WIND SPEED AND DESIGN CRITERIA FOR FLEXIBLE FACE SIGNS CONSTRUCTED OF ABC EXTRUSIONS

2005 EDITION

This edition is based upon ASCE 7-98 recommendations for wind speed and wind loads. These have changed since the last edition of this criteria was published by ABC. The new edition also includes valuable new information for the proper selection and use of steel plates and bolts for connecting ABC extrusions to center pole mounted signs.

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WIND SPEED AND DESIGN CRITERIA FOR FLEXIBLE FACE SIGN CONSTRUCTION WITH ABC EXTRUSIONS.

This is your reference source to build sign cabinets from the ABC A/Flexframe assemblies to properly support flexible face for any given wind-load which may be required.

NOTE: This information is intended to assist sign designers and sign builders in the proper construction of these assemblies. These guidelines are suitable for signs up to 250 square feet per face. Complete sign design should be reviewed by a certified structural engineer for signs larger than 250 square feet in area.

The structural strength of any sign cabinet with flexible face is extremely important. Unlike rigid plastic face, which are merely suspended on the frame, (free to expand and contract), flexible faces are attached to the frame much like a drumhead, and the tension load plus the total wind-load is imposed upon the minor axis of the frame.

By using simple engineering formulae, the ABC A/Flexframes are easy and economical to build to meet any required wind-load, with much less internal bracing than would be required for angle iron and sheet metal construction.

Three items of information are required to determine the proper structural design of the A/Flexframe for the installation of flexible faces.

1. Local wind load requirements based upon the Isotac map (Below).
2. The Distance from grade to the top of the sign cabinet.
3. Wind speed and design criteria.

To properly design the application of our A/Flexframe assemblies, please be sure that all the following steps are taken:

1. Determine the wind velocity from the Isotac Map for your area.
2. Determine the Design Wind Pressure from the table below, or obtain that information from local building codes.

DESIGN WIND PRESSURE TABLE

Distance from Ground To Top of Sign Cabinet — Design Wind Pressure (Pounds per square Ft.)

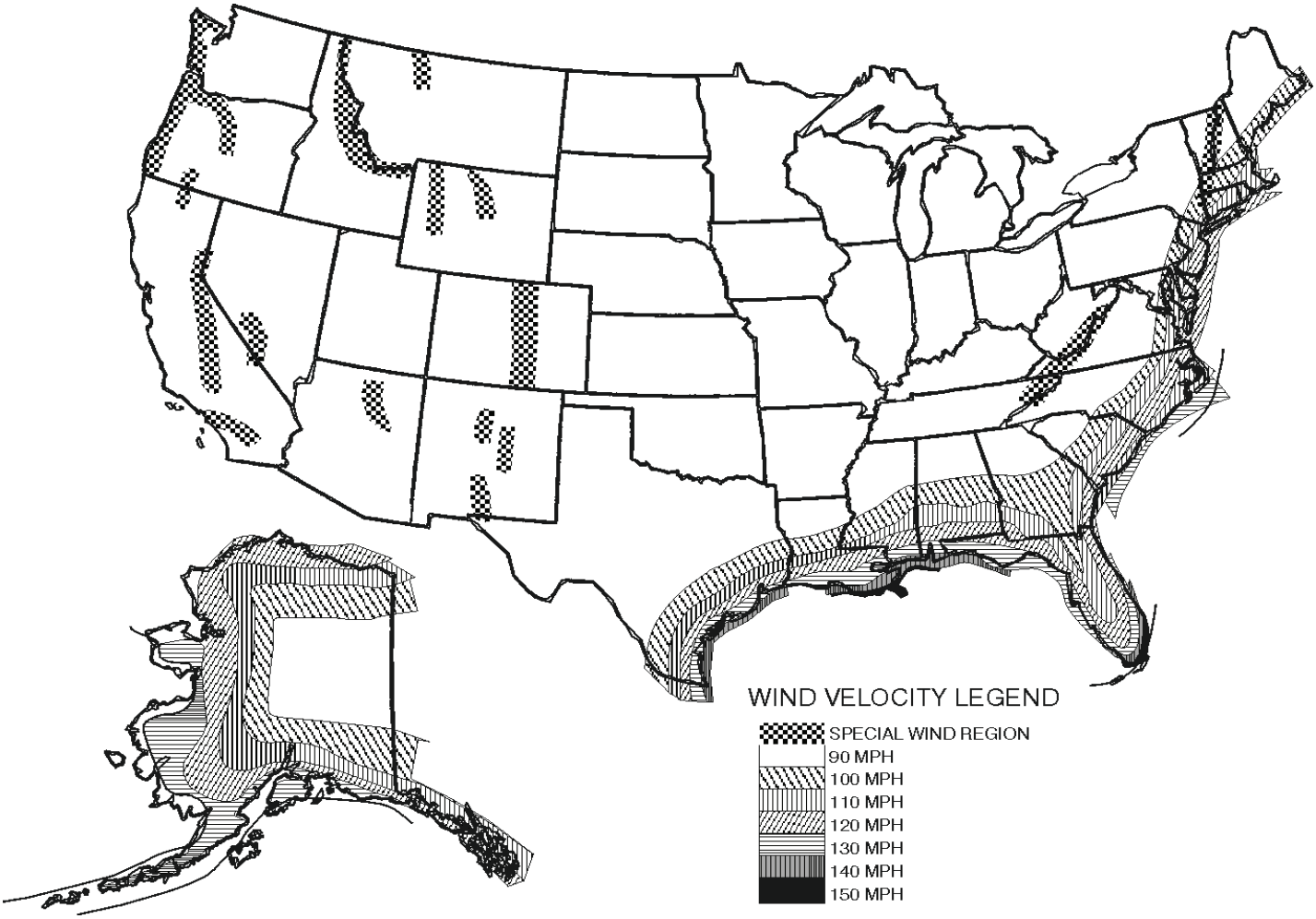
	90 MPH	100 MPH	110 MPH
15 to 30 Feet	30 PSF	35 PSF	45 PSF
31 to 50 Feet	35 PSF	45 PSF	55 PSF
51 to 100 Feet	40 PSF	50 PSF	60 PSF
101 to 150 Feet	45 PSF	55 PSF	65 PSF
151 to 200 Feet	50 PSF	60 PSF	70 PSF

EXCEPTIONS:

A. S/F Fascia signs may be designed for 5 PSF less than shown.
B. The table is a general reference minimum and does not apply to known special wind regions requiring greater design pressure.
C. ***Local Building Codes shall supersede the table values***.

Notes:

1. Values are 3 second gusts speeds in MPH at 33 feet above ground for Exposure C category and are associated with an annual probability of 0.02.
2. Linear interpolation between wind speed contours is permitted.
3. Islands and coastal areas shall use wind speed contour of coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.



3. Calculate the Perimeter Bending Force (on the frame) by using the following formula. $W = \frac{A \times P}{L} + 30$

WHERE:

W = Perimeter Bending Force (lbs/ft.)
A = Area of Sign (square feet per face)
P = Design Wind Pressure (lbs/sq ft.)
L = Perimeter of the sign Frame (feet)

4. Determine the maximum span between structural strut (braces) for the perimeter of the sign cabinet using the **MAXIMUM SPAN BETWEEN STRUTS TABLE** (below). Reading across the top of the table, locate the Perimeter Bending Force as calculated in step 3. The distance, in inches, listed in the column below the PBF is the maximum span between struts.

MAXIMUM SPAN, IN INCHES, BETWEEN STRUCTURAL STRUTS OR SUPPORT MEMBERS

Perimeter Bending Force Span (inches)	80	100	120	140	160	180	200	220	240	260
Large A/Flexframe	94”	87”	82”	78”	74”	72”	69”	67”	65”	63”
Small A/Flexframe	98”	90”	85”	81”	77”	74”	72”	69”	67”	66”
2 x 2 x 3/16” Steel L Frame	73”	66”	60”	55”	52”	49”	46”	44”	42”	41”

5. Based upon the Perimeter Bending Force, select the proper spacing of tensioners from the chart below for attaching the flexible face to the frame. Follow the instruction for proper tensioning as found in the ABC Easy Sheet #1.

TENSIONER HARDWARE SPACING:

(Based upon Perimeter Bending Force)

Up to 100 lbs/ft.	12” centers, maximum
101 - 110 lbs/ft.	11” centers, maximum
111 - 130 lbs/ft.	10” centers, maximum
131 - 150 lbs/ft.	9” centers, maximum
151 - 200 lbs/ft.	8” centers, maximum
201 - 300 lbs/ft.	7” centers, maximum
301 - 500 lbs/ft.	6” centers, maximum

6. To select the proper size support member for each strut, determine the net length of the strut required, in inches, from one inside edge of the frame to the inside edge of the opposite frame, or from the inside edge of the frame to a RIGID internal member, such as a pipe or tube used as the main support column, and divide that length by 150. This resulting number equals the RADIUS OF GYRATION. (r)

$$r = \frac{l}{150}$$

WHERE: r = Radius of Gyration
l = Length of strut member, (inches)

As an example, for a strut 82” long, r = 82/150 = 0.55

From a table of properties for steel angles and square tubes, under the column Z-Z axis for angles, (r), or the Radius of Gyration column for square tubes or angles, the proper size and wall thickness for a angle or square tube strut may be selected. A quick reference chart is provided below for your convenience.

QUICK REFERENCE CHART FOR INTERNAL STRUT MEMEBERS ASTM -36 STEEL OR 6061-T6 ALUMINUM

STRUT LENGTH	STEEL ANGLE	ALUM. ANGEL	STEEL SQ. TUBE	ALUM. SQ.TUBE
0 to 45 inches	1.5 x 1.5 x .125”	1.5 x1.5 x .125”	1 x 1 x .083”	1 x 1 x .083”
46 to 60 inches	2 x 2 x .125”	2 x 2 x .125”	1.25 x 1.25 x .083”	1.25 x 1.25 x .125”
61 to 72 inches	2.5 x 2.5 x .188”	2.5 x 2.5 x .188”	1.25 x 1.25 x .083”	1.25 x 1.25 x .125”
73 to 84 inches	3 x 3 x .188”	3 x 3 x .25”	1.5 x 1.5 x .083”	1.5 x 1.5 x .125”
85 to 114 inches	3.5 x 3.5 x .25”	4 x 4 x .25”	2 x 2 x .083”	2 x 2 x .125”
115 to 144 inches	4 x 4 x .25”	4 x 4 x .25”	3 x 3 x .188”	3 x 3 x .25”

From the above chart, it is obvious that angels are much heavier, more costly and larger, which can create shadows and lamp spacing problems. At ABC, we recommend the use of steel square tubes for internal structural struts. Inventory control can be simplified by stocking 1” inch, 1-1/4”, 1-1/2” inch, 2 inch and 3 inch square tubes for this purpose.

By prefabricating the strut brackets and C-iron brackets used to attach these struts to the extruded aluminum frames in quantities of 50 to 100 units at a time, a company can minimize the cost of the brackets and maximize labor efficiency associated with constructing struts inside extruded aluminum sign frames.

GUIDELINES FOR USING DEFLECTION CABLES FOR FLEXIBLE FACES

IMPORTANT NOTE: For signs over 10 ft. tall and also over 220 sq. ft. per face, use 1/8 inch diameter vinyl-coated aircraft cable in a rectangular grid (not to exceed 6 ft. x 6 ft. spacing) to limit face deflection. This helps to limit stress on the face substrate, the tensioning system and the sign frame. Attached the cables using small turnbuckles approximately 3 inches back from the inside surface of the flexible face. It is best to attach the turnbuckles using small eye-bolts through the c-irons or strut brackets which are used to reinforce the extrusion. It is critical to use vinyl-coated cable to prevent marking or damaging the inner surface of the face. These cables should be installed just tight enough to take all the slack out of the cables, but should **not** be pulled any tighter. For signs over 300 sq. ft. in area, use ABC’s Large Flex Joint.

SUPPORT PLATE SCHEDULE FOR CENTER POLE MOUNT SIGNS

DOUBLE-FACE ABC LARGE A/FLEXFRAME ASSEMBLIES
FOR SIGNS WITH LENGTHS 4 TIMES THEIR HEIGHT: (4 TO 1 ASPECT RATIO)

Sign size : No Greater Than	PIPE SIZE	35 PSF WIND LOAD			45 PSF WIND LOAD			55 PSF WIND LOAD		
		BOLT SIZE	PLATE THICKNESS	PLATE TYPE	BOLT SIZE	PLATE THICKNESS	PLATE TYPE	BOLT	PLATE	PLATE
								NOT RECOMMENDED		
6' - 4 1/2" X 25' - 0"	6" H.W.	1/2"	5/8"	C	5/8"	3/4"	C	5/8"	3/4"	C
5' - 4 1/2" X 21' - 6"	6" STD.	5/8"	5/8"	B	3/4"	5/8"	B	1/2"	5/8"	C
4' - 4 1/2" X 17' - 6"	5" STD.	1/2"	1/2"	A	1/2"	1/2"	A	5/8"	1/2"	A
3' -10 1/2" X 15' - 6"	4" STD.	1/2"	3/8"	A	1/2"	3/8"	A	1/2"	1/2"	A
3' - 4 1/2" X 13' - 6"	3-1/2" STD.	1/2"	1/4"	A	1/2"	1/4"	A	1/2"	1/4"	A

FOR SIGNS WITH LENGTHS UP TO 2 1/4 TIMES THEIR HEIGHT: (2-1/4 TO 1 ASPECT RATIO)

Sign size : No Greater Than	PIPE SIZE	35 PSF WIND LOAD			45 PSF WIND LOAD			55 PSF WIND LOAD		
		BOLT SIZE	PLATE THICKNESS	PLATE TYPE	BOLT SIZE	PLATE THICKNESS	PLATE TYPE	BOLT SIZE	PLATE THICKNESS	PLATE TYPE
7' - 4 1/2" X 16' - 7"	6" H.W.	1/2"	1/2"	A	1/2"	1/2"	A	1/2"	1/2"	A
6' - 4 1/2" X 14' - 4"	6" STD.	1/2"	1/2"	A	1/2"	1/2"	A	1/2"	1/2"	A
5' - 8 1/2" X 12' - 10"	5" STD.	1/2"	1/2"	A	1/2"	1/2"	A	1/2"	1/2"	A
5' - 4 1/2" X 12' - 1"	5" STD.	1/2"	3/8"	A	1/2"	3/8"	A	1/2"	3/8"	A
4' - 4 1/2" X 9' - 10"	4" STD.	3/8"	3/8"	A	3/8"	3/8"	A	3/8"	3/8"	A
3' - 4 1/2" X 7' - 7"	3" STD.	3/8"	1/4"	A	3/8"	1/4"	A	3/8"	1/4"	A

Note: Pipe sizes are based upon staging to a larger diameter pipe at a distance of 12 inches or less below the bottom of the sign cabinet

PIPE SIZES NOTED AS STD. ARE SCHEDULE 40 STRUCTURAL PIPE

PIPE SIZES NOTED AS H.W. ARE SCHEDULE 80 STRUCTURAL PIPE

NOTE: USE ASTM A-325 HARDENED BOLTS W/ DOUBLE WASHERS AND A-325 NUTS

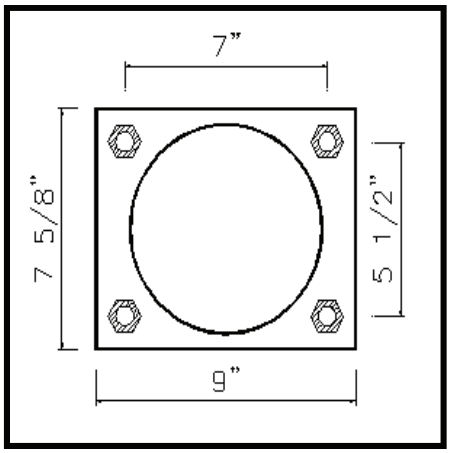


PLATE A

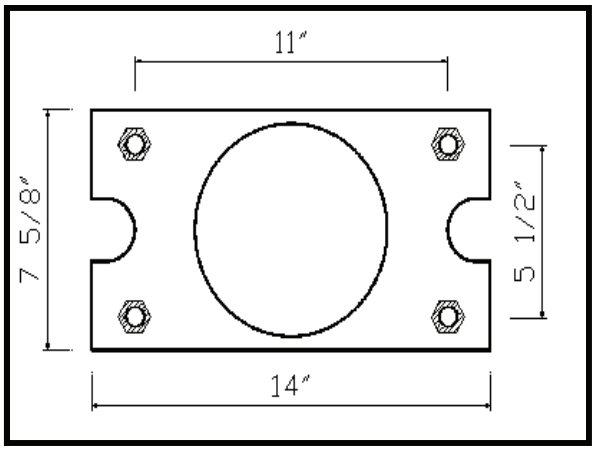


PLATE A

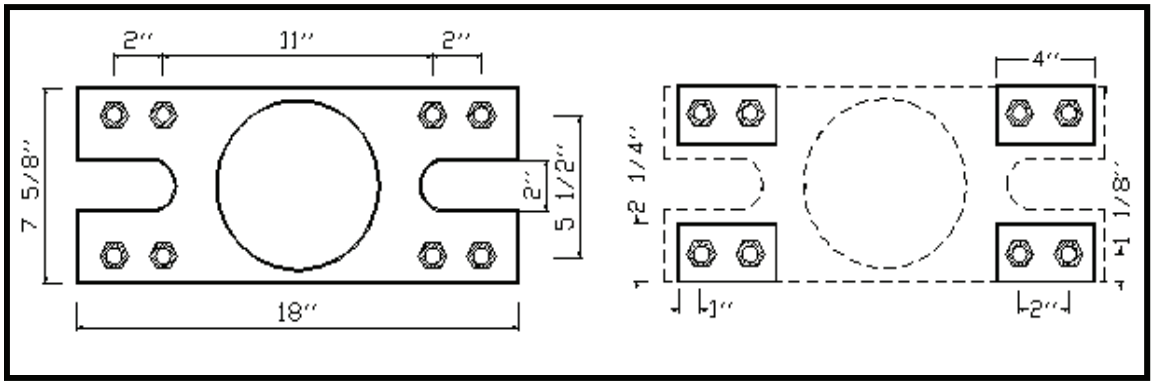


Plate thickness per charts above

PLATE C

Steel Plate 1/4 x 2 1/4 x 4 in.

BACKING PLATES FOR C

SUPPLEMENTAL STRUCTURAL GUIDELINES

FOR SIGN SIZES LARGER THAN THOSE SHOWN ON THE PRECEEDING CHARTS, REFER STRUCTURAL DESIGN TO A LICENSED PROFESSIONAL STRUCTURAL ENGINEER.

**** REQUIRED TORQUE ON GRADE 5 FASTENERS**

TORQUE: (FT-LB)	BOLT DIAMETER	PROOF LOAD
100 FT-LB	1/2 IN.	12,000#
200 FT-LB	5/8 IN.	19,000#
255 FT-LB	3/4 IN.	28,000#

PROVIDE HARDENED WASHERS, TYPICAL
WITH GRADE 5 BOLTS OR USE ASTM A-325 BOLTS.

**** NOTE:**

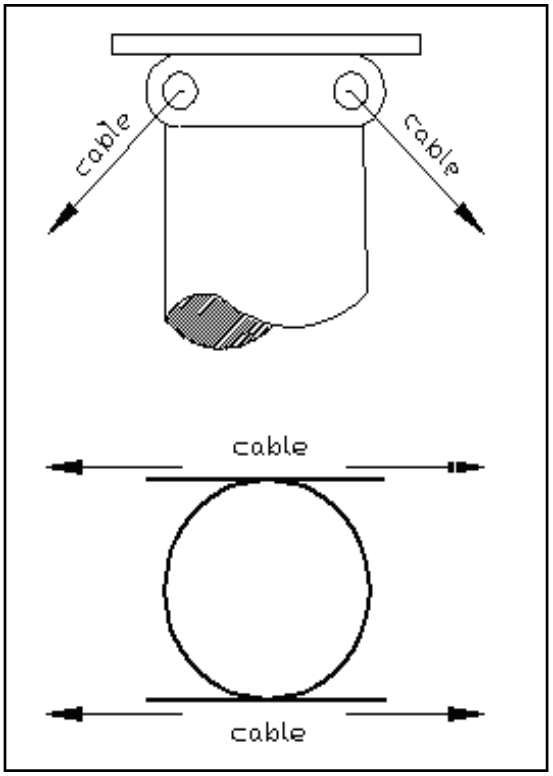
Proper friction connections require neatly fabricated holes in the aluminum and steel which are no larger than 1/32 inch over the bolt diameter. These holes should be free from burrs and carefully drilled for maximum strength.

**** NOTE:**

Do not weld aluminum within one inch of any bolt hole or other high-stress location.

Aluminum extrusions should be backed by steel plates or angles at points where diagonal truss cables attach at the outside lower corners of the sign cabinet.

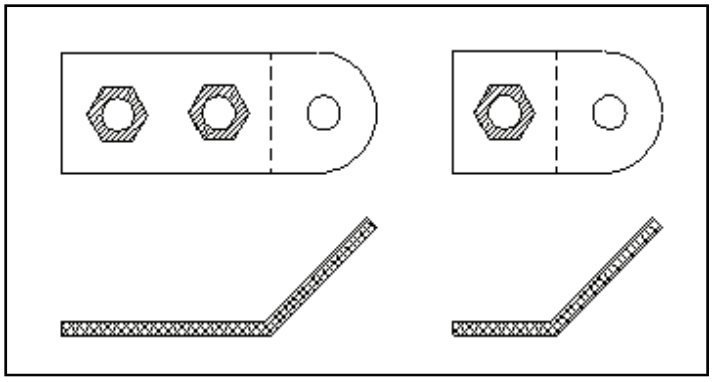
Aluminum in contact with steel needs protection from electrolytic action: Use plated bolts and provide bitumastic paint, water-white methacrylate lacquer, or zinc chromate coating on surfaces of dissimilar metals in contact with each other.



GUSSET PLATES
Gussets welded to pipe and to plate at abutment
(One On Each Side)

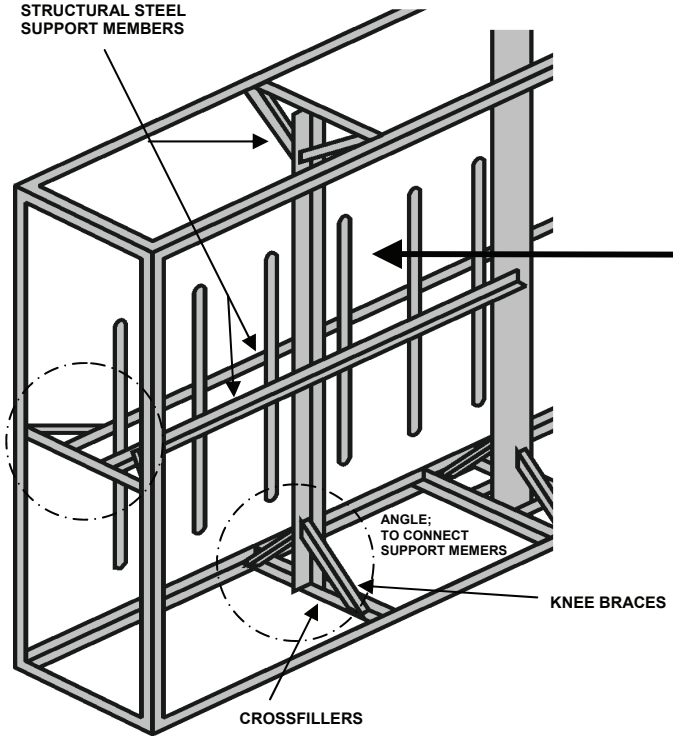
**** REGARDING CABLE EYES**

** Cables should be attached to gusset plates welded to side of center pipe & support plates. Support plate thicknesses for A, B, or C type plates should be increased by 1/8 inch minimum if cables are attached with bolts through cable eyes attached to connection plates. Bolt cable eyes in place and stitch weld cable eye to support / connection plate.



CABLE EYES

**** NOTE: FOR SIGNS WHICH ARE 1 1/2 TO 1 ASPECT RATIO OR LESS, USE CHART ON OPPOSITE PAGE FOR 2 1/4 TO 1 ASPECT RATIO WITH PLATE THICKNESS 1/8 IN. LESS (DO NOT USE ANY PLATE THICKNESS LESS THAN 1/4 INCH)**



FOR TYPICAL STEEL ANGLE FRAME CONSTRUCTION:

The angle Iron frame illustration shows the typical knee braces that are required at the top and bottom of each strut member and for all horizontal struts or internal brace members. The cross members which connect the parallel frame side members at each strut add additional labor cost. The engineering data and illustrations show how much stronger ABC extruded aluminum frames are, compared to angle iron construction, and why ABC's A/Flexframes are so much more economical to build.

For double face signs with vertical lamps, place the support struts centered between the faces, parallel to the lamps, (fig. 1) or for horizontal lamping, place the struts in tandem just outside the lamps, (fig. 2)

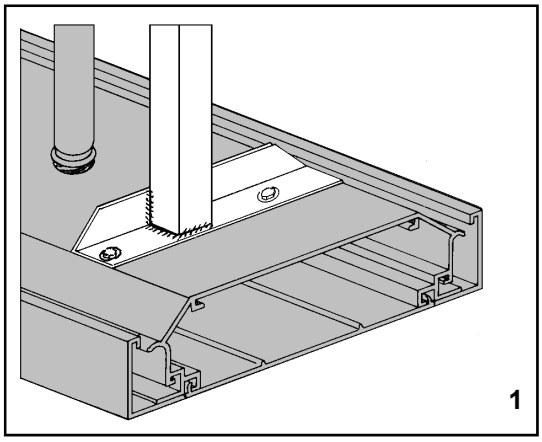
Fig. 3 shows a typical C-Iron bolted to a Small A/Flexframe for a single face sign, with the strut at the back of the sign to prevent and shadows on the face. By making these types of brackets in quantity, so they are an off-the-shelf inventory item, saves a great deal of time and cost. All such brackets are to be bolted to the extruded aluminum frames following the guidelines on pages 3 and 4. The struts are then welded to the brackets as illustrated.

Fig. 4 illustrates ABC Cad-Cam cut aluminum plate C-Iron brackets which are cut to precisely fit the Single Hinge Frame for single face signs. Aluminum struts can be welded to these brackets. Steel struts must be double bolted, as illustrated.

Fig. 5 illustrates the same technique as used for rigid plastic face sign built of ABC's Conventional Frames.

ANGLE IRON FRAME

TYPICAL KNEEBRACE TRUSS CONSTRUCTION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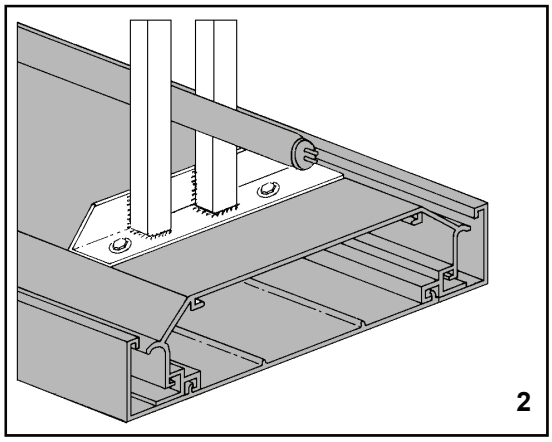
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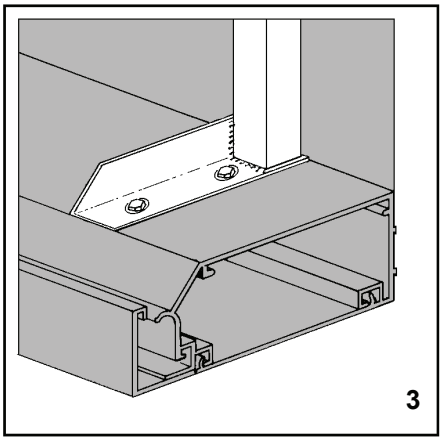
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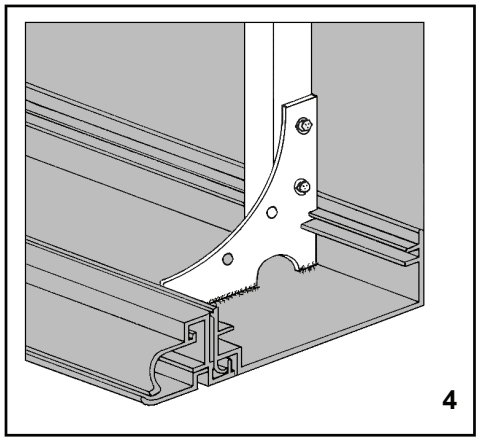
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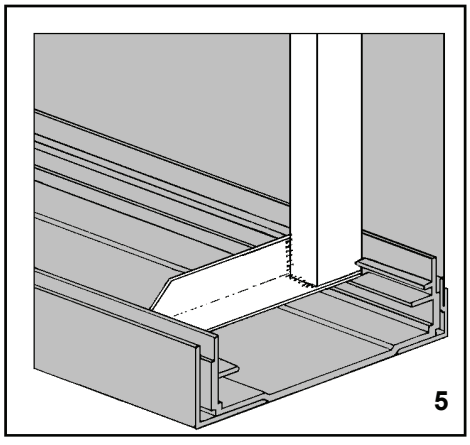
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The parts described on this page are covered by on or more of the following patents:

U.S.	4,007,552 4,265,039
CANADIAN	1,021,565 1,149,159 1,170,048 1,170,049 1,170,050

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