Insular

INSULATED STEEL FRAMING SYSTEM

GUIDELINES ON DESIGNING

The following information contains some of the many possible suggestions on calculations, methods of attachment, modifications, and designing assemblies. These suggestions are not to be considered necessarily the best possible solution for your needs, but it will serve as one of many possible solutions. All attachment of connections, calculations and designing must be reviewed by a certified architect or engineer for your particular application to insure that it meets with your individual requirement and/or structural application.

Revised 9/10/99

SUMMARY

I. THE SYSTEM

1. DESCRIPTION

The Insular System is a panelized composite structure of modified expanded polystyrene (EPS), bonded to a light-gauge, galvanized steel frame. The panels are produced in a single step to provide a light-weight, energy efficient, load bearing construction system.
The panels can be installed vertically as bearing walls and horizontally as floors and roofs. In addition to the panels; top and bottom tracks, connectors, reinforcements, king and additional studs, lintels, columns, beams, channels and blocking also conform to the system. Light gauge steel is an excellent alternative for these components to be built with.

2. MATERIAL PROPERTIES

The modified expanded polystyrene beads have a Class I flame-spread rating, and a smoke-density ratio of less than 450.
The steel is No.24 gauge, Grade B, complying with ASTM A 446 ***(Ref 6***), with G-90 galvanizing conforming to ASTM A 525 ***(Ref 7).***
The main physical properties of the components of the Insular System are:

A) STUDS and 2”x1” TOP AND BOTTOM ANGLES.

24 gauge steel	
Design thickness:	0.0219 in.
Design weight:	1.0 PSF.
Fy strength:	33.0 KSI.
Modulus of Elasticity:	29,500 KSI.
Inside Bend Radius:	3/32 in.

B) EPS

Following are strength properties of the modified expanded polystyrene:

	3½” PANEL	**5½” PANEL**
Density:	1.5 PCF	1.0 PCF
ARCO Chemical Co. Compressive strength at 10% Def.	21-27 PSI	12-17 PSI
ARCO Chemical Co. Flexural strength	55-70 PSI	28-3 5 PSI
Minimum Compressive Strength at yield or 10% Def. *	18.3 PSI	11.2 PSI
Minimum Flexural Strength **	43.3 PSI	27.0 PSI

* **Minimum**, whichever occurs first, per ASTM C 578 ***(Ref 8)***
** **Minimum** values per ASTM C 578 ***(Ref 8)***

C) GLUE

The glue bonds the steel with the EPS. It is applied to the steel before molding. The bond to the foam is formed in the press, by heat reactivation combined with adequate pressure.

D) LIGHT GAUGE STEEL COMPONENTS.

Gauge	**Fy** (KSI)	**Design Thickness** (in)	**Minimum Thickness** (in)
25	33	0.0188	0.0179
22	33	0.0283	0.0269
20	33	0.0346	0.0329
18	33	0.0451	0.0428
16	50	0.0566	0.0538
14	50	0.0713	0.0677
12	50	0.1017	0.0966

Note: - Thickness is for carbon sheet steel and uncoated steel.
- Minimum thickness represents 95% of the design thickness and is the minimum acceptable thickness delivered to the job site based on Section A3.4 of ***Ref 2.***

3. PANEL DIMENSION

Typical panels are 4' wide. Other characteristics of the standard panels are ***(Ref 3):***

Panel type	Thickness	EPS density	Steel studs	Length
A-1	3½"	1.5 PCF	@ 16"O.C.	8'-l" to 12'
B-1	3½"	1.5 PCF	@ 24"O.C.	8'-l" to 12'
C-1	5½"	1.0 PCF	@ 16"O.C.	8'-l" to 12'
D-1	5½"	1.0 PCF	@ 24"O.C.	8'-l" to 12'

4. PANEL WEIGHT

TABLE No.1 illustrates the theoretical weight per panel (8' and 12') and dead load for the floor, roof and wall panels. Interpolate for other lengths.
The weights shown in the table are for the panel as delivered by the manufacturer. Consider adding dead weight for screws, channels, tracks, lintels and any other additional components.

5. INSTALLATION

- Each panel has a steel overlap strip along the vertical edge at the outside face which overlaps the edge of the next panel approximately ¾' when set in place. This overlap strip serves as a point of attachment between panels using No. 8 ⅝" self-tapping screws @ 12" O.C.

- The wall panels are placed in a No.16 or No.18 gauge steel channel.

- After the walls are erected, No.16, No.18 or No.20 gauge steel channel are attached as top tracks.

- The metal channels are bolted to the foundation. Panels are secured in place by screwing through the channel and into the panel.

- If necessary, typical X-bracings; metal columns and beams; lintels and headers; and any other metal reinforcement, can be added to the system.

- Roof panels are set and attached together to bear on roof beams, trusses or bearing wall plates.

II. THERMAL INSULATION

1. PANEL R-VALUE

The following list shows R-values (^{o}F*ft*h/Btu) 75 °F for 1" of the foam, for different densities and from different sources.

Density	**1.00 PCF**	**1.50 PCF**
ARCO Chemical Company (EPS manuf.)	3.92	4.13
Hunstman Chemical Corporation (EPS manuf.)	3.90	4.15
ASHRAE recommendations * ***(Ref 9)***	3.85	4.17
Minimum R-Values per ASTM C 578 ***(Ref 8)***	3.68	4.07

* Technical Committee 4.4 selected the data from the ASTM standards as representative values.
Note: The R-value will increase for a condition with lower temperature.

For thermal calculation purposes. the following are the R-values adopted for each type of wall

	R-value per inch	**Panel R-value:**
3.5" Wall - 1.50 PCF	4.50	**16**
5.5" Wall - 1.00 PCF	4.50	**25**

The above R-values are solely for the panels. Since there is no thermal bridge between the exterior and the interior studs, there is no other thermal loss on the panel. However, consider a 1-2% loss due to the additional components (top and tracks, additional studs, channels, lintels, etc.).

2. ASSEMBLIES

TABLE No.2 illustrates some R-values of common building materials, air spaces and films. Use only for general reference purposes only.
Example: 5½" wall, with 5/8" gypsum wallboard interior and 7/8" stucco exterior.

	R-Value	
Outside Air film: winter value - 15 mph	0.170	0.75 %
7/8" stucco exterior	0.175	0.77%
5½"panel 1.00 PCF	21.180	93.04%
5/8" gypsum board	0.560	2.46 %
Inside Air film: heat flow horizontal	0.680	2.99 %

TOTAL R-Value for the assembly 22.77

The incidence of the panel insulation's value on the total R-value shows that Insular offers superior insulation values compared to any other traditional construction system. **TABLE No.3** shows R-values for other assemblies.

III. STRUCTURAL PERFORMANCE

1. GENERAL

The allowable Insular panel loads are shown in **TABLE No.4** (reproduced from Table No.1 from the ICBO report ***(Ref3)***). The safety factor used on the table is 2.5.

The first two columns show the allowable axial uniform load. The panels were tested as columns having flat ends at the bottom. The compressive load was applied uniformly to the upper end of the panel and a ¾" steel rod was used at the bottom to provide the required eccentricity.

The second two columns illustrate the axial center point loading. In this case the load was applied through 6" long wood member with same width as the panels. The allowable loads are shown in pounds per lineal foot of panel.

For transverse load (applicable for roofs, floors and walls resisting wind loads), the panels were tested by the vacuum method, attached to their resisting top and bottom plates.

As indicated in **TABLE No.4,** the racking shear values are for panels with ½" thick gypsum wallboard attached to one side of the panel with 1-¼" long drywall screws at 12" O.C. along the perimeter and in the field.

For ICBO purposes, all the panels were tested under the ASTM E-72 Standards ***(Ref 5)***. **TABLE No.5** illustrates more tests conducted on the panels that are not shown in ***Ref 3.***

2. VERTICAL LOADS

A) Axial Uniform Loading

When dimensioning a wall to bear a uniform load, consider the following:

a. R-value - This factor will set the thickness of the wall.

b. Bearing capacity.
- Table 1- for Axial Uniform Loading from ICBO ***(Ref 3)*** **(TABLE No.4)**
- Interpolation for 9' and 10' spans is acceptable.
- Safety factor used: ***2.5*** (failure/allowable).
- **TABLE No.5** for panels with windows or doors.
- If the opening does not fit in one panel, a lintel must be calculated (See 6. Lintel calculation)
- Check the top track for flexion (See 5. Top track verification).

c. Stud separation. - Preferably match the stud separation with the truss separation, for example; @24" with @24" and @16" with @16".

B) Axial Center Point Loading

When dimensioning a wall to bear a concentrated load, consider the following:

a. R-value - This factor will set the thickness of the wall.

b. Bearing capacity. - Table 1- for Axial Center Point Loading from ICBO ***(Ref 3)*** **(TABLE No.4)**

- Interpolation for 9' and 10' spans is acceptable.
- Safety factor used: 2.5 (failure/allowable).
- **TABLE No. 5** for panels with windows or doors.
- If the opening does not fit in one panel, a lintel must be calculated (See 6. Lintel calculation).
- Check the top track for flexion (See 5. Top track verification).

c. Stud Separation - Preferably match the stud separation with the truss separation, for example; @24" with @24" and @16" with @16".

3. TRANSVERSE LOADS

Transverse loads are applied in the plane of the panel. It could be wind for a wall or gravitational and/or uplift for roofs and/or floors.
If the applicable load exceeds the allowable transverse load showed in Table No. 1 from ICBO **(Ref 3) (TABLE No.4)**, a mid-length support could be the solution. Using the equivalent stress method for different spans or by using **TABLE No. 5,** the allowable load can be obtained for such conditions.

4. RACKING SHEAR

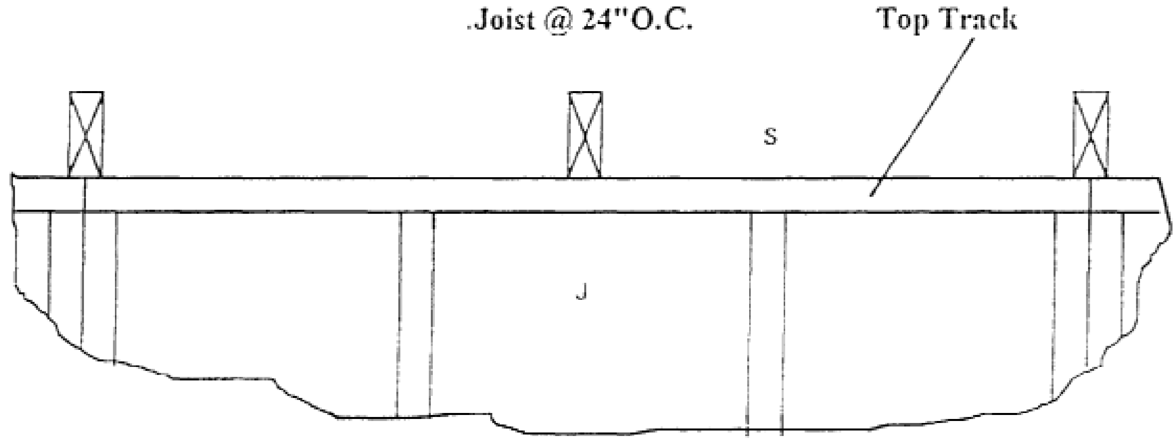
Table No. 1 from ICBO **(Ref 3) (Table No. 4)** shows the maximum allowable racking shear load in PLF.
As indicated in the ICBO report, those racking shear values are for panels with ½" thick gypsum wallboard attached to one side of the panel with 1-1/4" long drywall screws at 12" O.C. along the perimeter and in the field.
If those values are exceeded by the shear load, a shear reinforcement can be installed (Sec 8. Shear Reinforcement). Lateral load design including details for resistance to racking shear need to be submitted to the building official for approval.

5. TOP TRACK VERIFICATION

If the distance between studs and the distance between trusses is the same (@24"O.C. or @16"O.C.) it is recommended to bear each truss on each stud. The allowable axial center point load from Table No. 1 from ICBO **(Ref 3) (TABLE No. 4)** must be checked. If the distance between studs and the distance between trusses does not match, it is very likely that one truss will land in the center of two studs. If trusses or joists @ 24"O.C. bear on panels with metal 16"O.C., one joist will land between the two studs. The top track must be checked for the following moments:

$Ms = -P \times 16''/(40/3)$ negative moment @ studs.
$Mj = P \times 16''/(40/7)$ moment @ centered joist.

where P = joist (or truss) reaction. See figure in next page.



Studs @ 16”O.C.

The required section modulus will be Sreq = Ma * Ωf/ Fy,
where Ωf = 1.67 for Flexural members, flexure only.
TABLE No.6 shows allowable centered point loads (P_{allow}) and uniform loads (W_{allow}) for different types of top track. The uniform load moments are based on wL^2/12 for a continuous case loading.

6. LINTEL CALCULATION

TABLE No.7 shows the effective and full section modulus for angles b wide x d tall and for different gauges.
If there is an opening (door or window) that does not fit in a panel, a lintel should be considered as a good solution. To size the lintel, the span and the load must be known (see figure B-1.Details). The span will be distance between two full studs next to either side of the opening. The moment (M_a) will be a function of the span and loads applied.
The required section modulus will be Sreq = M_a * Ωf / Fy,
where Ωf = 1.67 for Flexural members, flexure only.

The reactions on the panels must be checked against the allowable axial center **point** load from Table No.1 from ***Ref 3*** **(TABLE No.4). If the reactions exceed the allowable load,** then either the lintel must be longer and bear on top of more studs, or a king stud can be installed.

7. ADDITIONAL COLUMN

If a concentrated load that applies to a panel exceeds its maximum capacity for point loads, then an additional stud is a good alternative. It consists of one or two (depending on the load) “C” channels connected back to back installed in between two panels (see figure1. Load Bearing Wall).

The size of the web will be determined by the thickness of the panel (3½" or 5½”). Flanges and gauge will be determined by the loads applied, the length of the column and the end conditions.

8. SHEAR REINFORCEMENT

If the racking shear loads shown in Table No. 1 from ICBO ***(Ref 3)*** **(TABLE No.4)** are not sufficient then a shear reinforcement is required.

One solution is an X-Bracing, on one or both sides of the wall.

Figure 4 - Shear Reinforcement shows all the components of an X-bracing, that need to be engineered:

- Lateral Stability straps.
- Multiple member at ends.
- Top and bottom tracks.
- Holddowns.
- Anchors.
- Gusset plates.
- Screws.

9. FENCE

Insular panels can also be used to build fences. The panels will be installed horizontally fastened to columns @ 8’O.C. or 10’ O.C. The columns (as in *7.* ADDITIONAL STUD) consist of two “C’ channels connected back to back installed in between two panels.

See **Figure 5. FENCE** for details.

10. STAGGERING PANELS

In roof and floor applications, the most convenient way of connection is by staggering the panels half their length. Each panel will be connected to two others half their lap. Additional connection plates might be required to connect the studs of two contiguous panels.

The same criteria can be followed for walls that exceed 12’ height.

11. KING STUD

If the size and length of the lintel becomes insufficient, then a king stud on each side of the opening should be installed. King studs consist of “C” channels installed on each side of the opening. The size of the web will be determined by the thickness of the panel (3½” or 5½”). Flanges and gauge will be determined by the loads applied, the length of the stud and the end conditions.

IV. FIRE RESISTANCE

1. GENERAL

Panels have been tested as a wall system with gypsum board thermal for 15 minutes, 1-hour and 2-hour ratings. Most codes require a 15 minute minimum thermal barrier.

	3½" - 1.5 PCF	5½" - 1.0 PCF
UL Flame Spread Rating	**5-10**	**5-20**
UL Smoke Developed Rating	**65-300**	**125-175**

Note: Rating ranges are from four manufacturers of the EPS beads and were determined while the material remained in the original test position.

2. 1-HOUR FIRE RESISTANCE RATED WALL ASSEMBLY

Where Insular panels are installed in fire resistance rated assembly, they shall be constructed in accordance with the details set forth in the manufacturer's instructions and the following:

1. One-hour fire resistance rated wall assembly consists of a modified 5½" panel with metal 24" O.C. protected with one layer of 5/8" Type X gypsum wallboard on both faces, attached using 1-5/8", type S, bugle head, self-tapping screws 12" O.C. All joints must be taped with joint tape and compound. Panels are attached to one another using No.8-5/8" self-tapping screws placed 12" O.C.
The assembly was tested to ASTM E 119 with an applied uniform compressive load of 300 PLF (or 33% of allowable design load). The modification to the panel was to manufacture the panel with a recess along the exposed face's vertical joints which allows the insertion of 3" wide strips of 5/8" thick Type X gypsum board panels. The strips are secured using 1" long, Type X, bugle head, self-tapping screws at 12" O.C.

2. Another one-hour fire resistance rated wall assembly consists of a modified 5½" panel with metal @24" O.C. protected on each side with: 5/8" Type X gypsum panel, 1-3/8" thick fiberglass insulation, and a ½" thick regular gypsum panel. The 5/8" gypsum board is attached using 1-½" self-tapping screws @ 12" O.C.. Hat studs are attached to the metal channel of the panel through the 5/8" gypsum board using 1-½" long self-tapping screws 12"O.C. The ½" gypsum board is then attached to the hat studs using 1" self-tapping screws @ 12" O.C. All joints must be taped with joint tape and compound. Panels are attached to one another using No.8 5/8" self-tapping screws placed 12" O.C.
The assembly was tested to ASTM El 19 with an applied uniform compressive load of 1250 PLF (or 96% of allowable design load).

See attached tests report and the panel approval as one-hour for property line setback mitigation issued by the Big Bear City Fire Department.

EPS COMBUSTION TOXICITY

As currently written, model building codes have deleted references to toxicity because it is recognized there is no acceptable test protocol simulating actual fire conditions.

Nevertheless, we are called upon by specifiers, code officials and fire marshals to establish relative toxicity levels of EPS versus other building materials. We have responded with a variety of test results from laboratories in Europe and the USA.

To inform you, we reprint below a summary of results contained in DBR Paper #711, Division of Building Research, National Research Council of Canada.

	TOXICITY FACTORS DUE TO:					MAXIMUM SUM OF
MATERIAL	CO	CO_2	HCl	HCN	OTHERS	TOXICITY FACTORS
Polystyrene	19	2				20
Polyethylene	21	1				20
Polyester fabric	24	2				30
Phenolic resin	5	1			22	30
Wood (white pine)	47	3				50
Cotton	59	2				60
PVC	12	1	343			360
Wool		1		375		390
ABS	10	1		367		230
Urethane (rigid)	14	1		273		290
Nylon-6	17	1		931		950
Polyacrylonitrile	7	1		1,201		1,201

As used in the test program and results, the term “Sum of Toxicity Factors” gives an indication of the potential hazard of a material in generating toxic gases and vapors.

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Denis C. Boyle
Business Manager
Polystyrenics & Engineering Resins

November 7, 1986

EPS DOES NOT THREATEN THE OZONE LAYER

Dear Customer:

In the past week the theory that chlorofluorocarbons reducing or eroding the atmospheric ozone layer has gained national attention. It has been featured on programs such as 20/20 on ABC-TV and Cable News Network as well as being picked up by prominent newspapers such as The New York Times and Wall Street Journal.

The scientific community has documented erosion of the ozone layer over recent years. The specific cause is unknown, but some scientists speculate that this is mainly due to the release of chlorofluorocarbons. These gases are widely used throughout the world in refrigeration systems, aerosol cans and some plastic foams, It is the area of the plastic foams on which there seems to be a great deal of confusion and misunderstanding.

I am writing this letter to clarify the situation with expandable polystyrene. There are no chlorofluorocarbons in the expandable polystyrene that we currently market under the tradename of DYLITE® Expandable Polystyrene. The blowing agent that is currently used in the manufacture of EPS is pentane, which is totally unrelated to the chlorofluorocarbons/ozone controversy.

If you have any questions or need additional information on this subject, please contact your local DYLITE resin sales representative for further information.

Sincerely,

EPS DOES NOT THREATEN THE OZONE LAYER

APPENDIX

A. References

1. - UBC 1994

2. - AISI - “Specifications for the Design of Cold-Formed Structural Members” 1986 edition, including the 1989 amendments

3. - ICBO Report No. PFC-4216

4. - BOCA Report No. 91-40

5. - ASTM E 72 - “Standard Methods of Conducting Strength Tests of Panels for Building Construction”

6. - ASTM A 446- “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality”

7. - ASTM A 525 - “Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process”

8. - ASTM C 578- “Standard Specification for Rigid, Cellular, Polystyrene Thermal Insulation”

9. - ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) - Fundamentals

TABLE No. 1
PANEL WEIGHT

PANEL TYPE	STEEL (sq ft)	STEEL (#)	EPS (cu ft)	EPS (#)	TOTAL PANEL WEIGHT (#)	DEAD LOAD ROOF WEIGHT (PSF)	DEAD LOAD WALL WEIGHT (PLF)	DEAD LOAD WALL WEIGHT (Height)
4 x 8 x 3.5 @ 24	24.00	28.00	10.00	14.00	42.00	1.30	10.00	8'wall
4 x 8 x 3.5 @ 16	31.00	35.00	10.00	14.00	49.00	1.50	12.00	8'wall
4 x 8 x 5.5 @ 24	24.00	28.00	15.00	15.00	43.00	1.30	10.00	8'wall
4 x 8 x 5.5 @ 16	31.00	35.00	15.00	15.00	50.00	1.50	12.00	8'wall
4 x 12 x 3.5 @ 24	34.00	39.00	14.00	21.00	60.00	1.30	16.00	12' wall
4 x 12 x 3.5 @ 16	44.00	51.00	14.00	21.00	71.00	1.50	18.00	12' wall
4 x 12 x 5.5 @ 24	34.00	39.00	22.00	22.00	61.00	1.30	16.00	12'wall
4 x 12 x 5.5 @ 16	44.00	51.00	22.00	22.00	73.00	1.50	18.00	12' wall

TABLE NO. 2 RESISTANCE FACTOR (R) OF COMMON BUILDING MATERIALS. AIR SPACES AND FILMS

BUILDING BOARD		**R-VALUE**
Gypsum Board	½”	0.45
Gypsum Board	5/8”	0.56
	¼”	0.31
	¾”	0.47
	½”	0.94
Insulation Board Sheathing	1”	1.32
	½”	1.32
	¼”	2.63
		0.31
Harboard Underlayment	1”	0.72
BUILDING PAPER		
Permeable Felt. 15 lb		0.06
Plastic Film		Neg
MASONRY MATERIALS		
Concrete blocks. three oval cores		
Cinder aggregate	4” thick	1.11
	12" thick	1.89
	8" thick	1.72
Sand and Gravel Aggregate	8" thick	1.11
Lightweight Aggregate	8" thick	2.00
	4” thick	1.50
Gypsum Mortar or Plaster	¼”	0.05
	½"	0.10
	1"	0.20
Gypsum Plaster (Perlite)	1”	.064
Gypsum Plaster (Vermiculite)	1"	0.59
Brick. Per Inch		0.20
Fake Brick. Per Inch		0.11
Stucco. Per Inch		0.20
ROOFING MATERIALS		
Asbestos Cement Shingles		0.21
Asphalt Roll Roofing		0.15
Asphalt Shingles		0.44
Built Up Roofing	⅜”	0.33
Wood Shingles		0.94
SIDING MATERIAL		
Asbestos Cement thick lapped		0.21
Asphalt		0.15
Wood Shingle.	16" x 7½" Exposure	0.87
	Double with 12” Exposure	1.19
Wood Drop Siding, 1” x 8"		0.77
Wood Bevel Siding ½" x 8" (lapped)		0.81
Wood Bevel Siding ¾” x 10" (lapped)		1.05
Wood Plywood.	⅜” (lapped)	0.59
Structural Glass		0.10
INSULATION MATERIALS		
Insulation Board—		
Huntsman EPS @ 2.0 pcf 75°F		4.4
Huntsman EPS @ 1.0 pcf 75°F		3.9
Extruded EPS w. skins 175°F Aged		5.0
Polyurethane Polyisocyanates (I is 75°F)		5.6
Insulation Batts. blankets		
Mineral Wool Per Inch 75°F		3.66
Insulation Loose Fill		
EPS		3.4
Celluslosic inch		3.1-3.7

Insulation Materials continued	**R-VALUE**
Perlite. Expanded inch	2.7
Mineral Fiber inch	2.2-2.9
Vermiculate Exfoliated inch	2.1-2.3
AIR SPACES(¾”)	**R-VALUE**
Heat Flow Up	
Non-reflective	0.75 (Summer)
	0.87 (Winter)
Reflective, one surface	2.22 (Summer)
	2.21 (Winter)
Heat Flow Down—	
Non-reflective	
	0.85 (Summer)
Reflective. one surface	1. 02 (Winter)
	3.29 (Summer)
Heat Flow Horizontal—	3. 59 (Winter)
Non-reflective	
	0.84 (Summer)
Reflective. one surface	1.01 (Winter)
	3.24 (Summer)
	3.46 (Winter)
SURFACE AIR FILMS, INSIDE (STILL AIR)	
Heat flow Up (through a horizontal surface)	
Non-reflective	0.61
Reflective	1.32
Heal Flow Down (through a horizontal surface)	
Non-reflective	0.92
Reflective	4.55
Heat Flow Horizontal (through a vertical surface)	
Non-reflective	0.68
MOVING AIR SURFACES	
Any Position or Direction	
15 mph wind (Winter)	0.17
7.5 mph wind (Summer)	0.25

EXAMPLE

Determine EPS required for typical insulated steel desk. under winter conditions when the U-value required is 0 05 MAX

Given — Substrate Components	R-Values
Outside Air Film (15 mph)	0.17
BUR. ⅛ inch	0.33
Fiberboard. ½ inch	1.32
Molded EPS	2
Gypsum. ⅝ inch. Type X	0.56
Metal Deck	0.00
Inside Air Film (Heat Flow Up Non-reflective)	0.61
Total R Without EPS	2.99
Total R Required =	20.00

20.00 - 2.99 = 17.01 R EPS Required
Molded EPS at 1.0 pcf and 25°F = 4.4 R inch
Therefore. 17.01 / 4.4 = 387 inches EPS required
Quote 4 inches Type I molded EPS

TABLE No.3 R-value for wall and floor assemblies

WALL	Thickness	R p/inch	R		
Outside surface			0.17	15 mph (winter)	1.07%
7/8” Stucco			0.18		1.10%
3½” Thermasteel Panel	3.50	4.10	14.35	1.5 PCF	90.05%
5/8” Gypsum			0.56		3.51%
Inside surface			0.68		4.27%
		R=	15.94		
WALL	**Thickness**	**R p/inch**	**R**		
Outside surface			0.17	15 mph (winter)	0.75%
3/8” Stucco			0.08		0.35%
5½”Thermasteel Panel	5.50	3.85	21.18	1.0 PCF	93.88%
½” Gypsum			0.45		2.00%
Inside surface			0.68		3.01%
		R=	22.56		
ROOF	**Thickness**	**R p/inch**	**R**		
Outside surface			0.17	15 mph (winter)	0.73%
Asphalt shingles			0.4	70 lb/ft3	1.71%
Plywood (Douglas Fir)	0.50		0.62	34 lb/ft3	2.69%
5½” Thermasteel Panel	5.50	3.85	21.18	1.5 PCF	90.39%
½” Gypsum			0.45		1.92%
Inside surface			0.61		2.60%
		R=	23.43		
ROOF	**Thickness**	**R p/inch**	**R**		
Outside surface			0.17	15 mph (winter)	0.74%
Metal			0.00		0.00%
Plywood (Douglas Fir)	0.50		0.62	34 lblft3	2.69%
5½” Thermasteel Panel	5.50	3.85	21.18	1.5 PCF	91 .97%
½” Gypsum Board			0.45		1.95%
Inside surface			0.61		2.65%
		R=	23.03		

TABLE No.4

TABLE No. 1 - ALLOWABLE ROOF AND WALL PANEL LOADS

ALLOWABLE LOADS [1]							
	Axial Uniform Loading		Axial Center Point Loading		Transverse		Racking Shear [2,3]
PANEL TYPE	8' Span (plf)	12' Span (plf)	8' Span (plf)	12' Span (plf)	8' Span [4] (psf)	12' Span[5] (psf)	(plf)
A – 1	1195	1120	595	-	25	10	165
B – 1	915	795	585	-	20	5	70
C – 1	1265	1230	630	890	40	15	125
D – 1	910	970	590	735	30	10	65

1. Values are not subject to increase for duration of loads and are for a minimum of 4 foot-wide panels with no openings.
2. The maximum height to width panel ratio is 2.
3. The racking shear values are for panels with ½" thick gypsum wallboard attached to one side of the panel with 1-¼" long drywall screws at 12" O.C. along the perimeter and in the field.
4. Values are for panel span equal to panel height (8 feet) or panels having a maximum cantilever of 2 feet.
5. Values are for panel span equal to panel height (12 feet) or panels having a maximum cantilever of 4 feet.

TABLE No.6
TOP TRACK CAPACITY

PANEL	Q allow	P allow	TOP TRACK					W allow	P allow
	PANEL		GAUGE	Fy-1	SPAN	Web	Flange	TOP VALUES	
Length=8'	(PLF)	(PLF)	(#)	(KSI)	(IN)	(IN)	(IN)	(PLF)	(#)
3½" @ 16 O.C.	1195	595	20	33	16.00	3.50	1.00	**217**	**138**
			20	33	16.00	3.50	1.00	**462**	**293**
			20	33	16.00	3.50	1.00	**783**	**497**
			20	33	16.00	3.50	1.00	**1173**	**745**
			18	33	16.00	3.50	1.00	**283**	**180**
			18	33	16.00	3.50	1.00	**615**	**391**
			18	33	16.00	3.50	1.00	**1051**	**667**
			18	33	16.00	3.50	1.00	**1195**	**1005**
			16	50	16.00	3.50	1.00	**532**	**338**
			16	50	16.00	3.50	1.00	**1163**	**738**
			16	50	16.00	3.50	1.00	**1195**	**1190**
			16	50	16.00	3.50	1.00	**1195**	**1190**
3½" @ 24 O.C.	915	585	20	33	24.00	3.50	1.00	**96**	**n/a**
			20	33	24.00	3.50	1.50	**205**	**n/a**
			20	33	24.00	3.50	2.00	**348**	**n/a**
			20	33	24.00	3.50	2.50	**521**	**n/a**
			18	33	24.00	3.50	1.00	**126**	**n/a**
			18	33	24.00	3.50	1.50	**274**	**n/a**
			18	33	24.00	3.50	2.00	**467**	**n/a**
			18	33	24.00	3.50	2.50	**703**	**n/a**
			16	50	24.00	3.50	1.00	**249**	**n/a**
			16	50	24.00	3.50	1.50	**547**	**n/a**
			16	50	24.00	3.50	2.00	**915**	**n/a**
			16	50	24.00	3.50	2.50	**915**	**n/a**
5½" @ 16 O.C.	1265	630	20	33	16.00	5.50	1.00	**220**	**140**
			20	33	16.00	5.50	1.50	**470**	**299**
			20	33	16.00	5.50	2.00	**796**	**505**
			20	33	16.00	5.50	2.50	**1192**	**757**
			18	33	16.00	5.50	1.00	**290**	**184**
			18	33	16.00	5.50	1.50	**630**	**400**
			18	33	16.00	5.50	2.00	**1077**	**684**
			18	33	16.00	5.50	2.50	**1265**	**1029**
			16	50	16.00	5.50	1.00	**546**	**347**
			16	50	16.00	5.50	1.50	**1192**	**757**
			16	50	16.00	5.50	2.00	**1265**	**1260**
			16	50	16.00	5.50	2.50	**1265**	**1260**
5½" @ 24 O.C.	910	590	20	33	24.00	5.50	1.00	**98**	**n/a**
			20	33	24.00	5.50	1.50	**209**	**n/a**
			20	33	24.00	5.50	2.00	**354**	**n/a**
			20	33	24.00	5.50	2.50	**530**	**n/a**
			18	33	24.00	5.50	1.00	**129**	**n/a**
			18	33	24.00	5.50	1.50	**280**	**n/a**
			18	33	24.00	5.50	2.00	**478**	**n/a**
			18	33	24.00	5.50	2.50	**720**	**n/a**
			16	50	24.00	5.50	1.00	**243**	**n/a**
			16	50	24.00	5.50	1.50	**530**	**n/a**
			16	50	24.00	5.50	2.00	**907**	**n/a**
			16	50	24.00	5.50	2.50	**910**	**n/a**

TABLE No.7
Lintels

Fy	50 ksi	12, 14, 16 gauge
Fy	33 ksi	18 gauge
E	29500 ksi	

					Corner		Effective	
b	**d**	**Gage**	Fy	t	R	ycg	Ie	Se
(in)	(in)	#	(ksi)	(in)	(in)	(in)	(in4)	(in3)
1.5	6.0	12	50	0.1017	0.1875	2.3636	2.661	0.732
1.5	7.0	12	50	0.1017	0.1875	2.8447	4.095	0.986
1.5	8.0	12	50	0.1017	0.1875	3.3300	5.950	1.274
1.5	9.0	12	50	0.1017	0.1875	3.8200	8.270	1.597
1.5	10.0	12	50	0.1017	0.1875	4.3135	11.103	1.952
1.5	11.0	12	50	0.1017	0.1875	4.8082	14.505	2.343
1.5	12.0	12	50	0.1017	0.1875	5.3040	18.526	2.767
2.5	6.0	12	50	0.1017	0.1875	2.2486	2.859	0.762
2.5	7.0	12	50	0.1017	0.1875	2.7343	4.355	1.021
2.5	8.0	12	50	0.1017	0.1875	3.2240	6.279	1.315
2.5	9.0	12	50	0.1017	0.1875	3.7162	8.680	1.643
2.5	10.0	12	50	0.1017	0.1875	4.2101	11.609	2.005
2.5	11.0	12	50	0.1017	0.1875	4.7052	15.117	2.401
2.5	12.0	12	50	0.1017	0.1875	5.2012	19.255	2.832
3.5	6.0	12	50	0.1017	0.1875	2.2081	2.928	0.772
3.5	7.0	12	50	0.1017	0.1875	2.6939	4.451	1.034
3.5	8.0	12	50	0.1017	0.1875	3.1837	6.404	1.330
3.5	9.0	12	50	0.1017	0.1875	3.6761	8.838	1.660
3.5	10.0	12	50	0.1017	0.1875	4.1702	11.804	2.025
3.5	11.0	12	50	0.1017	0.1875	4.6655	15.352	2.424
3.5	12.0	12	50	0.1017	0.1875	5.1617	19.535	2.857
1.5	6.0	14	50	0.0713	0.0938	2.4911	1.806	0.515
1.5	7.0	14	50	0.0713	0.0938	2.9854	2.764	0.688
1.5	8.0	14	50	0.0713	0.0938	3.4812	4.004	0.886
1.5	9.0	14	50	0.0713	0.0938	3.9781	5.563	1.108
1.5	10.0	14	50	0.0713	0.0938	4.4757	7.475	1.353
1.5	11.0	14	50	0.0713	0.0938	4.9737	9.776	1.622
1.5	12.0	14	50	0.0713	0.0938	5.4721	12.503	1.915
2.5	6.0	14	50	0.0713	0.0938	2.4460	1.862	0.524
2.5	7.0	14	50	0.0713	0.0938	2.9406	2.840	0.700
2.5	8.0	14	50	0.0713	0.0938	3.4368	4.103	0.899
2.5	9.0	14	50	0.0713	0.0938	3.9339	5.687	1.123
2.5	10.0	14	50	0.0713	0.0938	4.4317	7.628	1.370
2.5	11.0	14	50	0.0713	0.0938	4.9300	9.961	1.641
2.5	12.0	14	50	0.0713	0.0938	5.4286	12.722	1.936
3.5	6.0	14	50	0.0713	0.0938	2.4277	1.885	0.528
3.5	7.0	14	50	0.0713	0.0938	2.9224	2.870	0.704
3.5	8.0	14	50	0.0713	0.0938	3.4187	4.143	0.904
3.5	9.0	14	50	0.0713	0.0938	3.9160	5.737	1.128
3.5	10.0	14	50	0.0713	0.0938	4.4139	7.690	1.377
3.5	11.0	14	50	0.0713	0.0938	4.9123	10.035	1.648
3.5	12.0	14	50	0.0713	0.0938	5.4110	12.810	1.944

TABLE No.7
Lintels

Fy	50 ksi	12, 14, 16 gauge
Fy	33 ksi	18 gauge
E	29500 ksi	

					Corner		Effective	
b	**d**	**Gage**	Fy	t	R	ycg	Ie	Se
(in)	(in)	#	(ksi)	(in)	(in)	(in)	(in4)	(in3)
1.5	6.0	16	50	0.0566	0.0938	2.5585	1.377	0.400
1.5	7.0	16	50	0.0566	0.0938	3.0549	2.113	0.536
1.5	8.0	16	50	0.0566	0.0938	3.5523	3.070	0.690
1.5	9.0	16	50	0.0566	0.0938	4.0504	4.274	0.864
1.5	10.0	16	50	0.0566	0.0938	4.5489	5.755	1.056
1.5	11.0	16	50	0.0566	0.0938	5.0477	7.541	1.267
1.5	12.0	16	50	0.0566	0.0938	5.5467	9.661	1.497
2.5	6.0	16	50	0.0566	0.0938	2.5305	1 405	0.405
2.5	7.0	16	50	0.0566	0.0938	3.0272	2.151	0.541
2.5	8.0	16	50	0.0566	0.0938	3.5248	3.118	0.697
2.5	9.0	16	50	0.0566	0.0938	4.0231	4.335	0.871
2.5	10.0	16	50	0.0566	0.0938	4.5218	5.830	1.064
2.5	11.0	16	50	0.0566	0.0938	5.0207	7.632	1.276
2.5	12.0	16	50	0.0566	0.0938	5.5199	9.768	1.507
3.5	6.0	16	50	0.0566	0.0938	2.5190	1.416	0.407
3.5	7.0	16	50	0.0566	0.0938	3.0158	2.166	0.544
3.5	8.0	16	50	0.0566	0.0938	3.5136	3.138	0.699
3.5	9.0	16	50	0.0566	0.0938	4.0120	4.360	0.874
3.5	10.0	16	50	0.0566	0.0938	4.5107	5.861	1.068
3.5	11.0	16	50	0.0566	0.0938	5.0098	7.669	1.280
3.5	12.0	16	50	0.0566	0.0938	5.5089	9.812	1.512
1.5	6.0	18	33	0.0451	0.0938	2.5665	1.097	0.320
1.5	7.0	18	33	0.0451	0.0938	3.0632	1.683	0.427
1.5	8.0	18	33	0.0451	0.0938	3.5609	2.444	0.551
1.5	9.0	18	33	0.0451	0.0938	4.0591	3.402	0.689
2.5	6.0	18	33	0.0451	0.0938	2.5399	1.118	0.323
2.5	7.0	18	33	0.0451	0.0938	3.0369	1.711	0.432
2.5	8.0	18	33	0.0451	0.0938	3.5347	2.481	0.556
2.5	9.0	18	33	0.0451	0.0938	4.0332	3.449	0.694