steel upon request. This "high-recycled content" steel contains 50-75% recycled content. On average, the "pre-consumer" portion accounts for 20-35% and the "post-consumer" portion accounts for 30-40%.

These recycled content percentages were calculated using the LEED formula:
Recycled Content = (% post-consumer + ½% pre-consumer)

Steelscape's "high-recycled content" steel is available upon request and must be specified at the time of order entry. Please inquire with your Steelscape Sales Representative.

If you need more information or have further questions please feel free to call me direct.

Very truly yours,
STEELSCAPE, INC.
Renee Ramey
Marketing Manager
360-673-8236

Steelscape, Inc. Kalama 222 West Kalama River Road Kalama, WA 98625-9420 USA
Phone 360-673-8200 Fax 360-673-8250

Steel Takes LEED® with Recycled Content

steel beams and columns

steel studs

steel roofing

steel decking

steel doors

ductwork

steel siding

corrugated steel pipe

other steel components

STEEL®

AMERICAN INSTITUTE OF STEEL CONSTRUCTION AISC FOUNDED 1921

American Iron and Steel Institute

Designers and builders have long recognized and lauded steel for its strength, durability, and functionality. Increasingly, however, architects are recognizing steel's important environmental attributes—especially its high recycled content and high reclamation rate.

For many years, there has been a strong economic motive to incorporate recycling into the process for making steel, but today's environmental concerns make recycling even more important. Recycling saves money while conserving energy and resources, as well as reducing solid, liquid, and gaseous wastes. Recycling also helps to spread the energy impact of the original extraction and manufacturing of the material over infinite generations of new steel.

The efficiency with which a material is recycled can be measured by either its *percentage of recycled content* or its *reclamation rate.* Recycled content is a measure of how much recycled material is contained in a finished product. The reclamation rate is a measure of how often a product is actually recycled at the end of its useful life. Steel is an exceptional performer by both measurements. In the construction industry, recent interest in recycling has been driven largely by the U.S. Green Building Council's ***Leadership in Energy and Environmental Design*** (LEED®) rating system. The LEED rating system only promotes the use of materials with high levels of recycled content. The equally important reclamation rate of the materials is not currently considered.

Scrap consumption in the United States is maximized between the two types of modern steel mills, each of which generates products with varying levels of recycled content. One type of mill produces much of the steel for light flat-rolled steel products with about 30% *recycled content*. The other type of mill makes steel for a wide range of products, including flat-rolled, but is the only method used domestically for the production of structural shapes, which have about 80% *recycled content.* (These processes are covered in detail on the following pages.)

The amount of recycled content in steel products varies over time, both as a function of the cost of steel scrap and its availability. As the world-wide demand for steel increases, the available scrap will be stretched between more and more steel products, meaning that more raw steel will have to enter the production stream to meet the demand. Fortunately, steel is the country's most widely recycled material, and as more steel is used for construction and other products, more scrap is available for future recycling. At the end of their useful life, about 88% of all steel products and nearly 100% of structural steel beams and plates used in construction are recycled into new products—an amazing reclamation rate!

In addition to recycled content, steel can contribute toward several other LEED credits, either directly or indirectly. Steel is dimensionally stable and, when properly designed, can provide an exceptionally tight building envelope for less air loss and better HVAC performance over time. Steel is made to exact specifications, so on-site waste is minimized. Material from demolition or construction can be easily recycled, with the magnetic properties of steel greatly facilitating its separation from other materials. Thus, in addition to steel's outstanding recycled content and an enviable reclamation rate, steel's other functional properties contribute to the material's solid environmental performance.

As with any building process or material, there are areas for improvement. A great benefit of LEED is that it can help the steel industry recover even more scrap as contractors improve their recycling collection methods at the job site, so less incidental iron and steel scrap escapes to landfills. Similarly, commercial buildings and residential housing can have better disciplined recycling systems for increased recovery.

As steel products reach the end of their useful life, we want to see even more recycled into new steel products for future service to society.

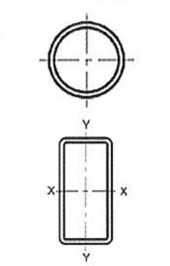
On-Line Steel Recycling Resources

www.recycle-steel.org
Includes detailed information on recycling rates, recycling databases, and the environmental benefits of steel for homes, buildings, steel roofing, and bridges.

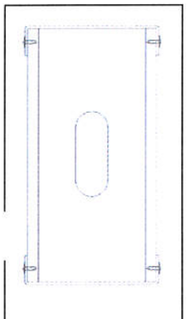
www.aisc.org/sustainability
Includes detailed information on how steel factors into the LEED® rating system, steel mill recycled content documentation, and articles about the use of steel in sustainable projects.

Modern Steel Production Technologies

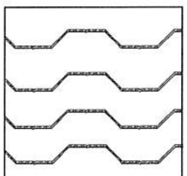
Typical BOF Products



hollow structural sections



steel studs



steel deck

plate

purlins

Steel is the most recycled material in North America and in the world, and in the United States alone, almost 83 million tons of steel were recycled or exported for recycling in 2007. This is done for economic as well as environmental reasons. It is always cheaper to recycle steel than to mine virgin ore and move it through the process of making new steel. However, it should also be clearly understood that many steel applications are durables, and even though two out of every three pounds of new steel are produced from old steel, the fact that cars, appliances, and bridges last a long time makes it necessary to continue to mine virgin ore to supplement the production of new steel. Economic expansion, domestically and internationally, creates additional demand that cannot be fully met by available scrap supplies.

Unlike other competing industries, recycled content in the steel industry is second nature. The **North American steel industry** has been recycling steel scrap for over 170 years through the growth of 2,500 scrap processors and some 12,500 auto dismantlers. Many of them have been in the business for more than 100 years. The pre-consumer, post-consumer, and total recycled content of steel products in the United States can be determined for the calendar year 2007 using information from the American Iron and Steel Institute (AISI), the Institute of Scrap Recycling Industries (ISRI), and the U.S. Geological Survey. Additionally, a study prepared for the AISI by William T. Hogan, S.A., and Frank T. Koelble of Fordham University is used to establish pre- and post-consumer fractions of purchased scrap.

Individual company statistics are not applicable or instructive because of the open loop recycling capability that the steel and iron industries enjoy, with available scrap typically going to the closest melting furnace. This open loop recycling allows, for example, an old car to be melted down to produce a new soup can, and then, as the new soup can is recycled, it is melted down to produce a new car, appliance, or perhaps a structural beam used to repair some portion of the Golden Gate Bridge.

Basic Oxygen Furnace

The basic oxygen furnace (BOF) facilities consumed a total of 14,552,500 tons of ferrous scrap in the production of 44,503,000 tons of raw steel during 2007. Based on U.S. Geological Survey statistics, 950,000 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. In the steel industry, these tons are classified as "home scrap," but are a mix of runaround scrap and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as pre-consumer scrap, equating to 760,000 tons (950,000 × 80%). Additionally, these operations reported that they consumed 10,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this timeframe. This volume is classified as post-consumer scrap.

As a result of the above, based on the total scrap consumed, outside purchases of scrap equate to 13,592,500 tons [14,552,500 – (950,000 + 10,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4%, while 16.6% of these purchases would be pre-consumer. This equates to 2,256,400 tons of pre-consumer scrap (13,592,500 × 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 44,503,000 tons of raw steel in the BOF is:

14,552,500 / 44,503,000 = 32.7%

(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(13,592,500 – 2,256,400) + 10,000 = 11,346,100

and

11,346,100 / 44,503,000 = 25.5%

(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(760,000 + 2,256,400) / 44,503,000 =
3,016,400 / 44,503,000 = 6.8%

(Pre-Consumer Scrap / Total Tons Raw Steel)

Electric Arc Furnace

The electric arc furnace (EAF) facilities consumed a total of 57,199,300 tons of ferrous scrap in the production of 61,329,700 tons of raw steel during 2007. Based on U.S. Geological Survey adjusted statistics, 15,403,700 of these ferrous scrap tons had been generated as unsalable steel product within the confines of these steelmaking sites. Again, in the steel industry, these tons are classified as "home scrap," but are a mix of run-around scrap and pre-consumer scrap. Estimates by the Steel Recycling Institute identify about 80% of this home scrap as pre-consumer scrap, equating to 12,323,000 tons (15,403,700 × 80%). Additionally, these operations reported that they consumed 85,000 tons of obsolete scrap (buildings and warehouses dismantled on-site at the mill) during this time frame. This volume is classified as post-consumer scrap.

As a result, based on the total scrap consumed, outside purchases of scrap equate to 41,710,600 tons [57,199,300 − (15,403,700 + 85,000)]. According to the Fordham University study, the post-consumer fraction of the purchased ferrous scrap would be 83.4%, while 16.6% of these purchases would be pre-consumer. This equates to 6,924,000 tons of pre-consumer scrap (41,710,600 × 16.6%). This "prompt scrap" is mainly scrap generated by manufacturing processes for products made with steel.

Therefore, the **total recycled content** to produce the 61,329,700 tons of raw steel in the EAF is:

57,199,300 / 61,329,700 = 93.3%

(Total Tons Ferrous Scrap / Total Tons Raw Steel)

Also, the **post-consumer recycled content** is:

(41,710,600 - 6,924,000) + 85,000 = 34,871,600

and

34,871,600 / 61,329,700 = 56.9%

(Post-Consumer Scrap / Total Tons Raw Steel)

Finally, the **pre-consumer recycled content** is:

(12,323,000 + 6,924,000) / 61,329,700 =
19,247,000 / 61,329,700 = 31.4%

(Pre-Consumer Scrap / Total Tons Raw Steel)

The above discussion and calculations demonstrate conclusively the inherent recycled content of **today's steel in North America**. To buy steel is to "Buy Recycled."

Understanding the recycled content of BOF and EAF steels, one should not attempt to select one steel producer over another on the basis of a simplistic comparison of relative scrap usage or recycled content. Rather than providing an enhanced environmental benefit, such a selection could prove more costly in terms of total life cycle assessment energy consumption or other variables. Steel does not rely on "recycled content" purchasing to incorporate or drive scrap use. It already happens because of the economics. Recycled content for steel is a function of the steelmaking process itself.

After its useful product life, regardless of its BOF or EAF origin, steel is recycled back into another steel product. Thus steel with more than 80% recycled content cannot be described as environmentally superior to steel with 30% recycled content. This is not contradictory because they are both complementary parts of the total interlocking infrastructure of steelmaking, product manufacture, scrap generation and recycling. The recycled content of EAF relies on the embodied energy savings of the steel created in the BOF.

Steel is truly the most recycled material.

Contact Us

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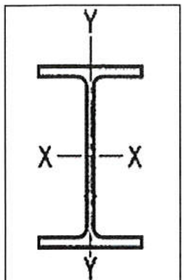
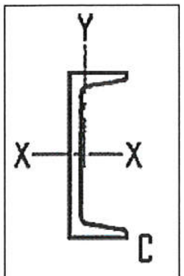
680 Andersen Dr. • Pittsburgh, PA 15220-2700
412.922.2772 • sri@recycle-steel.org
www.recycle-steel.org

American Institute of Steel Construction
One East Wacker Dr., #700 • Chicago, IL 60601
866.ASK.AISC • solutions@aisc.org
www.aisc.org

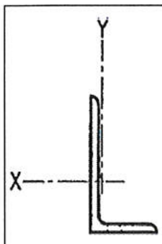
Typical EAF Products



beams and columns



channels



angles

plate

steel deck

piling

To: Architects, Engineers, Designers, and Specifiers
Re: LEED®-NC Version 2.2 and LEED®-NC 2009 Recycled Content Value of Steel Building Products

The U.S. Green Building Council Leadership in Energy & Environmental Design (LEED®) Green Building Rating System aims to improve occupant well-being, environmental performance and economic returns of buildings using established and innovative practices, standards, and technologies.

Materials & Resources Credit 4: Recycled Content intends to increase demand for building products that incorporate recycled content materials, therefore reducing impacts resulting from extraction and processing of new virgin materials. As discussed and demonstrated below, **North American** steel building products contribute positively toward points under Credits 4.1 and 4.2. The following is required by LEED-NC Versions 2.2 and 2009:

> **Credit 4.1 (1 point)** "Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project."
>
> **Credit 4.2 (1 point)** "Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% of the total value of the materials in the project."

"The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value." Since steel (the material) and steel (the building product) are the same, the value of the steel building product is directly multiplied by steel's recycled content, or:

Steel Recycled Content Value = (Value of Steel Product) (Post-Consumer % + ½ Pre-Consumer %)

The information contained within this brochure provides post-consumer and pre-consumer recycled content percentages for **North American steel building products**. These percentages and values of steel building products are easily entered into LEED Letter Template spreadsheet for calculation. To illustrate the application of these steel recycled content values to LEED, manual calculations are shown below for typical Basic Oxygen Furnace (BOF) and Electric Arc Furnace (EAF) steel building products with nominal $10,000 purchases, using 2007 data. Steel building products include steel stud framing, structural steel framing (wide-flange beams, channels, angles, etc.), rebar, roofing, siding, decking, doors and sashes, windows, ductwork, pipe, fixtures, hardware (hinges, handles, braces, screws, nails), culverts, storm drains, and manhole covers.

BOF Steel Recycled Content Value for Typical Product:
Steel Stud Framing
Value = ($10,000) (25.5% + ½ 6.8%) = ($10,000) (28.9%) = $2,890
(Positive net contributor to 10% and 20% goals)

EAF Steel Recycled Content Value for Typical Product:
Wide-Flange Structural Steel Framing
Value = ($10,000) (56.9% + ½ 31.4%) = ($10,000) (72.6%) = $7,260
(Positive net contributor to 10% and 20% goals)

Steel Recycling Institute
680 Andersen Dr.
Pittsburgh, PA
15220-2700
412.922.2772
sri@recycle-steel.org

American Institute of Steel Construction
1 East Wacker Dr., Suite 700
Chicago, IL
60601
866.ASK.AISC
solutions@aisc.org

American Iron and Steel Institute

American Iron and Steel Institute
1140 Connecticut Ave., Suite 705
Washington, DC
20036
202.452.7100

Jackson CONTRACTOR GROUP, INC.
P.O. Box 967, Missoula, MT 59806
406-542-9150 | FAX 542-3515

Submittal Transmittal

Detailed, Grouped by Each Number

Billings Public Library
510 N. Broadway
Billings, MT 59101

Project # 2012.35
Tel: 406-542-9150 Fax: 406-542-3515

Jackson Contractor Group Inc.

Date: 1/3/2014 **Reference Number: 0232**

Transmitted To:
Don Olsen
O2 Architects
208 N. Broadway
Suite 350
Billings, MT 59101
Tel: 406-259-7123
Fax: 406-256-7123

Transmitted By:
Mike Chase
Jackson Contractor Group Inc.
P.O. Box 967
Missoula, MT 59806
Tel: 406.542.9150
Fax: 406.542.3515

Qty	Submittal Package No	Description	Due Date	Package Action
1	0054 - 08 6300 - 3	Metal Framed Skylight - ETFE Skylight Package	1/17/2014	Submitted

Transmitted For	Delivered Via	Tracking Number
Approval	e-mail	

Items	Qty	Description	Notes	Item Action
0001	1	Mtl Frame Skylight - Calculations	Calculations only	Submitted
0002	1	Mtl Frame Skylight - Drawings		Submitted
0003	1	Mtl Frame Skylight - Samples	Foil previously approved, mock-up as requested.	Submitted

Cc:	Company Name	Contact Name	Copies	Notes

Remarks

Final Package for Record

mike chase

Signature

1.3.14

Signed Date

Jackson
CONTRACTOR GROUP, INC.
P.O. Box 967, Missoula, MT 59806
406-542-9150 | FAX 542-3515

Submittal Packages

Summary with Register Items & Stamp

Billings Public Library
510 N. Broadway
Billings, MT 59101

Project # 2012.35

Jackson Contractor Group Inc.
Tel: 406-542-9150 Fax: 406-542-3515

Item No	Register No	Rev	Spec Section	Sub Section	Description	Responsible	Supplier	Rec'd On	Action
0054 - 08 6300 - 3					**Metal Framed Skylight - ETFE Skylight Package**				
0001	00194	3	08 63 00	1.03.A	Mtl Frame Skylight - Calculations	Vectorfoiltec, LLC	Texlon	1/3/2014	Submitted
0002	00195	3	08 63 00	1.03.B	Mtl Frame Skylight - Drawings	Vectorfoiltec, LLC	Texlon	1/3/2014	Submitted
0003	00196	3	08 63 00	1.03.C	Mtl Frame Skylight - Samples	Vectorfoiltec, LLC	Texlon	1/3/2014	Submitted

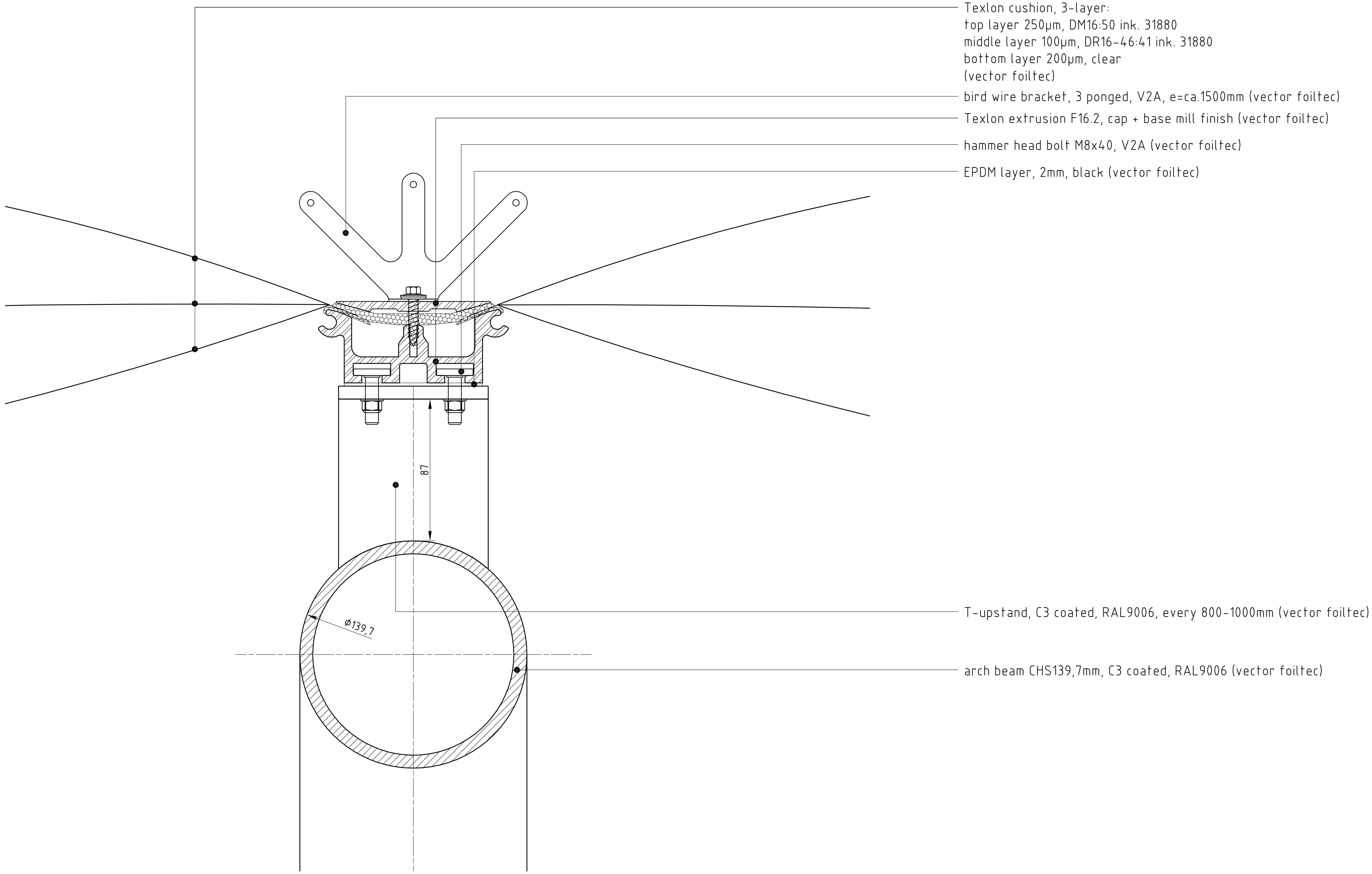
SUBMITTAL REVIEW

✓ __REVIEWED, NO EXCEPTIONS TAKEN __REVISE AND RESUBMIT
__NOTE COMMENTS __SEE ATTACHED COMMENTS

Corrections or comments made to the shop drawings during this review do not relieve subcontractor/vendor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The subcontractor/vendor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner.

JACKSON CONTRACTOR GROUP, INC.

BY mike chase DATE 1.3.14



Date	Rev	Rev.- Name	Revision
09.09.2013	C	JE	steel changed according to new roof geometry + structural engineering
26.03.2013	B	JE	steel changed according to structural engineering
22.01.2013	A	LL	amended air supply

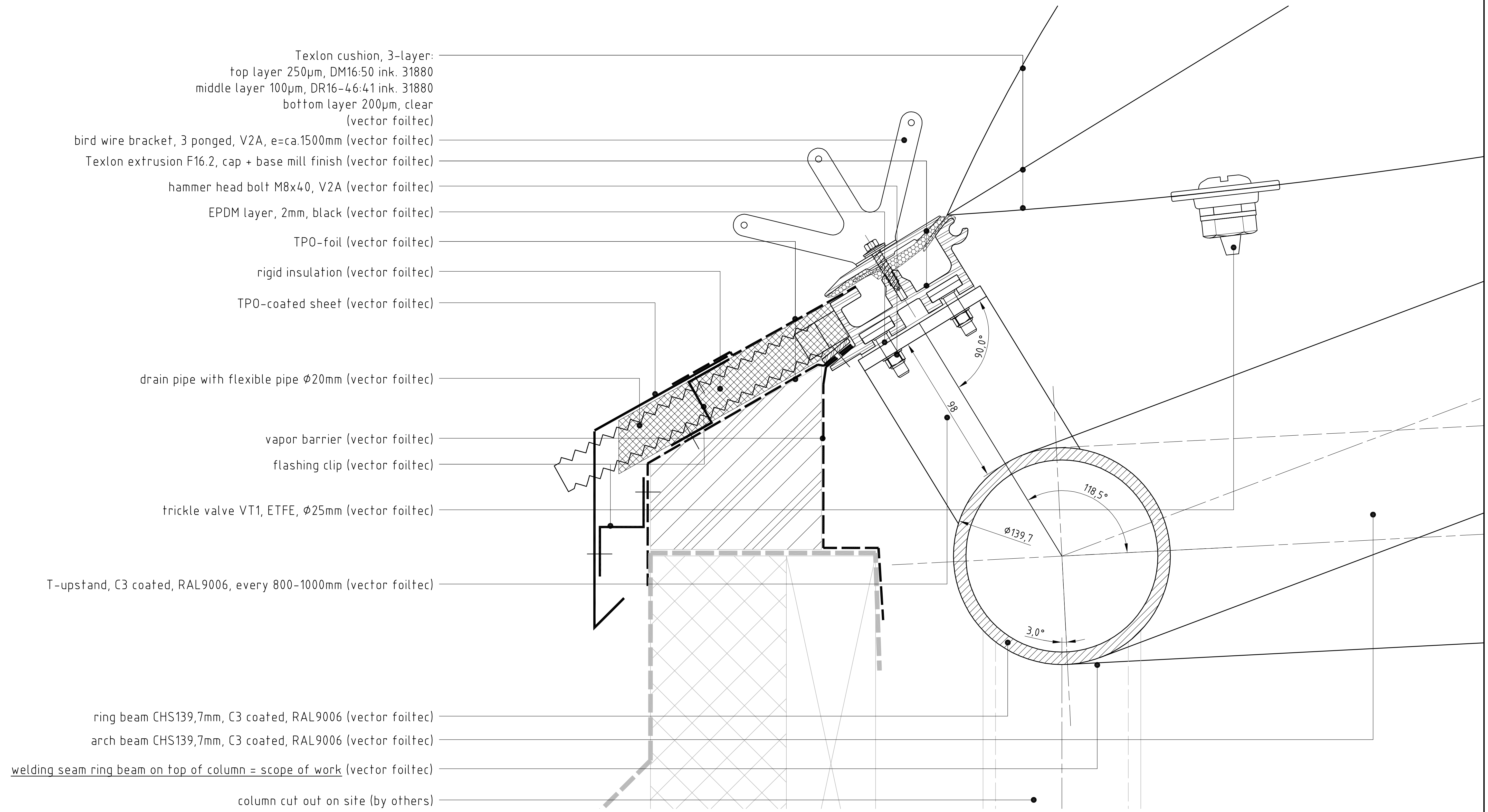
vector foiltec GmbH
Steinacker 3 · D-28717 Bremen
Telefon +49-(0)-421-69351-0
Telefax +49-(0)-421-69351-19
de@vector-foiltec.com

Drawing: Detail Beam			Project status: Construction		
			Scale/ Unit: 1:2,5 mm		Size: A3
Drawn by: JE	Date: 11/27/2012	Checked by: XX	Project: US - Billings MT - Parmly Library	Drawing No: 1059_2002	Rev: C

File: G:\PROJEKTE\US - Billings MT - Parmly Library - 1059\Zeichnungen VF DE\2000_Details Details\1059_2001_2002_2003_RevC_Details.dwg

Date: 09.09.2013 14:56:16

Remarks



Date	Rev	Rev.- Name	Revision
09.09.2013	C	JE	steel changed according to new roof geometry + structural calculation
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vector foiltec vector foiltec GmbH Steinacker 3 · D-28717 Bremen Telefon +49-(0)-421-69351-0 Telefax +49-(0)-421-69351-19 de@vector-foiltec.com	Drawing Detail Perimeter low point	Project status Construction	
		Scale/ Unit 1:2,5 mm	Size A3
Drawn by JE / Date 11/27/2012 / Checked by XX	Project US - Billings MT - Parmly Library	Drawing No 1059_2003	Rev C

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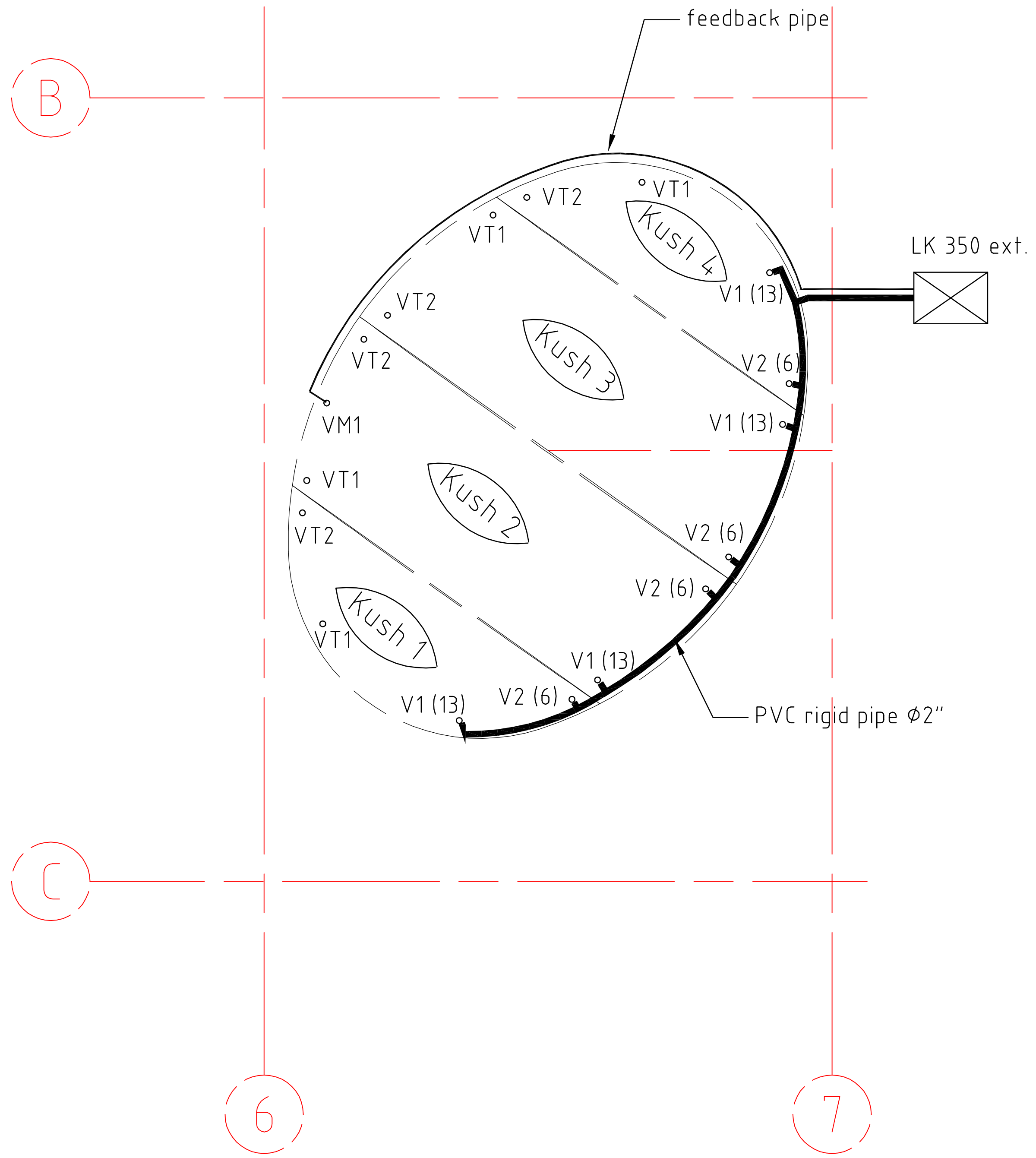
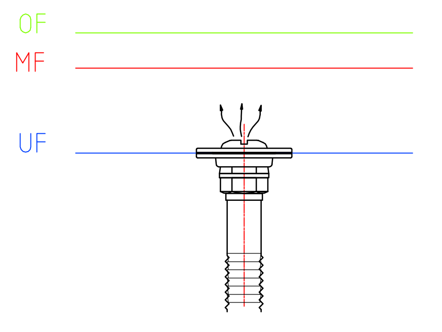
Remarks



001
1059_2900
plan view skylight
air supply



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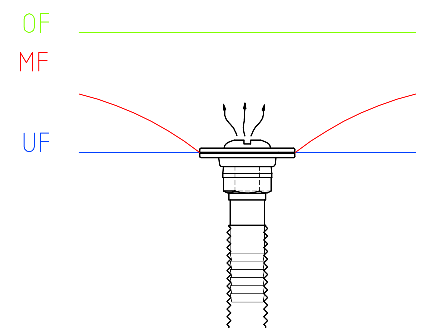
1059_2900
V1 (Ø25/Ø13)
distance 280mm



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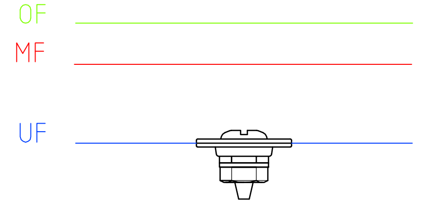
distance 180mm



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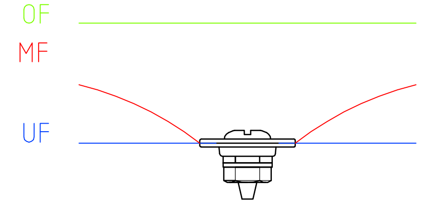
1059_2900
VT1 (Ø25)
distance 280mm



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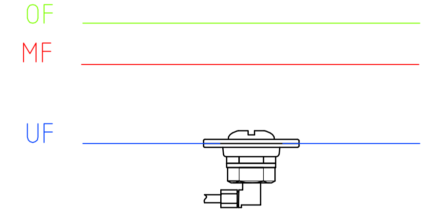
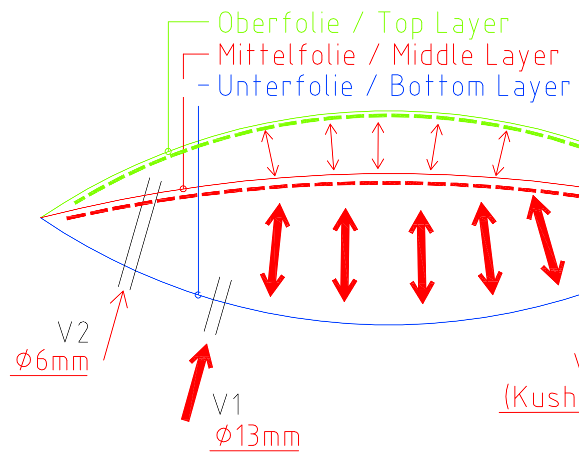
1059_2900
VT2 (Ø25)
distance 180mm



006
1059_2900
VM1 (Ø25)
distance 280mm



08/13/2013	C	JE	general amendments - new roof geometry
01/23/2013	B	JE	valve position changed
12/20/2012	A	A. Blohm	amended middle foil
Date	Rev	Rev.- Name	Revision

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Drawing General Arrangement air supply			Project status Construction		
			Scale/ Unit NTS	Size A3	
Drawn by JE	Date 12/07/2012	Checked by XX	Project US - Billings MT - Parmly Library	Drawing No 1059_2900	Rev C

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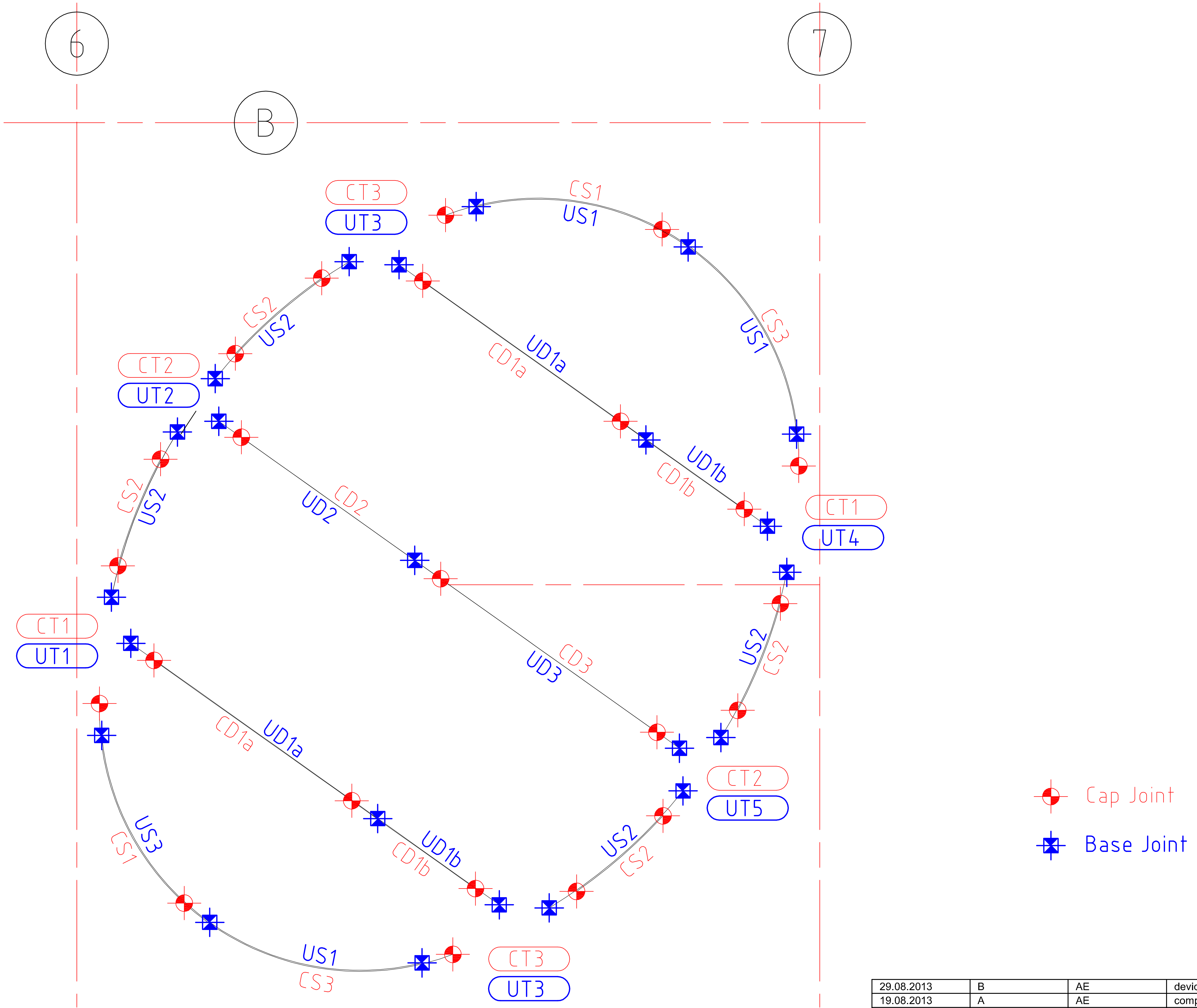
Date: 13.08.2013 14:11:52

Remarks



001
1059_5000

plan view skylight
General arrangement

29.08.2013	B	AE	devided UD1 in UD1a+b, changed CD1 to CD1a+b
19.08.2013	A	AE	complete new
Date	Rev	Rev.- Name	Revision

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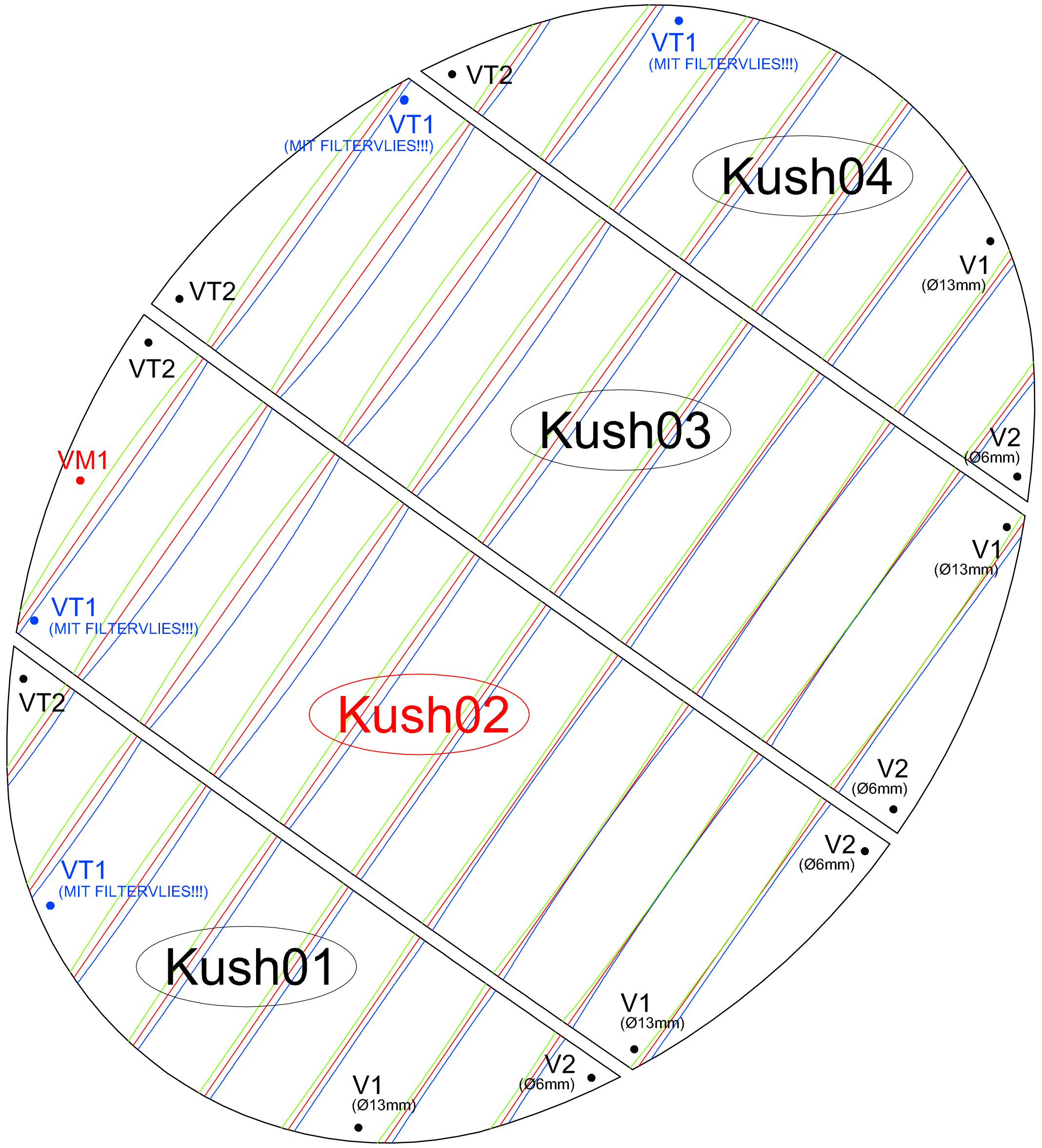
Drawing: General Arrangement F16.2 Extrusion			Project status: Construction	
			Scale/ Unit: NTS	Size: A3
Drawn by: JE	Date: 12/11/2012	Checked by: XX	Project: US - Billings MT - Parmly Library	Drawing No: 1059_5000	Rev: B

File: G:\PROJEKTE\US - Billings MT - Parmly Library - 1059\Zeichnungen VF DE\5000-6000_Profile Extrusions\1059_5000b_GA_extrusions_RevB.dwg
Date: 29.08.2013 10:07:05

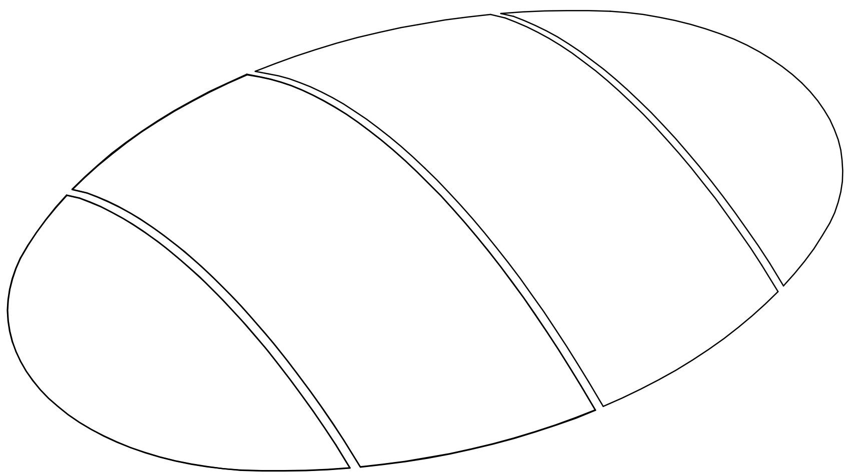
Remarks



001
1059_9000

Übersicht - Kissen, GA - cushions

nts



002
1059_9000

Isometrie, isometric view

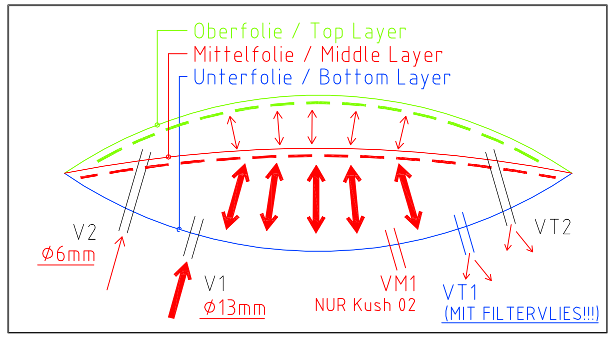
nts

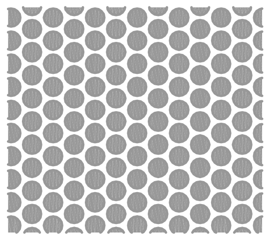
foil make-up:

Oberfolie (OF) / top layer (TL):	200µm - DM 16:50 ink. 31880
Mittelfolie (MF) / middle layer (ML):	100µm - DR 16-46:41 ink. 31880
Unterfolie (UF) / bottom layer (BL):	200µm - clear

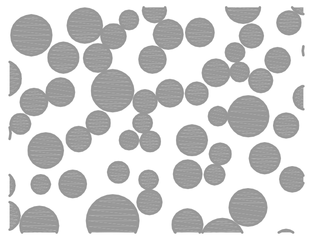
valves:

V1 (Ø25mm, 13mm):	distance from foiledge 280mm
V2 (Ø25mm, 6mm):	distance from foiledge 180mm
VT1 (Ø25mm) **MIT FILTERVLIES!!!**	distance from foiledge 280mm
VT2 (Ø25mm):	distance from foiledge 180mm
VM1 (Ø25mm) *NUR Kush 02*:	distance from foiledge 280mm





DM 16:50 ink. 31880



DR 16-46:41 ink. 31880

Kissenfläche / cushion area: 60,52m²

Date	Rev	Rev.- Name	Revision		
12.08.2013	A	A. Janßen	new geometry		
vector foiltec GmbH Steinacker 3 · D-28717 Bremen Telefon +49-(0)-421-69351-0 Telefax +49-(0)-421-69351-19 de@vector-foiltec.com			Drawing Übersicht - Kissen General Arrangement (GA) - cushions Kush 01-04	Project status CONSTRUCTION Scale/ Unit NTS	Size A3
Drawn by A. Blohm	Date 18.01.2013	Checked by XX	Project US - Billings MT - Parmly Library	Drawing No 1059_9000	Rev A
File:				Print Date:	

vectorfoiltec

www.vector-foiltec.com

US - Data Sheet for Inflation Unit LK-350-115V IP65
For TEXLON® Systems

OPERATION AIR
OUTLET ∅ 3.93''

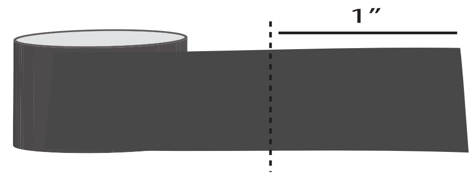
DIMENSIONS :	31.49'' × 23.6'' × 13.7''
LOCATION FOR INSTALLATION:	OUTSIDE
HOUSING: POWDER COATED:	STEEL SHEET 0,03" RAL 7035, LIGHT GREY
2 OPEN AREA AIR INTAKES:	RECTANGULAR, 11.6'' × 11.6''
DIAMETER AIR OUTLET:	∅ 3.93''
VOLUME FLOW RATE.	APPROX. 175 CFM
WEIGHT:	APPROX. 145.5 LBS
POWER REQUIRED: POWER SYSTEM: CONNECTION CABLE: FUSES:	 WYE POWER CONNECTION, SYSTEM VOLTAGE: 208VAC(208VAC BETWEEN PHASE AND PHASE AND 115VAC BETWEEN PHASE AND NEUTRAL) 5 WIRES WITH 3 CIRCUITS, N, PE FOR EACH CIRCUIT USE SINGLE SLOW-BLOW FUSE WITH 25AMP EACH THE UNIT MAKES USE OF THE SECONDARY VOLTAGE (115VAC) ONLY.
POWER CONSUMPTION: NORMAL MODE: OPERATION UPSET ("BACK-UP"):	 185W 370W
OPTIONAL:	CONNECTION EXTERN (SIGNAL LAMP) OR BUILDING MANAGEMENT SYSTEM
NOISE DEVELOPMENT: NORMAL MODE: OPERATION UPSET ("BACK-UP"):	 APPROX. 56 DB(A) APPROX. 59 DB(A)

Print Date: 24.08.2012

Two Sided Eternabond Tape - Directions for use with MIRO Support

1. Clear an   clean area of roof membrane.
2. Cut two 1” wide x 1” length strips.
3. Apply tape to two sides of the bottom of every MIRO pipe support.
4. Turn MIRO pipe support over and attach on desired area of roof membrane. Pipe support will not move after initial contact. Make sure to have desired location ready before attaching the MIRO pipe support.

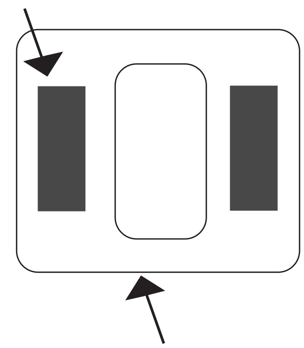
* Eternabond double sided tape is compatible with all roof membranes.
* MIRO will not be responsible for location or workmanship of attachment



Direcciones para utilizar Eternabond Tape de Doble Lado con el soporte fabricado por Industrias MIRO

1. Limpie la area del techo donde va a posicionar los soportes.
2. Corte pedasos de tape que miden 1” x 1”.
3. Aplique la cinta adhesiva a un lado debajo de cada tercer MIRO soporte.
4. Aplique el soporte MIRO en el puesto deseado. El soporte no se va a mover despues del inicio contacto con la superficie del techo. Asegurese que la area donde va a posicionar el soporte estece listo y limpio.

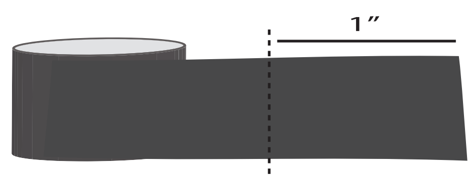
* Eternabond tape es comparable con toda clase de techos.
* MIRO no mantiene responsabilidad sobre la mano de obra en la posicion del soporte, ni la colocacion del soporte.



Two Sided Eternabond Tape - Directions for use with MIRO Support

1. Clear an   clean area of roof membrane.
2. Cut two 1” wide x 1” length strips.
3. Apply tape to two sides of the bottom of every MIRO pipe support.
4. Turn MIRO pipe support over and attach on desired area of roof membrane. Pipe support will not move after initial contact. Make sure to have desired location ready before attaching the MIRO pipe support.

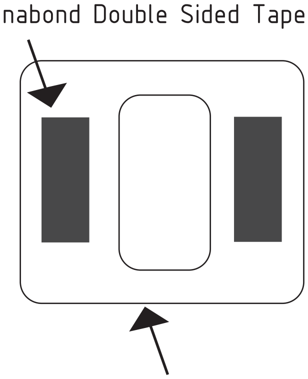
* Eternabond double sided tape is compatible with all roof membranes.
* MIRO will not be responsible for location or workmanship of attachment



Direcciones para utilizar Eternabond Tape de Doble Lado con el soporte fabricado por Industrias MIRO

1. Limpie la area del techo donde va a posicionar los soportes.
2. Corte pedasos de tape que miden 1” x 1”.
3. Aplique la cinta adhesiva a un lado debajo de cada tercer MIRO soporte.
4. Aplique el soporte MIRO en el puesto deseado. El soporte no se va a mover despues del inicio contacto con la superficie del techo. Asegurese que la area donde va a posicionar el soporte estece listo y limpio.

* Eternabond tape es comparable con toda clase de techos.
* MIRO no mantiene responsabilidad sobre la mano de obra en la posicion del soporte, ni la colocacion del soporte.



MIRO INDUSTRIES, INC.

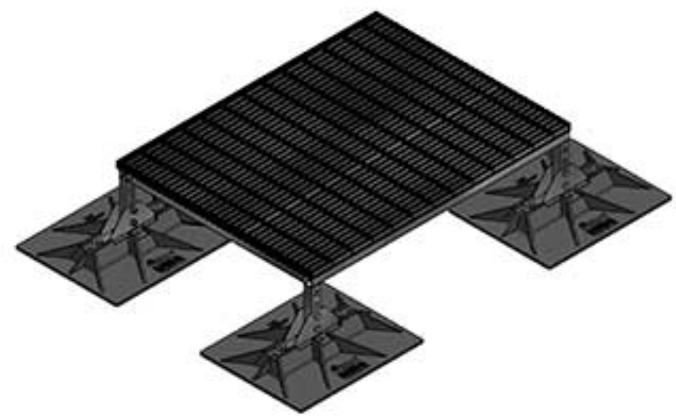
PRODUCTS COMPANY SERVICES DOWNLOADS

Mechanical Unit Supports » Mechanical Unit Support-HD

Download Specs (PDF)
Download Drawings (PDF)
Download Drawings (DWG)

Used to elevate rooftop mechanical units. Heavy Duty Use.

Product Description: MIRO Mechanical Unit Supports are supports to elevate rooftop mechanical units such as air conditioning or other devices. The Mechanical Unit Supports are designed so that the mechanical units rest in heavy-duty corner or side supports which are connected to bases designed with MIRO technology to protect the roof membrane. The Mechanical Unit Supports are adjustable in that the strut can be selected to the appropriate height and there is provided an additional threaded rod which allows fine adjustment to level the roof-top units. All metal pieces are made out of hot-dip galvanized steel for outdoor weathering protection. The MIRO Mechanical Unit Support consists of (1) a MIRO designed base with gently curved edges to protect the roof membrane and to distribute the weight over the maximum roof surface, (2) hot-dip galvanized steel strut and all-thread height adjustable column.



Mechanical Unit Support-HD

Key Information » Mechanical Unit Support-HD

Base Material:	MIRON TPC� or Polycarbonate Stainless Galvanized
Size:	Custom design required
Max Load Weight:	Maximum load weight is equivalent to and is part of the maximum roof top bearing load which MIRO has designed for its bases. MIRO recommends such loading not exceed two pounds per square inch.
Spacing:	The Mechanical Unit Support should be spaced at intervals so as to allow proper installation of the mechanical units or devices.

Patent numbers: 4502653; 4513934; 6364256; 6520456; D496058; D490295; D427049; D433615; D436522; D466393; D466394; D498133; D498660; D498661 and other patents pending

More Mechanical Unit Supports from MIRO®

Mech Support-LD

MIRON TPC� or
Polycarbonate

Mech Support-HD

MIRON TPC� or
Polycarbonate
Stainless
Galvanized

PRODUCTS » Pipe Supports | Conduit Supports | Pipe Hangers

Duct or "H" Type and Cable Tray Supports | Mechanical Unit Supports

Bridge Crossover & Ramp | Walkway & Service Platform

Seismic & Wind Up-Lift | Accessories | UNI-FLEX

Rooftop Sleeper Support

Contact Us | Catalog Request | Order Form | Rep Locator | Legal & Privacy | Rep Login | Site Map

Conduit Supports » Model 12-Base Strut-7 SS

Download Specs (PDF)

Download Drawings (PDF)

12" strut pipe support system used for ganging roof-mounted gas pipe.

Product Description: A pipestand with a strut and clamp pipe support system used for ganging roof-mounted gas pipes, electrical conduit, solar piping and other mechanical piping. Unique design absorbs thermal expansion and contraction of pipes thus preventing damage to the roof membrane. Pipes rest on a 12" length of strut which is mounted on the base. The pipes can then be fastened by using typical clamps locked to the strut.

Model 12-Base Strut-7 SS

Key Information » Model 12-Base Strut-7 SS

Base Material:	Stainless
Size:	The deck base is 12" by 16" , has a maximum bar length of 12".
Max Pipe Clearance:	Can adjust in height from a low of 2.5" to a high of 7.5" in elevation above the roof membrane.
Max Load Weight:	Maximum load weight may not exceed 150 lbs. per pipestand.
Spacing:	Manufacturer's recommended spacing is not to exceed 10 foot centers depending upon the load. Do not exceed 100 lbs. load weight.

Patent numbers: 4502653; 4513934; 6364256; 6520456; D496058; D490295; D427049; D433615; D436522; D466393; D466394; D498133; D498660; D498661 and other patents pending

More Conduit Supports from MIRO®

2.5-CS-2

MIRON TPC™ or Polycarbonate

2.5-CS-5

MIRON TPC™ or Polycarbonate

2.5-CS-7

MIRON TPC™ or Polycarbonate

2.5-CS-12

MIRON TPC™ or Polycarbonate

12-Base Strut-7

Stainless
Galvanized

16-Base Strut-7

MIRON TPC™ or Polycarbonate
Stainless
Galvanized

16-Base Strut-12

MIRON TPC™ or Polycarbonate

20-Base Strut-7

MIRON TPC™ or Polycarbonate

20-Base Strut-12

MIRON TPC™ or Polycarbonate

24-Base Strut-4

MIRON TPC™ or Polycarbonate

24-Base Strut-18

MIRON TPC™ or Polycarbonate

PRODUCTS » Pipe Supports | Conduit Supports | Pipe Hangers

Duct or "H" Type and Cable Tray Supports | Mechanical Unit Supports

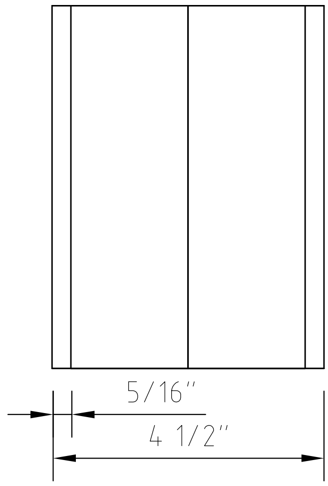
Bridge Crossover & Ramp | Walkway & Service Platform

Seismic & Wind Up-Lift | Accessories | UNI-FLEX

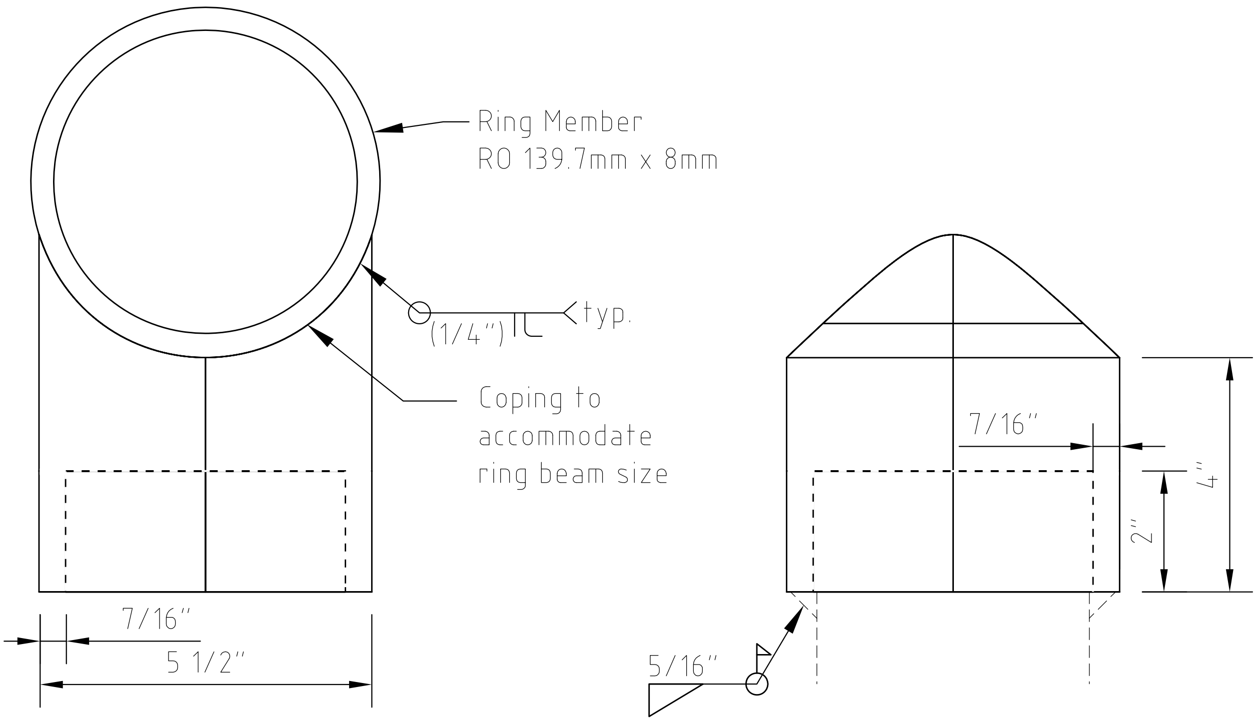
Rooftop Sleeper Support

Contact Us | Catalog Request | Order Form | Rep Locator | Legal & Privacy | Rep Login | Site Map

001 beam con. — Coping Axon View



002 beam con. — Post Side View



002 beam con. — Coping Side views

A36 Steel tube D.O.M.
5-1/2" OD

Date	Rev	Rev.- Name	Revision		
vector foiltec			Drawing Ring Beam Connection Details	Project status PRELIMINARY	
				Scale/ Unit NTS	Size letter
Drawn by kh	Date 10/11/13	Checked by cm	Project US-MT-Billings-Parmly Library	Drawing No beam con.	Rev

vector foiltec
13 Green Mountain Drive
Cohoes, NY 12047
Phone: 518-783-0575
Fax: 518-783-0474
us@vector-foiltec.com

File: B:\05-Project Files\01-active projects\1059-US-MT-Parmly Billings Library Skylight\09 Drawing Source Files\0000-Sketches\SK_2013.10.11 Ring Beam Connection.dwg Date: 10/11/2013 2:57:42 PM

Remarks

UNITED STATES PARMLY BILLINGS LIBRARY SKYLIGHT
BILLINGS, MONTANA

Weld Calculations for Structural Steel Ring Supports

DATE OF ISSUE: *November 19, 2013*

PREPARED FOR: Vector Foiltec
13 Green Mountain Drive
Cohoes, NY 12047

MONTANA
THOMAS J.
RITTENHOUSE
No. 14655 P.E.
LICENSED
PROFESSIONAL ENGINEER

WEIDLINGER

Weidlinger Associates, Inc. • 27 Wormwood Street, 2nd Floor • Boston, MA 02210
Phone 617 374 0000 • Fax 617 374 0010 • www.wai.com

A. PROVIDE WELD DESIGN FOR POST CONNECTION

TUBE STRENGTH = A36 $F_y = 36^{ksi}$
$F_u = 58^{ksi}$

$A_W = \pi d = 17.3 in$

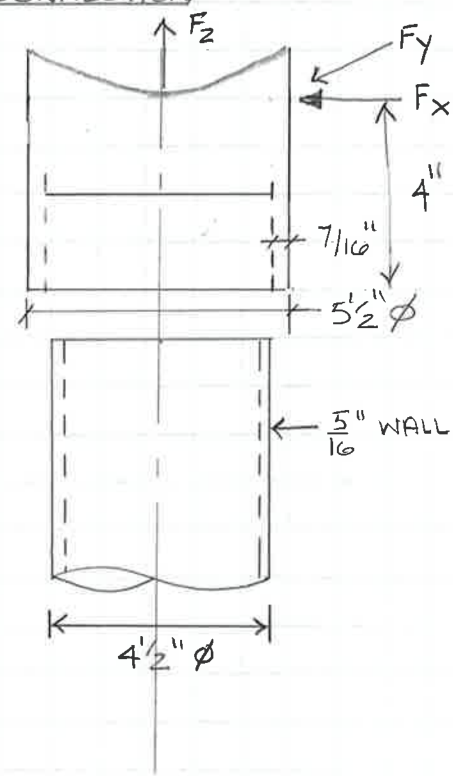
WELD STRENGTH = $.6 F_{exx}$
$= .6(70) = 42^{ksi}$

BASE STRENGTH OF WELD on STRENGTH OF SMALL TUBE

$F_y A_g = (36 ksi)(4.14 in^2) = 149^{kips}$

$\phi F_y A_g = 134^{kips}$

$\phi F_u A_e = .75(58)(.6)(4.14) = \underline{108}^{kips} \Leftarrow$



$\phi R_{nw} = \phi\, .6 F_{exx} (.707)\, D/16\, l_w$

$= .75(.6)(70)(.707)\, 5/16\, (17.3) = 120.4^k \Leftarrow$

USE 5/16" FILLET WELD

NOTE MAX ULTIMATE REACTION PER CALC'S BY GRID ENGINEERS

$F_x = 8.4^k$
$F_y = .65^k$
$F_z = 37^k$

$A_w = \pi d = 14.13 in^2$
$S_w = \pi d^2/4 = 15.9 in^3$

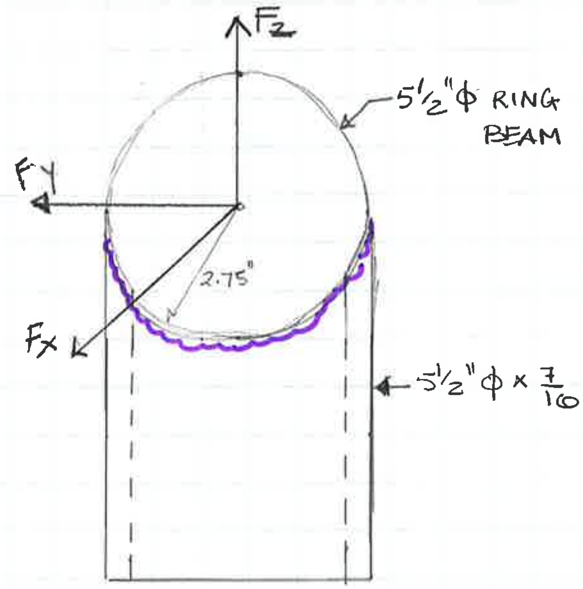
$M = 8.4(4") + .65(4") = 36.2^{k \cdot in}$

$f_R = \sqrt{(2.62 + 2.27)^2 + (.64)^2} = 4.93^{k/in}$

$f_p = 6.96^{k/in}$

B. Provide Weld Between Ring and Support

Perimeter Ring
Round 5½"Ø × 5/16" wall



Post
5½"Φ × 7/16"

Base design of weld from strength of perimeter ring

$\phi R_{nw} = \phi .6 F_u A$

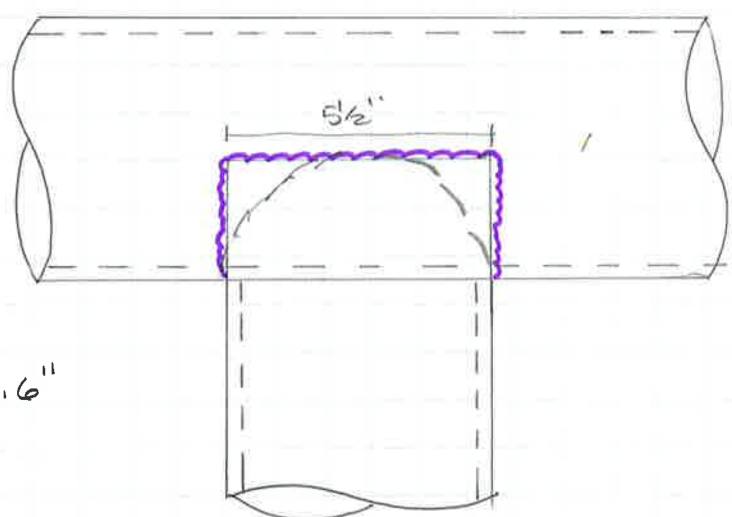
$= .75(.6)(58)$

Grove weld (PJP)

$\phi R_{nw} = \phi t_e \, .6 F_{exx} \times l_w$

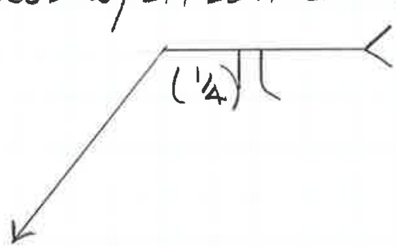
$= .9(1/4)(.6)(70)(19.6)$

$= 185$ kips



$l_w = 5\tfrac{1}{2} \times 2 + \frac{\pi(2.75)}{2} \times 2 \text{ sides} = 19.6"$

Use PJP grove weld w/ effective throat = ¼"



APPENDIX

VECTOR FOILTEC CALCULATIONS [NOT BY WEIDLINGER ASSOCIATES, INC.]

(USED FOR REFERENCE ONLY)

Structural Calculation Texlon Cushions & Steel Structure

Project: USA - Parmly Billings Library - Billings MT

Subject: **Texlon Skylight**
ETFE, Extrusion and Steel Joints
- Revision with new structure -

Volume of this structural calculation: pages 1 to 26 and annexes A, B, C

D-Bremen, August 14, 2013

vector foiltec

vector foiltec GmbH
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Telefax +49-(0)-421-69351-19
de@vector-foiltec.com

Introduction and Basics

Item

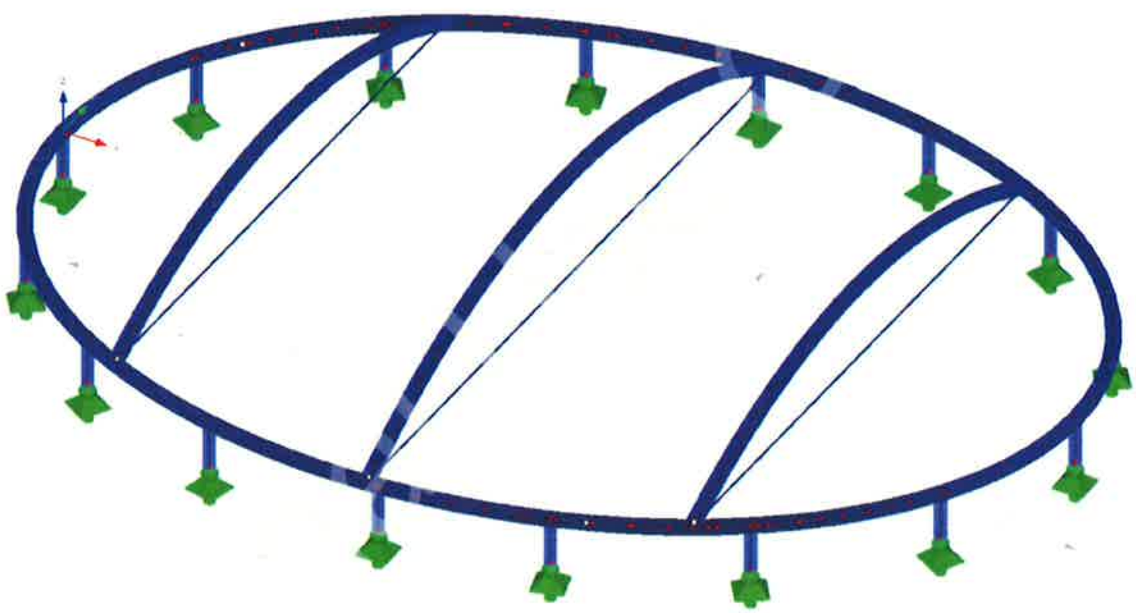
A skylight, made of ETFE cushion membran structure and structural steel, is subject of this structural anlysis. The membran cushions and structural steel members are statically proved. Elements of primary structure are not subject and have to be designed by someone else.

Dimensions of the oval plan view are

$a = 32 * 0{,}3048 = 9{,}754$ m

$b = 24 * 0{,}3048 = 7{,}315$ m

$$\text{Area} = \pi * a * \frac{b}{4} = 56{,}0 \text{ m}^2$$



Parts of the structural calculation

A new structural concept is analysed in this revision.

It substitutes all former parts from Dec. 2012/Jan. 2013
Part 1 - Structural steel design
Part 2 - ETFE membrane
Part 3 - Extrusion and steel joints

Revisions

Rev.	Date	Remarks
0	10-08-2013	Structural system switched to 3 parallel Arches

Basics

[1] construction documents of May 01,2012:
- a0.4 - code/occupancy plans
- s2.2 - level 2 framing plan
- s2.3 - roof framing plan
- s6.1 - roof framing details
- a7.9 - exterior details

by will bruder + Partners LTD, 2524 North 24. th Street, Phoenix, Arizona 85008, USA

[2] drawing 1059_3000: General Arrangement, Steel Structure, Positioning of ring beam + columns (November 16, 2012) vector foiltec GmbH, Steinacker 3, D-28717 Bremen (vector foiltec llc, 13 Green Mountain Drive, Cohoes, NY 12047, USA)

[3] ASCE Standard 7-05: Minimun Design Loads for Buildings and othher structures

[4] EN 1993-1-1 (2005): Design of steel structures - Part 1-1: General rules and rules for buildings

[5] EN 1993-1-8 (2010): Design of steel structures - Part 1-8: Design of joints

[6] EN 1990-0 (2002): Basis of structural design

conversion parameters

onePSF = 0,04788 kN/m²

one_ksi = 6,895 N/mm²

Material

structural steel members

Grade S355 J2H

youngs modulus E = 210000 N/mm²

E_{US} = E / 6,895 = 30456,9 ksi

yield strength f_y = 355 N/mm²

$f_{y,US}$ = f_y / 6,895 = 51,49 ksi

ultimate strength fu = 510 N/mm²

$f_{u,US}$ = f_u / 6,895 = 73,97 ksi

if not mentioned otherwise

Notes on Structural Analysises (Annex A - C)

<u>Annex A</u>

ETFE stress check under downward loads

Loads: Self weight + snow load 30 psf

net clearance ... e =			0,30 m
uniform load... s =	30 * onePSF	=	1,436 kN/m²
element load... se =	s * e/2	=	0,215 kN/m

Design:

upper layer ≥ 200 μm, initial camber 6%
middle layer ≥ 100 μm
bottom layer ≥ 200 μm, initial camber 6%

Stress Check:

received internal stress ... σ =			12,15 N/mm²
allowable stress... σallow =			12,00 N/mm²
degree of utilisation... η =	σ / σallow	=	1,01 ≅ 1

<u>Annex B</u>

ETFE and arched steel girder stress check under lifting loads

Loads: Self weight + wind load load 20,4 psf

net clearance ... e =			0,30 m
uniform load... w =	20,4 * onePSF	=	0,977 kN/m²
element load... we =	w * e/2	=	0,147 kN/m

Design:

upper layer ≥ 200 μm, initial camber 6%

Stress Check (stresses received from an analysis with 3% initial camber):

received internal stress ... σ =			17,80 N/mm²
allowable stress... σallow =			18,00 N/mm²
degree of utilisation... η =	σ / σallow	=	0,99 ≤ 1

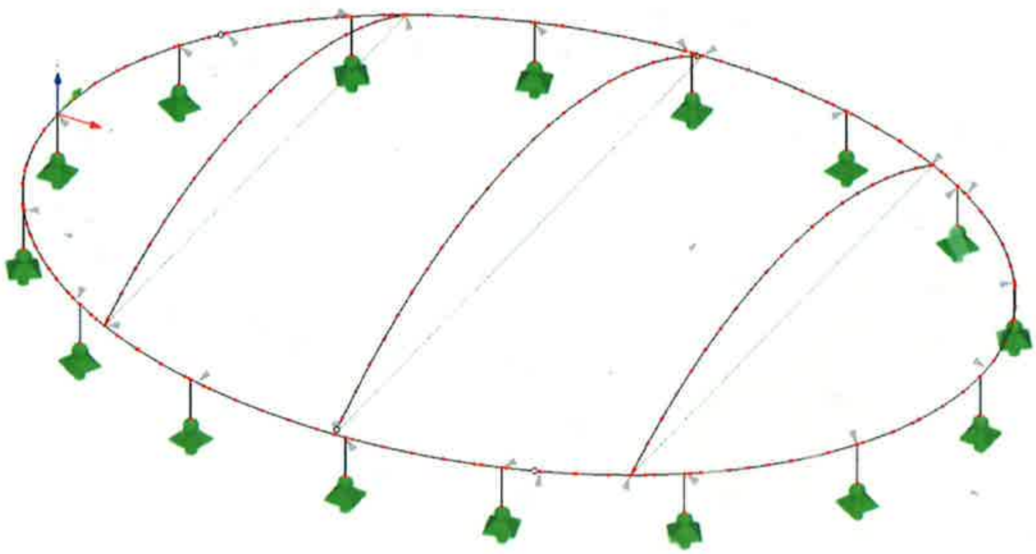
<u>Annex C</u>

Steel structure stress check under downward loads

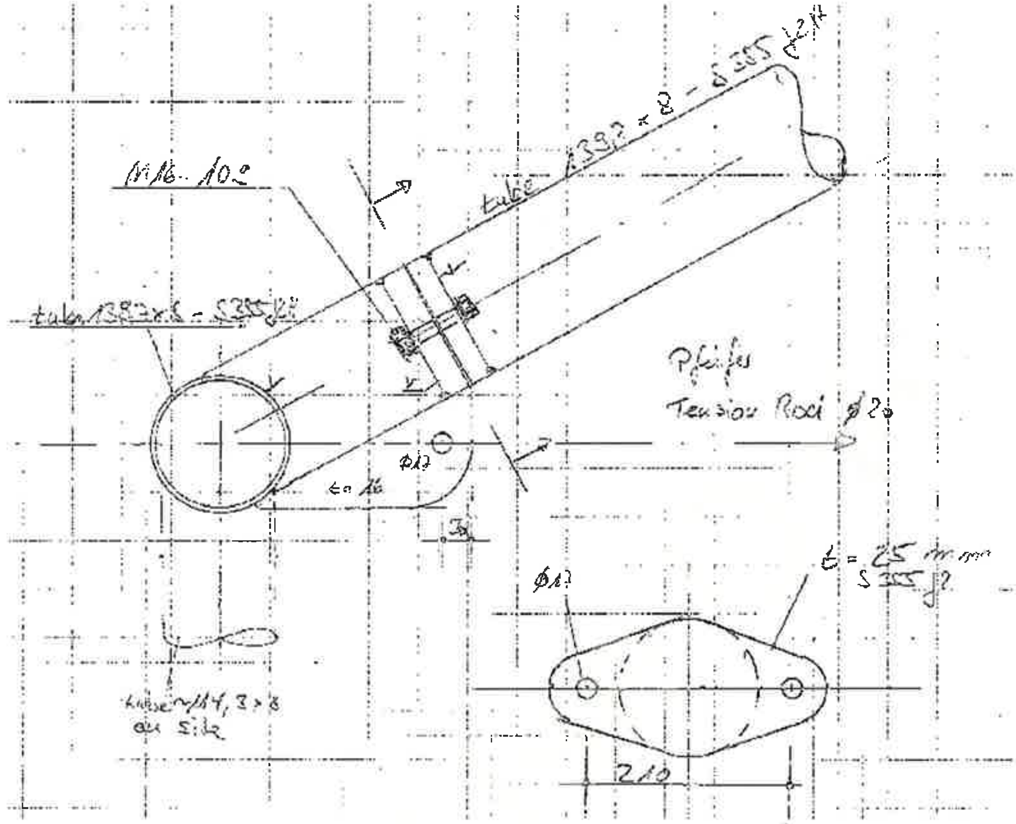
SPANNUNGEN QUERSCHNITTSWEISE

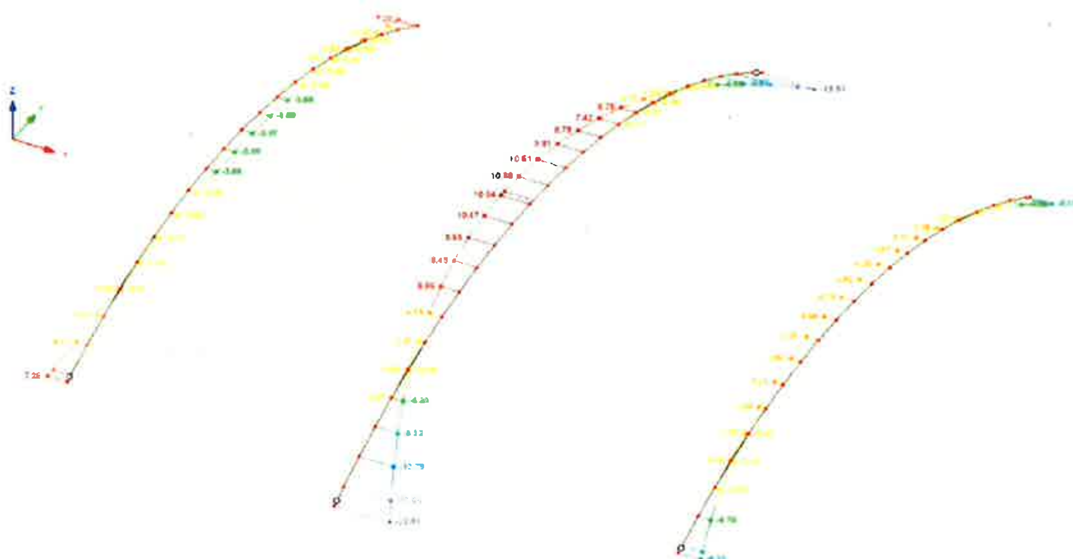
Quer.-Nr.	Stab Nr.	x-Stelle [mm]	S-Punkt Nr.	Last-fall	Spannungsart	Spannung [N/mm ²] vorh	grenz	Aus-nutzung
2	RO 114.3x8 - Column							
	495	451.9	26	LG11	Sigma gesamt	-115.523	218.182	0.53
	495	0.0	17	LG11	Tau gesamt	12.053	125.967	0.10
	495	451.9	26	LG11	Sigma-v	115.527	218.182	0.53
5	RO 139.7x8 - Ringbeam							
	789	0.0	4	LG13	Sigma gesamt	-113.618	327.273	0.35
	1118	70.2	21	LG11	Tau gesamt	25.858	188.951	0.14
	789	0.0	4	LG13	Sigma-v	114.706	327.273	0.35
6	RO 139.7x8 - Archbeams							
	815	0.0	19	LG13	Sigma gesamt	-214.734	327.273	0.66
	809	0.0	11	LG13	Tau gesamt	-17.908	188.951	0.09
	815	0.0	19	LG13	Sigma-v	214.798	327.273	0.66
7	Rundstahl 20 - Rod							
	817	7200.9	37	LG11	Sigma gesamt	172.190	327.273	0.53
	296	0.0	1	LG3	Tau gesamt	0.000	188.951	0.00
	817	7200.9	37	LG11	Sigma-v	172.190	327.273	0.53

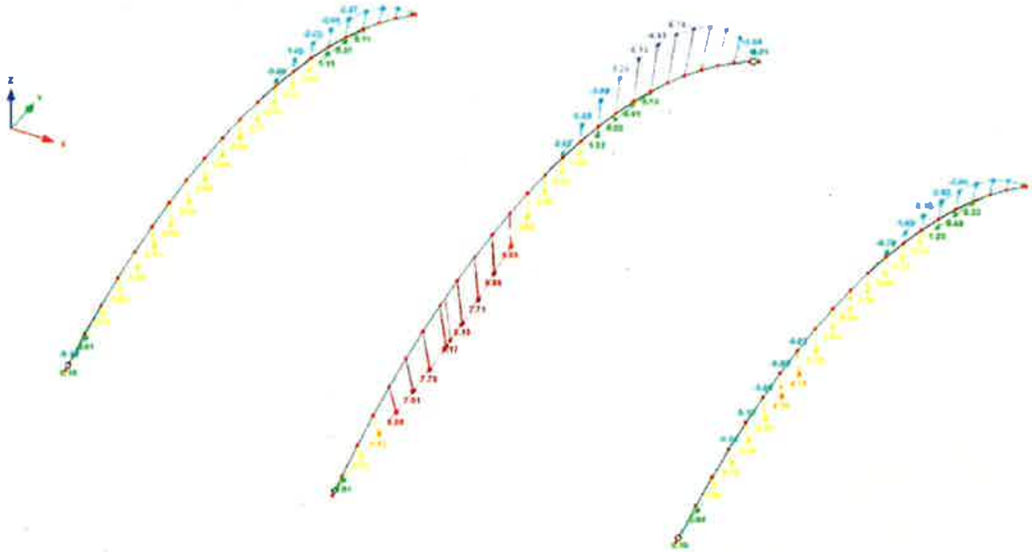
Steel Joints and Aluminium Extrusion



Pos. 31 T-Joint Arches to Eaves Ring







Acting Forces

$min\ N_d = -68$ kN

$V_{yd} = 19{,}0$ kN

$V_{zd} = 7{,}40$ kN

$M_{xd} = 3{,}1$ kNm

$M_{yd} = 0{,}0$ kNm

$M_{zd} = 20{,}81$ kNm

Schrauben (Bolted Joints)

$$V_{zdi} = \frac{3{,}10}{24} + \frac{7{,}4}{2} = 16{,}62 \text{ kN}$$

$$V_{ydi} = 19{,}0/2 = 9{,}5 \text{ kN}$$

$$V_{di} = \sqrt{16{,}6^2 + 9{,}5^2} = 19{,}2 \text{ kN}$$

$$F_t = 2081/21 = 99{,}1 \text{ kN}$$

gew. M16 – 10.9

$$F_t/F_{tRd} = \frac{99{,}1}{113} = 0{,}88 < 1$$

$$V_{di}/F_{vRd} = \frac{19{,}2}{62{,}8} = 0{,}3 < 1$$

$$0{,}3 + \frac{0{,}88}{1{,}4} = 0{,}93 < 1$$

Stirnplatte (End Plate)

$M = 99{,}12 \times 4{,}0 = 396{,}4$ kN/cm

$b = 11$ cm

$t = 2{,}5$

$W = 11 \cdot 2{,}5^2 / 4 = 17{,}2$

$387 / 17{,}2 = 23{,}10$ kN/cm²

$23{,}1 / 35{,}5 = 0{,}65 < 1$ ✓

Welded tube joint

(according to DIN EN 1993-1-8: 2010-12)

Einwirkungen (Acting Forces and Bending Moments)

Strebe (Brace) Column Member No. 327

$N_{1,Ed}$ = **-68,00 kN**

in-plane $M_{ip,1,Ed}$ = **20,81 kNm**

out-of-plane $M_{op,1,Ed}$ = **0,00 kNm**

Gurtstab (Chord) Eaves Ring Member No. 292

$N_{0,Ed}$ = **-14,70 kN**

pressure > 0.... $N_{p,Ed}$ = $-N_{0,Ed}$ = 14,70 kN

in-plane $M_{ip,0,Ed}$ = **11,20 kNm**

out-of-plane $M_{op,0,Ed}$ = **9,00 kNm**

Geometrie (geometry)

$a_w = t_1$

Θ_1 = 90,00 °

partial safety factor according to Eurocode γ_{M5} = **1,00**

Strebe (brace)

f_{y1} =	fy/10	=	**35,50 kN/cm²**
d_1 =	**139,7** /10	=	13,97 cm
t_1 =	**8,0** /10	=	0,80 cm

Gurtstab (chord)

f_{y0} =	fy/10	=	**35,50 kN/cm²**
d_0 =	**139,7** /10	=	13,97 cm
t_0 =	**8** /10	=	0,80 cm
A_0 =	$\pi/4*(d_0^2-(d_0-2*t_0)^2)$	=	33,10 cm²
$W_{el,0}$ =	$\pi/(32*d_0)*(d_0^4-(d_0-2*t_0)^4)$	=	103,12 cm³

Gurtspannung (Chord Stress) pressure > 0, tension < 0

$$\sigma_{p,Ed} = \frac{N_{p,Ed}}{A_0} + \frac{\sqrt{\left(M_{ip,0,Ed}^{\ 2} + M_{op,0,Ed}^{\ 2}\right)} \times 10^2}{W_{el,0}} = 14,38 \text{ kN/cm}^2$$

Parameter und Beiwerte (Coefficients):

$\beta = \quad d_1 / d_0 \quad = \quad 1{,}00$

$\gamma = \quad d_0 / (2 * t_0) \quad = \quad 8{,}73$

pressure >0!... $n_p = \quad \sigma_{p,Ed} / f_{y0} * \gamma_{M5} \quad = \quad 0{,}405$

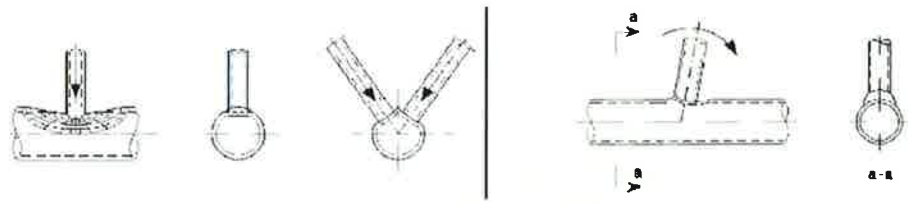
$k_p = \quad \text{MIN}(1-0{,}3*n_p*(1+n_p);1{,}0) \quad = \quad 0{,}829$

$k_p = \quad \text{WENN}(np < 0;1{,}0;k_p) \quad = \quad 0{,}829$

Gültigkeitsbereich nach Tab. 7.1 (Scope according to Eurocode table 7.1):

Durchmesserverhältnis = d_1 / d_0 = **1,0 (≤1,0 und ≥ 0,2)**
(diameter ratio)
Gurtstäbe Zug = d_0 / t_0 = **17,5 (≤ 50 und ≥ 10)**
(chord in tension)
Gurtstäbe Druck = d_0 / t_0 = **17,5 (≤ 50 und ≥ 10 sowie Klasse 1 oder 2)**
(chord in pressure, needs to be class 1 or 2 section ⇒ plastic design possible)
Streben Zug = d_1 / t_1 = **17,5 (≤ 50)**
(brace in tension)
Streben Druck (brace in pressure) **Klasse 1 oder 2 (class 1 or 2)**

Flanschversagen des Gurtstabes (flange failure of the chord)



$$N_{1,Rd,a} = \frac{\gamma^{0,2} * k_p * f_{y0} * t_0^2}{\sin(\Theta_1)} * (2{,}8 + 14{,}2 * \beta^2) / \gamma_{M5} \quad = \quad 494 \text{ kN}$$

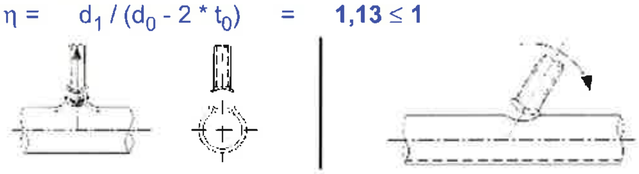
$$M_{ip,1,Rd,a} = 4{,}85 * \frac{f_{y0} * t_0^2 * d_1}{\sin(\Theta_1)} * \sqrt{\gamma} * \beta * k_p / \gamma_{M5} * 10^{-2} \quad = \quad 37{,}71 \text{ kNm}$$

$$M_{op,1,Rd,a} = \frac{f_{y0} * t_0^2 * d_1}{\sin(\Theta_1)} * \frac{2{,}7}{1 - 0{,}81 * \beta} * k_p / \gamma_{M5} * 10^{-2} \quad = \quad 37{,}39 \text{ kNm}$$

Durchstanzen der Wandung des Gurtstabes (punching shear)

nur bei (only to be considered if) $d_1 \leq d_0 - 2 * t_0$

$\eta = \quad d_1 / (d_0 - 2 * t_0) \quad = \quad$ **1,13 ≤ 1**



$$N_{1,Rd,d} = \text{WENN}(\eta \leq 1; \frac{f_{y0}}{\sqrt{3}} * t_0 * \pi * d_1 * \frac{1 + \sin(\Theta_1)}{2 * (\sin(\Theta_1))^2} * \frac{1}{\gamma_{M5}}; N1,Rd,a) \quad = \quad 494{,}00 \text{ kN}$$

$$M_{ip,1,Rd,d} = \text{WENN}(\eta \leq 1; \frac{f_{y0} * t_0 * d_1^2}{\sqrt{3}} * \frac{1 + 3 * \sin(\Theta_1)}{4 * (\sin(\Theta_1))^2} / \gamma_{M5} * 10^{-2}; Mip,1,Rd,a) \quad = \quad 37{,}71 \text{ kNm}$$

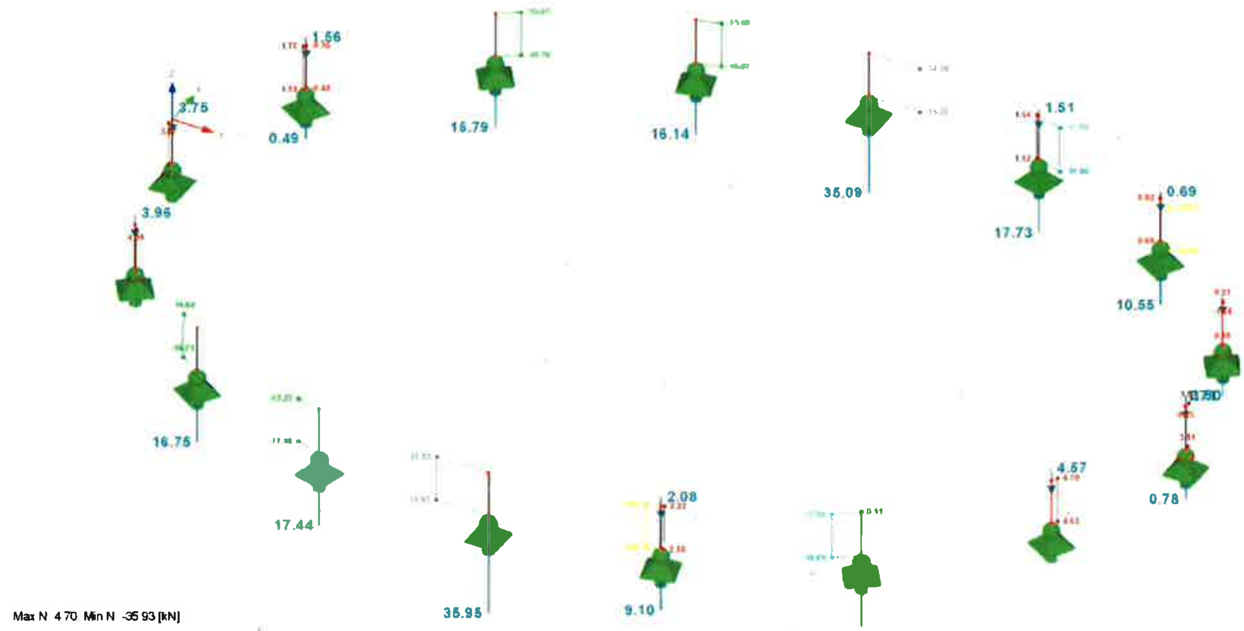
$$M_{op,1,Rd,d} = \text{WENN}(\eta \leq 1; f_{y0} * t_0 * \frac{d_1^2}{\sqrt{3}} * \frac{3 + \sin(\Theta_1)}{4 * (\sin(\Theta_1))^2} * \frac{1}{\gamma_{M5} * 10^2}; Mop,1,Rd,a) \quad = \quad 37{,}39 \text{ kNm}$$

Nachweis (Degree of Utilisation)

Normalkraft η_N =	$ABS(N_{1,Ed})/MIN(N_{1,Rd,a};N_{1,Rd,d})$	=	0,14 < 1,0
Moment in-plane η_{ip} =	$M_{ip,1,Ed}/MIN(M_{ip,1,Rd,a};M_{ip,1,Rd,d})$	=	0,55 < 1,0
Moment out-plane η_{op} =	$M_{op,1,Ed}/MIN(M_{op,1,Rd,a};M_{op,1,Rd,d})$	=	0,00 < 1
Interaktion η =	$\eta_N+\eta_{ip}^2+\eta_{op}$	=	0,44 < 1

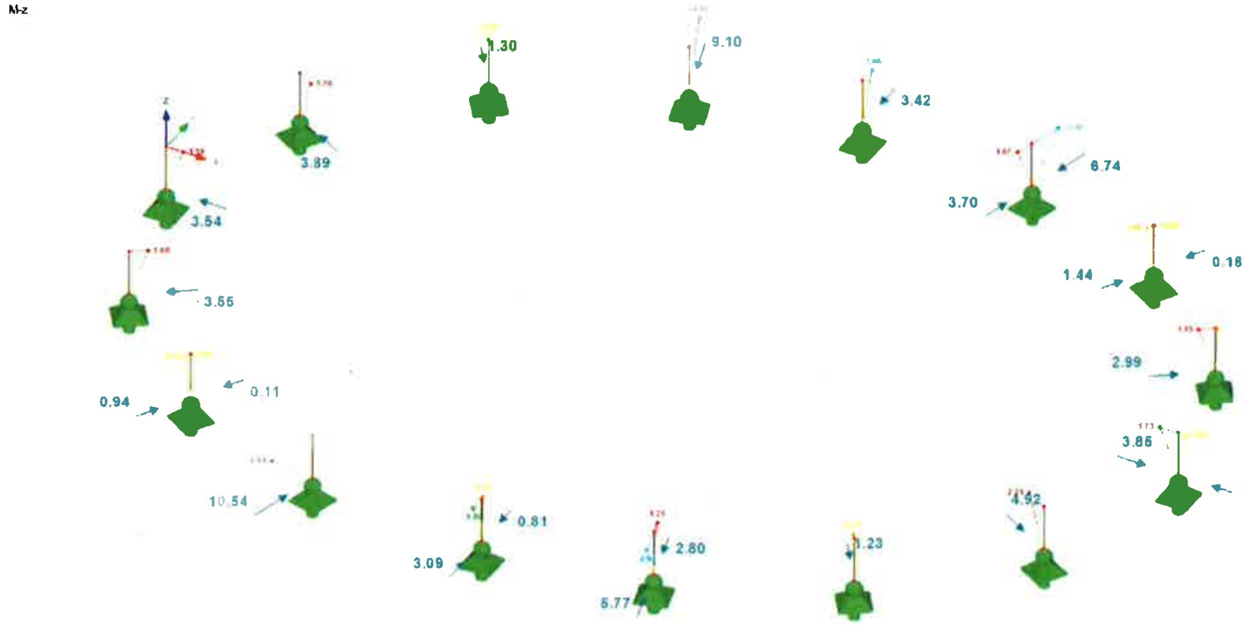
Pos. 32 T-Joint Column to Eaves Ring

(according to DIN EN 1993-1-8: 2010-12)

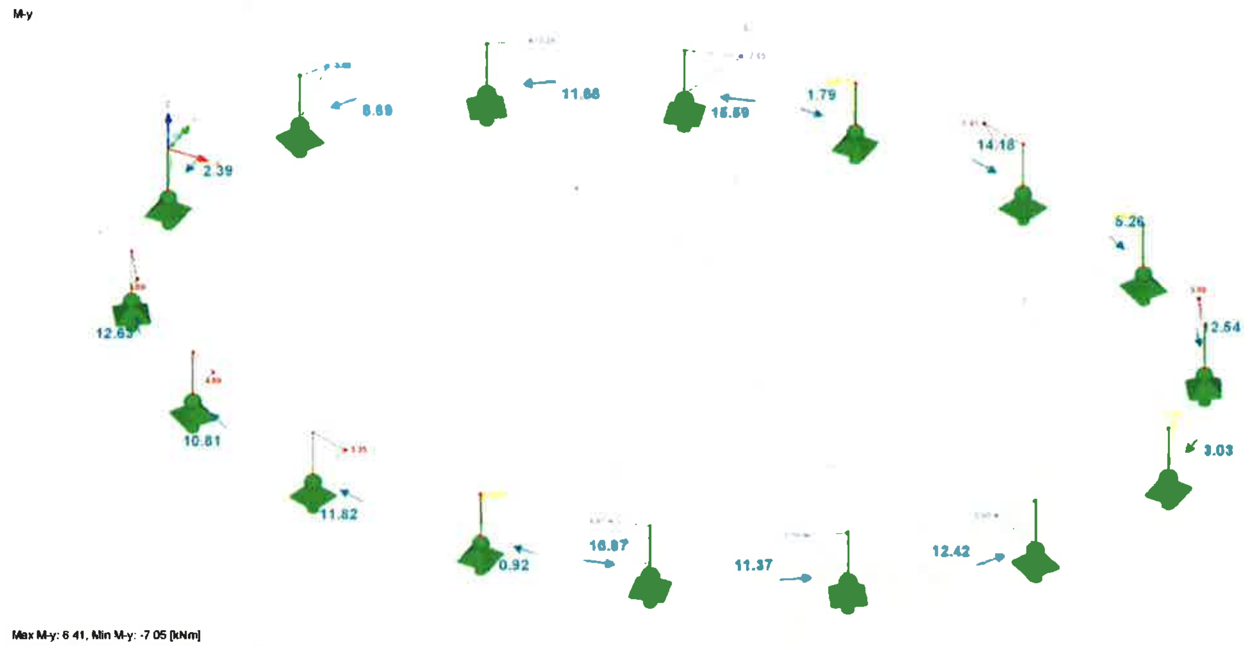


Max N 4.70 Min N -35.93 [kN]

M-z



Max M-z 2.21 Min M-z -4.81 [kNm]



Einwirkungen (Acting Forces and Bending Moments)

Strebe (Brace) internal forces worst of column members no. 329, 332

$N_{1,Ed}$ = **-36,00 kN**

in-plane $M_{ip,1,Ed}$ = **7,05 kNm**

out-of-plane $M_{op,1,Ed}$ = **4,81 kNm**

Gurtstab (Chord) eaves ring members no. 166 and 13

$N_{0,Ed}$ = **-16,30 kN**

pressure > 0.... $N_{p,Ed}$ = $-N_{0,Ed}$ = 16,30 kN

in-plane $M_{ip,0,Ed}$ = **8,70 kNm**

out-of-plane $M_{op,0,Ed}$ = **10,19 kNm**

Geometrie (Geometry)

$a_w = t_1$

Θ_1 = **90,00 °**

γ_{M5} = **1,00**

Strebe (Brace)

f_{y1} = 241/10 = **24,10 kN/cm²**

d_1 = **114,3** /10 = 11,43 cm

t_1 = **17,2** /10 = 1,72 cm

Gurtstab (Chord)

f_{y0} = fy/10 = **35,50 kN/cm²**

d_0 = **139,7** /10 = 13,97 cm

t_0 = **8** /10 = 0,80 cm

$A_0 = \pi/4*(d_0^2-(d_0-2*t_0)^2)$ = 33,10 cm²

$W_{el,0} = \pi/(32*d_0)*(d_0^4-(d_0-2*t_0)^4)$ = 103,12 cm³

Gurtspannung (Stress in chord, pressure with pos. algebraic sign):

$$\sigma_{p,Ed} = \frac{N_{p,Ed}}{A_0} + \frac{\sqrt{\left(M_{ip,0,Ed}^{\ 2} + M_{op,0,Ed}^{\ 2}\right)} \times 10^2}{W_{el,0}} = 13{,}49 \text{ kN/cm}^2$$

Parameter und Beiwerte (Coefficients):

$\beta = d_1 / d_0$ = 0,82

$\gamma = d_0 / (2 * t_0)$ = 8,73

pressure >0!... n_p = $\sigma_{p,Ed} / f_{y0} * \gamma_{M5}$ = 0,380

k_p = MIN(1-0,3*n_p*(1+n_p);1,0) = 0,843

k_p = WENN(np < 0;1,0;k_p) = 0,843

Gültigkeitsbereich nach Tab. 7.1 (Scope according to Eurocode table 7.1):

Durchmesserverhältnis = d_1 / d_0 = **0,8 (≤1,0 und ≥ 0,2)**

(diameter ratio)

Gurtstäbe Zug = d_0 / t_0 = **17,5 (≤ 50 und ≥ 10)**

(chord in tension)

Gurtstäbe Druck = d_0 / t_0 = **17,5 (≤ 50 und ≥ 10 sowie Klasse 1 oder 2)**

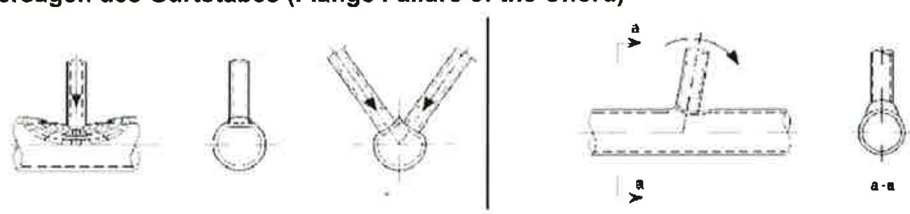
(chord in pressure, needs to be class 1 or 2 section ⇒ plastic design possible)

Streben Zug = d_1 / t_1 = **6,6 (≤ 50)**

(brace in tension)

Streben Druck (brace in pressure) **Klasse 1 oder 2 (class 1 or 2)**

Flanschversagen des Gurtstabes (Flange Failure of the Chord)



$$N_{1,Rd,a} = \frac{\gamma^{0,2} * k_p * f_{y0} * t_0^{\ 2}}{\sin(\Theta_1)} * (2{,}8 + 14{,}2 * \beta^2)/\gamma_{M5} = 365 \text{ kN}$$

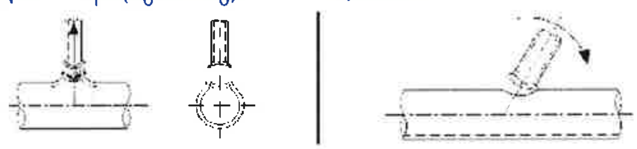
$$M_{ip,1,Rd,a} = 4{,}85 * \frac{f_{y0} * t_0^{\ 2} * d_1}{\sin(\Theta_1)} * \sqrt{\gamma} * \beta * k_p / \gamma_{M5} * 10^{-2} = 25{,}72 \text{ kNm}$$

$$M_{op,1,Rd,a} = \frac{f_{y0} * t_0^{\,2} * d_1}{\sin(\Theta_1)} * \frac{2,7}{1 - 0,81 * \beta} * k_p / \gamma_{M5} * 10^{-2} = 17,60 \text{ kNm}$$

Durchstanzen der Wandung des Gurtstabes (Punching Shear)

only to be considered if $d_1 \le d_0 - 2 * t_0$

$\eta = d_1 / (d_0 - 2 * t_0) =$ **$0,92 \le 1$**



$$N_{1,Rd,d} = \text{WENN}(\eta \le 1; \frac{f_{y0}}{\sqrt{3}} * t_0 * \pi * d_1 * \frac{1 + \sin(\Theta_1)}{2 * (\sin(\Theta_1))^2} * \frac{1}{\gamma_{M5}}; 0) = 588,78 \text{ kN}$$

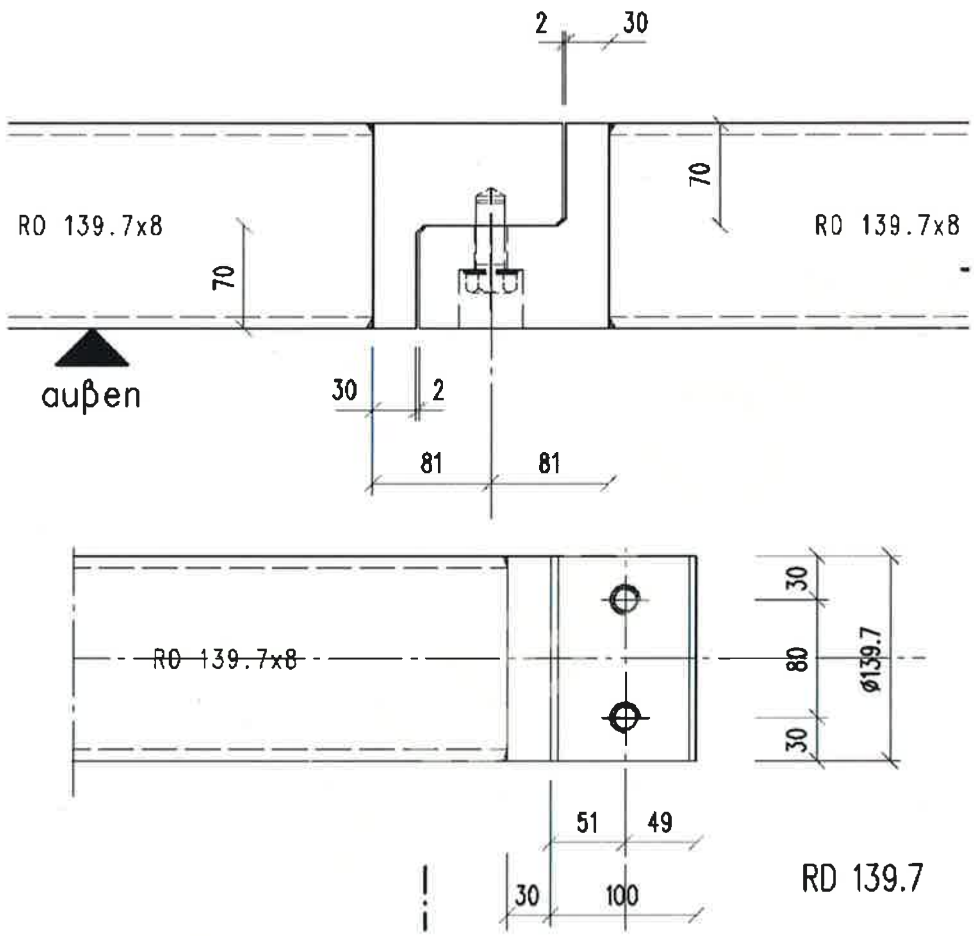
$$M_{ip,1,Rd,d} = \text{WENN}(\eta \le 1; \frac{f_{y0} * t_0 * d_1^{\,2}}{\sqrt{3}} * \frac{1 + 3 * \sin(\Theta_1)}{4 * (\sin(\Theta_1))^2} / \gamma_{M5} * 10^{-2}; 0) = 21,42 \text{ kNm}$$

$$M_{op,1,Rd,d} = \text{WENN}(\eta \le 1; f_{y0} * t_0 * \frac{d_1^{\,2}}{\sqrt{3}} * \frac{3 + \sin(\Theta_1)}{4 * (\sin(\Theta_1))^2} * \frac{1}{\gamma_{M5} * 10^2}; 0) = 21,42 \text{ kNm}$$

Nachweis (Degree of Utilisation)

Normal Force	η_N =	$ABS(N_{1,Ed})/MIN(N_{1,Rd,a};N_{1,Rd,d})$	= **0,10 < 1,0**
Moment in-plane	η_{ip} =	$M_{ip,1,Ed}/MIN(M_{ip,1,Rd,a};M_{ip,1,Rd,d})$	= **0,33 < 1,0**
Moment out-plane	η_{op} =	$M_{op,1,Ed}/MIN(M_{op,1,Rd,a};M_{op,1,Rd,d})$	= **0,27 < 1,0**
Interaction	η =	$\eta_N + \eta_{ip}^{\,2} + \eta_{op}$	= **0,48 < 1**

Pos. 33 Bolted Joints within the Eaves Ring



Geometry

section diameter... d0 = 139,7 mm

section wall thickness... t0 = 8,0 mm

joint plate thickness... tp = 30,0 mm

ultimate strength.. fu = 510 N/mm²

bolt diameter... db = 20,0 mm

grade 10.9... fub = 1000 N/mm²

design tension resistance... FtRd = 176,0 kN

design shear resistance... FvRd = 98,0 kN

(tread in the shear surface!)

gap between the bolts... eb = 80,0 mm

design punsch resistance BpRd = 248 * tp/10 = 744,0 kN

(248 kN acc. to a table for M20-10.9, 10 mm plate -S355)

bolt hole diameter... dh = db + 2 = 22 mm partial material safety factor... $\gamma M0$ = 1,00

partial connection safety factor... $\gamma M2$ = 1,25

Acting Internal Forces

LG3, eaves ring members no. 309 + 312, see annex A

pressure force... NEd = 16,30 kN

horizontal shear force.. VyEd = 5,26 kN

vertical shear force... VzEd = 10,87 kN

torsional moment... TEd = 3,14 kNm

forces acting on one bolt

FvEd = $\sqrt{(VzEd^2 + NEd^2)}/2$ = 9,8 kN

FtEd = 0,5*VyEd + 1000*TEd / eb = 41,9 kN

Degree of Utilization

ηv = FvEd / FvRd = $0,10 \leq 1$

ηt = FtEd / FtRd = $0,24 \leq 1$

η = $\eta v + \eta t/1,4$ = $0,27 \leq 1$

ηp = FtEd/BpRd = $0,06 \leq 1$

specific pressure on hole

edge distance lontigutinal to force... e1 = 30 mm

bolt gap transversal to force... e2 = 30 mm

bolt gap longitudinal to force... p2 = eb*COS(0) = 80 mm

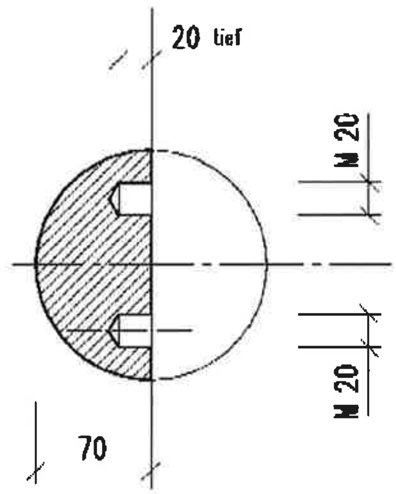
αb = MIN(e1/(3*dh); fub/fu; 1,0) = 0,455

k1 = MIN(2,8*e2/dh-1,7; 1,4*p2/db-1,7; 2,5) = 2,118

FbRd = k1 * αb * fu * db * tp / $\gamma M2$ / 1000 = 235,91 kN

η = FvEd / FbRd = $0,04 \leq 1$

Half Section



fys = 335,0 / 10 = 33,50 kN/cm²

shear + torsional moment

$r = \frac{d0}{2} = 69,85$ mm

$t_{notional} =$ 5,00 mm

$Am = 0,5 * \pi * (r - 0,5 * t_{notional})^2 = 7125$ mm2

$\Rightarrow WT = 2 * Am * t_{notional} / 1000 = 71,25$ cm³

$\tau T = 100 * \frac{TEd}{WT} = 4,41$ kN/cm²

$\tau v = 1,5 * MAX(VyEd; VzEd) / Am = 0,002$ kN/cm²

$\tau Ed = \tau T + \tau v = 4,41$ kN/cm²

$\tau Rd = fys / (\gamma M0 * \sqrt{(3)}) = 19,34$ kN/cm²

$\eta = \tau Ed / \tau Rd = 0,23 \leq 1$

Tension and Bending

$ri = r - t_{notional} = 64,85$ mm

$A = 0,5 * \pi * \frac{ri^2}{100} = 66,06$ cm²

$Wo = 0,191 * \frac{ri^3}{1000} = 52,09$ cm³

$My = VyEd * 8,1 = 42,61$ kNcm

$Wz = \frac{1}{8} * \frac{ri^3}{1000} = 34,09$ cm3

$Mz = VzEd * 8,1 = 88,05$ kNcm

$$\sigma d = \frac{NEd}{A} + \frac{My}{Wo} + \frac{Mz}{Wz} = 3{,}65\ kN/cm^2$$

$$\eta = \sigma d / (fys/\gamma M0) = 0{,}11 < 1$$

Pos. 34 skipped

Pos. 35 skipped

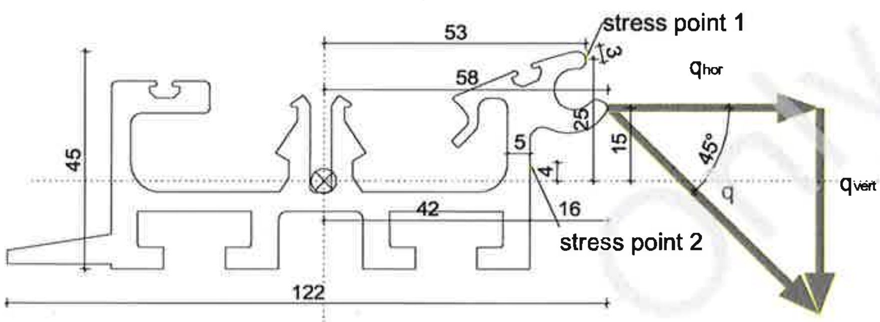
Pos. 36 Extrusion - F16.2

System

⊕ ε υ π ⊕ ε υ π ⊕
∅⊗⊗⊗⊗⊗⊗⊗⊗⊗⊗∅⊗⊗⊗⊗⊗⊗⊗⊗⊗⊗∅

! ! ! ! ! ! ! ! ! ! ∃ ! ! ! ! ! ! ! ! ! ! ∀

max. clearance between upstands e_{up} = 100,0 cm



load eccentritity e_y = 5,80 cm
load eccentritity e_z = 1,50 cm

Material

Aluminium AW-6060 T66
acc. to EN 1999-1-1:2010

0,2% offset yield strength $f_{o,alu}$= **15,00 kN/cm²**
tensile strength $f_{u,alu}$= **19,50 kN/cm²**

young' modulus E_{alu}= **70000,0 N/mm²**
shear modulus G_{alu}= **27000,0 N/mm²**

material safety factor $\gamma_{M1,alu}$= **1,10**

yield strength $f_{alu,d}$= $f_{o,alu} / \gamma_{M1,alu}$ = **13,64 kN/cm²**

Loads

Determination of loads from the ultimate strength of the membrane layers
partial load safety factor... γF = 1,50

sum layer thicknesses t_m = **0,20+0,20** = 0,40 mm
(middle + bottom layer, see part 2)
allowable stress f_{all} = **12,0 N/mm²**
max. slope of lower layer... α = **45,0 °**

tensile force per meter... q_d = $\gamma F * t_m * f_{all}$ = 7,20 kN/m

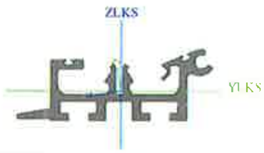
horizontal force $q_{hor,d}$ = $q_d * \text{COS}(\alpha)$ = 5,09 kN/m

vertical force $q_{vert,d}$ = $q_d * \text{SIN}(\alpha)$ = 5,09 kN/m

Note:
Maximum stresses of 12,0 N/mm² are relevant for long term load. In general these loads are acting on two layers (i. e. snow load). The subsequently used load "q" covers the maximum tensile membrane force of 12,0 N/mm² x 0,4 mm = 4,80 N/mm for snow load and 18,0 N/mm² x 0,2 mm = 3,6 kN/m or wind load acting on the upper layer.

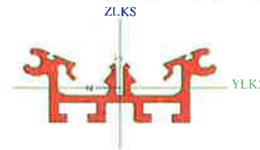
Cross section

Name	F16.2 Single	
Typ	Allgemeiner Querschnitt	
Materialangabe	S 235	
Herstellung	allgemein	
Knick y-y, z-z	c	c
FEM-Analyse	✓	



A [cm²]	14,61	
A y, z [cm²]	1,04	3,48
I y, z [cm⁴]	160,89	19,30
I YLCS, ZLCS [cm⁴]	21,64	158,55
I w [cm⁶], t [cm⁴]	280,71	1,23
Wel y, z [cm³]	24,26	7,47
Wpl y, z [cm³]	42,09	13,96
d y, z [mm]	-9,89	3,17
c YLKS, ZLKS [mm]	3,62	-4,24
Alpha [deg]	97,39	
IYZLKS [cm⁴]	18,06	
AL [m²/m]	0,65	
Mply +, - [Ncm]	1,01e+06	1,01e+06
Mplz +, - [Ncm]	3,35e+05	3,35e+05

Name	F16.2 Double	
Typ	Allgemeiner Querschnitt	
Materialangabe	S 235	
Herstellung	allgemein	
Knick y-y, z-z	c	c
FEM-Analyse	✓	



A [cm²]	14,87	
A y, z [cm²]	2,82	5,15
I y, z [cm⁴]	164,88	22,27
I YLCS, ZLCS [cm⁴]	22,27	164,88
I w [cm⁶], t [cm⁴]	241,98	1,24
Wel y, z [cm³]	28,25	9,12
Wpl y, z [cm³]	43,44	15,90
d y, z [mm]	-15,75	0,00
c YLKS, ZLKS [mm]	0,00	-1,96
Alpha [deg]	90,00	
IYZLKS [cm⁴]	0,00	
AL [m²/m]	0,67	
Mply +, - [Ncm]	1,04e+06	1,04e+06
Mplz +, - [Ncm]	3,82e+05	3,82e+05

⇒ values for extrusion type "F16.2 single" will be used

$I_y =$ **21,64 cm⁴**

$I_z =$ **158,55 cm⁴**

$I_t =$ **1,23 cm⁴**

design

double-span beam:

$M_{y,d} = q_{vert,d} * e_{up}^2 * 1/8 / 100 = 63{,}6$ kNcm

$M_{z,d} = q_{hor,d} * e_{up}^2 * 1/8 / 100 = 63{,}6$ kNcm

$M_{t,d} = (q_{hor,d} * e_z + q_{vert,d} * e_y) * e_{up}/2 / 100 = 18{,}6$ kNcm

stress point 1

$W_y = I_y / \mathbf{2{,}50} = 8{,}7$ cm³

$W_z = I_z / \mathbf{5{,}30} = 29{,}9$ cm³

$W_t = I_t / \mathbf{0{,}30} = 4{,}1$ cm³

$\sigma_d = M_{y,d} / W_y + M_{z,d}/W_z = 9{,}4$ kN/cm²

$\tau_d = M_{t,d} / W_t = 4{,}5$ kN/cm²

v. Mises $\sigma_v = \sqrt{(\sigma_d^2 + 3 * \tau_d^2)} = \underline{12{,}2}$ kN/cm²

coeff. of utilization $\eta = \sigma_v / f_{alu,d} = \underline{\mathbf{0{,}89 \le 1}}$

stress point 2

$W_y = I_y / \mathbf{0{,}40} = 54{,}1$ cm³

$W_z = I_z / \mathbf{4{,}20} = 37{,}8$ cm³

$W_t = I_t / \mathbf{0{,}50} = 2{,}5$ cm³

$\sigma_{x,d} = M_{y,d} / W_y + M_{z,d}/W_z = 2{,}86$ kN/cm²

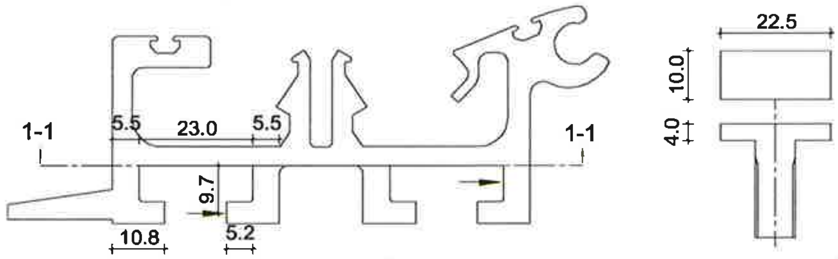
$\sigma_{z,d} = qv_{ert,d}/(0{,}5*100) + (q_{hor,d} * \mathbf{1{,}50} + q_{vert,d} * \mathbf{1{,}6}) / 100 / (0{,}50^2/6) = 3{,}89$ kN/cm²

$\tau_d = 0{,}5*q_{vert,d}*e_{up}/(3*0{,}5*4{,}0*100) + M_{t,d} / W_t = 7{,}86$ kN/cm²

v. Mises $\sigma_v = \sqrt{(\sigma_{x,d}^2 + \sigma_{z,d}^2 - \sigma_{x,d} * \sigma_{z,d} + 3 * \tau_d^2)} = \underline{14{,}05}$ kN/cm²

coeff. of utilization $\eta = \sigma_v / f_{alu,d} = \underline{\mathbf{1{,}03 \cong 1}}$

Local stress check at extrusion



section 1-1: Contact point at bolt shank

number of bolts n_b =		**4**	
h_{Ex} =		**0,970 cm**	
t_{Ex} =		**0,550 cm**	
b_{Ex} =	**1,08 - t_{Ex}/2** =	0,805 cm	

effective width, with angle of load-spreading = 45°

$b_{eff,Ex}$ =	$2^* (b_{Ex}+h_{Ex})$	= 3,550 cm
moment of restistance W =	$1{,}25 * b_{eff,Ex} * t_{Ex}^2 / 6$	= 0,2237 cm³
acting force, per bolt F_d =	$1{,}25 * q_{hor,d} * e_{up}/100 / n_b$	= 1,591 kN
stress σ_d =	$F_d * h_{Ex} / W$	= 6,90 kN/cm²
coeff. of utilization η =	$\sigma_d / f_{alu,d}$	= <u>0,51 ≤ 1</u>

section 1-1: Contact point between bolt head and vertical web

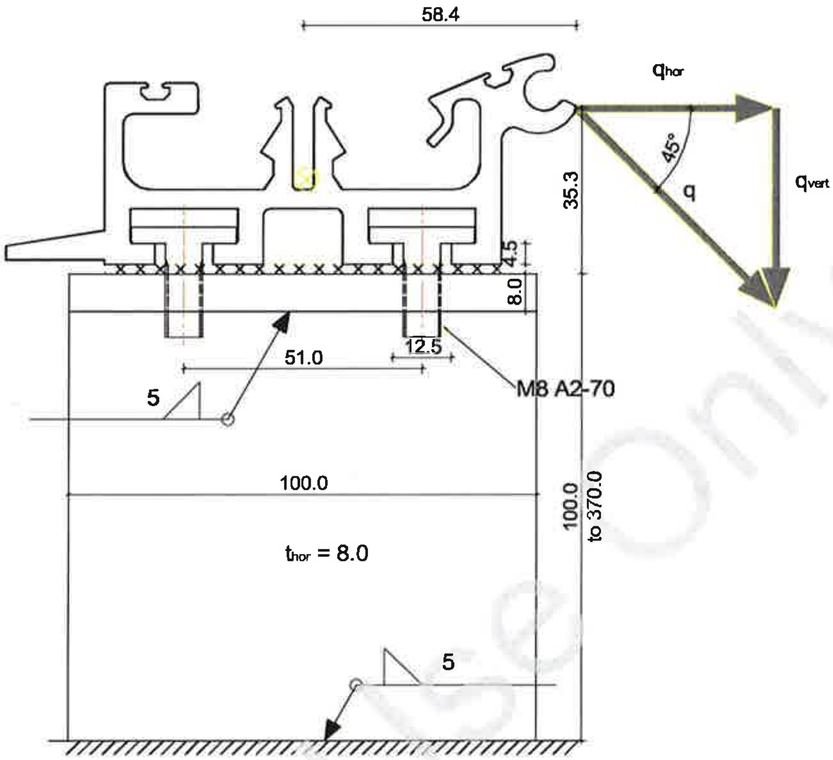
bolt head hight t_b =	**0,400 cm**
bolt head width b_b =	**1,000 cm**

effective width, with angle of load-spreading = 45°

$b_{eff,Ex}$ =	$2^* h_{Ex} + b_b$	= 2,940 cm
moment of restistance W =	$1{,}25 * b_{eff,Ex} * t_{Ex}^2 / 6$	= 0,1853 cm³
acting force, per bolt F_d =	$1{,}25 * q_{hor,d} * e_{up}/100 / n_b$	= 1,591 kN
stress σ_d =	$F_d * h_{Ex} / W$	= 8,33 kN/cm²
coeff. of utilization η =	$\sigma_d / f_{alu,d}$	= <u>0,61 ≤ 1</u>

Pos. 37 Upstands

Material and mechanical System



Hammer-head bolts M8x30 A2-70

number of bolts n_b =	**4**
max. hor. capacity V_{Rd} =	**8,70 kN**
hole diameter d_0 =	**1,25 cm**
bolt diameter d =	**0,80 cm**
eff. thread cross section area A_{Sp} =	**0,370 cm²**
partial safety factor γ_{M2} =	**1,25**
tensile strength bolt f_{ub} =	**70,00 kN/cm²**

steel grade S235 according to EN 10025-2

$f_{y,d}$ = 23,5 / γM0 = **23,5 kN/cm²**

$f_u = \frac{360}{10}$ = 36,0 kN/cm²

Geometry

max. clearance between upstands e_{up} =	e_{up}	= **100,00 cm**
clearance between bolts e_b =		**5,10 cm**
load eccentritity e_1 =		**5,84 cm**
load eccentritity e_2 =		**3,53 cm**
max. height of upstands h_{up} =		**10,00 cm**
thickness upstand plate t_{up} =		**0,80 cm**
thickness horizontal plate t_{hor} =		**0,80 cm**
width upstand plate b_{up} =		**10,00 cm**

Loads

Determination of loads from the ultimate strength of the membrane layers

sum layer thickness t_m = **0,20+0,20** = 0,40 mm

allowable stress f_{all} = **12,0 N/mm²**

max. slope of lower layer... α = **45,0 °**

tensile force per meter... q_d = $\gamma F * t_m * f_{all}$ = 7,20 kN/m

horizontal force $q_{hor,d}$ = $q_d * COS(\alpha)$ = 5,09 kN/m

vertical force $q_{vert,d}$ = $q_d * SIN(\alpha)$ = 5,09 kN/m

load component parallel to the extrusion:
horizontal force $q_{hor,II,d}$ = $e_{up}/100 * 0,20$ = 0,20 kN/m

Note:

Maximum stresses of 12,0 N/mm² are relevant for long term loads. In general these loads are acting on two layers (i. e. load). The subsequently used load "q" covers the maximum tensile membrane force of 18,0 N/mm² x 0,20 mm = 3,6 N/mm due to wind suction.

Design of upright plate

Area A = $b_{up} * t_{up}$ = 8,00 cm²

moment of resistance $W_{y,el}$ = $b_{up}^{2} * t_{up} / 6$ = 13,33 cm³

moment of resistance $W_{z,el}$ = $b_{up} * t_{up}^{2} / 6$ = 1,07 cm³

$M_{y,d}$ = $(q_{hor,d} * (h_{up}+e_2) + q_{vert,d} * e_1) * e_{up} / 100$ = 98,59 kNcm

$M_{z,d}$ = $(q_{hor,II,d} * (h_{up}+e_2) + q_{vert,d} * t_{up}/2) * e_{up} / 100$ = 4,74 kNcm

σ_d = $q_{vert,d}/100 * e_{up}/A + M_{y,d}/W_{y,el} + M_{z,d}/W_{z,el}$ = 12,46 kN/cm²

τ_d = $\sqrt{(q_{hor,d}^2 + q_{hor,II,d}^2)} * e_{up} / (100*A)$ = 0,64 kN/cm²

v. Mises σ_v = $\sqrt{(\sigma_d^2 + 3 * \tau_d^2)}$ = 12,51 kN/cm²

coeff. of utilization η = $\sigma_v / f_{y,d}$ = **0,53 ≤ 1**

plate has to be welded to substructure by fillet-welds
throat dimension **a = 4 mm** (nominal leg D = 5,6 mm)

design: 2 x 4,0 = 8 mm = 1,0 x t_{up}.

s235... βw = 0,80

fvwd = $fu/\sqrt{(3)} / (\beta w * \gamma M2)$ = 20,78 kN/cm²

coeff. of utilization η = σ_v / f_{vwd} = **0,60 ≤ 1**

Bolted connection between extrusion and horizontal plate

horizontal force per bolt $F_{v,d}$ =	$\sqrt{}(q_{hor,d}^2+q_{hor,II,d}^2) / (100*n_b) * e_{up}$	=	1,27 kN
vertikal force per bolt $F_{t,d}$ =	$(q_{hor,d} * e_2 + q_{vert,d} * e_1) / (e_b * n_b/2)$	=	4,68 kN

resistance according to EN 1993-1-4:2006

single shear

shear joint in thread α = **0,50**

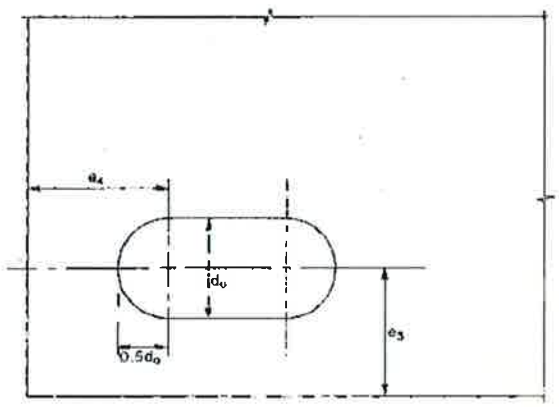
$F_{v,Rd}$ = $MIN(V_{Rd};\alpha * A_{Sp} * f_{ub} / \gamma_{M2})$ = 8,7 kN

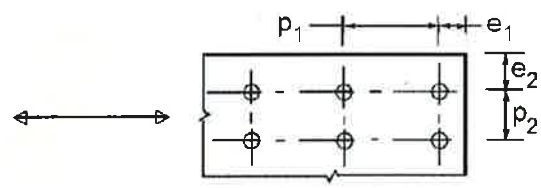
tensional force

k_2 = **0,90**

$F_{t,Rd}$ = $k_2 * A_{Sp} * f_{ub} / \gamma_{M2}$ = 18,6 kN

specific pressure on hole





min. edge distance in load direction e_1 =	$1,2*d_0$	=	1,50 cm
min. edge distance orthogonal to load direction e_2 =	$1,2*d_0$	=	1,50 cm
min. edge distance in load direction (elongated hole) e_3 =	$1,5*d_0$	=	1,88 cm
min. edge distance orthogonal to load direction (elongated hole) e_4 =	$1,5*d_0$	=	1,88 cm
min. bolt distance in load direction p_1 =	$2,2*d_0$	=	2,75 cm
min. bolt distance orthogonal to load direction p_2 =	$2,4*d_0$	=	3,00 cm

k_1 = $MIN(2,5 ; 2,8*e_2/d_0-1,7; 1,4*p_2/d_0-1,7)$ = 1,66

horizontal plate:

t_{hor} = **0,80 cm**

α_b = $MIN(e_1 / (3*d_0) ; p_1 / (3*d_0) - 1/4 ; f_{ub} / f_u ; 1,0)$ = 0,400

(for elongated hole = 0,60)

$F_{b,Rd,hor}$ = $0,60 * k_1 * \alpha_b * f_u * d * t_{hor} / \gamma_{M2}$ = 7,34 kN

extrusion profile:

(acc. to DIN EN 1999-1-1 = 0,80 for aluminium)

t_{Ex} = **0,45 cm**

α_b = $MIN(e_1 / (3*d_0) ; p_1 / (3*d_0) - 1/4 ; f_{ub} / f_u ; 0,66)$ = 0,400

$F_{b,Rd,Ex}$ = $0,80 * k_1 * \alpha_b * f_u * d * t_{Ex} / \gamma_{M2}$ = 5,51 kN

check due to shear forces

$F_{v,d}$		=	1,27 kN
$F_{v,Rd}$		=	8,70 kN
η_v =	$F_{v,d} / F_{v,Rd}$	=	$0,15 \leq 1$

check due to tensional forces

$F_{t,d}$ = 4,68 kN

$F_{t,Rd}$ = 18,60 kN

$\eta_t = F_{t,d} / F_{t,Rd} = \underline{0,25 \leq 1}$

check due to specific pressure on hole

horizontal plate:

$\eta_{b,hor} = F_{v,d} / F_{b,Rd,hor} = \underline{0,17 \leq 1}$

extrusion profile:

$\eta_{b,Ex} = F_{v,d} / F_{b,Rd,Ex} = \underline{0,23 \leq 1}$

interaction

$\eta_{v+t} = F_{v,d} / F_{v,Rd} + F_{t,d} / (1,4 * F_{t,Rd}) = \underline{0,33 \leq 1}$

Annex - Structural Analysis Printout

Part	Annex	Rev	Subject	Pages
	A	new	ETFE - downward loads	21
	B	new	Structural Steel - lifting loads	21
	C	new	Structural Steel - downward loads	25

D-Bremen, August 14, 2013
Dr.-Ing. Tobias Schween

O²A
O² ARCHITECTS

TRANSMITTAL LETTER

208 N. Broadway - Suite 350 Billings, Montana 59101 TEL (406) 259-7123 FAX (406) 256-7123 dono@o2architects.net

To: **Jackson Contractor Group**
Mike Chase

Date: 4/5/2013

CC: **WB+P**

Project Name: **Parmly Billings Library**

Project Number: **1101**

We transmit:

(x) Herewith
( ) In accordance with your request
( ) Under separate cover via:

For Your

( ) Approval	( ) Information	(X) Distribution to Others
( ) Review & Comment	( ) Record	( ) ____________

The following:

(X) Drawings	(X) Shop Drawings	(x) See Below
( ) Specifications	( ) Product Literature	( ) Digital Files

Copies	Date:	Description:	
1		08 6300 -1 (Phase 1) ETFE	**Approved**

Remarks

First of 3 submittals. Need to discuss possibility of offsetting tube to interior to avoid existing wall

Jackson CONTRACTOR GROUP, INC.
P.O. Box 967, Missoula, MT 59806
406-542-9150 | FAX 542-3515

Submittal Transmittal

Detailed, Grouped by Each Number

Parmly Billings Library 510 N. Broadway Billings, MT 59101	**Project # 2012.35** Tel: 406-542-9150 Fax: 406-542-3515	**Jackson Contractor Group Inc.**

Date: 4/2/2013 **Reference Number:** 0174

Transmitted To:	Don Olsen O2 Architects 208 N. Broadway Suite 350 Billings, MT 59101 Tel: 406-259-7123 Fax: 406-256-7123	**Transmitted By:**	Mike Chase Jackson Contractor Group Inc. P.O. Box 967 Missoula, MT 59806 Tel: 406.542.9150 Fax: 406.542.3515

Qty	Submittal Package No	Description	Due Date	Package Action
1	0054 - 08 6300 - 2	Metal Framed Skylight - ETFE Skylight	4/8/2013	Submitted

Transmitted For	Delivered Via	Tracking Number
Approval	e-mail	

Items	Qty	Description	Notes	Item Action
0001	1	Mtl Frame Skylight - Calculations		Submitted
0002	0	Mtl Frame Skylight - Drawings		Pending
0003	0	Mtl Frame Skylight - Samples		Pending

Cc:	Company Name	Contact Name	Copies	Notes

Remarks

Don,
Please see the below for sequence of necessary submittal review and approval. Submittals will be transmitted in this sequence to complete the total specification requirements.
April 2nd: Submit load calculations and connection requirements based on the redesign of the structural steel for the skylight system. Our team will be available to address any concerns and explain the modifications.
April 8th: Submit steel shop drawings and provide necessary assistance for approval.
April 16th: Submit Texlon System drawings

Thanks,
Mike

MIKE CHASE
Signature

4.2.13
Signed Date

Jackson CONTRACTOR GROUP, INC.
P.O. Box 967, Missoula, MT 59806
406-542-9150 | FAX 542-3515

Submittal Packages

Summary with Register Items & Stamp

Parmly Billings Library
510 N. Broadway
Billings, MT 59101

Project # 2012.35

Jackson Contractor Group Inc.
Tel: 406-542-9150 Fax: 406-542-3515

Item No	Register No	Rev	Spec Section	Sub Section	Description	Responsible	Supplier	Rec'd On	Action
0054 - 08 6300 - 2			**Metal Framed Skylight - ETFE Skylight**						
0001	00194	2	08 63 00	1.03.A	Mtl Frame Skylight - Calculations	Vectorfoiltec, LLC	Texlon	4/2/2013	Submitted
0002	00195	2	08 63 00	1.03.B	Mtl Frame Skylight - Drawings	Vectorfoiltec, LLC	Texlon	4/2/2013	Pending
0003	00196	2	08 63 00	1.03.C	Mtl Frame Skylight - Samples	Vectorfoiltec, LLC	Texlon	4/2/2013	Pending

SUBMITTAL REVIEW

__REVIEWED, NO EXCEPTIONS TAKEN __REVISE AND RESUBMIT
__NOTE COMMENTS __SEE ATTACHED COMMENTS

Corrections or comments made to the shop drawings during this review do not relieve subcontractor/vendor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The subcontractor/vendor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner.

JACKSON CONTRACTOR GROUP, INC.

BY MIKE CHASE DATE 4.2.13

SHOP DRAWING I SUBMITTAL REVIEW

[illegible]

willbruderarchitects *kent mcclure 04.05.13*

rudow + berry structural engineers

This review was performed only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Modifications or comments made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the plans and specifications. Approval of a specific item does not include approval of the assembly of which the item is a component.

Contractor is Responsible for:
* Dimensions to be confirmed and correlated at the jobsite.
* Information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction.
* Coordination of the work of all trades.
* Performing all work in a safe and satisfactory manner.

- [x] Approved
- [ ] Approved As Corrected
- [x] Reviewed For Loading Only
- [ ] Revise and Resubmit
- [ ] Rejected
- [ ] Resubmit Record Copy

Reviewed By: MAR Date: 04/05/2013

Architect Please Note: Please verify that revised ring beam size (TS14x6) is acceptable. *yes*

vectorfoiltec

Vector Foiltec • 13 Green Mountain Drive • Cohoes • New York 12047 USA

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us@vector-foiltec.com
www.vector-foiltec.com

March 26, 2013

Jackson Contractor Group, INC.
ATTN: Mike Chase

RE: Parmly Billings Library - Notice of Submittal Delay

A/E - FYI see proposed structural steel solution enclosed

Mike,

Vector Foiltec's original schedule required the shop drawings to be approved by 11/30/2012 to meet the completion date of 4/4/2013 (17 weeks after approval). As discussed previously, we will not be able to meet the hand-over date by the beginning of April. At this time all shop drawings and samples have been submitted, with the exception of the steel and Texlon shop drawings, which are dependant on the approved structural calculations.

The extended duration for resubmitting the necessary information was the result of the following activities:

The original design called for a 5" tubular ring beam to be welded to 16 upright posts. The architect's intent was for the skylight structure to transmit vertical loads to the posts without imposing additional horizontal loads. Based on the connection type, and the tubing size specified, the skylight structure was found to transmit unintended loads to the posts. Our engineer from TSS in Germany, Dr. Schween, first noted that the posts could not take the calculated loads and advised that their wall thickness be increased. Due to the connection detail described in the structural drawings, he also determined that there was still a limit to the post's capacity. Based on these limitations, he calculated for the climactic loads using the ASCE tables, in order to prevent the posts from being overstressed. It was also suggested that the structural steel may require re-design.

Vector Foiltec has concluded that re-design is necessary for the skylight structural steel in order to balance the loads among the support posts. The 16 support posts for the skylight are already supplied and installed. Grid Engineering, Seattle Washington, is currently specifying the required ring beam material and a connection detail between it and the posts. They will be providing the stamped calculations and drawings for review. These calculations with the modified structure are necessary to complete the steel and Texlon shop drawings. We have made every effort to resolve this issue without affecting the design, however the originally specified components and the provided posts limit this capability. This can only be accomplished by increasing the size of the steel ring beam and modifying the connection between it and the posts.

GRID engineers

April 01, 2013

Mr. Philipp Lehnert
Project Manager
Vector Foiltec
13 Green Mountain Drive
Cohoes, NY 12047

Re: Parmly Library
Main ETFE Roof Skylight

Dear Philipp,

Thank you for the opportunity to work with you on the Parmly Library project.

Attached please find the calculation package for the steel design and loads imposed on the existing roof structure. This package is in coordination with the ETFE designers in Bremen. Geometry and various design details for the existing structure were found within the set you forwarded us (01May 2012, 100CD set, 14 structural sheets s1.0-s7.0). If you determine any condition in the field varies from that what is stated here, please contact us before proceeding.

Please have the EOR contact us directly if there are any questions with the information during their review. We appreciate the opportunity to work with you on this project. If you have any questions, please feel free to call us at 206.838.4000.

Sincerely,

Bryan Tokarczyk
Partner

blt:psd:file

Enclosures
120059.10

Vector Foiltec
Parmly Library
[Main ETFE Skylight Assembly]

Billings, MT

Structural Calculations

Calculations Included:
These calculations cover the proposed skylight assembly loads imposed to the main facility roof

MONTANA
MADISON JEFFERY BATT
No. 15616PE
LICENSED
PROFESSIONAL ENGINEER

Project Number 120059.00
April 01, 2013

grid
box 30797
seattle 98113

Enclosure One

grid
box 30797
seattle 98113

GRID
structural engineers
seattle, wa
206 838 4000

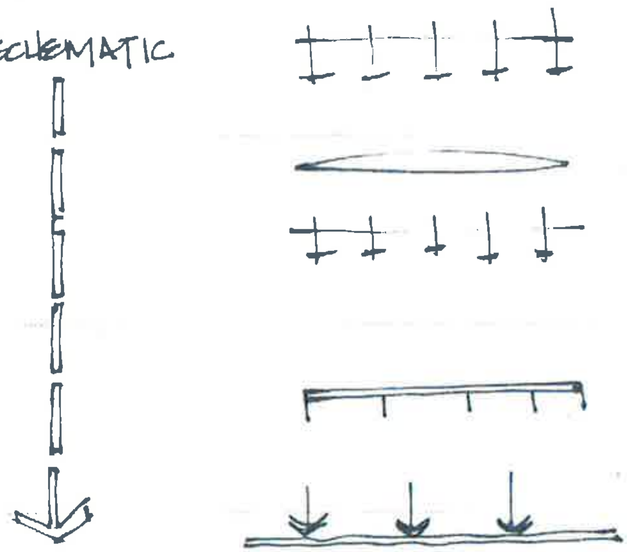
project: PARMLY LIBRARY - ETFE SKYLIGHT

job #: 120059

eng 1: | date:
eng 2: | page:

MAIN SKYLIGHT / ROOF

- SCHEMATIC



ENVIRO LOADING [DESCRIBED HERE]

ETFE DESIGN [ATTACHED AS REFERENCE]

ETFE LOAD XFER [DESCRIBED HERE]

STEEL DESIGN [DESCRIBED HERE]

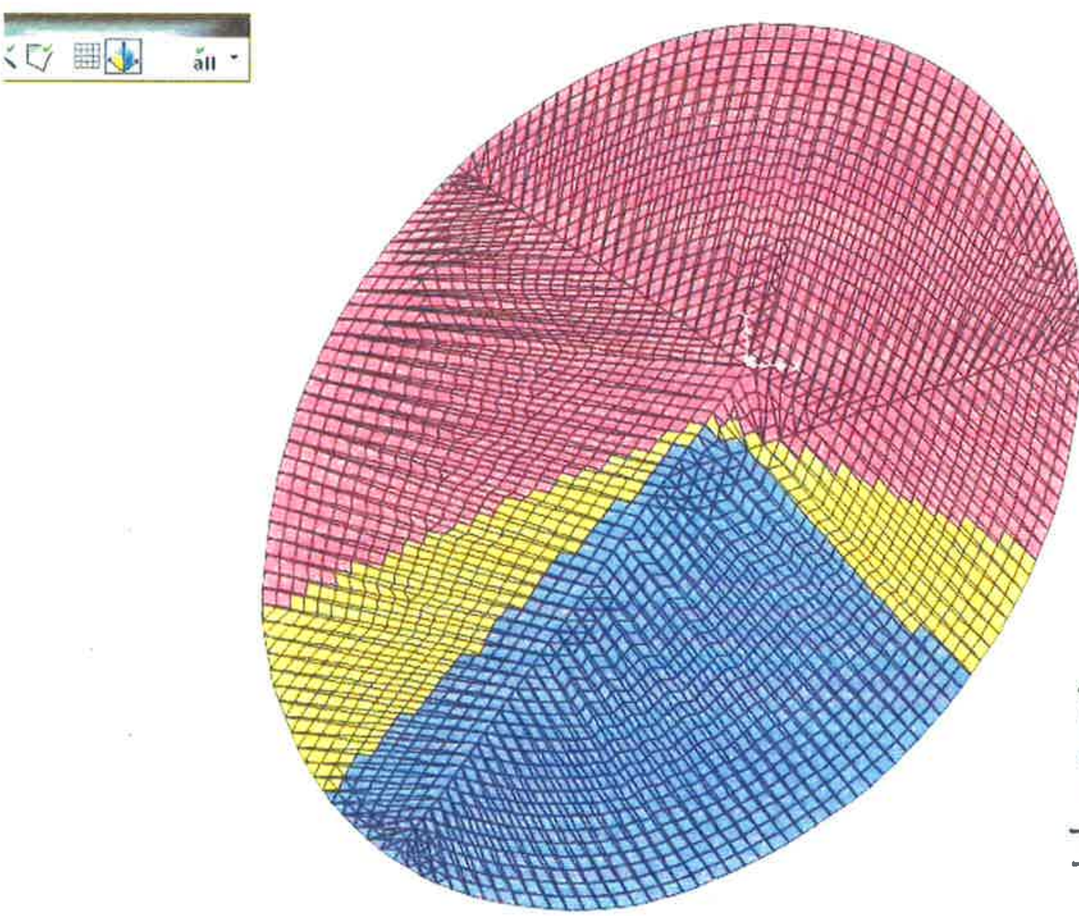
LOADS IMPOSED TO ROOF SUPPORTS [DESCRIBED HERE]

- SKYLIGHT SYSTEM CONSISTS OF STEEL FRAME WITH ETFE MEMBRANE CUSHIONS AS ENVIRONMENTAL SURFACE
- APPROX DIMENSIONS 24' x 32' (± 600□' AREA)(± 630□' SURFACED)
- ETFE ± 100 #/ft³ @ ± 10 Mil THICKNESS (.01")
- STEEL ± 490 #/ft³ @ 50ksi (E)
- TAKE-OFF

		PL	PPL	PPPL
STEEL PERI 2(25.5' + 18.25') =	87.5'	1660 #	2500	4640
STEEL CROSS (14.75' + 15.25' + 20')	50.0'	950 #	1425	2650
ETFE FOIL (630□ * .08#/□) = 50#	137.5'	2600 #	3900	7300

BASIC STEEL FRAME
(W/ORIENTATION)

IMAGE A



SHELLED FRAME
W/ EXAMPLE DRIFT
SNOW LOADING
APPLIED

IMAGE B

D) MAIN SKYLIGHT / ROOF

- LOAD COMBOS (IBC 09 / AT-5)

C1 = 1.4D + 1.4 Pn
C3 = 1.2D + 1.2 Pn + 1.6S + .8W
C4 = 1.2D + 1.2 Pn + .5S + 1.6W
C6 = .9D + 1.4 Pn + 1.6W

D = SELF STEEL + ETFE SYSTEM
Pn = PNUEMATIC LOADING FROM ETFE SYSTEM UNDER LOAD
S = SNOW - BAL + UNBALANCE CASES
W = WIND - DOMED SURFACE

* PONDING & ICE LOADS CONSIDERED AND NOT CONTROL
(FOLLOW DESIGN - ETFE STRESSING CONSIDER/REFERS)

- LOAD COMBOS (n = NORTH ATTACK WIND)

C1 1.4D + 1.4Pn

C3 1.2D + 1.2 Pn + 1.6S + .8W

[UNIFORM]	[DRIFTING]
C3SWn	C3DWn
C3SWs	C3DWs
C3SWe	C3DWe
C3SWw	C3DWw

C4 1.2D + 1.2Pn + .5S + 1.6W

[UNIFORM]	[DRIFTING]
C4SWn	C4DWn
C4SWs	C4DWs
C4SWe	C4DWe
C4SWw	C4DWw

D) MAIN SKYLIGHT / ROOF

- LOAD COMBOS (cont.)

  c6 $.9D + 1.4 P_n + 1.6W$

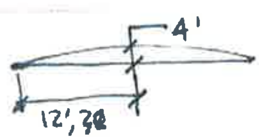
  c6 W_n
  c6 W_s
  c6 W_e
  c6 W_w

- WIND
  - V = 90 MPH (3 SEC) (FIG 6-1)
  - EXP. C / $I_w = 1.15$ (CAT III)
  - BUILDING ENVELOPE
  - IMPACT RESISTANT GLAZING
  - RIGID STRUCTURE
  - SIMPLIFIED (METH 1)
    - $P_{net} = \lambda I P_{net30}$ (H ≐ 40') ZONE 1 / ROOF ≐ 0° / ∈ $C_p = \pm .9$

      $= 1.49 (1.15) \{4.7, -13.3\}$

      $= \{ \text{~~8.1~~ } 10, -22.8 \}$ MIN PRESSURE OVERRIDE

  ∴ USE $P_{net} = \{+10, -22.8\}$ PSF

- SNOW
  - P_g ≐ 20 PSF (FIG 7-1)
  - 

    4' / 12' ≐ 18°   FLAT (A7) ≤ 5°
    4' / 16' ≐ 14°   ∴ NOT FLAT, SLOPED...

  - YET, CONSERVATIVE ESTIMATION IS FLAT DUE TO FLEXIBLE PILLOWS – SNOW WILL ACCUMULATE, WARM ROOF EFFECT NOT APPLY (CONSERV.)

  ∴ FLAT – $P_f = .7 C_e C_t I P_g$

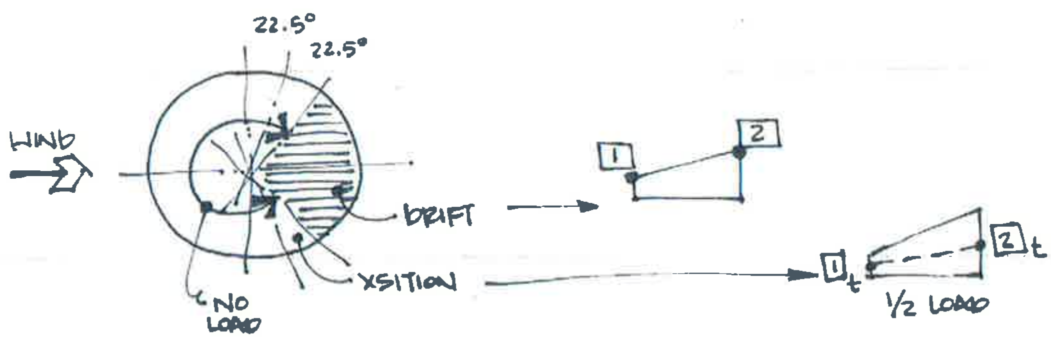
  $= .7 (1.0)(1.0)(1.1)(20\ PSF) = 15.4\ PSF$

NOTE: MT RULE OVERRIDE – TAKE $P_f = 30$ PSF ("ROOF LOADING" ≥ 30 PSF)

D MAIN SKYLIGHT / ROOF

• SNOW (cont.)

• UNBALANCED CONSIDERATION (7.6.4)(7.6.2)



$C_s = .8 - 1.0$ (FIG 7-2a)

$C_e = 1.0$ (TABLE 7-2)

△ DESIGN UNBALANCED

[1] $.5P_f = \frac{15.4}{2} =$ ~~7.7 PSF~~ 30 PSF

[2] $2.0 P_f \frac{C_s^*}{C_e}$

$2.0(15.4)\frac{.8}{1.0} =$ ~~24.6 PSF~~ 30 PSF

XSITION UNBALANCED

[1]t $= \frac{7.7}{2} =$ ~~3.85 PSF~~ 15 PSF

[2]t $= \frac{24.64}{2} =$ ~~12.3 PSF~~ 15 PSF

(OVERRIDE FOR MT RULE 30 PSF MIN ROOF LOADING)

• NOTE: LOADS IMPOSED AT TOP OF EXISTING TUBE POSTS (SEE DWGS)

GRID
structural engineers
seattle, wa
206.838.4000

project	job #	
	eng 1	date
	eng 2	page

MAIN SKYLIGHT / ROOF

- FIXITY SCHEME – TARGET ± Z FIXITY ON ALL 16 SUPPORTS
  - – RESTRAINT FOR STABILITY IN X + Y PER DIAGRAM
  - – LOADS IMPOSED WILL REFLECT (NOTE: CHOICE OF RESTRAINED X,Y POSTS IS ARBITRARY AND CAN BE MOVED IF NEEDED, PLEASE CONTACT)
  - – SEE IMAGE A
- ETFE PNUEMATIC XFER – SEE IMAGE C, D, E, F
- STEEL FRAME SIZING – SEE IMAGE G, H
- LOADS IMPOSED ON IMAGE J
- GLOBAL LOADS IMPOSED ON IMAGE K

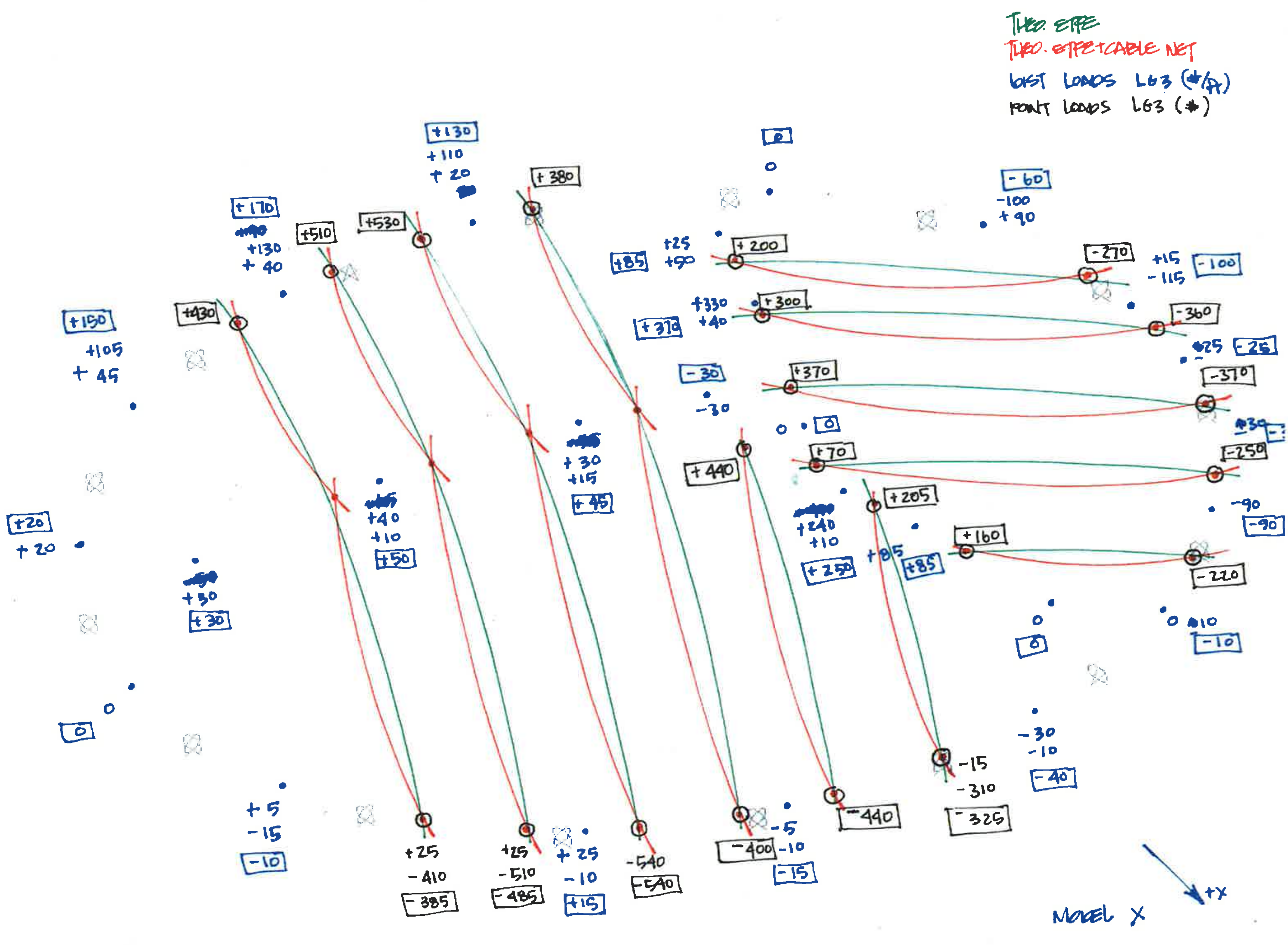
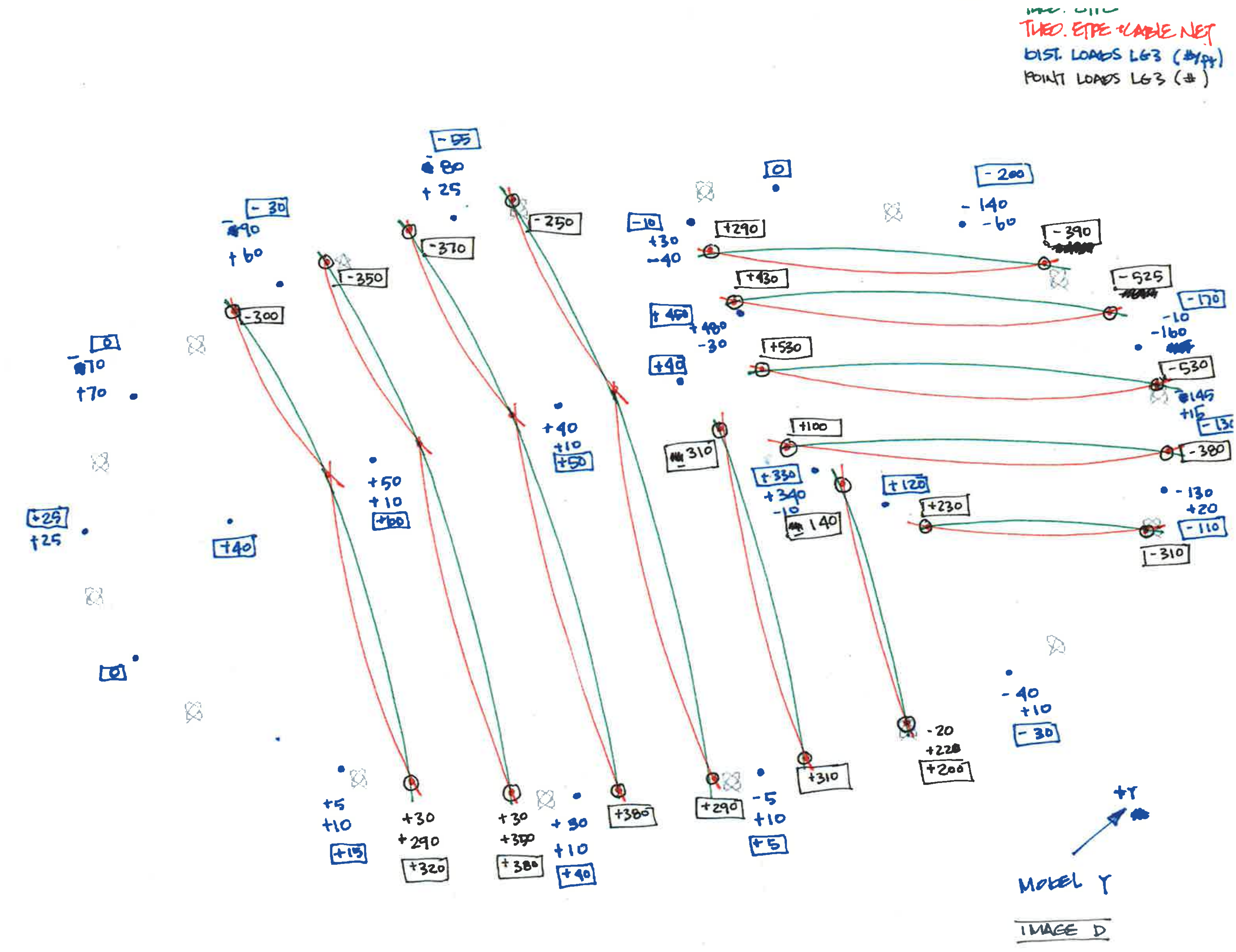

THEO. EFFE
THEO. EFFE+CABLE NET
DIST LOADS LG3 (#/ft)
POINT LOADS LG3 (#)
+X
MODEL X

IMAGE C


THEO. ETFE + CABLE NET
DIST. LOADS LG3 (#/ft)
POINT LOADS LG3 (#)
+Y
MODEL Y
IMAGE D

THEO. ETFE+CABLE NET

POINT LOADS (X) #

POINT LOADS (Y) #

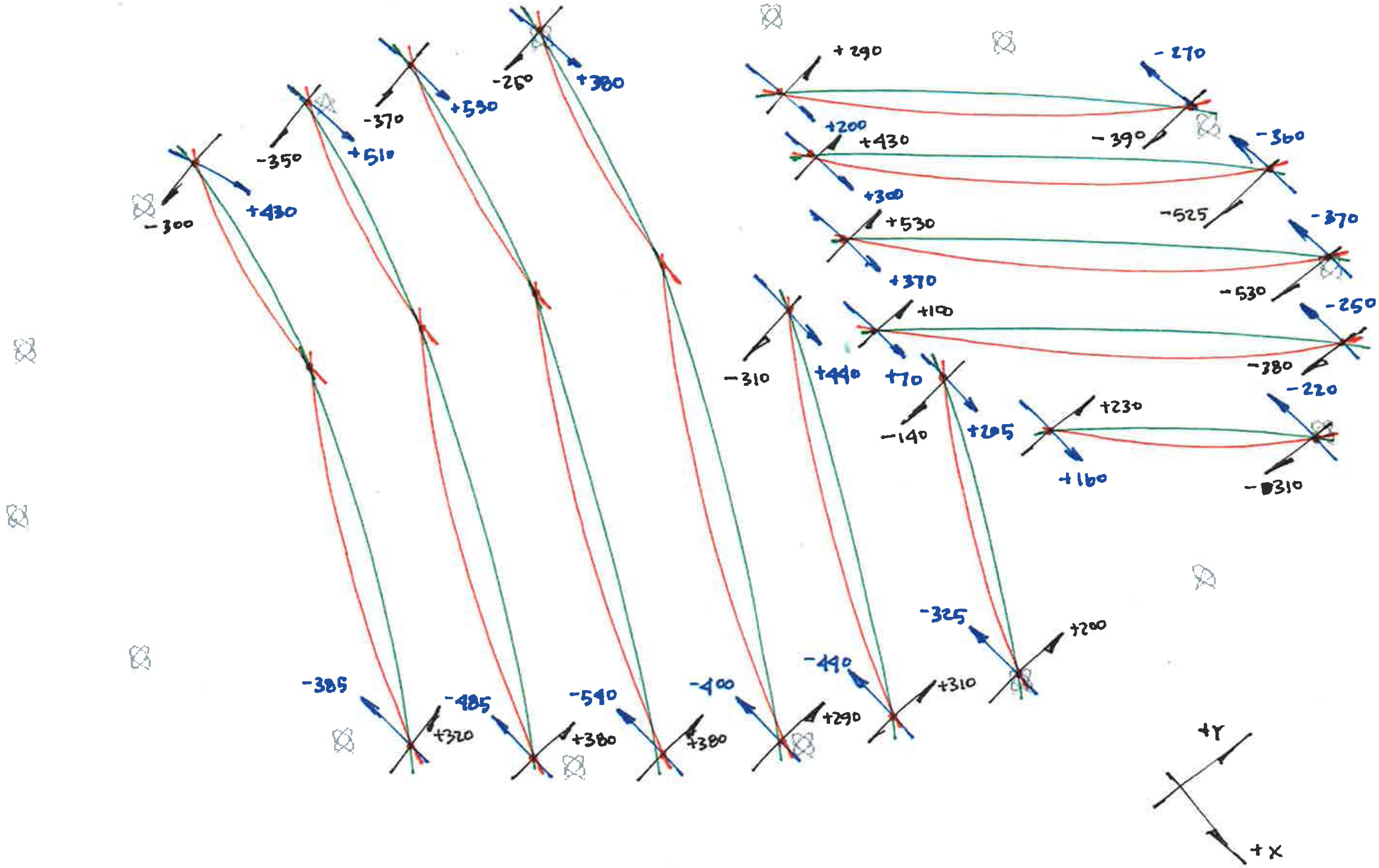


IMAGE E

INIT. ETFE
THEO. ETFE+CABLE NET
DIST LOADS (X) #/ft.
DIST LOADS (Y) #/ft.

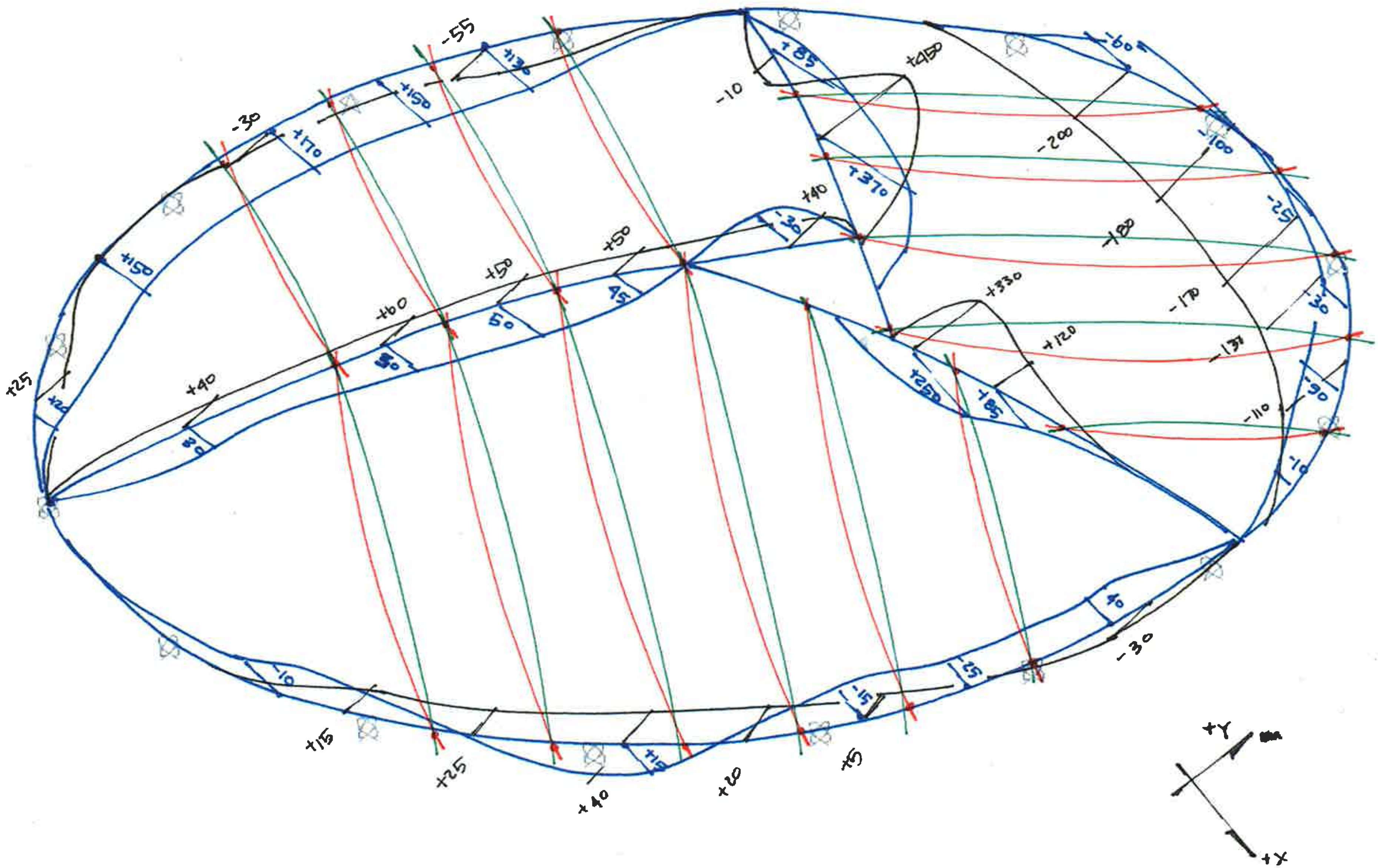


IMAGE F

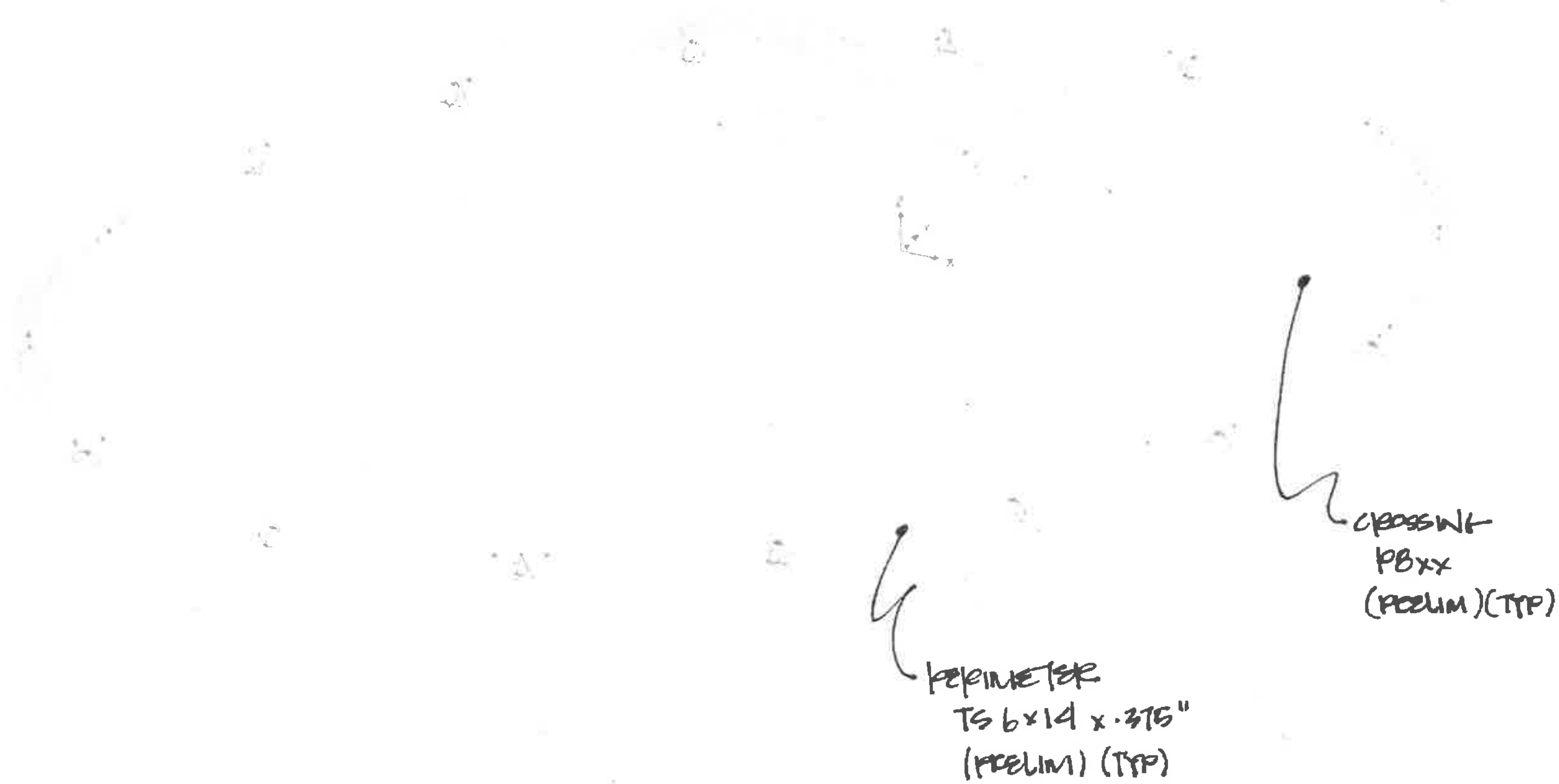
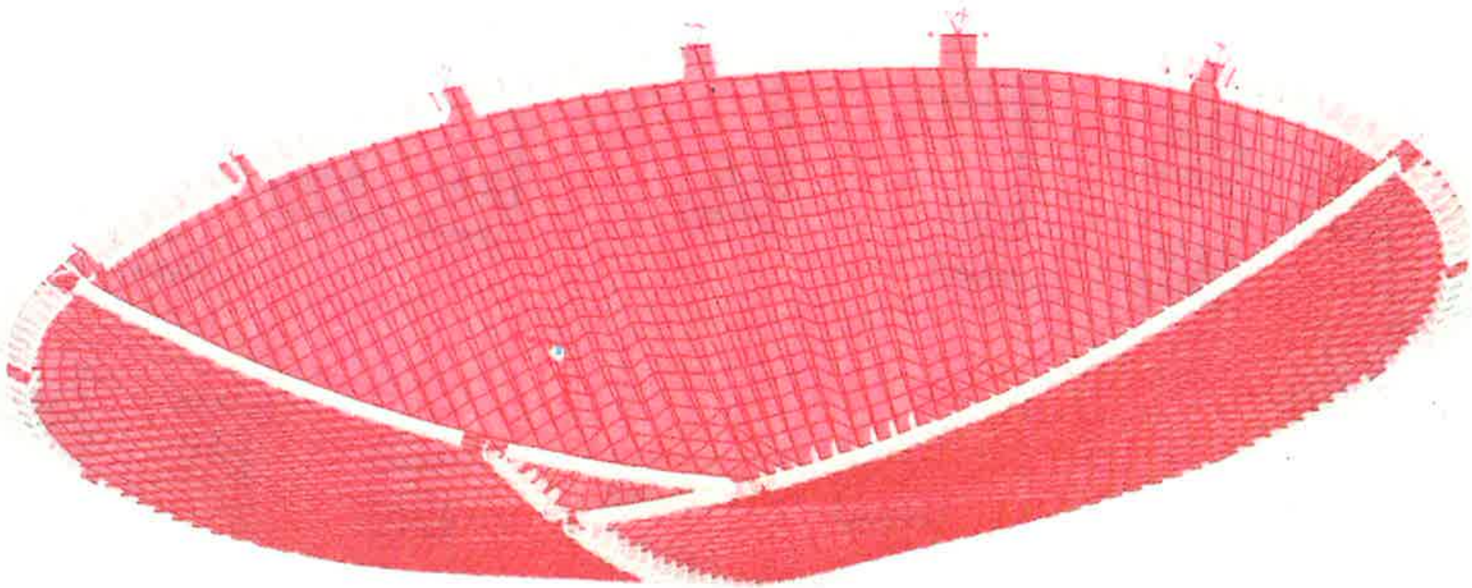
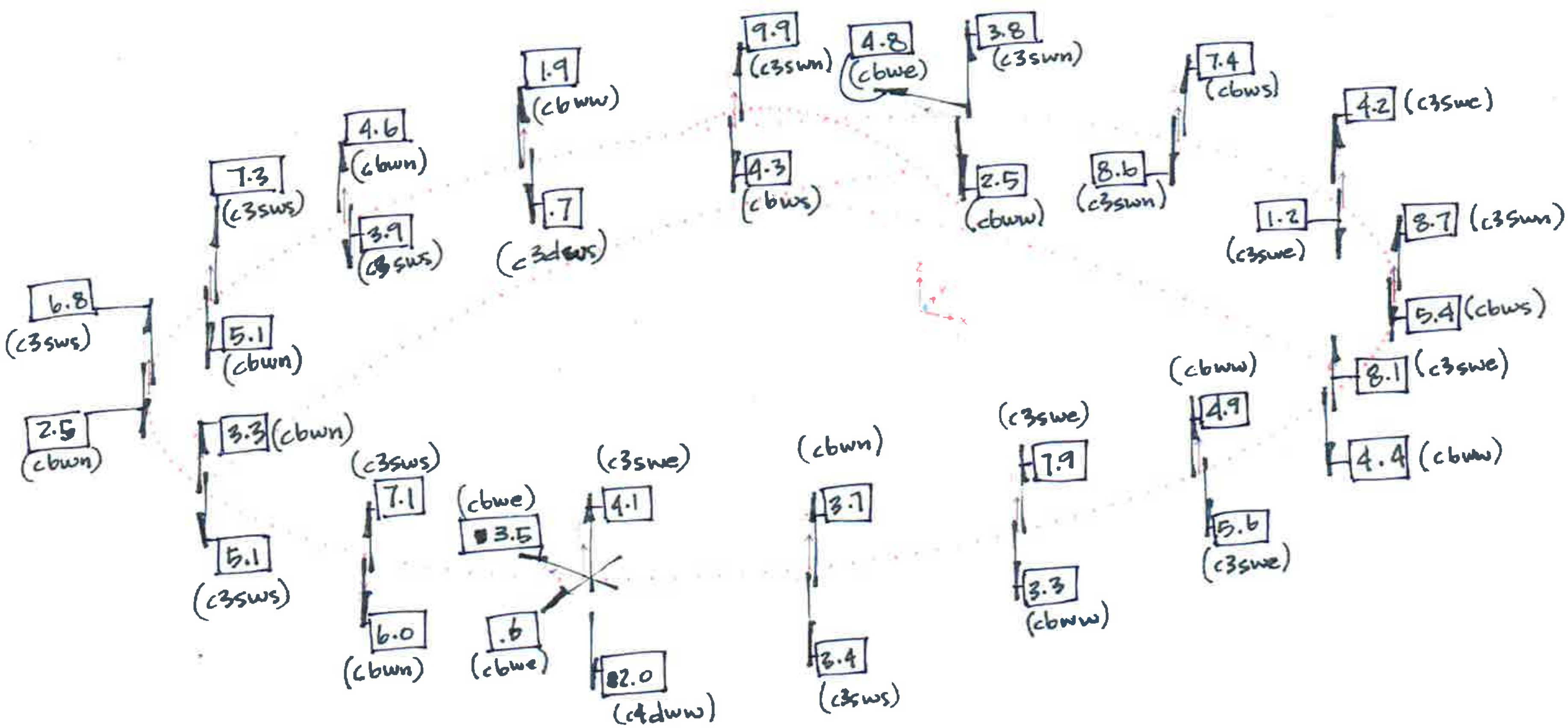


IMAGE 6

IMAGE H

STEEL + GLASS SYSTEM





- ULTIMATE LOADS (IN KIPS)
- REACTIONS (▲ UPWARD IS RESPONSE TO FORCE ACTING IN GRAVITY DIRECTION

STEEL FRAME W/ CONTROLLING REACTION (+L.CASE) (KIPS)

IMAGE J

Parmly ETFE foil skylight system - version D
GRID / akd / ffj
Mar-13

TABLE: Base Reactions									
OutputCase	GlobalFX	GlobalFY	GlobalFZ	GlobalMX	GlobalMY	GlobalMZ	XCentroidFZ	YCentroidFZ	ZCentroidFZ
Text	Kip	Kip	Kip	Kip-ft	Kip-ft	Kip-ft	ft	ft	ft
c1	-7.331	-0.548	10.567	-16.466	0.341	-11.323	-0.032	-1.558	0.000
c3swn	-5.246	-0.575	35.093	-51.751	50.066	-9.070	-1.427	-1.475	0.000
c3sws	-5.096	-0.447	37.153	-163.371	80.917	-6.981	-2.178	-4.397	0.000
c3swe	-5.589	-0.500	36.138	-93.785	17.202	-8.452	-0.476	-2.595	0.000
c3sww	-4.793	-0.538	35.865	-120.784	113.579	-7.647	-3.167	-3.368	0.000
c3dwn	-6.131	-0.407	16.654	-73.881	17.503	-10.031	-1.051	-4.436	0.000
c3dws	-5.804	-0.464	17.112	-12.418	14.035	-8.954	-0.820	-0.726	0.000
c3dwe	-5.787	-0.522	14.914	-35.792	36.301	-8.340	-2.434	-2.400	0.000
c3dww	-6.153	-0.355	14.188	-33.952	-6.074	-9.435	0.428	-2.393	0.000
c4swn	-6.293	-0.590	10.133	86.831	-23.514	-11.609	2.321	8.570	0.000
c4sws	-5.992	-0.335	14.253	-136.408	38.188	-7.432	-2.679	-9.571	0.000
c4swe	-6.980	-0.442	12.223	2.763	-89.241	-10.374	7.301	0.226	0.000
c4sww	-5.386	-0.518	11.678	-51.234	103.513	-8.764	-8.864	-4.387	0.000
c4dwn	-6.569	-0.538	4.370	79.915	-33.690	-11.909	7.709	18.286	0.000
c4dws	-6.213	-0.340	7.990	-89.236	17.288	-8.049	-2.164	-11.169	0.000
c4dwe	-7.041	-0.448	5.590	20.886	-83.273	-10.339	14.897	3.736	0.000
c4dww	-5.811	-0.461	4.903	-24.099	66.121	-9.323	-13.485	-4.915	0.000
c6wn	-7.727	-0.652	-1.575	129.572	-55.124	-13.816	-34.990	-82.246	0.000
c6ws	-7.426	-0.396	2.545	-93.667	6.579	-9.639	-2.585	-36.811	0.000
c6we	-8.414	-0.504	0.515	45.504	-120.851	-12.581	234.862	88.433	0.000
c6ww	-6.820	-0.580	-0.030	-8.492	71.903	-10.972	2364.679	279.290	0.000

IMAGE K

Enclosure Two

grid
box 30797
seattle 98113

TEST REPORT

PTCAlliance

Alliance Tubular Products LLC
A PTC Alliance Company
P.O. Box 2298
Alliance, OH 44601-0298

BUY AMERICAN

PURCHASE ORDER NUMBER	PTC Order Number	PAGE	FORM:
33345	821444	1	48-001

SHIP TO:
TEAM TUBE LLC
C/O BUCKEYE HONE
1882 BUTLER PIKE
MERCER, PA 16137

SOLD TO:
TEAM TUBE LLC
13821 NE JARRETT ST

PORTLAND, OR 97230

The following tests were successfully performed:
NON-DESTRUCTIVE ELECTRICALLY TESTED

Killed Steel

The following shipments are included in this report:

SHIP DATE:	04/03/13			
B/L NUMBER:	04105113	ship# 0001		

Inches (mm)

ERW STEEL MECHANICAL TUBES- CD SIZE: 5.500 (139.70) OD x 4.488 (114.00) ID
SPEC: ASTM A513-12, ST52.3, ERW, TYPE 5, SRA, AW, MECHANICAL TUBING
GRADE: ST52C / 317MM HT: STRESS RELIEVE

HEAT NUMBER	PCS.	TOTAL LENGTH SHIPPED	YS- ksi (N/mm2)	TS- ksi (N/mm2)	% ELONG. IN 2"	HARDNESS	Y/T
46677D	18	416' 7"	83.5 (576)	102.9 (709)	24%	96 RB	

HEAT NO.	TYPE	C	MN	P	S	SI	CR	NI	MO	CU	AL	CA	V	SN
46677D	LADLE	0.14	1.44	.011	.002	0.24	0.04	0.01	<.01	0.03	.043	.002	<.001	<.01

THIS IS TO CERTIFY THAT THE ABOVE PRODUCTS HAVE BEEN MADE IN THE U.S.A. AND HAVE BEEN INSPECTED AND TESTED IN ACCORDANCE WITH AND HAVE MET ALL REQUIREMENTS OF THE SPECIFICATION.
PTC ALLIANCE by David E. Misutka

"THE RECORDING OF FALSE, FICTITIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES, INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47."