



Insurance Institute for
Highway Safety



Side Impact Crashworthiness Evaluation Moving Deformable Barrier Specification

October 2007

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Side Impact Crashworthiness Evaluation Moving Deformable Barrier Specification

Scope

This specification describes a deformable impact barrier to be used in Insurance Institute for Highway Safety side impact crashworthiness evaluations.

Purpose

The design and performance criteria described in this specification are intended to provide a measurement tool with sufficient precision to ensure repetitive and correlative results under similar test conditions and to reflect adequately the protective performance of a motor vehicle or item of motor vehicle equipment with respect to human occupants.

General Description

The side impact moving deformable barrier consists of two parts: a main honeycomb block and a bumper consisting of three honeycomb elements. Both honeycomb layers are covered with aluminum sheets and adhesively bonded to each other. Barrier construction and assembly drawings (Figures 1-10) are included at the end of the specification.

Barrier Component Dimensions and Specifications

The dimensions of the moving deformable barrier are illustrated in Figure 1. All dimensions allow a tolerance of ± 2.5 mm and ± 0.5 degrees unless otherwise specified.

Main Honeycomb Block Material

The main honeycomb block is manufactured out of aluminum 5052, with a cell size of 9.5 mm, a density of $25.6 \text{ kg/m}^3 \pm 4 \text{ kg/m}^3$, and a crush strength of $310 \text{ kPa} \pm 17 \text{ kPa}$, measured in accordance with the certification procedure described in US Department of Transportation, NHTSA, Lab Test Procedure for FMVSS No. 214 “Dynamic” Side Impact Protection, TP214D Appendix C TP214D-07 C-1.

The main honeycomb block is cut/shaped from one honeycomb block to exhibit the length, width, height, and bevel dimensions shown in Figure 2, with the foil ribbon running parallel to the length dimension and the cell axis running parallel to the height dimension.

Bumper Element Honeycomb Material

The bumper element honeycomb is manufactured out of aluminum 3003, with a cell size of 6.35 mm, a density of $83.0 \text{ kg/m}^3 \pm 4 \text{ kg/m}^3$, and a crush strength of $1690 \text{ kPa} \pm 103 \text{ kPa}$, measured in accordance with the certification procedure described in US Department of Transportation, NHTSA, Lab Test Procedure for FMVSS No. 214 “Dynamic” Side Impact Protection, TP214D Appendix C TP214D-07 C-1.

The bumper section consists of three individual honeycomb elements that are cut from one honeycomb block to exhibit the length, width, height, bevel, and contour dimensions shown in Figure 3, with the foil ribbon running parallel to the width dimension and the cell axis running parallel to the height dimension.

Main Honeycomb Base Plate

Dimensions – The backing sheet has a height of $860 \text{ mm} \pm 1.0 \text{ mm}$ and a width of $1676 \text{ mm} \pm 1.0 \text{ mm}$ as shown in Figure 4.

Material – The main honeycomb backing sheet is manufactured out of aluminum 5251 H22 or 5052 H34, with a thickness of 0.8 mm ± 0.05mm.

Main Honeycomb Top Cladding

Dimensions – The cladding sheet covers the top and front face of the main honeycomb block. The cladding sheet blank is cut to the dimensions shown in Figure 5 and then bent along the indicated folding lines in Figure 5 to attain a folded shape that matches the top and front surfaces of the main honeycomb block as shown in Figure 6.

Material – The main honeycomb cladding sheet is manufactured out of aluminum 5251 H24 or 5052 H34, with a thickness of 0.7 mm ± 0.04 mm.

Main Honeycomb Upper Corner Plate

Dimensions – The top corner plate covers the intersection of the top and front face of the main honeycomb. The top corner plate blank is cut to the dimensions shown in Figure 7 and then bent along the indicated folding lines in Figure 7 to attain the contoured shape as shown in Figure 8.

Material – The top corner plate is manufactured out of aluminum 5251 H24 or 5052 H34, with a thickness of 1.6 mm ± 0.07 mm.

Bumper Element Base Plate

Dimensions – The bumper element backing sheet blank has a height of 203 mm ± 1.0 mm and is bent to the dimensions shown in Figure 9, matching the final shape of the front surface of the main honeycomb cladding sheet after this cladding sheet has been bonded to the main honeycomb block.

Material – The bumper element backing sheet is manufactured out of aluminum 5251 H22 or 5052 H34, with a thickness of 3.0 mm ± 0.07 mm.

Bumper Element Profile Sheet

Dimensions – The bumper element cladding sheet blank has a height of 159 mm ± 1.0 mm and shall be bent to the dimensions shown in Figure 10.

Material – The bumper element backing sheet is manufactured out of aluminum 5251 H22 or 5052 H34, with a thickness of 3.0 mm ± 0.07 mm.

Adhesive Bonding Procedure

Prior to bonding, all aluminum backing and cladding sheets shall be degreased. The adhesive to be used throughout should be a two-part polyurethane (such as Ciba Geigy XB5090/1 resin with XB5304 hardener) or equivalent.

Bonding Strength Tests

- Flatwise tensile testing is used to measure bond strength of adhesive according to ASTM C 297.
- The test pieces should be 100 mm × 100 mm, and 15mm deep, bonded to a sample of the back plate material. The honeycomb used should be representative of that in the impactor.
- The minimum bonding strength shall be 0.6 MPa (87 psi).

The adhesive is only applied to the aluminum sheet surfaces when bonding aluminum sheets to honeycomb surfaces. A maximum of 0.5 kg/m² must be applied evenly over the surface, giving a maximum film thickness of 0.5 mm.

Construction

The *main honeycomb block* is centered on and adhesively bonded to its *back plate*. The back plate extends beyond the height of the main honeycomb block at the bottom and top, providing mounting flanges. The front portion of the *top cladding* is bonded to the main honeycomb block. The top portion of the top cladding is not bonded to the cell edges of the honeycomb block. The top cladding sheet flange, integral to the top portion of the main honeycomb cladding sheet, is overlapping, but not bonded to the top flange of the main honeycomb backing sheet.

The *main honeycomb upper corner plate* is positioned over the edge of the top and front portion of the main honeycomb top cladding and attached via bonding and pop-rivets.

The three *bumper honeycomb element* sections are adhesively bonded to the *bumper base plate* and *bumper profile* such that the honeycomb cell axes are perpendicular to both sheets and such that the bottom contour of the bonded bumper assembly closely matches the front face contour of the main honeycomb assembly.

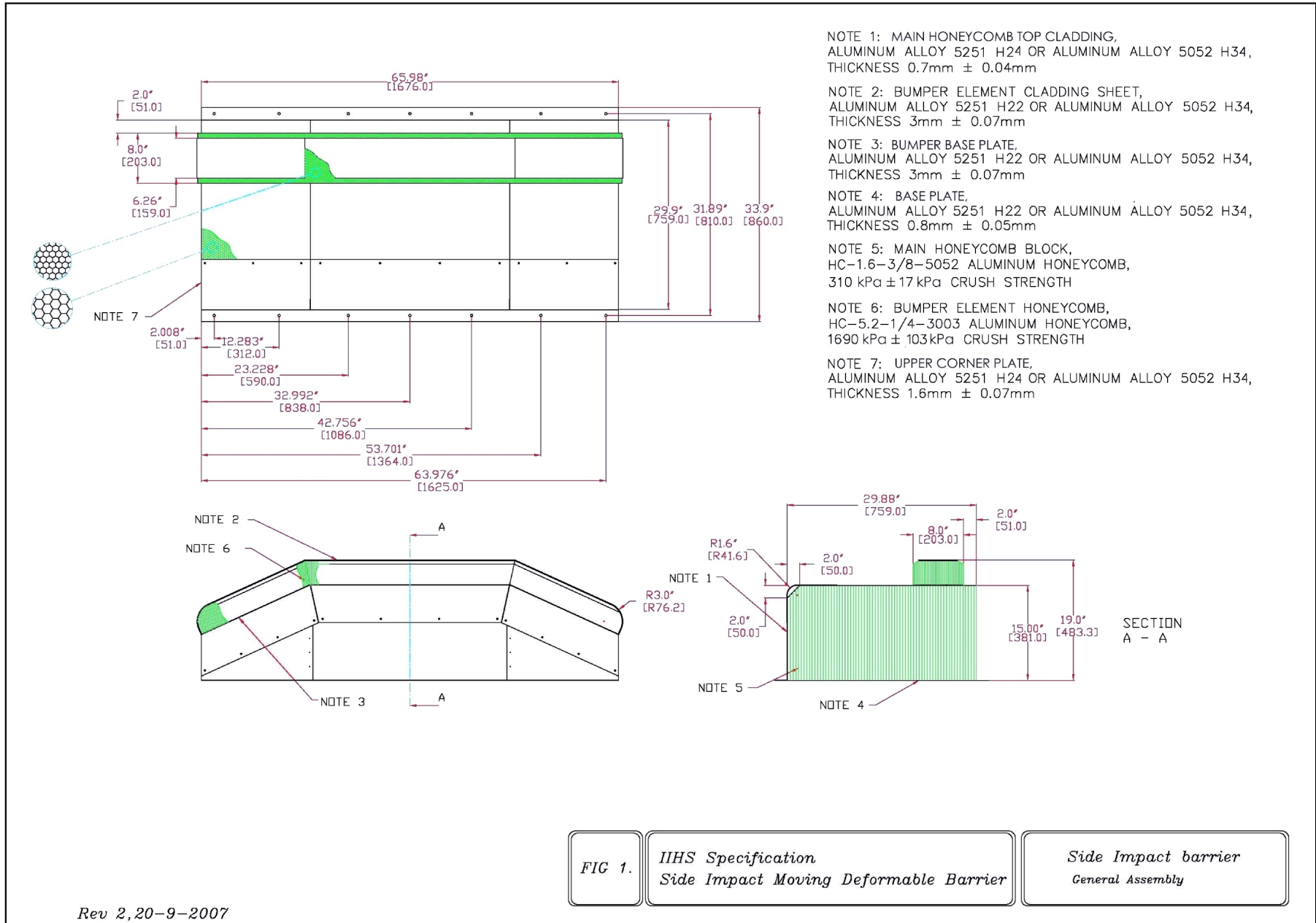
Clearance holes for mounting the deformable barrier are located in the flange of the main honeycomb base plate as shown in Figure 1.

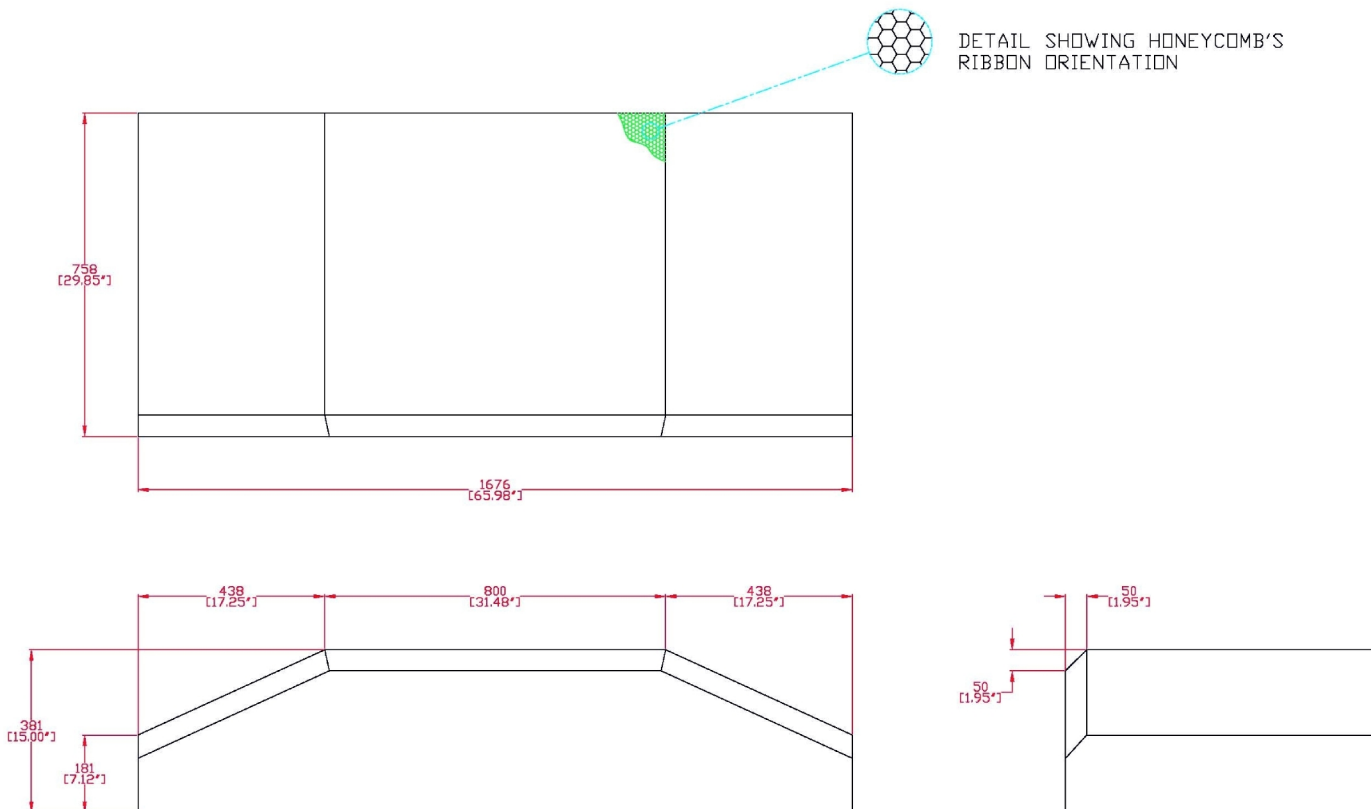
Barrier Identification and Marking

Each barrier shall carry a serial number that is stamped, etched, or otherwise permanently attached, from which the manufacturing details and version can be established.

Barrier Certification

Each barrier shall have (included in its shipping container or in electronic format) a certification package available providing information according to US Department of Transportation, NHTSA, Lab Test Procedure for FMVSS No. 214 “Dynamic” Side Impact Protection, TP214D Appendix C TP214D-08 C-1.





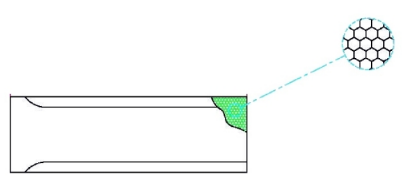
NOTE: DUE TO THE NATURE OF HONEYCOMB AND MANUFACTURE USED, DETAILED DIMENSIONAL CHECKS ARE NOT PERFORMED UNTIL THE CLADDING AND CORE HAVE BEEN BONDED

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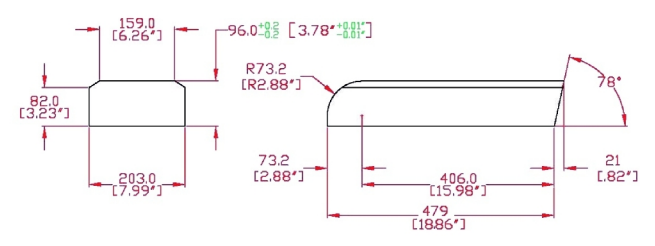
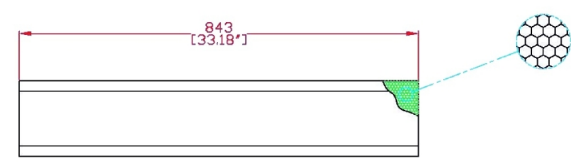
FIG 2.

IIHS Specification
Side Impact Moving Deformable Barrier

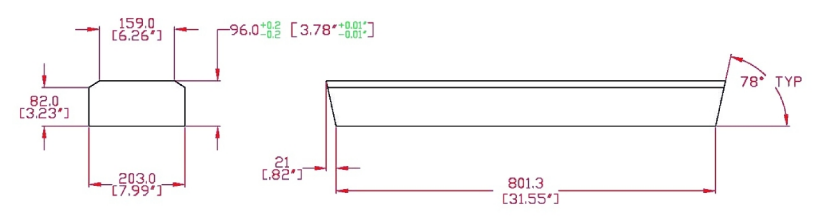
Main Honeycomb Block
Material: Aluminum Honeycomb
HC-1.6-3/8-5052



DETAIL SHOWING HONEYCOMB'S RIBBON ORIENTATION



SIDE CORE ~ 2 REQUIRED



CENTRAL CORE ~ 1 REQUIRED

NOTE: DUE TO THE NATURE OF HONEYCOMB AND MANUFACTURE USED, DETAILED DIMENSIONAL CHECKS ARE NOT PERFORMED UNTIL THE CLADDING AND CORE HAVE BEEN BONDED

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FIG 3.

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Bumper Element Honeycomb Blocks
Material: Aluminum Honeycomb
HC-5.2-1/4-3003

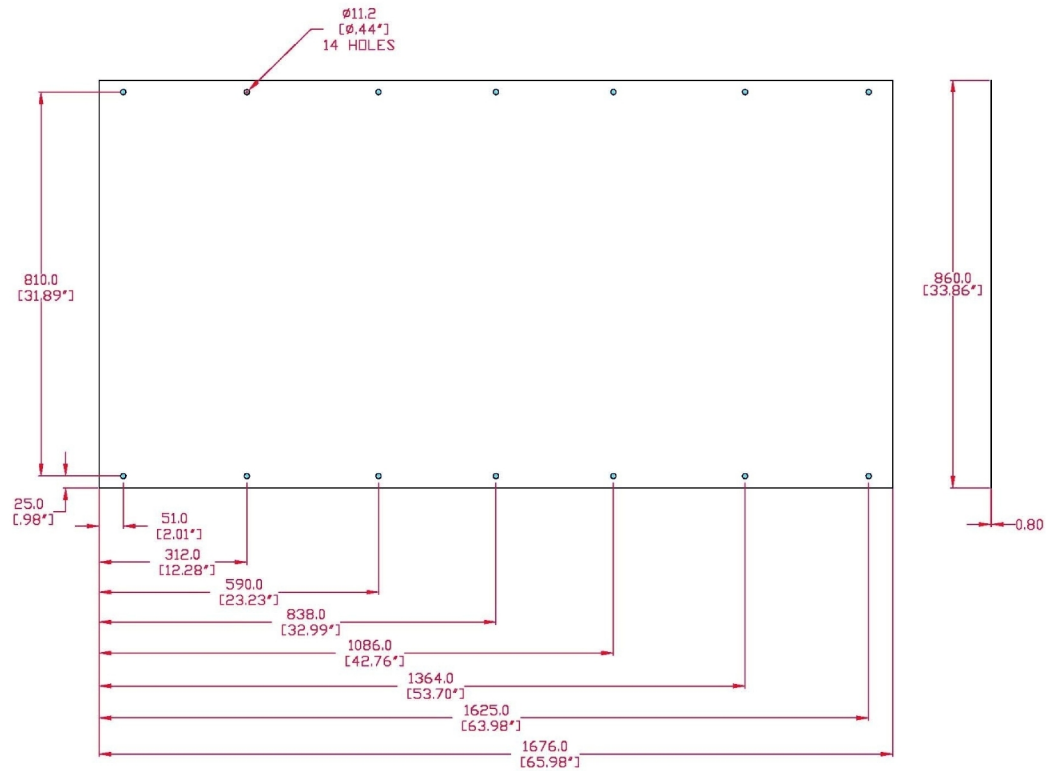


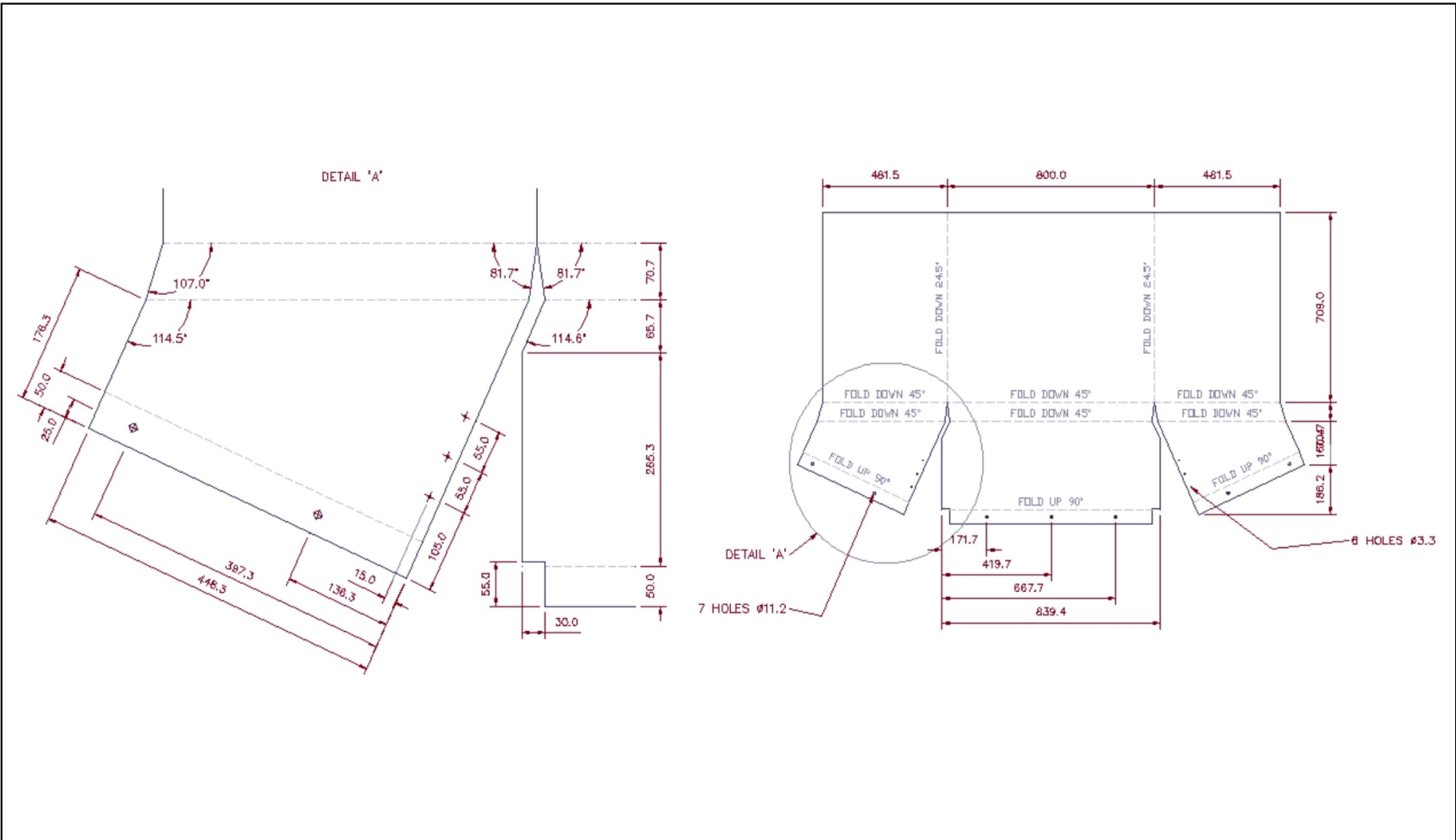
FIG 4.

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Base Plate

Material: Al. Alloy 5251 H22 0.8mm
Or Al. Alloy 5052 H34 0.8mm

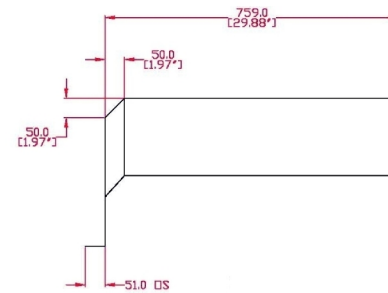
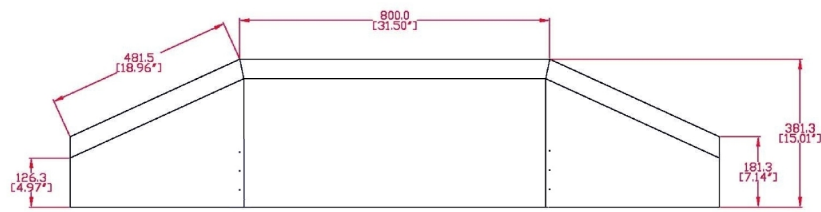
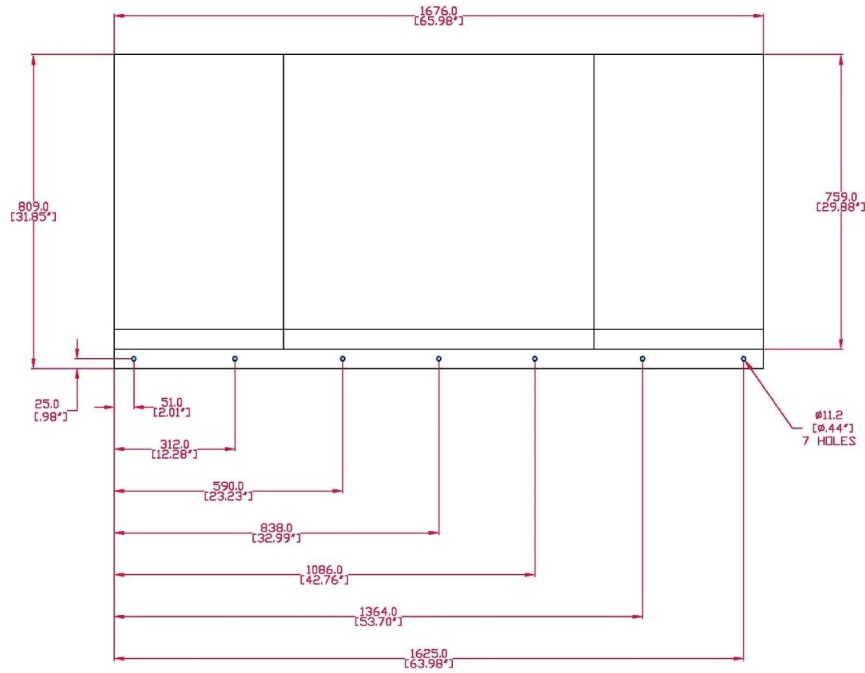
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FIG 5. *IIHS Specification
Side Impact Moving Deformable Barrier*

*Main Honeycomb Top
Cladding ~ blank
Material: Al. Alloy 5251 H24 0.7mm
Or Al. Alloy 5052 H34 0.7mm*



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FIG. 6.

*IIHS Specification
Side Impact Moving Deformable Barrier*

*Main Honeycomb Top
Cladding ~ folded
Material: Al. Alloy 5251 H24 0.7mm
Or Al. Alloy 5052 H34 0.7mm*

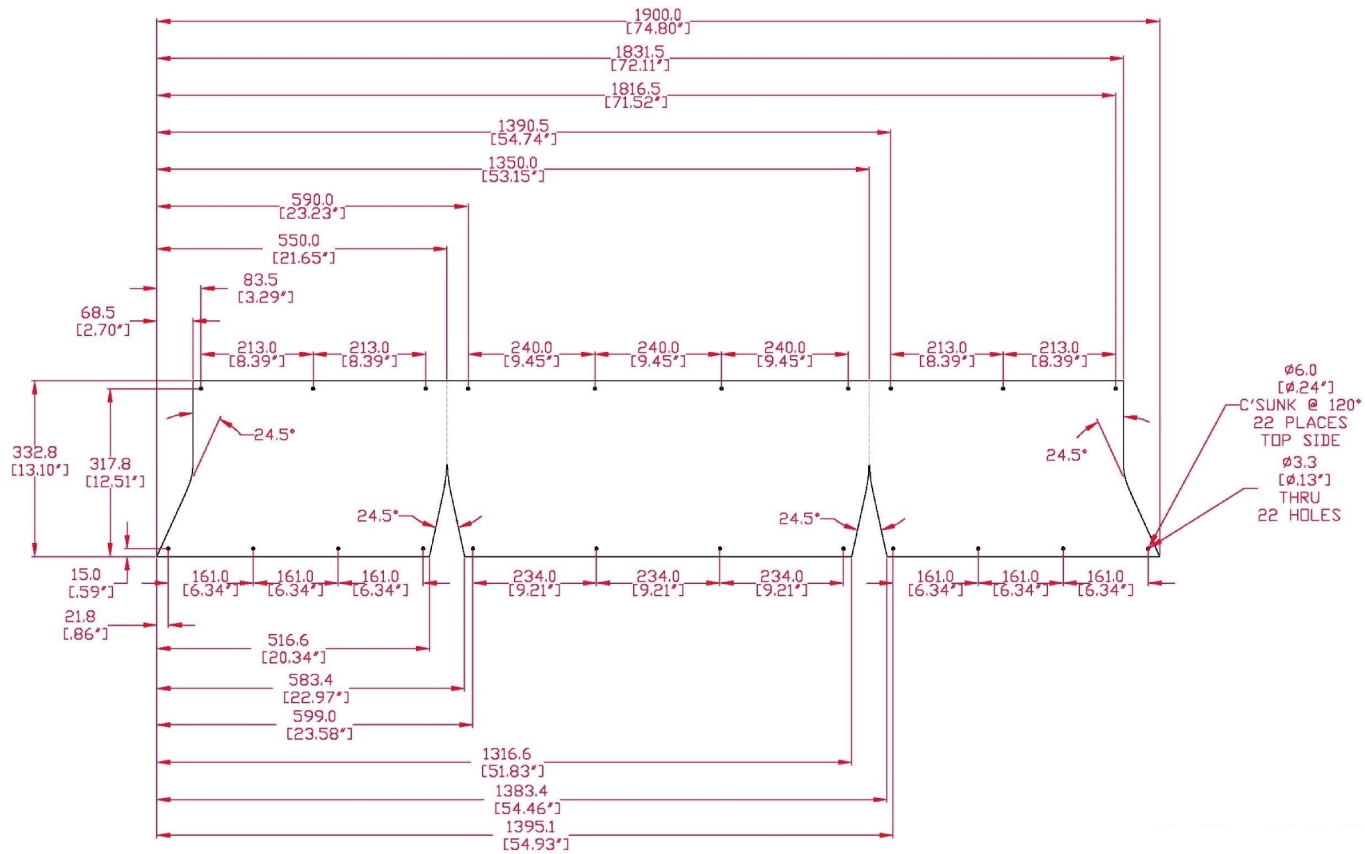
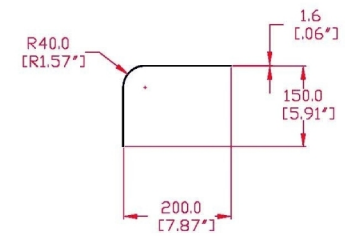
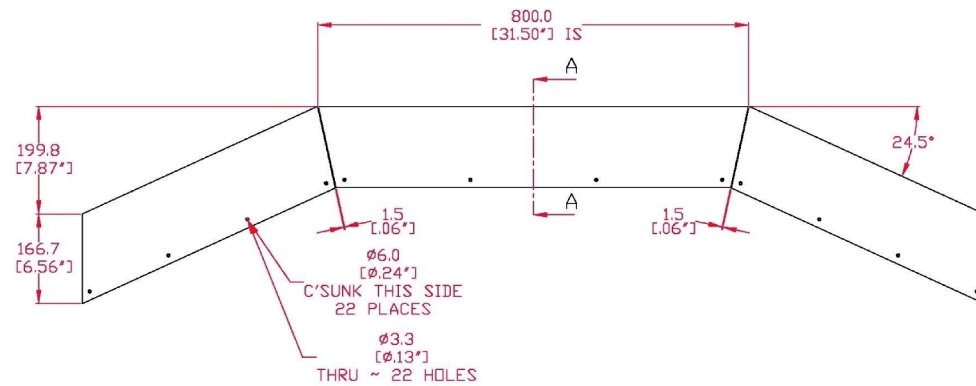
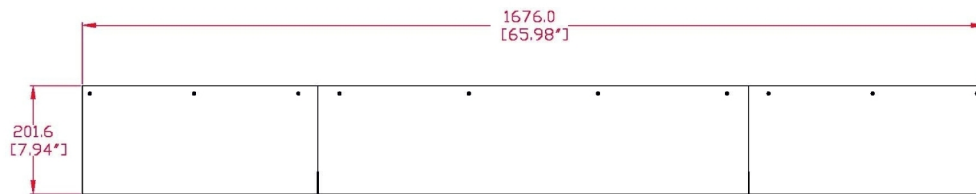


FIG 7.

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Side Impact Moving Deformable Barrier

Upper Corner Plate ~ blank
Material: Al. Alloy 5251 H24 1.6mm
Or Al. Alloy 5052 H34 1.6mm

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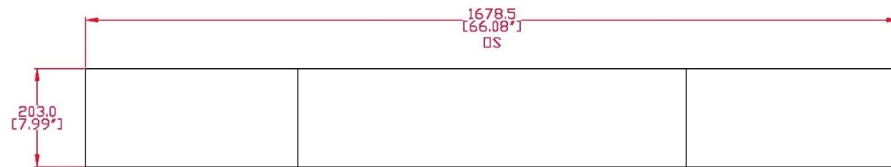
SECTION: A - A

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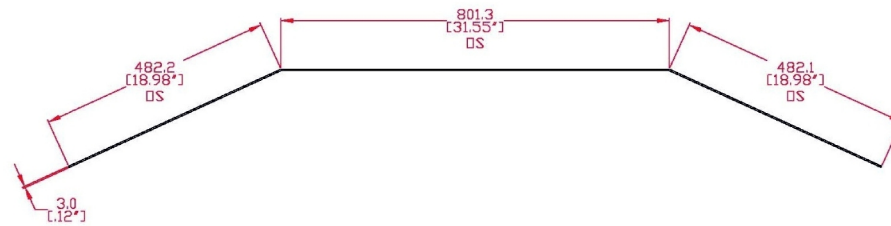
FIG 8.

IIHS Specification
Side Impact Moving Deformable Barrier

Upper Corner Plate ~ folded
Material: Al. Alloy 5251 H24 1.6mm
Or Al. Alloy 5052 H34 1.6mm



FOLDED PART DIMENSIONS

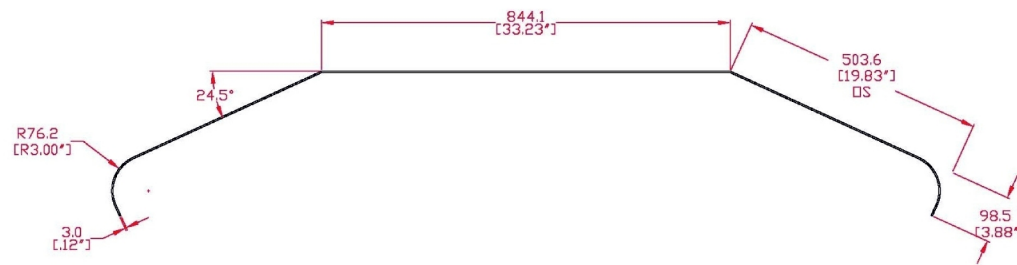


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FIG 9.

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Bumper Base Plate ~ folded
Material: Al. Alloy 5251 H22 3.0mm
Or Al. Alloy 5052 H34 3.0mm



FOLDED PART DIMENSIONS

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FIG 10.

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Side Impact Moving Deformable Barrier

Bumper Profile Sheet ~ folded

Material: Al. Alloy 5251 H22 3.0mm
Or Al. Alloy 5052 H34 3.0mm