



*Progressive Engineering Inc.*

**U.S. ARCHITECTURAL PRODUCTS**

ASTM E455 Floor Diaphragm Test  
on a 10' x 20' 2" Floor using  
3/4" Versapanel and Steel Joist Framing

12/10/2004

This test report contains fifty-two (52) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2004-1994

(A)

3370 State Road 15, Coalinga, CA 93238  
Phone: 574-555-1887

**1. TITLE**

ASTM E455 floor diaphragm test (simple beam).

**2. OBJECTIVE**

The objective of this test was to determine the horizontal diaphragm strength of a simple span floor diaphragm constructed per the enclosed details using 3/4" Versapanel and steel joist framing.

**3. TESTED FOR**

U.S. Architectural Products  
55 Industrial Circle  
Lincoln, RI 02685

**4. TESTING ORGANIZATION**

*Progressive Engineering, Inc.*  
58640 State Road 15  
Goshen, IN 46528  
[www.p-e-i.com](http://www.p-e-i.com)

*See IAS Evaluation Report No. TL-178 for ISO 17025 Accreditation*

**5. TESTING PERSONNEL**

Test Engineer	- Timothy A. Baldrige, P.E.
Director of Testing	- Greg A. Weeden
Laboratory Manager	- Jason R. Holdeman
Technician	- Rodd Lehman
Technician	- Lonnie Camp

Test witnessed by Bob Cauley and Mark Kubian of US Architectural Products, Inc.

**6. TEST CRITERIA**

The tests were conducted in accordance with ASTM E455-98. The test was conducted using the simple beam method.

## 7. TEST SPECIMEN MATERIALS

### A. Floor Diaphragm Materials:

3/4" Versapanel by Euroform Products Ltd. Marketed in U.S. by U.S. Architectural Products as Versaroc - Comprised of Portland Cement, mineralized wood particles and mineral additives. A tongue and groove is located along the 96" dimension of the 46 1/2" x 96" sheets. See drawing no. B4 for T & G detail.

Fasteners - #8-18 x 1-5/8" lg. self-drilling, S-12, Rock-On screw manufactured by ITW Buildex. (See appendix page no.'s A20-A22 for fastener details) The screws were spaced 12" o.c. along the perimeter and 12" o.c. in the field of the panels. All fasteners were placed a minimum of 3/4" in from panel edges and seams. At panel corners the fasteners were inset a minimum of 2" and where two fasteners were located at the same corner, the second fastener was inset a minimum of 3". See drawing no. B4 for fastener locations.

Adhesive - Alpha Systems, Inc., P5100 one-part polyurethane adhesive was applied to all framing, butt-joints, and tongue and groove joints. (See appendix page no's A23 & A24 for adhesive information.) One (1) 3/16-1/4" bead was applied to each joist and rim track and a double bead was applied at a butt-joint location. One (1) 1/16" - 1/8" bead was applied to the top of the tongue and the bottom of the groove before setting into place. A 1/8" gap was left at the butt-joint to allow one (1) 1/16" - 1/8" bead of adhesive to be applied in the gap, before sliding the joint together.

### B. Floor Framing:

Joists - 16 ga. x 10" deep x 10' long Stud-Rite™ Joists manufactured by MarinoWare.

Rim Track - 16 ga. x 10-3/8" deep x 22' long.

Utility Angle - 16 ga. x 2" x 3" x 10"  
- 16 ga. x 2" x 2" x 10"

used to attach the joist to the rim track. (See appendix page no.'s A10-A19 for frame details.)

Fasteners -

1. #10-16 x 3/4" long hex-head, self-drilling screws.
  2. #8-16 x 1/2" long wafer head, self-drilling screws
- (Fasteners were supplied by a local Fastenal warehouse.)

## 8. TEST SPECIMEN CONSTRUCTION

Two (2) test samples were constructed to an overall dimension of 10'-0" x 20'-2" by Progressive Engineering, Inc. The steel framework was assembled by Progressive Engineering, Inc. personnel in accordance with its standard installation guidelines as set by MarinoWare.

A. The joists were attached to the track using a 2" x 2" x 10" utility angle at each joist end with two (2) #10-16 x 3/4" lg. screws into the joists and two (2) #10-16 x 3/4" lg. screws into the rim track. One (1) #10-16 x 3/4" lg. Screws was placed through the bottom of the rim track into each joist. One (1) #8-16 x 1/2" lg. wafer head screw was placed through the top of the rim track into the joist end at each Versapanel butt joint location.

B. Metal strapping was fastened to the bottom of the joists across the center line of the floor. The strapping was attached with one (1) #10-16 x 3/4" long screw into each joist.

C. Solid blocking was added to the midspan of the outside two (2) bays at each end of the test sample. A piece of rim track was used along with utility angles for the solid blocking. Two (2) #10-16 x 3/4" lg. screws were set into each leg of the utility angle.

D. Horizontal blocking was added, in four locations, to the rim track on the load side to strengthen the rim track for point loading purposes. See attached drawing no. B3 for details.

E. One (1) 3/16" - 1/4" bead of P5100 adhesive was applied along the center of each joist and along the rim track. At butt-joint locations, two (2) 3/16" - 1/4" beads of adhesive were applied. All adhered surfaces, including the Versapanel edges, were wiped down with a dry cloth prior to adhesive application

F. The frame was squared and then the Versapanel was fastened to it. The Versapanel was fastened at 12" o.c. on the perimeter and 12" o.c. in the field with #8-18 x 1-5/8" lg. ITW Buildex, Rock-On screws. Care was taken to ensure that the fasteners were kept flush or slightly below the surface of the Versapanel and also did not strip-out in the steel framing. At the butt-joints and tongue and groove locations, a 1/16"-1/8" bead of P5100 adhesive was applied in the joint.

G. 1/8" x 2" x 2" angle iron was then fastened to the end joists flush to the bottom of the joists to minimize crumpling of the joists at the bearings and to represent the top plate member. An additional 10" lg. angle was fastened at the bearing side of the end joists flush to the top of the joist also to minimize crumpling. See attached drawing no. B1 for details.

H. The test sample set for a minimum of 48 hours to allow the adhesive to cure.

## 9. TEST INFORMATION

The test sample was supported by appliance rollers at 2'-0" o.c. around perimeter of sample on a concrete floor. A bearing support was placed at both ends of the test sample. Four (4) loading cylinders were located on the opposite side of the test sample. The load was applied from the cylinders through steel I-beams, to eight (8) 18" bearing blocks to uniformly apply the load to the floor. Five (5) dial indicators were placed along the bearing side of the test sample to measure deflections. See attached drawings for details.

## 10. TEST EQUIPMENT

- A. Four (4) Enerpac Model P-39 hydraulic hand pumps.
- B. Four (4) Enerpac Model RC-1010 hydraulic cylinders.
- C. Five dial indicators.  
2" movement - .001" increments.
- D. Four (4) Omega digital meters.
- E. Four (4) Omega pressure transducers.
- F. Four (4) 6 ft. I-beams.
- G. Six (6) rigid bearings bolted to floor.

## 11. PROCEDURE

- A. The loads were generated using four (4) 1-1/2" diameter x 10" stroke hydraulic cylinders, one at each load point. The applied forces were measured with four (4) digital meters and pressure transducers. A permanent record of the applied forces was made on the attached data sheets.
- B. The loads were generated by applying hydraulic pressure to create mechanical force until the required load was indicated on the digital meters.
- C. The entire floor assembly was loaded in increments of 700 lbs. Each load was held for 1 minute before the deflection readings were taken. After the 14,000 lbs. deflection reading was taken, the assembly was then loaded at a rate of approximately 2800 pounds per minute, until a failure occurred

## 12. ANALYSIS OF RESULTS

Using a factor of safety of 3.0, the following values were obtained.

Average Ultimate Load = 21,280.2 lbs./10.0 ft. = 2128.0 PLF

Design Shear = 2128.0/3.0 = 709.3 PLF

## 13. CONCLUSIONS

Based on the data obtained from this investigation; a design shear of 709.3 PLF can be achieved from a floor diaphragm constructed as follows:

- A. 3/4" Versapanel in 46-1/2" x 96" sheets, tongue and groove.
- B. 16 ga. steel joists and rim track manufactured by MarinoWare. Steel frame constructed per the guidelines set by MarinoWare with the modifications shown on the attached drawings for the purpose of this test.
- C. #8-18 x 1-5/8" lg. Self-drilling and self-countersinking, ITW Buildex, Rock-On screws spaced 12" o.c. along the panel perimeter and 12" o.c. in the panel field of the Versapanel.
- D. One (1) 3/16" - 1/4" bead of Alpha Systems, Inc. P5100 One-Part Polyurethane Adhesive applied to all framing members and a double bead applied at butt-joint locations.
- E. One (1) 1/16"-1/8" bead of Alpha Systems, Inc. P5100 One-Part Polyurethane Adhesive applied to all tongue and groove and butt-joints.



*Timothy A. Baldrige*  
Date Signed January 5, 2005

*Progressive Engineering Inc.*  
FLOOR DIAPHRAGM TEST

Floor Width: 120"

Design Load: 420 P.L.F. (estimated)

TEST No. 1

**FLOOR TEST LOADS**

Loading Increments	Total Ceiling Load (lbs.)	Load No.1 (lbs.)	Load No.2 (lbs.)	Load No.3 (lbs.)	Load No.4 (lbs.)
No Load	0	0	0	0	0
1	700	175	175	175	175
2	1400	350	350	350	350
3	2100	525	525	525	525
4	2800	700	700	700	700
5	3500	875	875	875	875
6	4200	1050	1050	1050	1050
7	4900	1225	1225	1225	1225
8	5600	1400	1400	1400	1400
9	6300	1575	1575	1575	1575
10	7000	1750	1750	1750	1750
11	7700	1925	1925	1925	1925
Design Load	8400	2100	2100	2100	2100
13	9100	2275	2275	2275	2275
14	9800	2450	2450	2450	2450
15	10500	2625	2625	2625	2625
16	14000	3500	3500	3500	3500

Ultimate Load	44157	10,842	11,246	10,782	11,287
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Design Load **736.0 P.L.F.**

# *Progressive Engineering Inc.*

## FLOOR DIAPHRAGM TEST

Test No. 1

Date: 12/3/04

Temp. & Humidity During Construction: 69 deg. F / 28%

Temp. & Humidity During Test: 70 deg. F / 32%

Sample Desc. : 3/4" Versa panel adhered to 16 ga. - 10" steel joists. using Alpha Systems P5100 One-Part Polyurethane Adhesive

Time Load/Reading	Load Increment	Load (lbs.)	Clear Span				RESULTANT DEFLECTION*
			Indicator #2 Reading   Deflection	Indicator #3 Reading   Deflection	Indicator #4 Reading   Deflection	Indicator #4 Reading   Deflection	
11:00	No Load	0 lbs.	.067	.035	.093	----	----
11:01/11:02	1	700 lbs.	.088	.061	.117	.026	.017
11:03/11:04	2	1400 lbs.	.103	.086	.148	.051	.040
11:05/11:06	3	2100 lbs.	.116	.106	.173	.071	.056
11:07/11:08	4	2800 lbs.	.127	.121	.190	.086	.068
11:09/11:10	5	3500 lbs.	.134	.130	.198	.095	.075
11 11/11:12	6	4200 lbs.	.140	.138	.206	.103	.082
11.13/11 14	7	4900 lbs.	.146	.147	.214	.112	.089
11.15/11 16	8	5600 lbs.	.152	.155	.222	.120	.096
11:17/11 18	9	6300 lbs.	.157	.162	.228	.127	.103
11.19/11 20	10	7000 lbs.	.162	.168	.234	.133	.109
11.21/11:22	11	7700 lbs.	.167	.175	.239	.140	.116
11:23/11.24	Design Load	8400 lbs.	.173	.181	.245	.146	.122
11 25/11:26	13	9100 lbs.	.180	.190	.251	.155	.131
11 27/11:28	14	9800 lbs.	.183	.194	.255	.159	.135
11'29/11:30	15	10500 lbs.	.189	.201	.261	.166	.142
11.31/11.32	16	14000 lbs.	.232	.255	.317	.220	.178

Mode of Failure: Versapanel core failure starting approximately 5' in from end on load side and went at an angle to the bearing.  
(See attached pictures for further details)

\* - The resultant deflection is equal to the average deflection of the bearings minus the greatest point of deflection across the clearspan

FLOOR DIAPHRAGM TEST

Test No. 1  
Date: 12/3/04

Time Load/Reading	Load Increment	Load (lbs.)	Bearing Points				AVERAG BEARINC DEFLECTI
			Indicator #1 Reading	Indicator #1 Deflection	Indicator #5 Reading	Indicator #5 Deflection	
11:00	No Load	0 lbs.	.148	----	.113	----	
11:01/11:02	1	700 lbs.	.161	.013	.118	.005	.009
11:03/11:04	2	1400 lbs.	.163	.015	.121	.008	.012
11:05/11:06	3	2100 lbs.	.165	.017	.127	.014	.016
11:07/11:08	4	2800 lbs.	.167	.019	.130	.017	.018
11:09/11:10	5	3500 lbs.	.168	.020	.133	.020	.020
11:11/11:12	6	4200 lbs.	.168	.020	.136	.023	.022
11:13/11:14	7	4900 lbs.	.168	.020	.139	.026	.023
11:15/11:16	8	5600 lbs.	.168	.020	.141	.028	.024
11:17/11:18	9	6300 lbs.	.167	.019	.142	.029	.024
11:19/11:20	10	7000 lbs.	.167	.019	.142	.029	.024
11:21/11:22	11	7700 lbs.	.167	.019	.142	.029	.024
11:23/11:24	Design Load	8400 lbs.	.167	.019	.142	.029	.024
11:25/11:26	13	9100 lbs.	.167	.019	.142	.029	.024
11:27/11:28	14	9800 lbs.	.167	.019	.142	.029	.024
11:29/11:30	15	10500 lbs.	.168	.020	.142	.029	.025
11:31/11:32	16	14000 lbs.	.168	.020	.178	.065	.043

*Progressive Engineering Inc.*  
FLOOR DIAPHRAGM TEST

Floor Width: 120"

Design Load: 420 P.L.F. (estimated)

TEST No. 2

**FLOOR TEST LOADS**

Loading Increments	Total Ceiling Load (lbs.)	Load No.1 (lbs.)	Load No.2 (lbs.)	Load No.3 (lbs.)	Load No.4 (lbs.)
No Load	0	0	0	0	0
1	700	175	175	175	175
2	1400	350	350	350	350
3	2100	525	525	525	525
4	2800	700	700	700	700
5	3500	875	875	875	875
6	4200	1050	1050	1050	1050
7	4900	1225	1225	1225	1225
8	5600	1400	1400	1400	1400
9	6300	1575	1575	1575	1575
10	7000	1750	1750	1750	1750
11	7700	1925	1925	1925	1925
Design Load	8400	2100	2100	2100	2100
13	9100	2275	2275	2275	2275
14	9800	2450	2450	2450	2450
15	10500	2625	2625	2625	2625
16	14000	3500	3500	3500	3500

Ultimate Load	40964	10,370	10,438	10,086	10,070
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Design Load **682.7 P.L.F.**

**FLOOR DIAPHRAGM TEST**

Test No. 2  
 Date: 12/10/2004  
 Temp. & Humidity During Construction: 72 deg. F / 35%  
 Temp. & Humidity During Test: 69 deg. F / 39%  
 Sample Desc. 3/4" Versa panel adhered to 16 ga.- 10" steel joists. using Alpha Systems P5100 One-Part Polyurethane Adhesive.

Time Load/Reading	Load Increment	Load (lbs.)	Clear Span				RESULTANT DEFLECTION*
			Indicator #2 Reading   Deflection	Indicator #3 Reading   Deflection	Indicator #4 Reading   Deflection	Indicator #4 Reading   Deflection	
1:40	No Load	0 lbs.	.025	.022	.025	----	----
1:41/1:42	1	700 lbs.	.079	.089	.105	.067	.080
1:43/1:44	2	1400 lbs.	.098	.109	.121	.087	.096
1:45/1:46	3	2100 lbs.	.121	.129	.138	.107	.113
1:47/1:48	4	2800 lbs.	.134	.143	.152	.121	.127
1:49/1:50	5	3500 lbs.	.143	.154	.162	.132	.137
1:51/1:52	6	4200 lbs.	.151	.163	.170	.141	.145
1:53/1:54	7	4900 lbs.	.161	.173	.179	.151	.154
1:55/1:56	8	5600 lbs.	.165	.180	.186	.158	.161
1:57/1:58	9	6300 lbs.	.172	.187	.192	.165	.167
1:59/2:00	10	7000 lbs.	.178	.194	.198	.172	.173
2:01/2:02	11	7700 lbs.	.185	.203	.206	.181	.181
2:03/2:04	Design Load	8400 lbs.	.191	.211	.213	.189	.188
2:05/2:06	13	9100 lbs.	.198	.219	.219	.197	.194
2:07/2:08	14	9800 lbs.	.203	.225	.226	.203	.201
2:09/2:10	15	10500 lbs.	.208	.231	.232	.209	.207
2:11/2:12	16	14000 lbs.	.236	.270	.271	.248	.246

Mode of Failure Frame (end joist and rim track) collapsed at bearing on end #2.

\* - The resultant deflection is equal to the average deflection of the bearings minus the greatest point of deflection across the clearspan.

**FLOOR DIAPHRAGM TEST**

Test No. 2

Date: 12/10/2004

Time Load/Reading	Load Increment	Load (lbs.)	Bearing Points		Indicator #5 Reading   Deflection	AVERAG BEARIN DEFLECT
			Indicator #1 Reading   Deflection	Indicator #5 Reading   Deflection		
3:30	No Load	0 lbs.	.108	----	.103	----
3:31/3:32	1	700 lbs.	.136	.028	.160	.043
3:33/3:34	2	1400 lbs.	.151	.043	.160	.050
3:35/3:36	3	2100 lbs.	.162	.054	.162	.057
3:37/3:38	4	2800 lbs.	.166	.058	.163	.059
3:39/3:40	5	3500 lbs.	.168	.060	.164	.059
3:41/3:42	6	4200 lbs.	.171	.063	.167	.061
3:43/3:44	7	4900 lbs.	.173	.065	.169	.064
3:45/3:46	8	5600 lbs.	.174	.066	.170	.066
3:47/3:48	9	6300 lbs.	.175	.067	.170	.067
3:49/3:50	10	7000 lbs.	.176	.068	.170	.067
3:51/3:52	11	7700 lbs.	.176	.068	.170	.068
3:53/3:54	Design Load	8400 lbs.	.178	.070	.171	.068
3:55/3:56	13	9100 lbs.	.178	.070	.172	.069
3:57/3:58	14	9800 lbs.	.178	.070	.173	.070
3:59/4:00	15	10500 lbs.	.179	.071	.174	.070
4:01/4:02	16	14000 lbs.	.184	.076	.185	.071
						.079

*Prooressive Engineering Inc.*  
FLOOR DIAPHRAGM TEST

Floor Width: 120"

Design Load N/A

TEST No. 3 (Framing Only)

**FLOOR TEST LOADS**

Loading Increments	Total Ceiling Load (lbs.)	Load No.1 (lbs.)	Load No.2 (lbs.)	Load No.3 (lbs.)	Load No. 4 (lbs.)
No Load	0	0	0	0	0
1	30	8	8	8	8
2	60	15	15	15	15
3	90	23	23	23	23
4	120	30	30	30	30
5	150	38	38	38	38
6	180	45	45	45	45
7	210	53	53	53	53
8	240	60	60	60	60

*Progressive Engineering Inc.*

FLOOR DIAPHRAGM TEST

Test No. 3 (Framing Only)

Date: 12/5/2004

Sample Desc. : 16 ga - 10" Steel Joists

Time Load/Reading	Load Increment	Load (lbs.)	Indicator #2		Indicator #3		Indicator #4		RESULTANT DEFLECTION
			Reading	Deflection	Reading	Deflection	Reading	Deflection	
12:00	No Load	0 lbs.	.189	----	.135	----	.106	----	----
12:01/12:02	1	30 lbs.	.297	.108	.255	.120	.140	.034	.119
12:03/12:04	2	60 lbs.	.353	.164	.342	.207	.200	.094	.204
12:05/12:06	3	90 lbs.	.526	.337	.594	.459	.402	.296	.448
12:07/12:08	4	120 lbs.	.860	.671	1.180	1.045	.750	.644	1.021
12:09/12:10	5	150 lbs.	1.210	1.021	1.680	1.545	1.110	1.004	1.507
12:11/12:12	6	180 lbs.	1.475	1.286	2.000	1.865	1.447	1.341	1.818

FLOOR DIAPHRAGM TEST

Test No. 3 (Framing Only)  
Date: 12/5/2004

Time Load/Reading	Load Increment	Load (lbs.)	Bearing Points				AVERAGE BEARING DEFLECTION
			Indicator #1 Reading	Indicator #1 Deflection	Indicator #5 Reading	Indicator #5 Deflection	
12:00	No Load	0 lbs.	.356	----	.100	----	----
12:01/12:02	1	30 lbs.	.359	.003	.100	.000	.002
12:03/12:04	2	60 lbs.	.361	.005	.102	.002	.004
12:05/12:06	3	90 lbs.	.368	.012	.110	.010	.011
12:07/12:08	4	120 lbs.	.380	.024	.125	.025	.025
12:09/12:10	5	150 lbs.	.390	.034	.142	.042	.038
12:11/12:12	6	180 lbs.	.401	.045	.150	.050	.048

**Progressive Engineering, Inc.**

**Floor Diaphragm Test  
using 3/4" Versapanel**

Load (lbs)	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	
14000 lbs.																					
13300 lbs.																					
12600 lbs.																					
11900 lbs.																					
11200 lbs.																					
10500 lbs.																					
9800 lbs.																					
9100 lbs.																					
8400 lbs.																					
7700 lbs.																					
7000 lbs.																					
6300 lbs.																					
5600 lbs.																					
4900 lbs.																					
4200 lbs.																					
3500 lbs.																					
2800 lbs.																					
2100 lbs.																					
1400 lbs.																					
700 lbs.																					
0 lbs.																					
	◆	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△

◆ Test No. 1  
 △ Test No. 2  
 △ Framing Only

Deflection (in)

ONE (1) #8-16x $\frac{1}{2}$ " WAFER HEAD SELF DRILLING SCREWS - ONLY AT VERSAPANAL BUTT-JOINT LOCATIONS

TWO (2) #10-16x $\frac{3}{4}$ " HEX HEAD SCREWS IN EACH SIDE OF UTILITY ANGLE

ONE (1) #10-16x $\frac{3}{4}$ " HEX HEAD SCREW THROUGH BOTTOM OF RIM TRACK INTO EACH JOIST

1 $\frac{1}{4}$ " x .032" THK. METAL STRAPING

FOUR (4) 22" x 10 $\frac{1}{2}$ " x 1 $\frac{3}{8}$ " x .045" THK. SOLID BLOCKING

ELEVEN (11) JOISTS, FOR ACTUAL DETAIL SEE DRAWING B3

FOUR (4) 24" BLOCKING FOR LOAD SUPPORT

RIM TRACK

TWO (2) 10" x 2 $\frac{1}{2}$ " x 2" x .060" THK STEEL ANGLE FASTENED TO JOIST 1" O.C. WITH  $\frac{3}{4}$ " I.G. DRIVALL SCREWS AND ONE (1)  $\frac{3}{4}$ " LG SCREW TO RIM TRACK

.125" THK. x 2" x 2" STEEL ANGLE SPACED STARTING AT BEARING SIDE AND SPANNING UP TO 3" FROM THE LOAD SIDE ANGLE IS FIXED WITH #10 $\frac{1}{4}$ " DRIVALL SCREWS @ 6" O.C

- NOTE:
- 1) SEE DWG. B5 FOR DETAILS ON RIM TRACK
  - 2) SEE DWG. B6 FOR DETAILS ON JOIST
  - 3) SEE ENC. DWG. FOR ASSEMBLY
  - 4) SOLID BLOCKING IS ATTACHED TO JOISTS BY A UTILITY ANGLE WITH FOUR (4) SCREWS PER BLOCKING

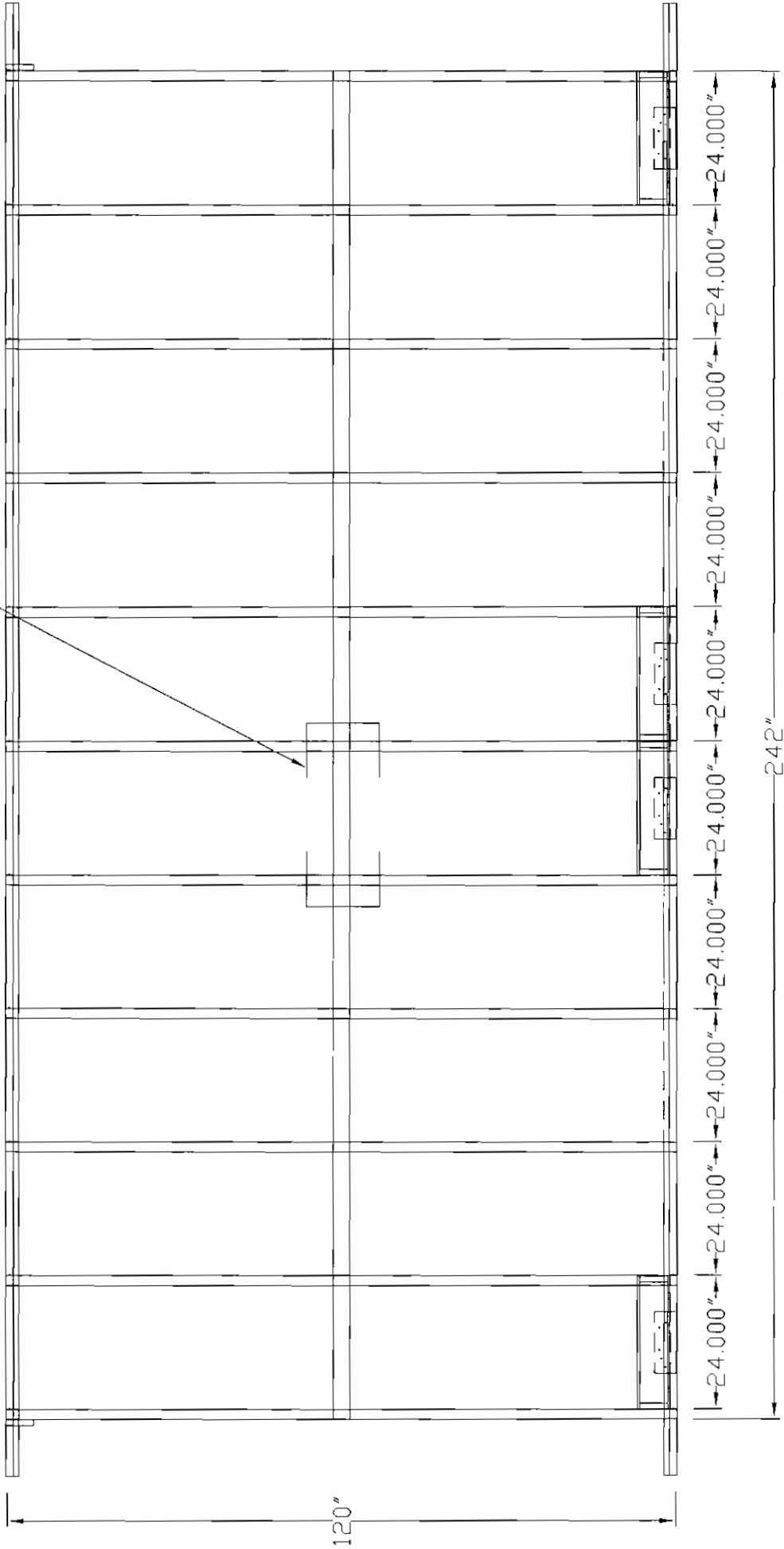
THIS DRAWING IS A PART OF TEST REPORT NO. 2004-1994

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DATE	12/18/01	REVISED		U.S. ARCHITECTURAL PRODUCTS
SCALE				FLOOR FRAMING
JOB NO.	2004-1994			
DRAWN BY	ASD			

BEARING SIDE

TWO METAL PIECES OVERLAP  
WITHIN THIS AREA



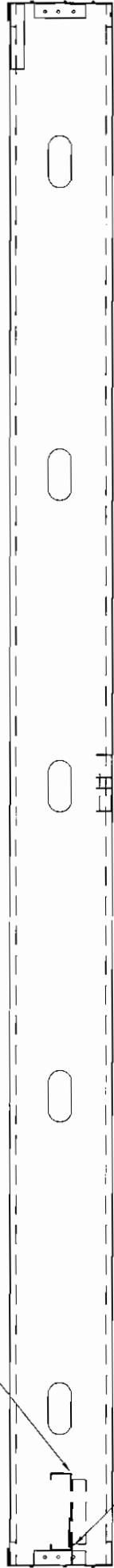
LOAD SIDE

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DATE	12/10/04	DESCRIPTION	U.P.N.T.	U.S. ARCHITECTURAL PRODUCTS
SCALE				
JULINJ	2004-1994			TITLE
DRG NO.	B2			FLOOR FRAMING

SEE PICTURE #1 FOR MORE DETAIL



1 1/8" x 4" x 11" ANGLE ATTACHED TO THE BLOCKING WITH DRIVALL SCREWS USED TO PROVIDE LOAD SUPPORT

SIDE VIEW

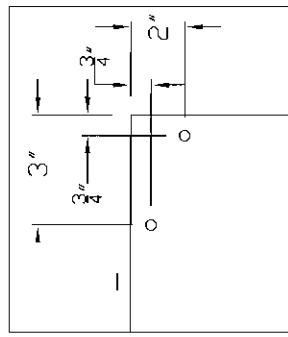
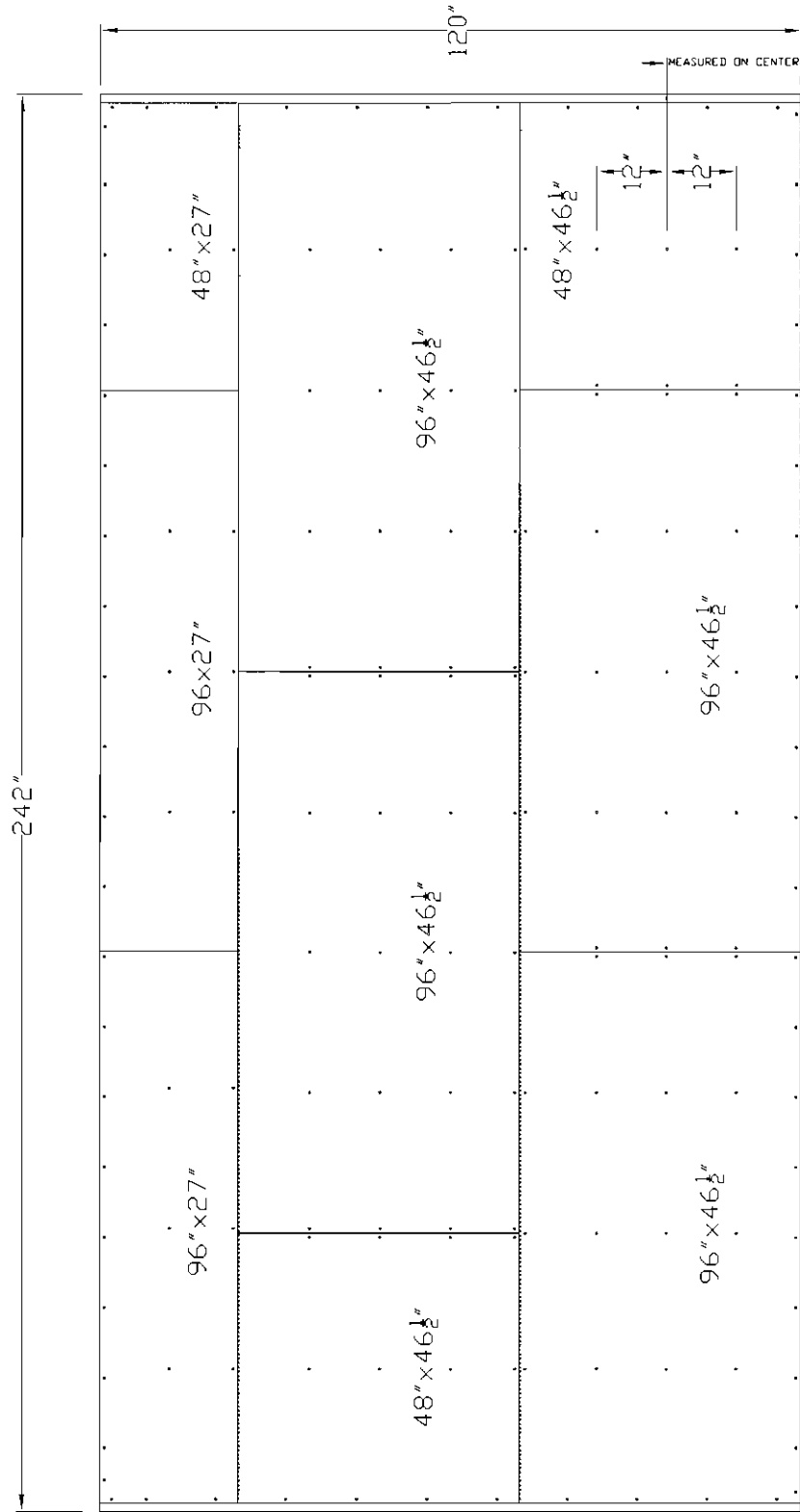


FRONT VIEW

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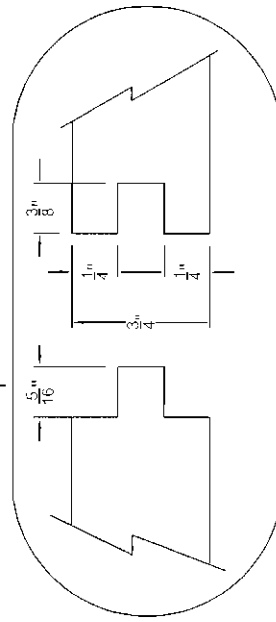
DRAWN BY: A. BENDER DATE: 12/10/04 SCALE: PROJECT: 2004-1994 DRAWING NO: B3	REVISION         	TITLE U.S. ARCHITECTURAL PRODUCTS FLOOR FRAMING	This drawing and all information contained herein is the property of PROGRESSIVE ENGINEERING INC. and is not to be reproduced without the written permission of _____ assumes no responsibility for unauthorized use of this drawing.
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LOAD SIDE



BEARING SIDE

BUTT-JOINT (TYP)  
2 BEADS OF P5100  
ADHESIVE ON FRAMING



- NOTES:
- VERSAPANEL/VERSAROC ADHERED TO FRAME WITH THE TONGUE AND GROOVE JOINTS AND BUTT JOINTS ADHERED TOGETHER WITH ALPHA SYSTEMS P5100, ONE PART POLYURETHANE.
  - 1. ADHESIVE JOISTS AND RIM TRACK,  $\frac{3}{16}$ "- $\frac{1}{4}$ " BEAD
  - 2. TONGUE AND GROOVE,  $\frac{1}{16}$ "- $\frac{1}{4}$ " BEAD TO THE BOTTOM OF GROOVE AND TOP OF TONGUE
  - 3. BUTT-JOINTS,  $\frac{1}{16}$ "- $\frac{1}{8}$ " BEAD.
  - 4. #8x $1\frac{1}{2}$ " LG. "x 167" SHANK DIA.x.388" HEAD DIA, SELF-DRILLING AND SELF-COUNTERSINKING SCREWS ATTACHED TO FRAMING 12" O.C. AROUND THE OUTERMOST EDGE AND ON BOTH SIDES OF THE BUTT JOINTS. ATTACHED AT 12" O.C. IN THE FIELD. (SEE PICTURE #3 FOR MORE DETAIL)

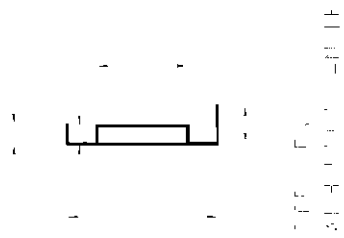
CONNECTING  
VERSAPANEL/VERSAROC

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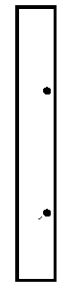
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DESIGNED BY	A. BENDIGER	PROJECT NO.	PLV-2004-01	DATE	12/10/04	SCALE	AS SHOWN	JOB NO.	2004-1994	REV.		DESCRIPTION	U.S. ARCHITECTURAL PRODUCTS
DATE		PROJECT		SCALE		JOB NO.		REV.		DESCRIPTION			PLYCEM PLACEMENT

11



12



13

14

NOTE-RIM TRACK MEASURED THICKNESS=.049" THK

THIS DRAWING IS A PART OF TEST REPORT NO. 2004-1994

DRAWN BY: A. BENDER DATE: 12/13/04 SCALE: TITLE: 2004-1994 DWG. NO.: B5	REVISED BY: DATE: SCALE: TITLE: DWG. NO.:	CLIENT: <b>U.S. ARCHITECTURAL PRODUCTS</b> RIM TRACK	[This drawing and all information contained herein is the property of PROGRESSIVE ENGINEERING INC. and is not to be reproduced without the written permission of Progressive Engineering, Inc. I assume no responsibility for unauthorized use of this drawing.]	Progressive Engineering, Inc.
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M

M



NOTE-JOIST MEASURED THICKNESS .052" THK.

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DATE	12/10/04	REVISION	U.S ARCHITECTURAL PRODUCTS
BY	SAE		TITLE
JOB NO	2004-1994		JOIST
DRAWN BY	B6		



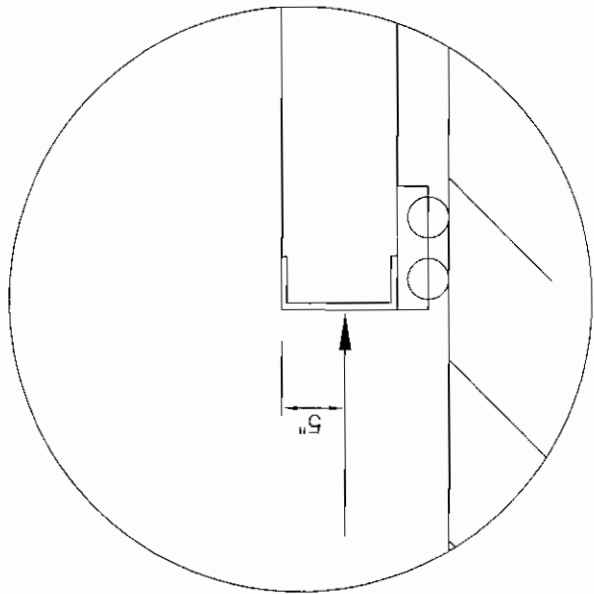
Picture #1 - solid blocking reinforcement for load support

#10-16 x 3/4"  
hex head screw

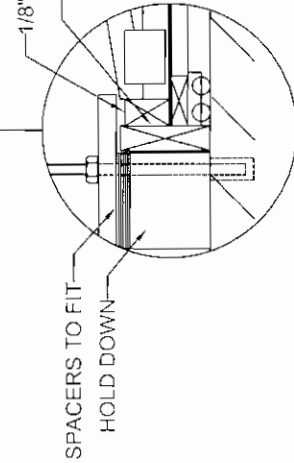
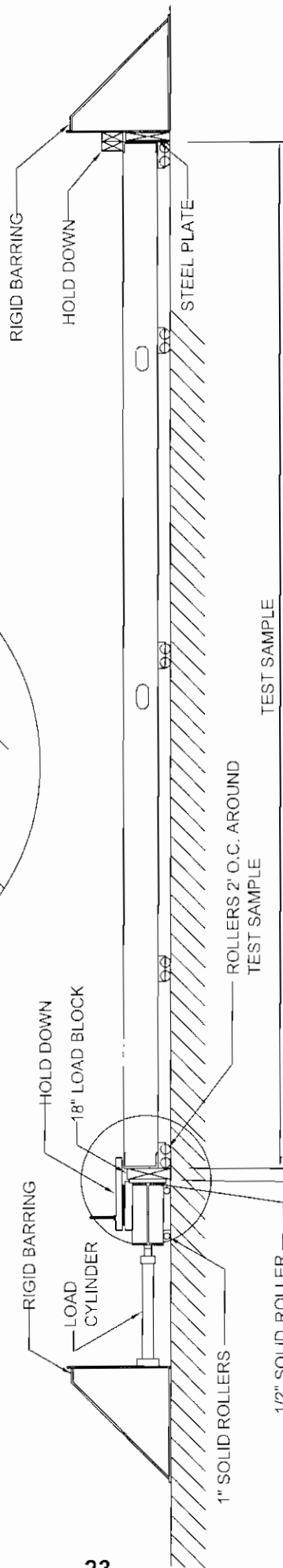
#8-16 x 1/2"  
wafer head screw

#8-18 x 1-5/8"  
S-12, Rock-on screw

Picture #2 - Fasteners



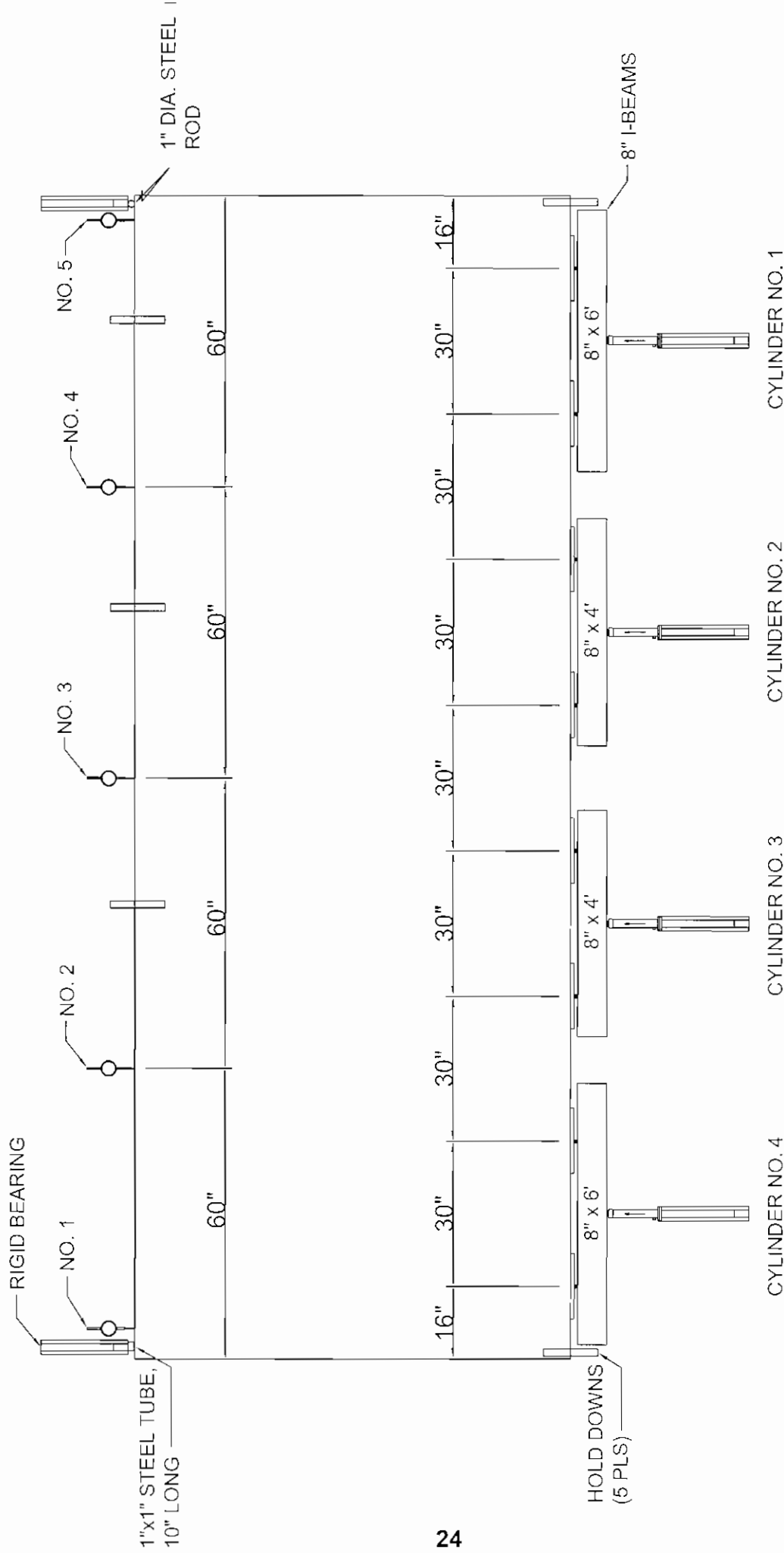
CENTER  
LINE  
OF LOAD



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SCALE	AS SHOWN	
DESIGNER	A. BENDER	TITLE <b>F887</b>
TEST SET-UP		

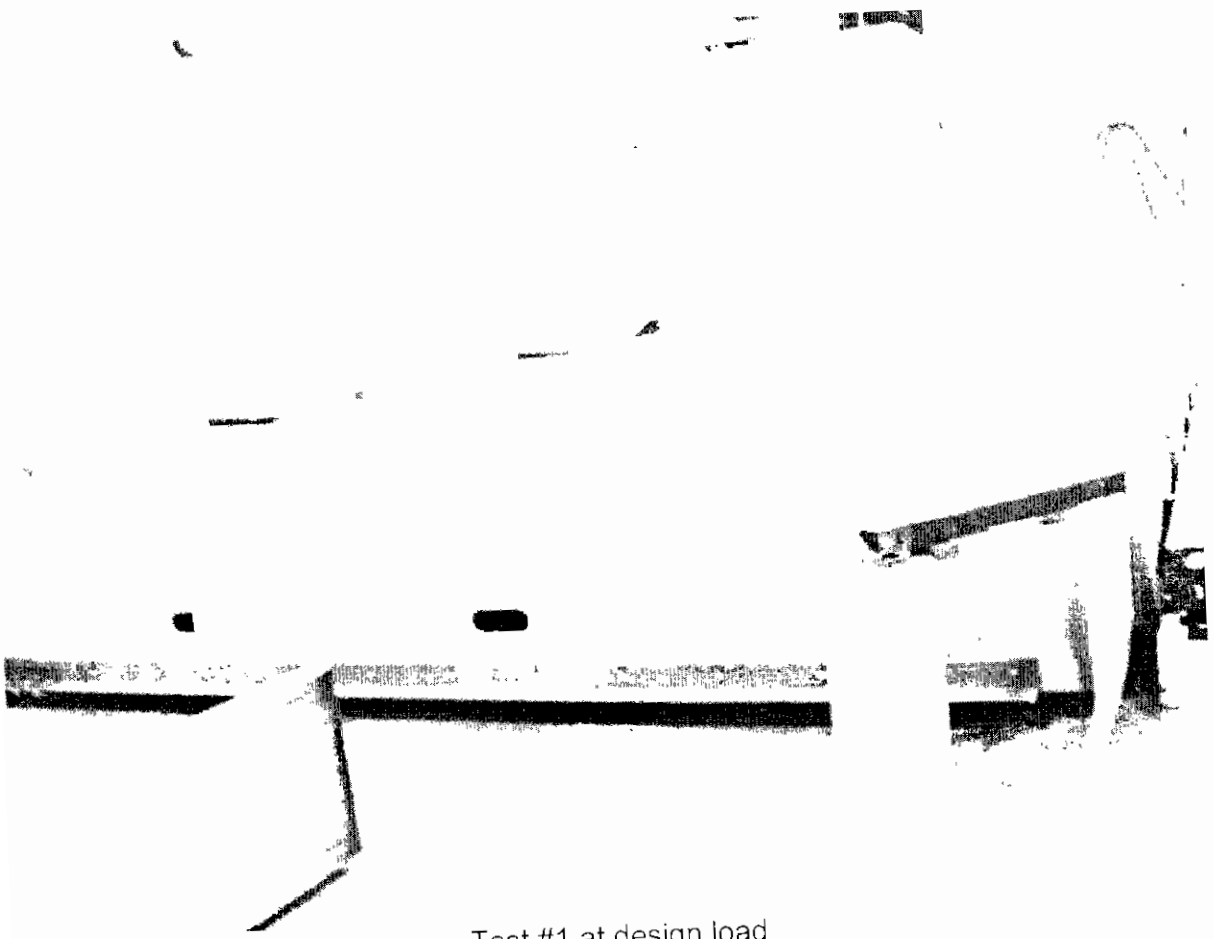
END NO. 2

END NO. 1



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PART NO. A-BLENDER	DATE 12/10/04
DRAWING NUMBER F1163	TITLE TEST SET-UP

PROGRESSIVE ENGINEERING, INC.  
 1000 W. 10th Street  
 Oklahoma City, Oklahoma 73106  
 (405) 231-1111  
 www.progressive-engineering.com



Test #1 at design load



Floor #1 at failure

Test #2 at design load



Floor #2 failure



Test #3 Floor diaphragm test on the frame only

# **APPENDIX**

**U.S. ARCHITECTURAL PRODUCTS, INC.  
2004-1994**

**UNMATCHABLE**

# **VERSAROC®**

**STRUCTURAL**

## **CEMENT BONDED PARTICLE BOARD**

WEATHER RESISTANT      IMPACT RESISTANT  
VERMIN & TERMITE RESISTANT

FOR CONSTRUCTION OF DURABLE, FIRE RESISTANT

- FLOOR SYSTEMS
- WALL SYSTEMS
- ROOF SYSTEMS

Another Premium Quality Product From  
U.S. ARCHITECTURAL PRODUCTS, INC.  
800-243-6677

**A2**

# VERSAROC® CEMENT BONDED PARTICLE BOARD

## Introduction

VERSAROC® is a cement bonded particle board composed of mineralized wood particles and Portland cement. It is light gray in color and is flat and smooth on both surfaces. VERSAROC® combines the strength and workability of wood with the durability and resistance values of cement. During the manufacturing and curing process, the wood content in VERSAROC® is mineralized with non-toxic chemical agents to render it fire resistant. These treated mineralized wood elements combine with the Portland cement matrix to add strength and flexibility, giving the panel significant structural characteristics coupled with the qualities contributed by Portland cement: fire resistance, moisture resistance, and resistance to rot, vermin, and decay. VERSAROC®'s structural integrity make it impact resistant and easy to handle. As a result of its mass and density, VERSAROC® offers excellent sound attenuation properties.



The uniting of wood fiber and Portland cement produces a building panel which is non-toxic, does not contain hazardous volatiles and is free of any silica, asbestos, or formaldehyde. VERSAROC® does not present health hazard and is environmentally safe. VERSAROC® is composed of 71% Portland cement, 19% mineralized wood fiber, 9% water, and 1% bonding chemicals. VERSAROC® is a noncombustible building material in accordance with ASTM E136 and has superior structural integrity. It will not delaminate in water and is dimensionally stable. VERSAROC® can be sawn, planed, sanded, drilled, routed, nailed, and screwed.

VERSAROC®'s outstanding features make it suitable for both exterior and interior wall construction, floors, ceilings, or as a general purpose building panel. VERSAROC® is distributed in the United States by U.S. Architectural Products, Inc., Lincoln, Rhode Island and stocked in our warehouses in New England, California, and Florida as well as at the locations of our authorized stocking distributors.

VERSAROC® is supplied in 4' x 8' and 4' x 10' sizes in thickness of 5/16", 3/8", 1/2", 3/4", 7/8", and 1". Square edge boards are standard on thickness 5/16" through 1/2". Tongue and groove edges are supplied on the boards' long dimensions on thickness of 3/4" through 1" for flooring applications. All 3/4" through 1" thickness flooring applications are supplied factory sealed all sides and edges for dimensional stability and weather resistance for open job site conditions. VERSAROC® is stable when subjected to water immersion without any sealant applied to the boards. VERSAROC®'s properties are non-directional and present no difficulties when installing regardless of panel orientation.

## VERSAROC® FOR HIGH PERFORMANCE FIRE-RESISTANT FLOOR AND WALL CONSTRUCTION

VERSAROC® is unique panel as its physical properties make it applicable in high performance areas where there are strict fire regulations, conditions requiring long-term durability, as well as moisture and water resistance requirements.

## Fire Resistance

VERSAROC® is a noncombustible building material having passed the stringent requirements of ASTM E136. It has zero flame spread and zero smoke development ratings. Wall and floor construction assemblies with fire ratings ranging from 1 to 2 hours are easily achievable.

## Highly Impact Resistant

High impact resistance is a significant product advantage over other building materials. VERSAROC® is ideal for use in public areas of airports, hospitals, prisons, or any type installation expected to be subjected to high abuse.

## Acoustic Performance

Because of its high density (78 lbs/ft<sup>3</sup>), VERSAROC® contributes significant acoustic performance when used as a wall or floor sheathing. The following chart lists STC (Sound Transmission Control) ratings for VERSAROC® when used as a component in walls, ceilings, and floor assemblies

Sound Transmission Control Ratings (STC)

THICKNESS	LBS/SQ.FT.	STC RATING
8mm (5/16")	2.0	30
10mm (3/8")	2.5	31
12mm (1/2")	3.0	31
19mm (3/4")	4.75	33
22mm (7/8")	5.50	33
25mm (1")	6.25	35

STC ratings can be enhanced by including VERSAROC® as part of a steel stud or wood stud partition or floor assembly with insulation in the stud or joist cavities.

## Weatherability / Durability

VERSAROC® has been used in a wide range of climatic conditions throughout the world and has been thoroughly tested for weatherability and durability by United States and European agencies. Copies of all tests are available upon request.

## Wind Load Properties

Maximum allowable wind loads in mph velocity while limiting deflection to 1/360 under indicated conditions for exterior walls.

Thickness	16" oc supports	24" oc supports
10mm (3/8")	120 mph	75 mph
12mm (1/2")	150 mph	90 mph
19mm (3/4")	150+ mph	150 mph

## Exterior Wall Construction

VERSAROC® functions well as a structural substrate in prefabricated modular or on-site construction, employing either steel or wood studs. It can be used in large, multi-panel units because of its strength and dimensional stability, or as individual panels. In either case, VERSAROC® assemblies are lightweight, fire resistant and structurally sound. These features make VERSAROC® easy to install and contribute to significant in-place economies. VERSAROC® installation is simple. Panels are applied to metal studs with countersunk self-tapping screws, or the case of wood studs, with screws, automatic nailers or stapler. If a decorative coating is to be applied, holes are patched with compatible non-shrinking filler. Where multi-panel assemblies are

employed, joints between the panels are a maximum of 1/8" and are filled with an elastomeric sealant.

THE FOLLOWING DESIGN NOTES ARE INTENDED AS A GENERAL GUIDE TO PROJECT SPECIFICATION DEVELOPMENT BY A QUALIFIED ARCHITECT OR ENGINEER.

**Framing Notes**

Normally wall framing assemblies are designed for a maximum allowable deflection of L/240 for cementitious and elastomeric coatings. Maximum allowable deflection of L/360 or less is common for ceramic, quarry, and stone tile as well as for thin brick. Where greater load resistance is required by local building codes or unique project conditions, structural criteria should be established by a qualified engineer.

**Steel Framing**

Studs shall be a minimum of 20 gauge and be spaced 16" or 24" on centers depending upon the wind load requirements and the thickness of the VERSAROC® board selected. At panel joints, studs must have a minimum flange width of 2" or use double studs at all panel joints to accommodate the 1/8" minimum space between panels and the fastening requirements specific to VERSAROC®. Minimum requirements of metal framing must be in accordance with ASTM C-645 "Specification for Non-Load Bearing Steel Stud Runners and Rigid Furring Channels in Screw Application", and have a minimum of G40 galvanized coating per ASTM A-525 and A-586. Framing shall meet ANSI A108.3 for uniform dimension and be fabricated from steel conforming to ASTM A-446.

**Wood Framing**

Framing shall be a minimum of 2" x 4" (nominal) and be spaced 16" or 24" on centers depending on wind load requirements and the thickness of the VERSAROC® panel selected. Use double studs at panel joints to accommodate the 1/8" minimum space between panels and fastening requirements specific to the At panel joints, studs must have a minimum flange width of 2" or use double studs at all panel joints to accommodate the 1/8" minimum space between panels and the fastening requirements specific to VERSAROC® panels. Framing shall be installed in conformance with ANSI 108.3 specification and bear the mark of a registered grading agency.

**Fascias, Soffits, and other Exterior Uses**

Additional exterior applications for VERSAROC® include fascias, wall re-cladding, soffits, balcony panels, balcony floors and canopies, as well as a variety of agricultural building uses such as barns, paddocks and stall enclosures at race tracks where fire-resistance and durability is desired.

**Sheathing Applications**

Where weather resistance and continuing serviceability is a consideration for applications such as brick or masonry veneer exteriors. VERSAROC® installed as the sheathing behind the brick or masonry veneer systems assures strength, durability, and weather resistance to the installation.

**Fastener Recommendations**

VERSAROC® can be fastened using nails, screws or staples and is also suitable for manual, pneumatic and powdered fastener methods. All fasteners must be corrosion resistant. The following table is a guide to fastener locations for most common applications.

**Screws:** Corrosion resistant self-countersinking heads such as ITW Buildex 'Rock-On' type fasteners #8 diameter minimum with S-12 self-drilling 'TEK' point for metal framing Length = 2-1/2 to 3 times board thickness.



**Screw Fastening Methods:**

- Pre-drilling of VERSAROC® panels is not necessary when using electric or pneumatic powered screw driving guns and self-drilling screws.
- Pre-drill VERSAROC® panels if manually fastening by hand.
- Fasteners must be positioned as shown in above table and diagram.

**Nails**

Type of nail: flat-headed, galvanized or stainless steel, twisted or sheradized serrated. Diameter = 2.2 to 3.1 mm Length = 3 to 3.5 times board thickness. If nailing by hand, pre-drill board at nailing locations.

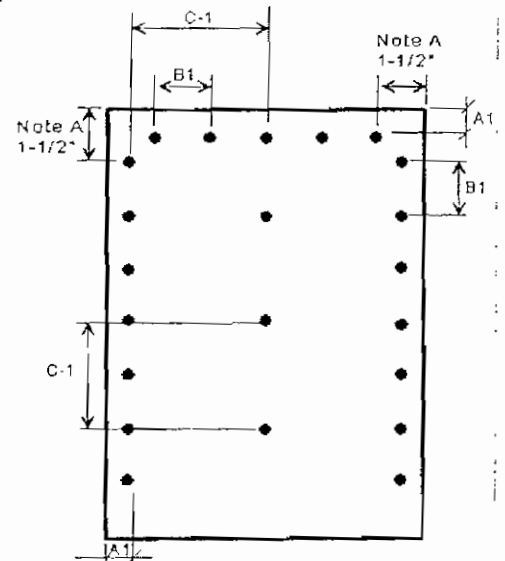
**Nail Fastening Methods:**

- For thickness up to 1/2", nailing can be by hand, however pre-drill nailing holes is recommended
- For thickness greater than 1/2", use pneumatical operated nailing guns set to 5-6 bars pressure with tap loader or nail coil.

**VERSAROC® Wall Installation Fastener Placement**

Board Thickness inches	Fastener Spacing (inches)			
	A	A1	B1	C1
5/16" – 1/2"	1-1/2"	3/4"	8"	16"
5/8" – 3/4"	1-1/2"	1"	12"	24"
7/8" & thicker	1-1/2"	1-1/4"	16"	24"

Note A: First fastener in from the corner must be 1-1/2" in from the edge.



**Important Note:** Unsealed VERSAROC® panels can be affected by slight dimensional changes according to variation in relative humidity. If the boards are not sealed or a surface treatment used which allows the boards to be subjected to the varying effects of relative humidity, then the fastener locations, and particularly, the joints between the boards, must allow movement, i.e., oversize the fastener hole and leave a 1/8" minimum gap at board joints.

## Adhesives & Bonding

Only alkali resistant adhesives should be used, suitable for VERSAROC® pH value of 11-13. For high-quality bonding, VERSAROC® with calibrated surfaces is most suitable. For adhesive bonding by means of hot pressing, a board moisture content of no more than 6% -9% is required but this should be determined with the adhesive manufacturer. When bonding to one face of VERSAROC® the reverse should always be counterbalanced. For large-area adhesive bonding, some pre-testing should always be carried out in cooperation with the adhesive manufacturer.

## Applications and Types of Adhesives

When the walls of a room are to be completely covered with ceramic tiles (e.g. laboratories and sanitary facilities) the back of the VERSAROC® must also be primed/sealed. Without sealing the back of the boards, moisture can penetrate the board, which can result in distortion. Distortion can also take place when the back of the board dries out on one side only. For adhesive bonding to free floating floors VERSAROC® primed on both sides should be used, to avoid one-sided penetration of moisture which could lead to distortion. Boards with a calibrated surface can easily absorb moisture.

## Full Surface Bonding of VERSAROC® to Each Other

Dry Rooms: Dispersion adhesive or one component reaction resin adhesives.

Wet Rooms: Double component resin adhesive polyurethane based or epoxy resin adhesive.

## Bonding of Tongue & Grooved Edges

Use PEMCO 5100 non-flammable, solvent free, zero V.O.C. polyurethane adhesive as supplied by Alpha Systems, Inc., Elkhart, IN or equal. Follow manufacturer's directions for application.

## Full Surface Bonding of Laminates and Veneers

VERSAROC® is an excellent substrate for the application of decorative laminates and veneers. The sanded/calibrated finish should always be used, when bonding a decorative surface to one face the reverse of the panel must have a compensator layer applied. With timber veneers a cross band veneer is usually required. In all instances the above operations should be carried out by experienced companies specializing in bonding techniques using the input from adhesive manufacturers for bonding to cement board material.

**Note:** Always consult adhesive manufacturer and laminate manufacturer for technical assistance on suitability of use. Always test a small sample of the materials before application.

**VERSAROC® can be used for a wide range of applications including such as:**

- Structural Insulated Panels.
- Fire resistant wall construction.
- Weather resistant backer board for synthetic coating systems.
- High performance shear wall construction
- High impact resistant wall construction
- Versaroc® Cem-Deck floor systems offer non-combustible structural alternatives to poured concrete and 'FRT' plywood.

## HANDLING & STORAGE

### Transport

VERSAROC® boards are usually delivered secured in plastic bound, edge protected pallets. When loose boards are transported they must be laid flat and fully protected with a



waterproof sheet. When manually moving VERSAROC® it must be carried in a vertical position.

### Storage

VERSAROC® boards should be stored flat on level supports at 30 inch maximum support spacing. It must never be stored on edge or upright. If outside, a protective plastic sheet must be secured to protect from weather.

### Conditioning

VERSAROC® has an ex-works moisture content of 9% (+ - 3%) and is in equilibrium when the temperature is 68°F with a relative air humidity of 50-60%. VERSAROC® adapts to the ambient humidity level, therefore to adjust to its working conditions it should be allowed to acclimatize for 24 - 48 hours prior to installation.

## PROCESSING / MACHINING

VERSAROC® is machined and processed in the same manner as resin bonded particle boards, but ensuring that tungsten carbide tipped blades are used at all times. Comprehensive tests have shown that wear on tools during the processing of VERSAROC® is significantly lower when compared with resin bonded board. This is due to the lack of resin build-up and a lower degree of heating.

## SAWING

### Equipment

- Cross cut hand saws of thickness up to 12mm (1/2").
- Jigsaw for thickness up to 12mm (1/2") and small work.
- Portable circular saw.
- Fixed saw for dimensioning (vertical or horizontal)

### Type of blade

- Alternative or trapezoidal tooth carbide tipped.
- 

### Milling

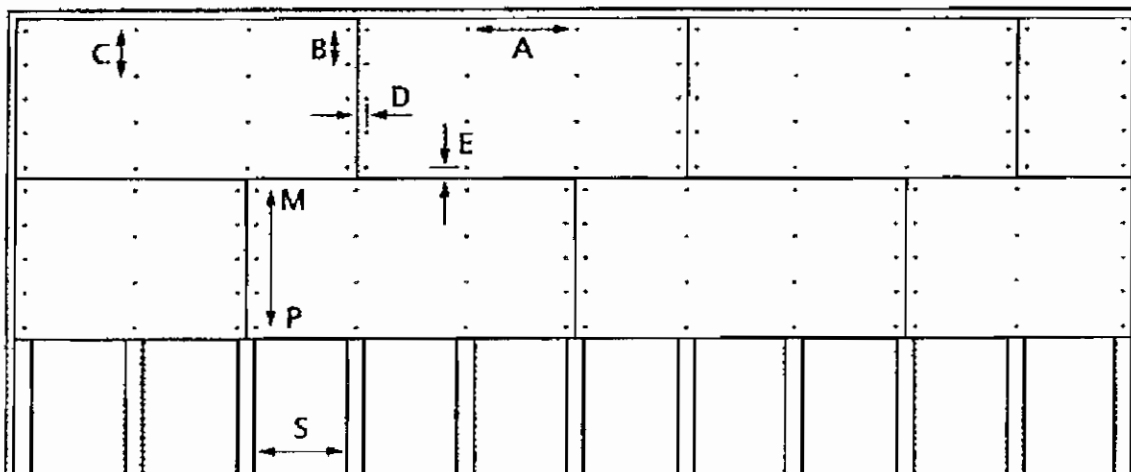
Common machines with carbide tipped tools. The higher the RPM, the better the milled edge.

# VERSAROC® FLOOR SYSTEM

## Factory Finished High Performance Flooring System

- VERSAROC® is available in several grades to best suit your project requirements.
- All VERSAROC® is noncombustible and available in uncalibrated, calibrated, factory sealed, and T&G grades.
- VERSAROC® is available factory primed and sealed all sides and edges for weather protection. The factory primer/sealer renders the VERSAROC® Cem-Deck dimensionally stable against swelling and shrinkage under moisture conditions encountered on open job site conditions.
- VERSAROC® is available with tongue & groove edges on the long dimensions of the panels.
- VERSAROC® is available calibrated for extreme accuracy of thickness with a tolerance of +/- 0.011 inch making it suitable for finishing with vinyl tile flooring, roll-out linoleum, or thin carpet layers.

### TYPICAL FASTENER LAYOUT FOR INSTALLATION OF VERSAROC® Floors



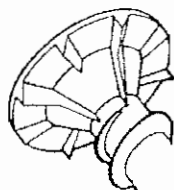
- S = Support centers not to exceed 24 inches on centers.
- A = 16" or 24" dependent upon support spacing.
- B = 12" on center at panel endings over supports.
- C = 16" on center along supports within field of panel.
- D = 1" from panel end joint edges.
- E = 2" from panel side joint edges.
- M-P = Bond all board edges with non-flammable adhesive.

All long dimensions of panels are tongue & groove configuration. All short dimensions of panels are square edges. Both tongue & groove as well as square edged conditions are to be bonded using PEMCO 5100 Polyurethane Adhesive or equivalent Adhesive to be non-flammable, solvent free, and zero V.O.C.

#### Fastener Recommendations

VERSAROC® can be fastened using nails, screws or staples and is also suitable for manual, pneumatic and powdered fastener methods. All fasteners must be corrosion resistant.

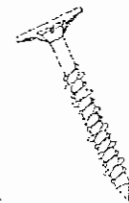
**Screws:** Corrosion resistant self-countersinking heads such as ITW Buildex 'Rock-On' type fasteners #8 diameter minimum with S-12 self-drilling 'TEK' point for metal framing. Length = 2-1/2 to 3 times board thickness.



Self countersinking head



Steel Studs



Wood Studs

# VERSAROC® FLOOR SYSTEM

## LOAD TABLES\*

1. Continuous loading conditions where panels span 3 or more supports of equal spacing.  
Uniformly distributed live loads in pounds per square foot allowable on VERSAROC® panels.

### PANELS SPANNING 3 OR MORE SUPPORTS

VERSAROC® PANEL THICKNESS	LOAD GOVERNED BY	12" o.c. Supports	16" o.c. Supports	24" o.c. Supports
16mm (5/8")	L/240 ▲ between supports	212	117	50
	L/360 ▲ between supports	212	117	50
19mm (3/4")	L/240 ▲ between supports	299	166	71
	L/360 ▲ between supports	299	166	71
22mm (7/8")	L/240 ▲ between supports	402	224	96
	L/360 ▲ between supports	402	224	96
25mm (1")	L/240 ▲ between supports	520	290	125
	L/360 ▲ between supports	520	290	125
28mm (1-1/8")	L/240 ▲ between supports	654	365	158
	L/360 ▲ between supports	654	365	158
32mm (1-1/4")	L/240 ▲ between supports	790	477	208
	L/360 ▲ between supports	790	477	208
38mm (1-1/2")	L/240 ▲ between supports	889	605	264
	L/360 ▲ between supports	889	605	264

2. Single Span Condition  
Uniformly distributed live loads in pounds per square foot allowable on VERSAROC® panels.

### SINGLE SPAN CONDITIONS

VERSAROC® PANEL THICKNESS	LOAD LIMITED BY	12" o.c. Supports	16" o.c. Supports	24" o.c. Supports
16mm (5/8")	L/240 ▲ between supports	169	93	39
	L/360 ▲ between supports	169	93	30
19mm (3/4")	L/240 ▲ between supports	239	132	56
	L/360 ▲ between supports	239	132	51
22mm (7/8")	L/240 ▲ between supports	321	178	76
	L/360 ▲ between supports	321	178	76
25mm (1")	L/240 ▲ between supports	415	231	99
	L/360 ▲ between supports	415	231	99
28mm (1-1/8")	L/240 ▲ between supports	521	290	125
	L/360 ▲ between supports	521	290	125
32mm (1-1/4")	L/240 ▲ between supports	682	380	164
	L/360 ▲ between supports	682	380	164
38mm (1-1/2")	L/240 ▲ between supports	865	482	209
	L/360 ▲ between supports	865	482	209

\* Load calculations based upon a safety factor of 4. Moisture content of VERSAROC is assumed to be 9% by weight (+3%) as shipped from the factory – this is considered 'dry' condition. If VERSAROC is allowed to become saturated, reduce live load working capacity approximately 30% until the boards have re-dried. All load table data remains valid for re-dried boards. Technical tables and specifications are provided as a general guideline only. No table can be sufficiently comprehensive to cover all details of a specific project design. We recommend that all installations be designed and reviewed by a qualified architect or engineer.

**WATER RESISTANT – FREEZE/THAW RESISTANT – FIRE RESISTANT – IMPACT RESISTANT  
SOUND RESISTANT – FABRICATES & INSTALLS LIKE WOOD  
THE ANSWER TO 'FRT' PLYWOOD PROBLEMS!**

PHYSICAL PROPERTIES	VALUE	TEST STANDARD
Thermal Conductivity (12mm / 1/2")	'K' value 1.02 BTU/hr-ft <sup>2</sup> -°F 'R' value 0.45 hr-ft <sup>2</sup> -°F/BTU	ASTM C518
Coefficient of Linear Thermal Expansion (12mm / 1/2")	6.06 x 10 <sup>-6</sup> per °F 1.09 x 10 <sup>-5</sup> per °C	ASTM D696
Density – Oven Dry	78 lbs. per cu. ft.	ASTM D1037
Moisture Content	9%	ASTM D1037
Linear Variation With Change In Moisture 50% to 90% relative humidity: Parallel to fibers Perpendicular to fibers	0.11% 0.14%	ASTM D1037
Saturated Thickness Swelling (24 hour water immersion)	0.7%	Manufacturer
PH Value	12	Manufacturer
Water Vapor Permeance	3.93 Perms	ASTM E96
Formaldehyde Content	Zero	EN 120
Asbestos Content	Zero	EN 120
Silica Content	Zero	EN 120
Frost Resistance	No Effect – 50 cycles Freeze/Thaw	EN 112
Rot & Termite Resistance	Resistant to destruction	100% Resistant

MECHANICAL PROPERTIES	VALUE	TEST STANDARD
Modulus of Elasticity, psi	625,500	ASTM C120
Modulus of Rupture, psi	1,840	ASTM C120
Shear Strength, psi	1,260	ASTM D732
Tensile Strength, psi	844	ASTM D209
Compressive Strength, psi	2,220	ASTM C170
Impact Strength, Izod Method	0.40	ASTM D256
Permissible Design Value, psi	326	Manufacturer

COMBUSTION CHARACTERISTICS	VALUE	TEST STANDARD
Noncombustible	Passed	ASTM E136
Flame Spread / Smoke Development Classifies as Class 0 building board	Zero / Zero	BS 476 Part 6.7
Fire Resistance Ratings	1 & 2 hour Walls & Floor/Ceiling Assemblies	ASTM E119 (Pending)

**VERSAROC® is warranted not to crack, spall, or degrade for a period of five years from the purchase date from U.S. Architectural Products, Inc., when used in applications as shown in the product literature. This limited warranty is non-transferable and applies only if VERSAROC® is stored and installed in accordance with the manufacturer's published guidelines following good construction practice. The manufacturer, at its option, shall either replace any VERSAROC® that is found to be defective or refund the original purchase price.**

# U.S. ARCHITECTURAL PRODUCTS, INC.

55 Industrial Circle

Lincoln, Rhode Island 02865

800-243-6677 Local 401-725-8550

Fax: 401-725-8540

<http://www.architecturalproducts.com>

## VERSAROC® WEIGHTS AND PACKAGING SPECIFICATIONS

ITEM	NOMINAL DIMENSION	PCS. / SQ. FT.		WEIGHT PER SQ. FT.
		PER CRATE 4' x 8' 4' x 10'	Per T/L 4' x 8' 4' x 10'	
8 mm	5/16"	52 / 1,664 42 / 1,680	624 / 19,968 420 / 16,800	2.0 lbs
10 mm	3/8"	42 / 1,344 35 / 1,400	504 / 16,128 350 / 14,000	2.5 lbs.
12 mm	1/2"	35 / 1,120 29 / 1,160	420 / 13,440 290 / 11,600	3 lbs.
16mm	5/8"	27 / 864 21 / 840	324 / 10,368 210 / 8,400	4 lbs
19 mm	3/4"	22 / 704 18 / 720	264 / 8,448 180 / 7,200	4.75 lbs.
22 mm	7/8"	19 / 608 16 / 640	228 / 7,296 160 / 6,400	5.50 lbs.
25 mm	1"	16 / 512 13 / 520	192 / 6,114 130 / 5,200	6.25 lbs.
28 mm	1-1/8"	15 / 480 12 / 480	180 / 5,760 120 / 4,800	7 lbs.
32 mm	1-1/4"	13 / 416 10 / 400	156 / 4992 100 / 4000	8 lbs.
38 mm	1-1/2"	11 / 352 8 / 320	132 / 4,224 80 / 3,200	9.50 lbs.
40 mm	1-5/8"	10 / 320 8 / 320	120 / 3,840 80 / 3,200	10 lbs.

### Company Profile

U.S. Architectural Products, Inc., is a wholesaler and master distributor of noncombustible cement board sheathing products used for construction of fire-resistant and noncombustible floor, roof, and wall assemblies. Corporate offices are located at 55 Industrial Circle, Lincoln, Rhode Island 02865 U.S.A., with a technical support and sales office in Fairview, NC. Warehousing and shipping facilities are located at South Kearny, NJ, Savannah, GA, and Rancho Dominguez, CA (suburb of Los Angeles). All our products are shipped on common carrier trucks with products packaged and loaded for side forklift unloading.



MEMBER



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U.S. Architectural Products, Inc., is the exclusive North American distributor of VERSAROC®

# MARINOWARE

"THE STUD PEOPLE"

QUALITY & SERVICE COUNT

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**STUD-RITE™**  
LIGHTWEIGHT STEEL FRAMING SYSTEMS

## QUALITY AND SERVICE COUNT

MarinoWare is proud to present this catalog that details our Lightweight Steel Framing Products. For over 70 years, MarinoWare has been providing their customers with top quality steel framing products.

MarinoWare is committed to customer satisfaction. This starts with QUALITY. MarinoWare products are manufactured from quality steel and precision formed to meet or exceed industry standards established by the ASTM, SSMA and the AISI.

MarinoWare prides itself on providing the fastest delivery and finest service in the steel framing industry. Most steel framing manufacturers speak of lead times and deliveries in terms of weeks. MarinoWare with its own fleet of trucks, 3 shift operation, latest technology in roll forming capabilities and commitment to service excellence, in most cases provides next day delivery. MarinoWare stands prepared to exceed your expectations. Steel framing products, competitive prices, excellent service along with timely deliveries and technical assistance are available to you. Call MarinoWare today.

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## TECHNICAL SERVICES

MarinoWare's Technical Services personnel are available to assist their clients in all aspects of Cold-Formed Steel Design. This includes answering technical calls regarding products and installation applications as well as providing accurate certified shop drawings. For Technical Services, please call 1-800-MARINO-1.

## BENEFITS OF COLD-FORMED STEEL FRAMING PRODUCTS

Cold-formed steel framing is a versatile structural product for use in load bearing and curtainwall construction. The popularity of corrosion resistant galvanized steel framing can be attributed to these benefits:

### High Strength to Weight Ratio

In curtainwall applications, the reduced dead load may result in primary frame and foundation material savings. Exterior retrofits are less likely to require expensive reinforcement of the existing structure. In load bearing construction, a light weight steel framing system is a benefit when the site is plagued by poor soil conditions. Multi-story residences requiring unique ground level con-

dition (parking structure, meeting or dining facilities, etc.) benefit from the reduced dead weight applied to the supporting structure.

### Non-combustible Construction

The use of steel framing protected with fire resistive materials, offers the designer numerous rotol non-combustible assemblies. As an alternate to conventional wood framing, increases in floor areas and/or building heights may be obtained. Non-combustible ratings may also yield long term insurance savings.

### Design Versatility

Curtainwalls in various finishes and profiles are obtainable. Whether used as floor joists and roof rafters or in mansard and truss framing works well independently or in combination with other structural systems. Steel framing is adaptable to numerous applications traditionally constructed with hot rolled structural steel or masonry.

### Low In Place and Performance Costs

Steel framing systems are conducive to prefabrication at or away from the job site. Quality is improved due to the controlled work atmosphere while its efficiency of construction may result in earlier building enclosure and ultimate occupancy.

Framing will not shrink or crack. It does not rot and is impenetrable to termites, vermin and insects. Factory punched holes permit easy installation of pipe and conduit.

## WARRANTY AND LIMITATIONS

All products presented herein are warranted to the buyer to be free from defects in material and workmanship.

The foregoing warranty is non-assignable and in full and excludes all other warranties not expressly set forth herein, whether express or implied by operation of law or otherwise, including but not limited to any implied warranties of merchantability or fitness for a particular purpose. All details and specifications presented herein are intended as a general guide for the use of MarinoWare framing systems. These products should not be used without evaluation by a qualified engineer or architect to determine their suitability for

a specific use. MarinoWare assumes no responsibility for failure resulting from use of its details or specifications, or for failure resulting from improper application or installation of these products.

## GOVERNING LAW

All issues arising in connection with your order and all transactions associated with it shall be interpreted according to the laws of the State of New Jersey and all actions or other proceedings arising out of such issues shall be brought only in Superior Court, State of New Jersey, County of Essex, or United States District Court for the District of New Jersey. No action may be brought more than one year after accrual of the cause of action herefore.

## GENERAL INFORMATION

### Steel Thickness:

Product	Design		Minimum		ASTM C955 Color Code
	(in.)	(mm.)	(in.)	(mm.)	
20 Gage	.0346	.879	.0329	0.838	White
18 Gage	.0451	1.156	.0428	1.087	Yellow
16 Gage	.0566	1.4376	.0538	1.367	Green
14 Gage	.0713	1.8110	.0677	1.720	Orange
12 Gage	.1017	2.5832	.0966	2.454	Red
10 Gage	.1442	3.6547	.1380	3.000	Blue

### Finish:

Galvanized in accordance with ASTM A924. Products will be furnished with a G-60 or equivalent coating if specified and ordered to be in conformance with ASTM C955. Otherwise a G-40 coating or equivalent coating will be provided.

### Grades of Steel:

- 20 and 18 gage studs and all tracks
- Fy (min) = 33 KSI
- 16 gage studs and joists
- Fy (min) = 33 KSI
- Fy (min) = 50 KSI must be requested upon ordering
- 14, 12 and 10 gage studs and joists
- Fy (min) = 50 KSI



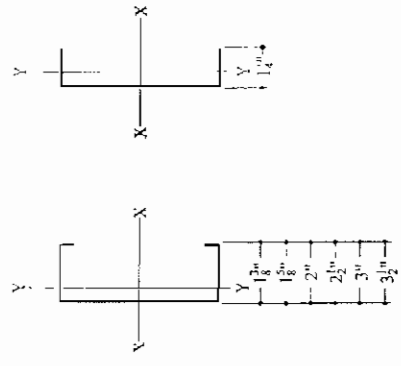
# STRUCTURAL PROPERTIES

## SYMBOLS AND DEFINITIONS:

A	Gross cross sectional area of the member.
$I_x, I_y$	Moment of inertia of the gross section about the principal axis.
$I_{x_e}$	Moment of inertia of the effective section stressed at yield about the principal axis.
$R_x, R_y$	Radius of gyration of the gross section.
$S_x$	Section Modulus of the gross section
$S_{x_e}$	Section Modulus of the effective section stressed at yield about the principal axis.
Ma	Allowable bending moment with contribution due to coldworking where applicable.
Va	Allowable shear force of punched sections
Cw	Torsional warping constant of the cross section
J	St Venant torsion constant
Ro	Polar radius of gyration of the cross section about the shear center
Beta	$1-(X_o/R_o)^2$
Xo	Distance from shear center to centroid along the principal axis

## NOTES:

- Section properties are based on the North American Specification for the Design of Cold Formed Steel Structural Members, 2001 edition.
- Gross and torsional properties were based on the unreduced cross section of the shape.
- $S_{x_e}$  was based on the effective section stressed at yield. For further information consult AISI Section B2.
- All products denoted by \*\* exceed the h/t ratio of 200 and require a web stiffener at support and concentrated load locations.
- Allowable bending moment, Ma was calculated according to AISI Section C3.1.1.
- Refer to page 3 for physical dimensions of sections.
- Weights shown are based on the uncoated base metal design thickness.
- Designer should check the Product Availability Matrix on page 3
- Allowable shear, Va was calculated in accordance with Section C3.2.2 at punched section.



## Physical and Structural Properties

A12 AW Type	Member Physical Properties										Effective Section Properties										Torsional Properties					
	SSMA	Flange/Lip	Lip	Design Thickness	Weight (pcf)	Area (in <sup>2</sup> )	Gross Section Properties					33ksi					50 ksi					J	Cw	Xo	Ro	Beta
							Ix	Sx	Rx	Iy	Ry	Ixe	Sxe	Va	Ma	Va	Ixe	Sxe	Va	Ma	Va					
35S137-33	1.38	3/8	3/8	0.0340	0.671	0.703	0.53	1.05	0.352	0.515	0.195	0.144	3.123	0.129	3.172	0.282	0.770	0.075	-1.170	1.633	0.486					
35S137-43	1.38	3/8	3/8	0.0481	0.889	0.740	0.268	1.01	0.367	0.511	0.249	0.155	4.306	0.163	5.555	0.302	0.773	0.094	-1.158	1.620	0.489					
35S137-54	1.38	3/8	3/8	0.0766	1.175	0.761	0.255	0.985	0.365	0.504	0.304	0.263	5.457	0.203	7.785	0.426	0.837	0.133	-1.130	1.609	0.489					
35S157-33	1.38	3/8	3/8	0.0713	1.321	0.930	0.259	0.935	0.395	0.509	0.388	0.254	6.546	0.213	9.133	0.462	0.967	0.134	-1.141	1.583	0.487					
35S157-43	1.58	1/2	1/2	0.0346	0.760	0.723	0.188	0.727	0.067	0.243	0.172	0.127	3.391	0.153	4.586	0.282	0.888	0.142	-1.501	1.923	0.391					
35S157-54	1.58	1/2	1/2	0.0457	0.964	0.749	0.332	0.742	0.111	0.220	0.291	0.169	5.017	0.209	6.129	0.362	0.755	0.152	-1.489	1.909	0.392					
35S162-33	1.58	1/2	1/2	0.0506	1.119	0.930	0.286	1.019	0.135	0.353	0.356	0.284	6.301	0.271	8.959	0.276	0.833	0.219	-1.582	1.898	0.391					
35S162-43	1.58	1/2	1/2	0.0713	1.509	1.442	0.352	1.008	0.162	0.383	0.433	0.345	7.870	0.342	11.595	0.162	0.752	0.252	-1.474	1.885	0.389					
35S162-54	1.58	1/2	1/2	0.0346	0.988	0.773	0.192	1.094	0.077	0.387	0.166	0.103	2.033	0.157	2.875	0.124	0.569	0.303	-0.771	1.365	0.681					
35S178	2501125-33	1 1/4	none	0.0481	0.768	0.725	0.259	1.085	0.035	0.395	0.271	0.147	2.909	0.220	4.093	0.205	0.153	0.042	-0.768	1.362	0.684					
35S178	2501125-43	1 1/4	none	0.0585	0.951	0.782	0.318	1.062	0.044	0.392	0.310	0.253	4.013	0.297	5.643	2.954	0.301	0.054	-0.763	1.365	0.684					
35S178	2501125-54	1 1/4	none	0.0713	1.243	0.835	0.400	1.054	0.054	0.389	0.409	0.281	5.556	0.403	7.847	3.199	0.602	0.088	-0.758	1.370	0.684					

## 3-5/8" Members

35S200	3525137-33	1.38	3/8	0.0345	0.804	0.736	0.478	1.424	0.059	0.501	0.486	0.235	4.433	0.464	5.937	0.552	0.024	0.167	-1.026	1.826	0.634
35S200	3525137-43	1.38	3/8	0.0451	1.041	0.818	0.618	1.419	0.076	0.497	0.605	0.371	6.346	0.602	8.760	0.832	0.207	0.204	-1.05	1.814	0.637
35S200	3525137-54	1.38	3/8	0.0566	1.281	0.756	0.417	1.412	0.091	0.490	0.404	0.404	7.976	0.745	11.467	1.016	0.405	0.246	-1.008	1.801	0.635
35S200	3525157-33	1.38	3/8	0.0713	1.620	0.923	0.509	1.401	0.109	0.481	0.513	0.500	11.686	0.862	14.846	1.004	0.797	0.294	-0.956	1.783	0.635
35S200	3525162-33	1.58	1/2	0.0346	0.832	0.553	0.304	1.540	0.093	0.611	0.539	0.265	5.335	0.235	7.047	0.592	0.105	0.293	-1.334	2.035	0.592
35S200	3525162-43	1.58	1/2	0.0451	1.156	0.340	0.710	1.392	0.127	0.616	0.699	0.373	7.385	0.322	9.651	0.832	0.230	0.371	-1.323	2.032	0.595
35S200	3525162-54	1.58	1/2	0.0566	1.436	0.422	0.673	1.458	0.154	0.605	0.864	0.468	9.251	0.705	13.325	1.016	0.451	0.449	-1.314	2.040	0.595
35S200	3525182-33	1.58	1/2	0.0713	1.762	0.574	0.669	1.429	0.185	0.588	1.060	0.581	13.244	0.862	17.259	1.004	0.887	0.540	-1.305	2.024	0.595
35S200	3525182-43	1.58	1/2	0.0828	2.044	0.724	1.435	1.392	0.241	0.577	1.427	0.761	18.716	0.925	27.696	0.875	2.496	0.695	-1.285	1.982	0.584
35S200	3525182-54	1.58	1/2	0.1270	2.845	0.880	1.701	1.390	0.277	0.561	1.684	0.925	23.054	1.034	33.966	0.774	4.742	0.803	-1.270	1.985	0.582
35S200	3525200-33	2	5/8	0.0345	1.010	0.739	0.648	1.478	0.177	0.772	0.633	0.283	5.785	0.607	7.771	0.592	0.118	0.371	-1.710	2.432	0.470
35S200	3525200-43	2	5/8	0.0451	1.310	0.305	0.838	1.461	0.227	0.767	0.925	0.428	8.455	0.822	11.278	0.832	0.261	0.276	-1.758	2.419	0.472
35S200	3525200-54	2	5/8	0.0566	1.628	0.479	1.030	1.459	0.277	0.751	1.021	0.589	10.347	0.931	14.899	1.016	0.511	0.384	-1.750	2.407	0.472
35S200	3525225-33	2	5/8	0.0713	2.025	0.595	1.266	1.459	0.337	0.745	1.266	0.690	13.347	1.206	20.021	1.004	1.006	0.370	-1.741	2.393	0.471
35S200	3525225-43	2	5/8	0.0828	2.442	0.724	1.435	1.446	0.446	0.735	1.703	0.933	16.198	1.314	23.195	0.975	2.847	0.540	-1.724	2.383	0.466
35S200	3525225-54	2	5/8	0.1270	3.427	1.007	2.042	1.424	0.522	0.720	2.035	1.114	26.783	1.511	39.851	0.774	5.415	1.034	-1.710	2.339	0.460
35S200	3521125-33	1 1/4	none	0.0340	0.721	0.212	0.338	1.439	0.030	0.377	0.365	0.174	1.024	0.260	4.922	1.038	0.065	0.067	-0.667	1.630	0.833
35S200	3521125-43	1 1/4	none	0.0451	0.939	0.276	0.572	1.392	0.332	0.330	0.531	0.245	4.839	0.300	6.892	2.141	0.187	0.037	-0.663	1.628	0.834
35S200	3521125-54	1 1/4	none	0.0566	1.177	0.346	0.723	1.378	0.445	0.346	0.705	0.332	6.569	0.312	9.342	3.572	0.363	0.272	-0.659	1.637	0.834
35S200	3521157-33	1 1/4	none	0.0713	1.482	0.426	0.921	1.475	0.500	0.370	0.921	0.436	8.955	0.364	12.771	4.700	0.738	0.555	-0.655	1.637	0.840
35S200	3521157-43	1 1/4	none	0.0828	1.821	0.544	1.364	1.467	0.582	0.364	1.243	0.675	13.242	0.430	20.245	6.642	2.400	0.846	-0.646	1.648	0.846
35S200	3521157-54	1 1/4	none	0.1270	2.635	0.774	1.708	1.435	0.699	0.359	1.707	0.878	19.508	0.598	28.945	5.178	4.403	0.821	-0.639	1.658	0.851

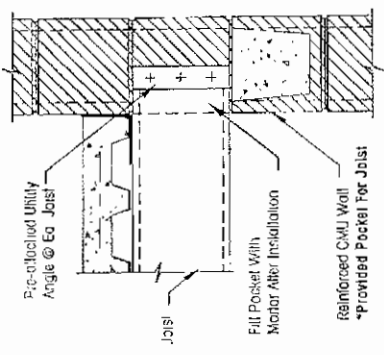


**Floor and Roof Applications**

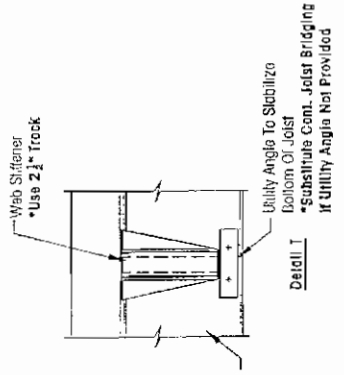
Member	Spans														
	11'-0"		12'-0"		13'-0"		14'-0"		15'-0"		16'-0"		17'-0"		
M/W Type (SSMA)	T	L	T	L	T	L	T	L	T	L	T	L	T	L	
6" Members	12" 6SW18 (600S162-43)	92	76	77	59	66	46	55	37	45	30	37	25	31	21
	16" 6SW16 (600S162-54)	59	57	58	44	49	35	41	28	34	22	28	19	23	15
	24" 6SW14 (600S162-68)	46	38	39	29	33	23	28	18	22	15	19	12	15	10
	12" 6SW12 (600S200-97)	141	94	109	72	85	57	68	46	56	37	46	31	38	25
8" Members	16" 8J18 (800S200-43)	106	70	81	54	64	43	51	34	42	28	34	23	29	19
	24" 8J16 (800S200-54)	70	47	54	36	43	28	34	23	28	19	23	15	19	13
	12" 8J14 (800S200-68)	174	116	134	89	105	70	84	56	68	48	56	38	47	31
	16" 8J12 (800S200-97)	130	87	100	67	79	53	63	42	51	34	42	28	35	24
10" Members	12" 10SW18 (1000S162-43)	158	101	117	78	95	61	72	48	57	38	47	31	38	25
	16" 10SW16 (1000S162-54)	118	79	91	61	72	48	57	38	47	31	38	26	32	21
	24" 10SW14 (1000S162-68)	82	54	63	44	50	33	40	26	32	21	27	18	22	15
	12" 10SW12 (1000S200-97)	202	135	156	104	122	82	98	65	80	53	66	44	55	38
12" Members	16" 12J18 (1200S200-43)	191	101	117	78	92	61	73	49	60	40	49	33	41	27
	24" 12J16 (1200S200-54)	101	67	78	52	61	41	49	33	40	27	33	22	27	18
	12" 12J14 (1200S200-68)	278	184	213	142	167	112	134	89	109	73	90	60	75	50
	16" 12J12 (1200S200-97)	207	138	160	106	125	84	101	67	82	55	67	45	56	37

Member	Spans														
	18'-0"		19'-0"		20'-0"		21'-0"		22'-0"		23'-0"		24'-0"		
M/W Type (SSMA)	T	L	T	L	T	L	T	L	T	L	T	L	T	L	
12" Members	12" 12SW16 (1200S162-43)	124	118	111	100	101	86	91	74	83	65	76	56	70	50
	16" 12SW14 (1200S162-54)	93	88	84	75	75	64	68	58	62	48	57	42	52	37
	24" 12SW12 (1200S162-68)	62	59	56	50	50	43	46	37	42	32	38	28	35	25
	12" 12SW10 (1200S200-97)	181	146	162	124	147	107	133	92	120	80	105	70	93	62
12" Members	16" 12J18 (1200S200-43)	136	110	122	93	110	80	100	69	90	60	79	53	69	46
	24" 12J16 (1200S200-54)	90	73	81	62	73	53	65	46	50	40	53	35	46	31
	12" 12J14 (1200S200-68)	303	202	258	172	221	147	191	127	166	111	145	97	128	85
	16" 12J12 (1200S200-97)	227	152	185	123	166	110	143	95	125	83	109	73	96	64
12" Members	12" 12SW16 (1200S162-43)	152	101	129	86	110	74	95	64	83	55	73	48	64	43
	16" 12SW14 (1200S162-54)	101	82	105	75	88	61	101	72	116	81	101	78	117	78
	24" 12SW12 (1200S162-68)	68	64	63	57	57	50	53	44	50	40	50	38	48	33
	12" 12SW10 (1200S200-97)	246	164	209	134	184	124	209	134	184	124	209	134	184	124
12" Members	16" 12J18 (1200S200-43)	136	110	122	93	110	80	100	69	90	60	79	53	69	46
	24" 12J16 (1200S200-54)	90	73	81	62	73	53	65	46	50	40	53	35	46	31
	12" 12J14 (1200S200-68)	303	202	258	172	221	147	191	127	166	111	145	97	128	85
	16" 12J12 (1200S200-97)	227	152	185	123	166	110	143	95	125	83	109	73	96	64
12" Members	12" 12SW16 (1200S162-43)	152	101	129	86	110	74	95	64	83	55	73	48	64	43
	16" 12SW14 (1200S162-54)	101	82	105	75	88	61	101	72	116	81	101	78	117	78
	24" 12SW12 (1200S162-68)	68	64	63	57	57	50	53	44	50	40	50	38	48	33
	12" 12SW10 (1200S200-97)	246	164	209	134	184	124	209	134	184	124	209	134	184	124
12" Members	16" 12J18 (1200S200-43)	136	110	122	93	110	80	100	69	90	60	79	53	69	46
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	12" 12J14 (1200S200-68)	303	202	258	172	221	147	191	127	166	111	145	97	128	85
	16" 12J12 (1200S200-97)	227	152	185	123	166	110	143	95	125	83	109	73	96	64

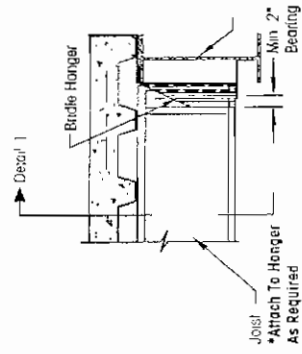
T = Total Load  
L = Live Load  
\* = Exceeds the h/T ratio of 200



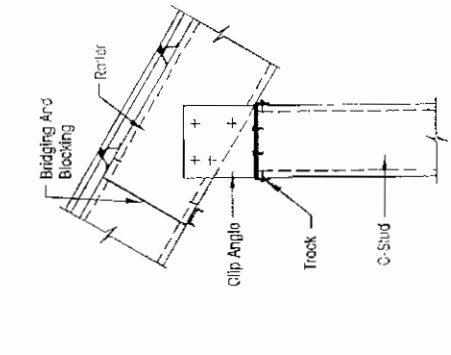
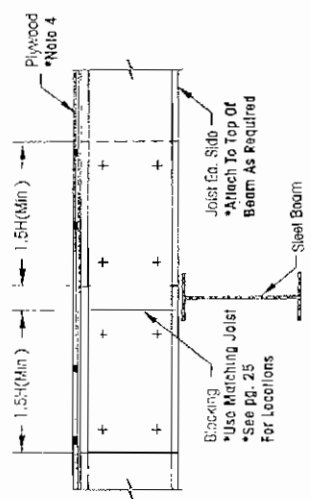
↑ JOIST @ REINFORCED CMU WALL



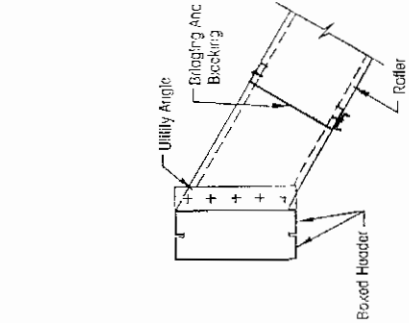
↑ JOIST @ STEEL BEAM W/ BRIDLE HANGER



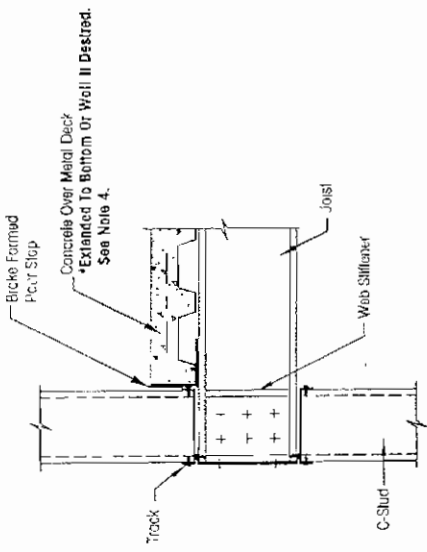
↑ LAPPED JOIST @ INTERIOR SUPPORT



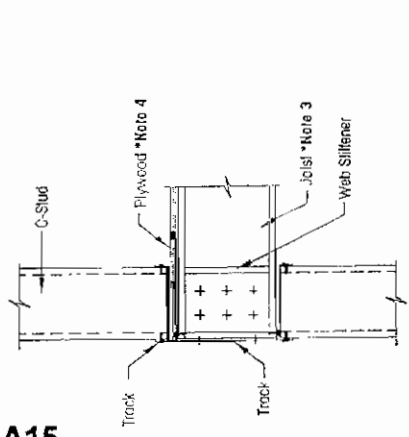
↑ RAFTER @ STUD BEARING WALL



↑ RAFTER @ RIDGE BEAM



↑ JOIST @ EXTERIOR BEARING WALL



↑ JOIST @ EXTERIOR BEARING WALL

- NOTES:**
1. Size spacing and anchorage of framing components shall be qualified by design.
  2. Reference page 31 Specification Section 3.5, Installation Joist, for additional information.
  3. Align webs of joist and stud or install continuous distribution header at top of wall below.
  4. Investigate capacity of flooring materials to transfer axial load through system.
  5. Connections between lapped joists, see detail above, are not moment resisting.

**MAXIMUM VERTICAL SPACING OF BRIDGING**

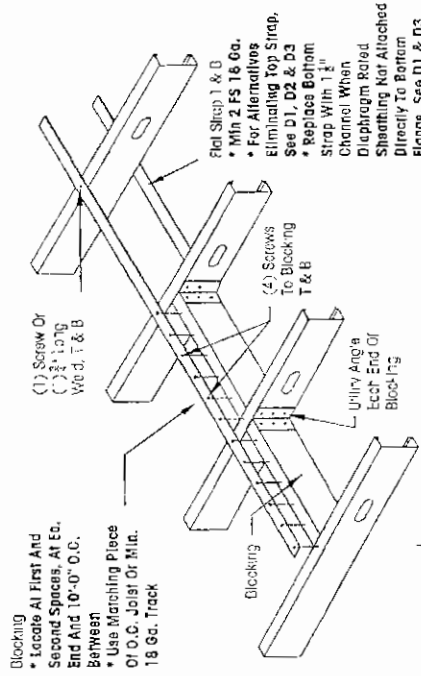
Max/Minimum Depth of Stud	Non-Axial (Curtainwall)		Axial (Load Bearing)	
	First Row	Balance	First Row	Balance
4"	5'-0"	4'-0" O.C.	3'-0"	4'-0" O.C.
6"	5'-0"	4'-0" O.C.	3'-0"	4'-0" O.C.
All Depths	5'-0" O.C. Max.	4'-0" O.C. Max.	4'-0" O.C. Max.	4'-0" O.C. Max.

**NOTES:**

In curtainwall construction, studs shall be braced against rotation by diaphragm rated sheathing board applied full height to each side of the wall. The installation of mechanical bridging, spaced 5'-0" on center, provides adequate rotational restraint for walls under construction before the installation of sheathing. Where the wall is not sheathed full height each side or sheathed on one side only, continuous bridging spaced 5'-0" on center shall provide rotational support. Reductions in allowable bearing capacity must be investigated separately. When sheathing is used to brace the studs, the products shall maintain their structural integrity during the course of construction and the service life of the wall. The attachment of the sheathing should conform to the minimum requirements of applicable standards and/or products specifications.

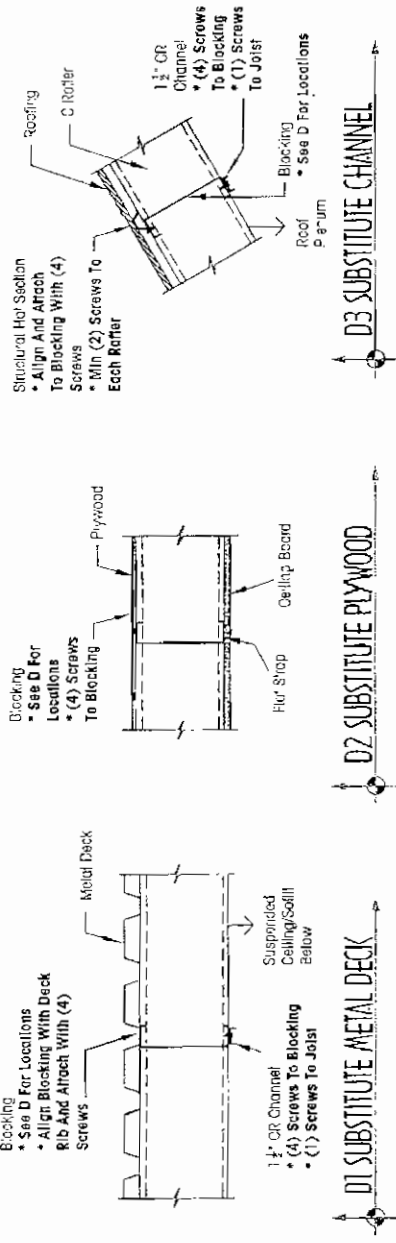
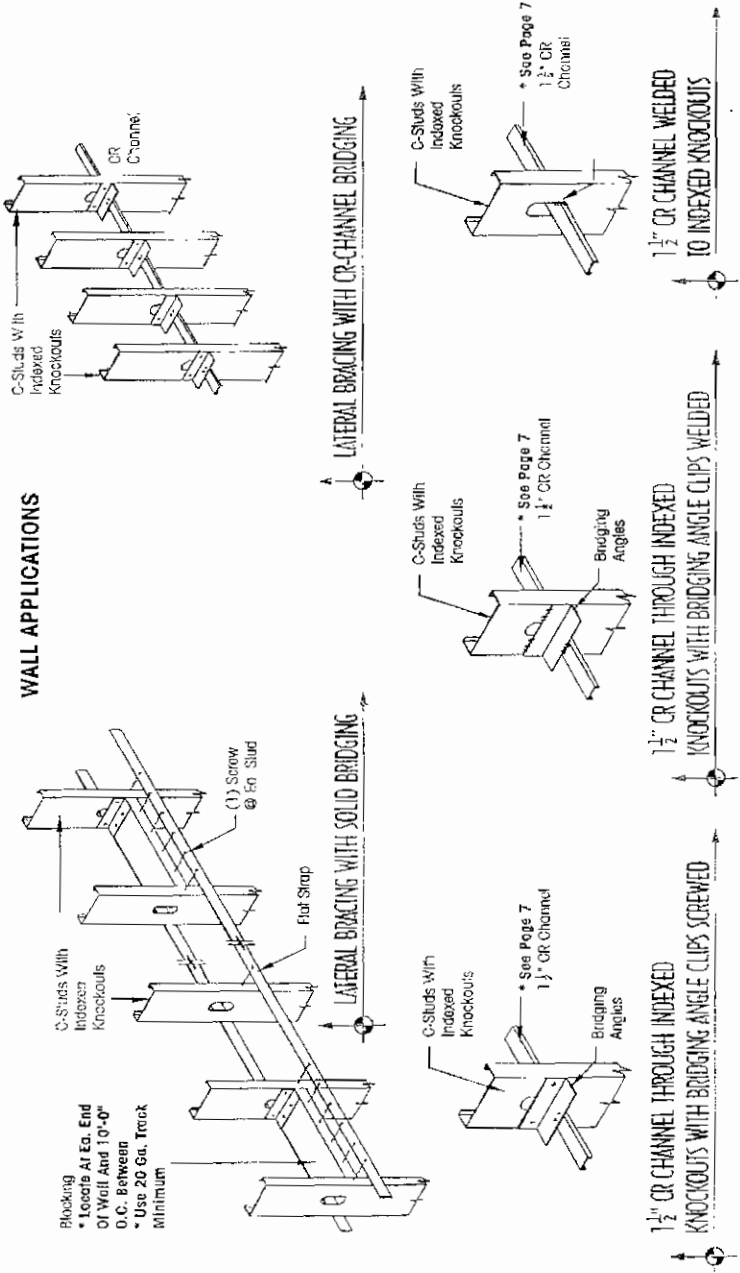
In all load bearing construction, studs shall be braced against rotation before loading. Install bridging spaced at intervals not exceeding 4'-0" on center. Reference page 3 for additional information regarding indexing of stud web knockouts. The first knockout occurs 12" from the indexed end and 24" on center thereafter.

**LOOR/ROOF APPLICATIONS**



**D FLAT STRAP AND BLOCKING**

**WALL APPLICATIONS**



**NOTE:**

The compression flange of the section should be braced by the attachment of continuous diaphragm rated sheathing or decking. Additionally mechanical bridging shall be installed at intervals not to exceed 7'-0" on center.

The following suggested specification is intended to serve as a general guide it must be modified to suit the conditions of use, with particular attention given to the deletion of inapplicable provisions.

**DIVISION 5 - METALS**  
**REFERENCE NO. 05400 - COLD FORMED METAL FRAMING**

**PART 1 - GENERAL**

**Related Work Specified Elsewhere**

*(Architect Note: List appropriate specifications sections of related work here).*

**1.2 Quality Assurance**

*(Architect Note: Quality Assurance sections should include provisions for checking shop drawings, controlled on-site inspections, etc).*

**1.3 Submittals** - The following items shall be furnished by the contractor for approval prior to fabrication or delivery of material to the site:

- 1.3.1 Shop Drawings - Shop drawings shall be documents illustrating materials, shop coatings, steel thickness, details of fabrication, details of attachment to adjoining work, size, location and spacing of fasteners for attaching framing to itself, details of attachment to the structure, accessories and their installation, and critical installation procedures. Drawings may include plans, elevations, sections and details.
- 1.3.2 Samples - Samples shall be representative pieces of all framing component parts and accessories. Unless otherwise specified, pieces shall be 12" long and tagged with name of part and manufacturer.
- 1.3.3 Certifications - Certifications shall be statements from the manufacturer certifying that the materials conform to the appropriate requirements as outlined in the contract documents.
- 1.3.4 Calculations - Engineering calculations or data shall be submitted verifying the framing assembly's ability to meet or exceed design requirements as required by local codes and authorities or by the Architect. These calculations shall include, but not be limited to the following items:
  - 1.3.4.1 Steel Framing used to support rigid materials shall be designed for an allowable deflection of L/360. Steel framing used to support semi-rigid materials shall be designed for an allowable deflection of L/240. *(Architect Note: Insert any special criteria such as more stringent deflection, wind loading etc., in this section).*
  - 1.3.4.2 All connections (member to member and member to structure) shall be thoroughly examined and designed.
  - 1.3.4.3 Selected exterior and interior walls, as required, shall be designed to provide frame stability and lateral load resistance. If diagonal steel strapping is used to transfer lateral loads to the structure and foundation, additional studs may be required to resist the vertical component of the load from the diagonal bracing.

**A17**

**SUGGESTED SPECIFICATIONS**

- 1.3.4.4 Wall bracing shall be designed to provide resistance to minor axis bending and rotation of wall studs.
- 1.3.4.5 In accordance with AISI Specifications, rigid collateral facing materials may be considered as adequate support of members against rotation.
- 1.3.5 Descriptive Literature - Manufacturer's literature containing product and installation specifications and details shall be submitted for approval.

**1.4 Applicable Documents**

- 1.4.1 ASTM Standards:
  - A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - A924 Standard Requirements for Steel Sheet, Metallic-Coated by the Hot-Dipped Process
  - C-840 Standard Specifications for the Application and Finishing of Gypsum Board
  - C-842 Standard Specification for the Application of Gypsum Veneer Plaster
  - C928 Standard Specification for the Application of Portland Cement-Based Plaster
  - C-954 Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in Thickness
  - C-955 Standard Specifications for Load Bearing (Transverse and Axial) Steel Studs, Runners (Track) and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
  - C-1007 Standard Specification for the Installation of Load-Bearing (Transverse and Axial) Steel Studs and Related Accessories.
- 1.4.2 American Iron and Steel Institute (AISI):
  - "North American Specification for the Design of Cold-Formed Steel Structural Members", latest edition.
- 1.4.3 American Welding Society (AWS):
  - Structural Welding code (D1.1) Specifications for Welding Sheet Steel in Structures (E1.3)
- 1.4.4 Military Specification (Mil. Spec):
  - MIL-P-21035...Paint, High Zinc Dust Content, Galvanizing Repair.
- 1.4.5 Federal Specification (Fed Spec):
  - FF-P-396...Pin, Drive, Guided and Pin Drive, Power Actuated Fasteners for Power Actuated and Hand Actuated Fastening Tools
  - FF-S-325...Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring Masonry)

**PART 2 - PRODUCTS**

**2.1 Materials**

- 2.1.1 All Materials shall be equal to those manufactured by MarinoWare, 400 Metuchen Road, South Plainfield, NJ, 07080. Phone: 800-627-4661

- 2.1.2 All studs and/or joists and accessories shall be of the type, size steel thickness and spacing shown on the plans. Studs, runners (track), bracing and bridging shall be manufactured per ASTM Specification C 955.

2.1.3 All galvanized studs, joists and accessories, 16ga or heavier, shall be formed from steel that conforms to the requirement of ASTM A653 with a yield of either 50 KSI or 33 KSI as specified.

2.1.4 All galvanized studs, joists and accessories, 18ga and lighter and all track sections shall be formed from steel that conforms to the requirements of ASTM A653, with a yield of 33 KSI minimum.

2.1.5 All galvanized studs, joists and accessories shall have a minimum G-60 coating if required to be in conformance with ASTM C-955. Otherwise G-40 or equivalent we be provided.

2.1.6 Physical properties and allowable load capabilities of members shall be developed in accordance with AISI, "North American Specification for the Design of Cold-Formed Steel Structural Members", latest edition.

**PART 3 - EXECUTION**

**3.1 Storage of Materials**

- 3.1.1 Products shall be protected from conditions that may cause any physical damage.
- 3.1.2 Materials shall be stored on a flat plane.
- 3.1.3 It shall be the responsibility of the project architect or engineer or their appointed personnel to determine what material is damaged (e.g. rusted, dented, bent or twisted). Any damaged materials shall be removed from the job site immediately.

**3.2 Installation General**

- 3.2.1 Methods of construction may be either piece by piece (stick-built), or by fabrication into panels either on or off site.
- 3.2.2 Connections shall be accomplished with self drilling screws or welding so that the connection meets or exceeds the design loads required at that connection.
- 3.2.3 Transversely loaded studs need not sit squarely in tracks but must be attached to them with the exception of special slip conditions that must be designed accordingly.
- 3.2.4 Axially loaded studs shall be installed seated squarely (within  $\frac{1}{8}$ " ) against the web portion of the top and bottom tracks. Tracks shall rest on a continuous, uniform bearing surface.
- 3.2.5 Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load bearing members is not permitted. Cutting of loaded members is not permitted unless under supervision of the project architect or engineer.
- 3.2.6 Temporary bracing shall be provided and left in place until work is permanently stabilized.
- 3.2.7 Bridging shall be of size and type shown on the drawings and as called for in the design calculations.

- 3.2.8 Diaphragm rated sheathing materials may be substituted for bridging, however, it shall be installed prior to loading the wall. If such material is installed on one side of the wall only, then the other stud flanges shall be bridged with suitable bridging. This bridging may be removed if and when such diaphragm rated sheathing is installed.
- 3.2.9 Install headers in all openings that is larger than the stud spacing in that wall. Form headers as shown on the drawings.
- 3.2.10 Insulation equal to the job requirements shall be placed in all jamb and header type conditions that will be inaccessible after their installation into the wall.
- 3.2.11 Provide jack studs to support each end of headers. These studs shall be securely connected to the header and must seat squarely in the lower track of the wall and be properly attached to it.
- 3.2.12 If by design a header is low in the wall, the less than full-height studs (cripples) that occur over the header shall be designed to carry all imposed loads.
- 3.2.13 Wall track shall not be used to support any load unless specifically designed for that purpose.
- 3.2.14 All axially loaded members shall be aligned vertically, to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections or alternate provisions for load transfer may be made.
- 3.2.15 Holes that are field cut into steel framing members shall be within the limitations of the product and its design. Provide reinforcement where holes are cut through load bearing members in accordance with manufacturer's recommendations and as approved by project architect or engineer.
- 3.2.16 Touch up all steel bared by welding using zinc rich paint
- 3.2.17 Studs shall be spaced to suit the design requirements and limitations of collateral facing materials.
- 3.2.18 Gypsum board shall be attached to steel studs in accordance with ASTM Specification C 840, except that the steel drill screws used (Specification ASTM C 954) shall be spaced not more than 8" on center at the edges and ends, and not more than 12" on center in the field of the board.
- 3.2.19 Metal plaster bases shall be attached in accordance with ASTM Specification C 841, except screw heads shall be of size and type suitable for positive (no movement) attachment.
- 3.2.20 Care should be taken to allow for additional studs at intersections, corners, doors, windows, control joints, etc., and as called for in the shop drawings or design calculations.
- 3.2.21 Provision for structure movement (expansion) shall be allowed where indicated and necessary by design or code requirements.
- 3.2.22 Splicing of axially loaded members shall be not permitted.
- 3.2.23 Wire tying of members is not permitted
- 3.3 Installation: Panelized Construction
- 3.3.1 Panels shall be designed to resist construction and handling loads as well as live loads.
- 3.3.2 Handling and lifting of prefabricated panels shall not cause permanent distortion in any member or collateral material.
- 3.3.3 Make oil stud to track connections prior to hoisting of panel.
- 3.3.4 Where splicing of track is necessary between stud spacing a piece of stud shall be placed in the track fastened with two screws or welds per flange to each piece of track.
- 3.3.5 Complete bearing shall be maintained under tracks to provide for load transfer in axially loaded assemblies. If the erecting contractor is bearing on work set by another trade, it is his responsibility to insure that bearing criteria are met. Any discrepancy shall be brought to the attention of the project architect or engineer.
- 3.3.6 Attachment of the panel to the structure shall be as shown on the shop drawings.
- 3.3.7 Align all panels to provide continuity of any wall/floor surface
- 3.4 Installation: Stick-Built Construction
- 3.4.1 Align track accurately of supporting structure and fasten to structure as shown on shop drawings.
- 3.4.2 Track intersections shall cut evenly
- 3.4.3 Studs shall be plumbed, aligned, and securely attached to flanges or webs of upper and lower tracks. Axially loaded studs shall be seated squarely in both top and bottom tracks
- 3.4.4 Where splicing of track is necessary between stud spacing, a piece of stud shall be placed in the track fastened with two screws or welds per flange to each piece of track.
- 3.4.5 Complete bearing shall be maintained under tracks to provide for load transfer in axially loaded assemblies. If the erecting contractor is bearing on work set by another trade, it is his responsibility to insure that bearing criteria are met. Any discrepancy shall be brought to the attention of the project architect or engineer prior to the commencement of work.
- 3.5 Installation: Joists
- 3.5.1 Joist shall be located directly over bearing studs or a load distribution member shall be provided to transfer loads.
- 3.5.2 Provide web stiffeners where necessary at reaction points, and at points of concentrated loads.
- 3.5.3 Joists shall be installed with their web area perpendicular to the bearing surface.
- 3.5.4 Bridging, either steel strap or solid, shall be provided as shown on the shop design calculations.
- 3.5.5 Provide additional joists under parallel partitions where the partition length exceeds 1/2 of the joist span.
- 3.5.6 Provide additional framing around all floor/roof openings that are larger than the joist spacing.
- 3.5.7 End blocking shall be provided where joist ends are not otherwise restrained from rotation.
- 3.5.8 Joist ends must be built solidly into masonry construction prior to placing any load on the joist.
- 3.5.9 All bridging, bracing, blocking, strapping, web reinforcement, etc., must be in place prior to loading of floors.
- 3.5.10 If the floor is to be of concrete, care must be exercised in its placement.
- 3.5.11 Core must be taken by all trades not to disturb joist placement, alignment, plumbness, etc., prior to the completion of the floor system.
- 3.5.12 Care must be taken not to overload the floor system during construction. Please place heavy loads, materials, equipment, etc., directly over structural supports, bearing walls or as directed by the architect or engineer.
- 3.6 Fastenings and Attachments
- 3.6.1 Anchorage of the tracks to the structure shall be with methods designed for that specific application. Size, penetration, type, and spacing shall be determined by design
- 3.6.2 Welds shall conform to the requirements of AWS E1.3 AWS D1.3, and AISI Manual. Welds may be butt, fillet, spot or groove type in the appropriateness of which shall be determined by and within the design calculations. All welds shall be touched up using zinc rich paint
- 3.6.3 Steel drill screws shall be of the minimum diameter indicated by the design of that particular attachment detail. Penetration through joined materials shall not be less than 3 exposed threads.
- 3.6.4 Screws shall have a protective coating at least equivalent to zinc plating when used in exterior assemblies.
- 3.7 Tolerances
- 3.7.1 Vertical alignment (plumbness) of studs shall be within 1/8" (1/8" in 10'0") of the span.
- 3.7.2 Horizontal alignment (levelness) of walls shall be within 1/4" (1/4" in 10'-0") of their respective lengths.
- 3.7.3 Spacing of studs shall not be more than 1/2" +/- from the designed spacing providing that the cumulative error does not exceed the requirements of the finishing materials
- 3.7.4 Prefabricated panels shall be not more than 1/2" +/- out of square within the length of that panel.
- 3.8 Inspections
- 3.8.1 Inspections by a qualified/independent authority shall be performed in order to assure strict conformance to the shop drawings at all phases of construction.
- 3.8.2 All members shall be checked for bearing, completeness of attachments, reinforcement, etc.
- 3.8.3 All attachments shall be checked for conformance with the shop drawings and/or the design calculations. All welds shall be touched up in accordance with Section 3.6.2.
- 3.8.4 General inspection of structure shall be completed prior to applying loads to those members.
- 3.8.5 Inspectors where and as required by local codes shall be conformed to inspection.



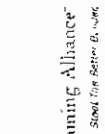
# STUD-RITE™ LIGHTWEIGHT STEEL FRAMING SYSTEMS

All technical data, tables and product properties were furnished by CSC Engineering, Kingston, NJ. Section properties are based on "American Iron and Steel Institute (AISI) North American Specification for the Design and Cold Formed Steel Structural Members," 2001 edition.

**CORPORATE OFFICES:**

**SALES OFFICES:**

**SOUTH EAST FACILITY:**



[www.marinoware.com](http://www.marinoware.com)

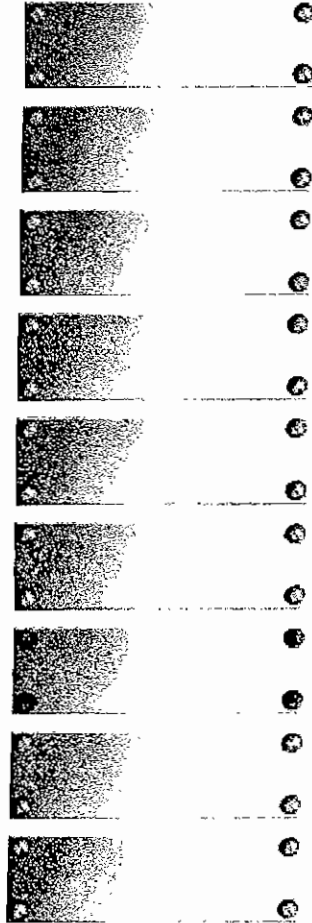


BUILDING IDEAS THAT WORK<sup>™</sup>

# ROCK-ON<sup>™</sup>

## Cement Board Fasteners

*High performance rib design is still the best!!!*

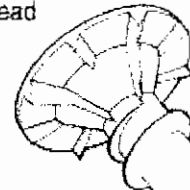


### Applications

- Cement-type boards or any dense sheathings to steel or wood studs.
- Wire lath to steel or wood studs.
- Plywood to steel or wood studs.
- Brick ties to steel or wood studs.



Ribs under head



### Product Features

- Rib design under head countersink into dense material while preventing stripouts.
- Two point types for steel and wood applications.
- Larger head diameter increases board surface contact for greater pullover resistance.



### Product Specifications

Diameter.....	#8 - S-12
	#9 - Hi-Lo
Thread Form.....	8-18 S-12
	9-15 Hi-Lo
Head Style.....	#2 Phillips Water with counter-sinking ribs
Drill Point.....	#8 Type S-12

#9 Type "S"  
 Finish.....Climacoat<sup>™</sup>

**Corrosion Resistance**

- Kesternich Results (DIN 50018, 2.0L)
  - 20 Cycles - 10% or less red rust
- Salt Spray Results (ASTM B117)
  - 500 hours - 10% or less red rust

**Selector Guide**

Part#	Length	Material Attachment Range	Applications
<b>Hi-Lo<sup>™</sup></b>			
2151500*	9 x 1-1/4"	Up to 5/8" Material Thickness to Wood 3/8" - 7/8" Material Thickness to Steel	Cement Board to Wood or Light Gauge Steel 26-20 Gauge
2153500*	9 x 1-5/8"	Up to 1" Material Thickness to Wood 3/8" to 1-1/4" Material Thickness to Steel	
2155500	9 x 2-1/4"	Up to 1-3/4" Material Thickness to Wood 1" to 1-7/8" Material Thickness to Steel	
<b>S-12<sup>™</sup></b>			
2156500*	8 x 1-1/4"	3/8" to 3/4" Material Thickness	Cement Board to Steel Studs 20-12 Gauge
2159500*	8 x 1-5/8"	3/8" to 1-1/8" Material Thickness	
2139500	8 x 2-1/4"	1" to 1-3/4" Material Thickness	

\* Fully Threaded

XXXXXXX - Now available in small box packaging.

## Performance Data

Pullout Values in Steel (Gauge)								
	26	24	22	20	18	16	14	12
S-12 $\dot{y}$	120	191	239	285	470	663	910	1424
Hi-Lo $\dot{y}$	163	242	314	370	-	-	-	-

Wood (Embedment)				
#2 SPF 2 X 4				
	3/8"	3/4"	1"	1-1/4"
Hi-Lo $\dot{y}$	223	312	555	676

Sheet Steel Gauges								
Gauge No.	12	14	16	18	20	22	24	26
Decimal Equivalent	.105"	.075"	.060"	.048"	.036"	.030"	.024"	.018"

The values listed are ultimate averages achieved under laboratory conditions and apply to Buildex manufactured fasteners only. Appropriate safety factors should be applied to these values for design purposes.

Information: submit a [request](#) or contact, [dpinto@itwbuildex.com](mailto:dpinto@itwbuildex.com)

Last modified: July 12, 2002



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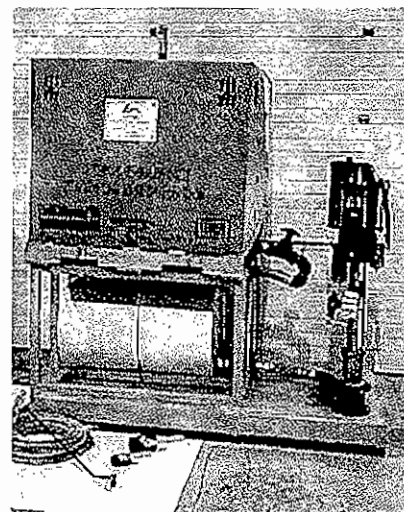


## One-Part Polyurethane Adhesive System



### THE ALPHA 5100 SYSTEM

The Alpha 5100 system is one-component polyurethane adhesive. P5100 is used in the manufactured housing industry to bond the walls and floor panels to the framework of the house. Alpha System's componentry has been carefully designed and field-tested.



P5100 is technologically advanced one-component moisture-cure polyurethane adhesive. P5100 is V.O.C. free and meets or exceeds many industry standards. During the curing process P5100 "foams-up" and this feature creates unmatched gap filling properties. Other adhesives usually shrink during the curing process. When cured, P5100 is a rigid foam with great structural integrity.

The utilization of the Alpha System allows home builders to quickly apply two 1/16" diameter beads of P5100 Polyurethane Adhesive to required framework. The moisture in the wood causes the polyurethane to foam-up. During this "open-time" period, 15-20 minutes are available to position required drywall panels or floor decking, then fasten as required.

Alpha Systems Inc. first pioneered this system in 1989. Today, nine of the top ten high volume manufactured housing producers use P5100. These major manufacturers enjoy a 90% plus reduction in "panel-pops". P5100 also has out-performed all other adhesives in the reduction and or elimination of floor squeaks. This

proven system assists home builders in applying dependable polyurethane adhesive in a fast, precise cost effective waste free manner.

**Available in 1/10 Gal Tubes, 52.9 Gal Drums, 316 Gal Totes**

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