

# Structural Calculations

For

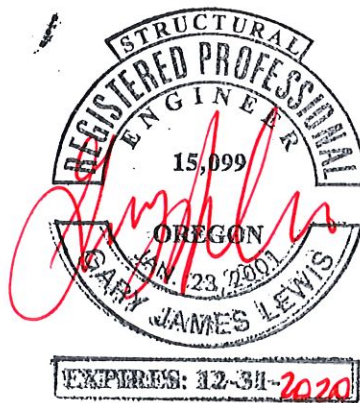
Silverton FD – Maintenance Building  
819 Railway Drive  
Silverton, Oregon

Prepared for

Studio **3** Architecture, Inc.  
Salem, OR 97031

**LVVI Project Number 19165**

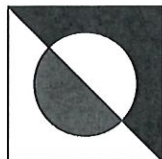
December 20, 2019



\*\*\*Limitations\*\*\*

Engineer was retained in limited capacity for this project. Design is based upon information provided by the client, who is solely responsible for the accuracy of same. No responsibility and/or liability is assumed by, or is to be assigned to the engineer for items beyond that shown on these sheets. \_\_\_\_\_ sheets total including this cover sheet.

This Packet of Calculations is *NULL and VOID* if Signature above is not Original



**Lewis & Van Vleet, Inc.**  
18660 SW Boones Ferry Rd.  
Tualatin, OR 97062  
(503) 885-8605 | [www.lvvi.com](http://www.lvvi.com)

LEWIS &



consulting engineers

18660 s.w. boones ferry road  
tualatin, oregon 97062  
(503) 885.8605 phone (503) 885.1206 fax

VAN VLEET  
incorporated

Sheet No PSD1

**Project Scope and Data**

Project Name: Silverton FD - Maintenance Building Job No: 19165

**Project Scope:** Seismic upgrade for the maintenance building based on the September 2016 Seismic Evaluation Report as prepared by CSE Engineering, Inc.

**Site Coordinates:** 45.00372 deg. N, 122.79596 deg. W

**Project Specifications:**

Code: 2014 Oregon Structural Specialty Code based on the 2012 IBC  
ASCE 7-10 Minimum Design Loads for Buildings and Other Structures

Risk Category: IV ASCE 7-10, 1.5-1

**Live Loads:**

Roof SL: 25 psf Importance Factor,  $I_s$ : 1.20 ASCE 7-10 Table 1.5-2

Floor LL: \_\_\_\_\_ psf Floor LL: \_\_\_\_\_ psf

Floor LL: \_\_\_\_\_ psf Floor LL: \_\_\_\_\_ psf

**Wind Loads:**

Wind Speed: 120 mph (Ultimate) Exposure: B

Wind Analysis Procedure: Envelope Procedure - ASCE 7-10 Chapter 28

**Seismic Loads:**

Spectral Response Coefficient,  $S_{DS}$ : 0.6670 g USGS Design Maps

Spectral Response Coefficient,  $S_{D1}$ : 0.4310 g USGS Design Maps

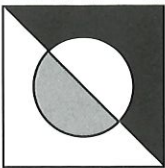
Seismic Design Category: D ASCE 7-10 Table 11.6-1 & 11.6-2

Importance Factor,  $I_E$ : 1.50 ASCE 7-10 Table 1.5-2

Seismic Analysis Procedure: Equivalent Procedure - ASCE 7-10 Section 12.8

**Soil Data:**

Soil Bearing Pressure: 1,500 psf by: **Assumed**  
dated:



- UPGRADE DESIGN

THIS UPGRADE IS BASED ON THE EVALUATION DONE BY CSE ENGINEERING, INC., DATED: SEPTEMBER 2014. THE REPORT COVERS BOTH THE MAIN STATION THE MAINTENANCE SHOP, AND THE SHOP. THIS CALC COVERS THE MAINTENANCE BUILDING ONLY.

FOR THE MAINTENANCE BUILDING, THE REPORT LISTED TWO AREAS WITH DEFICIENCIES; STRUCTURAL AND NONSTRUCTURAL. THE ITEMS UNDER THOSE HEADINGS ARE AS FOLLOWS:

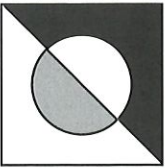
- STRUCTURAL

- DIMINISH WALL BETWEEN THE APPARATUS MAINTENANCE AND THE APPARATUS STORAGE. REPORT REQUIRED THAT WALL BE MODIFIED TO WORK AS SHEARWALL, w/ (N) SHEATHING, ANCHORAGE TOP & BOTTOM.
- INCREASE GAP AT MEZZANINE FLOOR & THE RIGID FRAME LEGS.

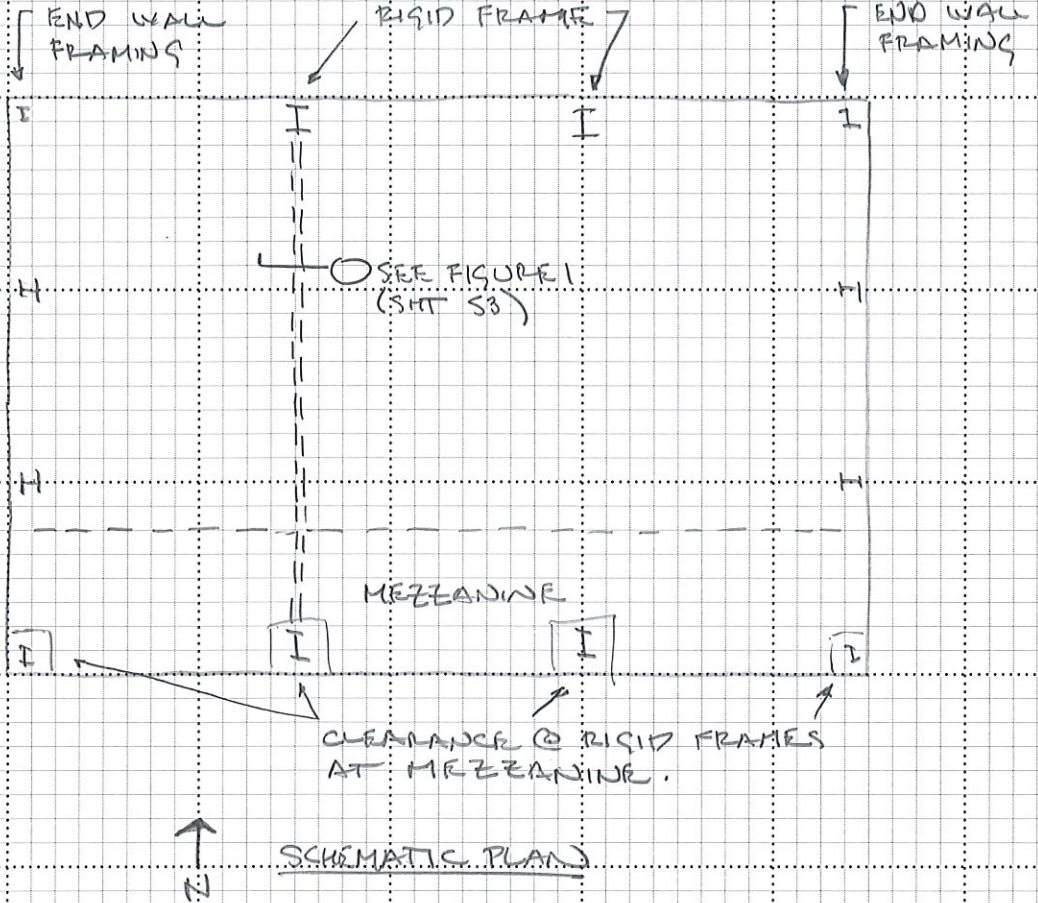
- NONSTRUCTURAL

- BRACE SUSPENDED LIGHT FIXTURES
- UPGRADE WINDOWS TO SAFETY GLASS. (ARCH.)
- BRACE ISOLATED RACKS
- SECURE ITEMS @ TOP OF RACKS (BOXES, ETC.)
- STRAP WATER HEATER
- FLEXIBLE COUPLINGS @ WALL PENETRATIONS.
- FLEXIBLE COUPLINGS @ FIRE SPRINKLERS.
- BRACE EXTERIOR ANTENNA.

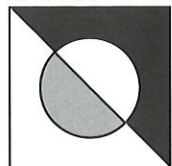
- CALCS / COMMENTS TO FOLLOW



• UPGRADE DESIGN



NOTE: PER OBSERVATION ON 11/25/19, IT WAS NOTED THAT THE MEZZANINE FLOOR WAS RATED @ 200psf. HOWEVER, 70% ± OF THE FLOOR SPACE IS USED BY HVAC DUCTS. THEREFORE, THE MEZZ. COULD NEVER SEE THE NOTED LOAD



• UPGRADE DESIGN

+ STRUCTURAL - DIMISING WALL

PAGE 12 OF THE ASCE 41-13 EVALUATION REPORT,  
IT STATES THE FOLLOWING:

"EXISTING NORTH-SOUTH SEPERATION WALL  
THAT COINCIDES WITH THE EXISTING METAL  
BUILDING STEEL MOMENT FRAME WALL ATTRACT  
LATERAL FORCES INTENDED FOR MOMENT FRAME.  
THIS WALL WILL BECOME A SHEAR WALL AND  
MAY REQUIRE ADDITIONAL ANCHORAGE TO THE  
STEEL FRAME AND FOUNDATION. THIS SHEAR WALL  
MAY REQUIRE PLYWOOD SHEATHING BE INSTALLED  
TO RESIST THE LATERAL FORCES."

ON 11/25/16, I MET WITH CHIEF BILL MILLS AND  
ED SPAMBUSCH, TO WALK THRU THE MAINTENANCE  
BUILDING, I OBSERVED THE EXISTING WALL  
CONSTRUCTION (SEE FIGURE 1, BELOW).

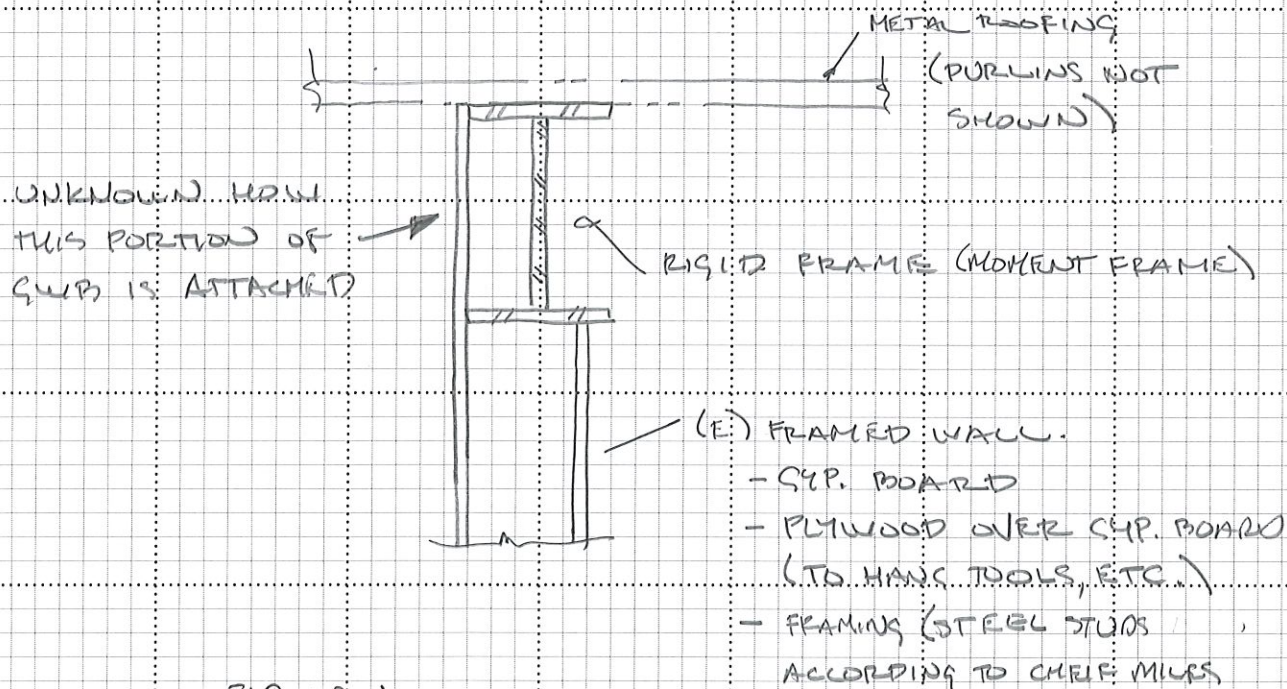
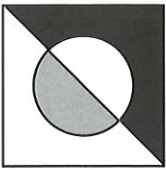


FIGURE 1



## consulting engineers

18660 s.w. boones ferry rd.  
tualatin, oregon 97062  
(503) 885.8605 phone (503) 885.1206 fax

Job SILVERTON F.S.

Client SBJob No. 19195 By MDDate 11/2/14 Sheet No. 54

- UPGRADE DESIGN

- + STRUCTURAL - DIMISING WALL

IN THE REPORT, UNDER THE "MITIGATION CONCEPTS" SECTION, IT IS RE-ITERATED THAT,

"ENSURE THAT THE EXISTING SEPARATION WALL BETWEEN THE MAINTENANCE BAY AND APPARATUS BAY IS CONSISTENT WITH SHEAR WALL CONSTRUCTION. THIS WILL REQUIRE ADEQUATE ANCHORAGE TO THE EXISTING METAL STEEL FRAME BEAM AND COLUMN, AND ANCHORAGE TO THE FOUNDATION."

(SEE PAGE 16 OF CSE'S REPORT)

LOOKING AT ASCE 7-10, TABLE 12.2-1

"LIGHT-FRAME (COLD-FORMED STEEL) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE OR STEEL SHEETS."

$$R = 6\frac{1}{2}$$

THIS IS ASSUMING THAT THE EXISTING SYP WALL SHEATHING IS REPLACED W/ PLYWOOD SHEATHING.

IF THE DIMISING WALL IS LEFT AS SYP WALL SHEATHING, THEN

$$R = 2$$

"LIGHT-FRAME WALLS WITH SHEAR PANELS OF ALL OTHER MATERIALS."

THE RISID FRAME, PER 12.2-1

$$R = 4\frac{1}{2}$$



## consulting engineers

18660 s.w. boones ferry rd.  
tualatin, oregon 97062  
(503) 885.8605 phone (503) 885.1206 fax

Job SILVERTONClient 53Job No. 19169 By MWDate 12/19/19 Sheet No. 55

- UPGRADED DESIGN

- CONCLUSION

IN REGARDS TO THE ASCE 41 REPORT, THE (E) SWP IS FLEXIBLE & THE Rigid FRAME IS Rigid. INSTALLING PLWOOD, TURNING THE WALL INTO A SHEAR WALL STILL MAKE IT FLEXIBLE.

THE WALL CAN BE LEFT AS IT IS ALREADY CONSTRUCTED. DURING A SEISMIC EVENT, THE WORST-CASE WOULD BE THAT THE WALLS WILL SHOW SIGNS OF CRACKING.

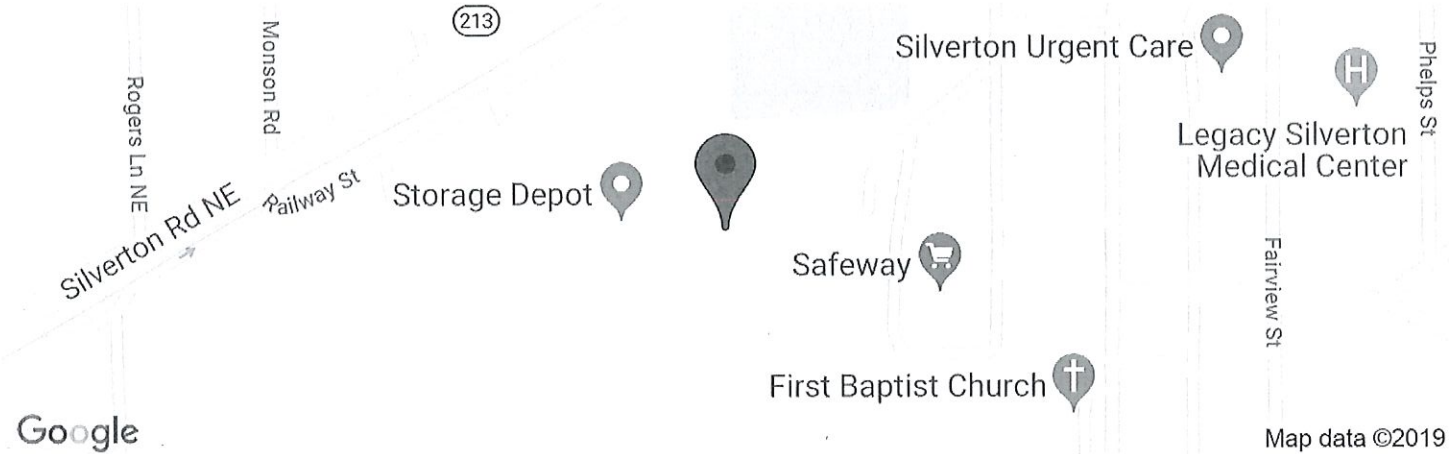
RECOMMEND EXPLORING EXISTING CONNECTIONS AT TOP & BOTTOM.

DETAILS HAVE BEEN ADDED TO THE DESIGN DOCUMENTS.



# Silverton FD Maintenance Building

Latitude, Longitude: 45.00372, -122.79596



<b>Date</b>	11/21/2019, 4:58:50 PM
<b>Design Code Reference Document</b>	ASCE7-10
<b>Risk Category</b>	II
<b>Site Class</b>	D - Stiff Soil

Type	Value	Description
S <sub>S</sub>	0.886	MCE <sub>R</sub> ground motion. (for 0.2 second period)
S <sub>1</sub>	0.406	MCE <sub>R</sub> ground motion. (for 1.0s period)
S <sub>MS</sub>	1.015	Site-modified spectral acceleration value
S <sub>M1</sub>	0.647	Site-modified spectral acceleration value
S <sub>DS</sub>	0.677	Numeric seismic design value at 0.2 second SA
S <sub>D1</sub>	0.431	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F <sub>a</sub>	1.146	Site amplification factor at 0.2 second
F <sub>v</sub>	1.594	Site amplification factor at 1.0 second
PGA	0.398	MCE <sub>G</sub> peak ground acceleration
F <sub>PGA</sub>	1.102	Site amplification factor at PGA
PGA <sub>M</sub>	0.439	Site modified peak ground acceleration
T <sub>L</sub>	16	Long-period transition period in seconds
SsRT	0.886	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.996	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.651	Factored deterministic acceleration value. (0.2 second)
S1RT	0.406	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.47	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.605	Factored deterministic acceleration value. (1.0 second)
PGAd	0.621	Factored deterministic acceleration value. (Peak Ground Acceleration)
C <sub>RS</sub>	0.89	Mapped value of the risk coefficient at short periods
C <sub>R1</sub>	0.863	Mapped value of the risk coefficient at a period of 1 s

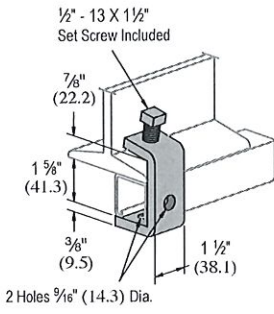




Pf2

1 1/2" Channel  
Telestrut  
Nuts & Hardware  
General Fittings  
Pipe/Conduit Supports  
Electrical Fittings  
Concrete Inserts  
Solar  
Unipier®

### P1271S DF, EG, GR, HG

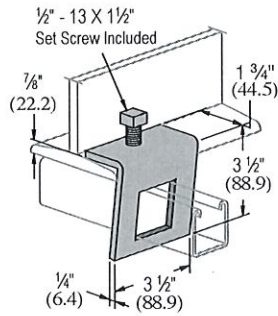


Note: Requires P1010 Channel Nut and bolt.

**Design Load Each**  
500 Lbs (2.22 kN)  
Use in Pairs Only

Wt/100 pcs: 95 Lbs (43.1 kg)

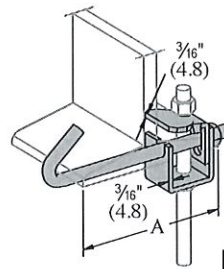
### P1796S EG GR HG



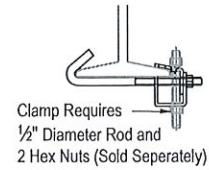
**Design Load Each**  
500 Lbs (2.22 kN)  
Use in Pairs Only

Wt/100 pcs: 91 Lbs (41.3 kg)

### P2824-6,-9,-12 EG GR HG

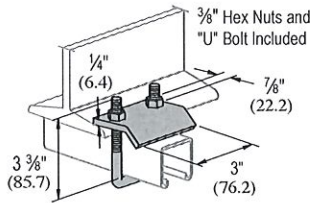


For use with Beams up to 3/4" (19.1) max flange thickness



Part Number	"A" In (mm)	Wt/100 pcs Lbs (kg)	Design Load Lbs (kN)
P2824-6	2 1/2 - 6	125	500
	63.5 - 152.4	56.7	2.22
P2824-9	5 1/2 - 9	140	500
	139.7 - 228.6	63.5	2.22
P2824-12	8 1/2 - 12	171	500
	215.9 - 304.8	77.6	2.22

### P2785 DF, EG, GR, HG

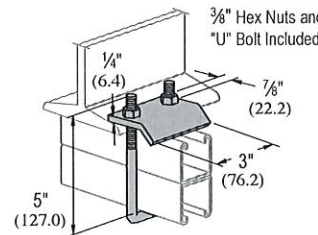


• For use with Beams up to 3/4" (19.1) Flanges and with Channels P1000, P1100, P2000, P3000, P3300, P3301, P4000, P4001, P4100, and P4101.

**Design Load Each**  
1000 Lbs (4.45 kN)  
Use in Pairs Only

Wt/100 pcs: 83 Lbs (37.6 kg)

### P2786 DF, EG, GR, HG

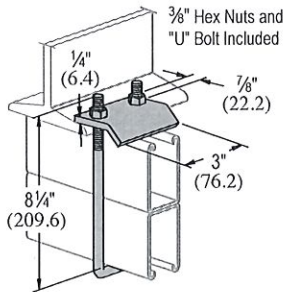


• For use with Beams up to 3/4" (19.1) Flanges and with Channels P1001, P1101, P2001, P3001, P5000, and P5500.

**Design Load Each**  
1000 Lbs (4.45 kN)  
Use in Pairs Only

Wt/100 pcs: 92 Lbs (41.7 kg)

### P2787 DF, EG, GR, HG

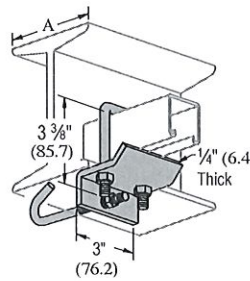


• For use with Beams up to 3/4" (19.1) Flanges and with Channels P5001 and P5501.

**Design Load Each**  
1000 Lbs (4.45 kN)  
Use in Pairs Only

Wt/100 pcs: 112 Lbs (50.8 kg)

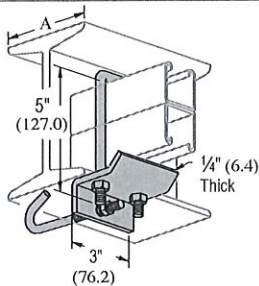
### P2867 EG GR HG



Part Number	Beam Size "A"	Wt/100 pcs Lbs (kg)
P2867	4"-6"	142 (64.4)
P2867-9	6"-9"	151 (68.5)
P2867-12	9"-12"	160 (72.6)
P2867-15	12"-15"	170 (77.1)
P2867-18	15"-18"	179 (81.2)

• Includes: "J" Bolt, "U" Bolt and Hex Nuts.  
• For use with Channels P1000, P1100, P2000, P3000, P3300, P3301, P4000, P4001, P4100, and P4101.

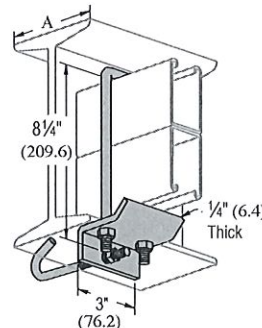
### P2867A EG GR HG



Part Number	Beam Size "A"	Wt/100 pcs Lbs (kg)
P2867A	4"-6"	151 (68.5)
P2867A-9	6"-9"	157 (71.2)
P2867A-12	9"-12"	166 (75.3)
P2867A-15	12"-15"	176 (79.8)
P2867A-18	15"-18"	185 (83.9)

• Includes: "J" Bolt, "U" Bolt and Hex Nuts.  
• For use with Channel P1001, P1101, P2001, P3001, P5000, and P5500.

### P2867B EG GR HG



Part Number	Beam Size "A"	Wt/100 pcs Lbs (kg)
P2867B	4"-6"	161 (73.0)
P2867B-9	6"-9"	167 (75.7)
P2867B-12	9"-12"	176 (79.8)
P2867B-15	12"-15"	186 (84.4)
P2867B-18	15"-18"	195 (88.5)

• Includes: "J" Bolt, "U" Bolt and Hex Nuts.  
• For use with Channel P5001, and P5501.

Note: When used for mechanical supports, load capacities of brackets and fittings should be in compliance with the American Standard Code for Pressure Piping. Clamps are designed to be used with W, M, S & HP Shape beams, Standard C & Misc. MC Channels, Angles & Structural Tees. Clamps must be used in pairs where indicated. For beam clamps with HG finish, standard hardware is EG finish. For optional stainless steel hardware, please contact the factory for availability.



243

1 1/8" Channel

Telestrut

Nuts & Hardware

General Fittings

Pipe/Conduit Supports

Electrical Fittings

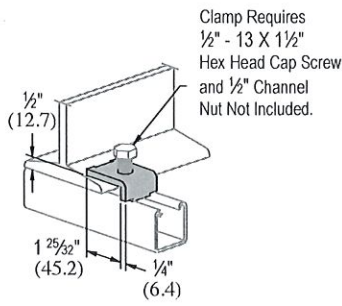
Concrete Inserts

Solar

Unipier®

### P1386

DF, EG, GR, HG



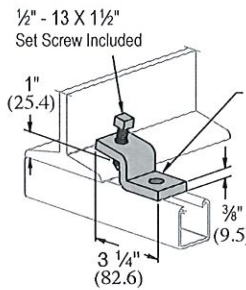
Clamp Requires 1/2" - 13 X 1 1/2" Hex Head Cap Screw and 1/2" Channel Nut Not Included.

Channel Style	Design Load Each (Use in Pairs Only) Lbs (kN)
P1000	600 2.67
P1100	500 2.22
P2000	450 2.00

Wt/100 pcs: 27 Lbs (12.2 kg)

### P1379S

EG GR HG



1/2" - 13 X 1 1/2" Set Screw Included

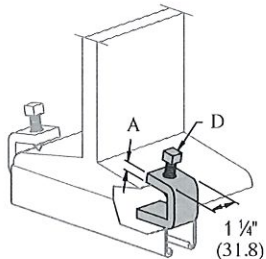
Clamp Requires 1/2" x 1 3/16" Hex Head Cap Screw and 1/2" Channel Nut Not Included.

Channel Style	Design Load Each (Use in Pairs Only) Lbs (kN)
P1000	600 2.67
P1100	500 2.22
P2000	450 2.00

Wt/100 pcs: 75 Lbs (34.0kg)

### P1272S, P1985S, P1986S

EG GR HG

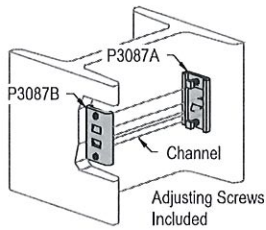


Part Number	"A" In (mm)	Flange Thickness In (mm)	"D" Set Screw Included	Wt/100 pcs Lbs (kg)	Design Load Per Pair (Use in Pairs Only) Lbs (kN)
P1272S	1/4	Up to 3/4	3/8-16 x 1 1/2	39	450
	6.4	Up to 19.1		17.7	2.00
P1985S	3/8	Up to 3/4	1/2-13 x 1 1/2	62	1,000
	9.5	Up to 19.1		28.1	4.45
P1986S	3/8	1/2 to 2	1/2-13 x 1 1/2	74	900
	9.5	22.2 - 50.8		33.6	4.00

### P3087

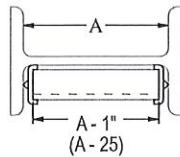
COLUMN INSERT

EG



Channel Part Number	Design Pull Out Load Lbs (kN)	Design Slip Load Lbs (kN)
P1000	1,000 4.45	800 3.56
P1100	700 3.34	500 2.22
P2000	500 2.22	300 1.33

Safety factor of 3.

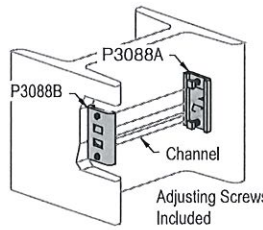


- Adjusting Screws Included.
- Unistrut channel not included.
- Part number P3087 consists of:
  - (1) piece P3087A,
  - (1) piece P3087B and
  - (2) set screws, 3/8" Dia.

Wt/100 pcs: 136 Lbs (61.7 kg)

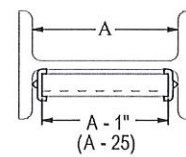
### P3088

COLUMN INSERT



Channel Part Number	Design Pull Out Load Lbs (kN)	Design Slip Load Lbs (kN)
P3300	1,000 4.45	800 3.56
P4100	700 3.11	500 2.22
P4000	500 2.22	300 1.33

Safety factor of 3.

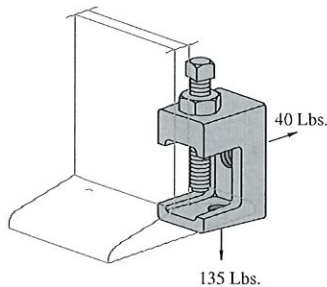


- Adjusting Screws Included.
- Unistrut channel not included.
- Part number P3088 consists of:
  - (1) piece P3088A,
  - (1) piece P3088B and
  - (2) set screws, 3/8" Dia.

Wt/100 pcs: 120 Lbs (54.4 kg)

### PLLC025

FLANGE CLAMP



Cup point set screw and lock nut included.

Set Screw Torque = 3 Ft-Lb  
Lock Nut Torque = 3.5 Ft-Lb

Part Number	Rod Size	"Z" Set Screw Size	Wt/100 pcs Lbs (kg)
PLLC025	1/4"	1/4"	16 (7.3)

X, Y are threaded holes.

Part Number	Dimensions				
	"S" In (mm)	"T" In (mm)	"U" In (mm)	"V", "W" In (mm)	"X", "Y" In
PLLC025	3/8	1	1 1/8	3/4	1/4 X 20
	15.9	25.4	36.5	19.1	

Material: Malleable Iron.

**Note:** When used for mechanical supports, load capacities of brackets, fittings and other supporting elements should be in compliance with the American Standard Code for Pressure Piping. Clamps are designed to be used with W, M, S & HP Shape beams, Standard C & Misc. MC Channels, Angles & Structural Tees. Clamps must be used in pairs where indicated. For beam clamps with HG finish, standard hardware is EG finish. For optional stainless steel hardware, please contact the factory for availability.