



# Architecturally Exposed Structural Steelwork (AESS)



## Code of Practice (for Fabricators)





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### Architecturally Exposed Structural Steel (AESS)

#### 1.1 SCOPE AND REQUIREMENTS

**1.1.1 General Requirements.** When structural steel members are specifically designated as “Architecturally Exposed Structural Steel” or “AESS” in the Contract Documents, the requirements in Sections 3 and 4 shall apply as modified by this section. AESS members or components shall be fabricated and erected with the care and dimensional tolerances that are stipulated in Sections 1.2 through 1.5.

**1.1.2 Definition of Categories.** Categories are listed in the AESS Matrix shown in Table 1 where each Category is represented by a set of Characteristics. The following Categories shall be used when referring to AESS:

**AESS 1: Basic Elements**

Suitable for “basic” elements which require enhanced workmanship.

**AESS 2: Feature Elements viewed at a Distance > 6 m**

Suitable for “feature” elements viewed at a distance greater than six metres. The process involves basically good fabrication practices with enhanced treatment of weld, connection and fabrication detail, tolerances for gaps, and copes.

**AESS 3: Feature Elements viewed at a Distance ≤ 6 m**

Suitable for “feature” elements – where the designer is comfortable allowing the viewer to see the art of metalworking – welds are generally smooth but visible, some grind marks are acceptable. Tolerances are tighter than normal standards. The structure is normally viewed closer than six metres and is frequently subject to touch by the public.

**AESS 4: Showcase Elements**

Suitable for “showcase or dominant” elements – used where the designer intends that the form is the only feature showing in an element. All welds are ground and filled edges are ground square and true. All surfaces are sanded/filled. Tolerances of fabricated forms are more stringent – generally ½ of standard tolerance. All surfaces to be “glove” smooth.

**AESS C: Custom Elements.**

Suitable for elements which require a different set of characteristics as specified in Category 1, 2, 3 or 4.

**1.1.3 Additional Information.** The following additional information shall be provided in the Contract Documents when AESS is specified:

- a. Specific identification of members or components that are AESS using the AESS Categories listed in 1.1.2. Refer to Table 1;
- b. Fabrication and/or erection tolerances that are to be more restrictive than provided for in this Appendix;
- c. For Categories AESS 2, 3, 4 requirements, if any, of a visual sample or first-off component for inspection and acceptance standards prior to the start of fabrication;
- d. For Category AESS C, the AESS Matrix included in Table 1 shall be used to specify the required treatment of the element.

## 1.2 SHOP DETAIL, ARRANGEMENT AND ERECTION DRAWINGS

**1.2.1 Identification.** All members designated as AESS members are to be clearly identified to a Category, either AESS 1, 2, 3, 4 or C, on all shop detail, arrangement and erection drawings.

**1.2.2 Variations.** Any variations from the AESS Categories listed must be clearly noted. These variations could include machined surfaces, locally abraded surfaces or forgings. In addition:

- a. If distinction is to be made between different surfaces or parts of members, the transition line/plane must be clearly identified/defined on the shop detail, arrangement and erection drawings;
- b. Tack welds, temporary braces, fixtures used in fabrication are to be indicated on shop drawings;
- c. All architecturally sensitive connection details will be submitted for approval by the Architect/Engineer prior to completion of shop detail drawings.

## 1.3 FABRICATION

**1.3.1 General Fabrication.** The fabricator is to take special care in handling the steel to avoid marking or distorting the steel members.

- a. All slings will be nylon type or chains with softeners or wire rope with softeners.
- b. Care is also taken to minimized damage to any shop paint or coating.
- c. If temporary braces or fixtures are required during fabrication, during shipment, or to facilitate erection, care must be taken to avoid and/or repair any blemishes or unsightly surfaces resulting from the use or removal of such temporary elements.
- d. Tack welds are ground smooth.

**1.3.2 Unfinished, Reused or Weathering Steel.** Members fabricated of unfinished, reused or weathering steel that are to be AESS may still have erection marks, painted marks or other marks on surfaces in the completed structure. Special requirements shall be specified as Category AESS C.

**1.3.3 Tolerances for Rolled Shapes.** The permissible tolerances for depth, width, and out of square, camber and sweep of rolled shapes shall be as specified in AS/NZS 3678 or AS/NZS 3679.1 as appropriate for depth, flange width, flange and web thickness, out of square and web off centre. AS 4100 covers the specification details for any built up section, tension or compression member. The following exceptions apply:

- a. For Categories AESS 3 and 4 and otherwise specified in the Contract Documents: The matching of abutting cross-sections shall be required;
- b. For Categories AESS 2, 3 and 4: The as-fabricated straightness tolerance of a member is one-half of the standard camber and sweep tolerance in AS 4100.

**1.3.4 Tolerances for Built-up Members.** The tolerance on overall profile dimensions of members made up from a series of plates, bars and shapes by welding is limited to the accumulation of permissible tolerances of the component parts as provided by AS 4100. For Categories AESS 2, 3 and 4, the as-fabricated straightness tolerance for the member as a whole is one-half of the standard camber and sweep tolerances in AS 4100.

**1.3.5 Joints.** For Categories AESS 3 and 4, all copes, mitres and butt cuts in surfaces exposed to view are made with uniform gaps, if shown to be open joint, or in uniform contact if shown without gap.

**1.3.6 Surface Appearance.** For Categories AESS 1, 2 and 3, the quality surface as delivered by the mills should be acceptable. For Category AESS 4, the steel surface imperfections should be filled and sanded.

**1.3.7 Welds.** For corrosive environments, all joints should be seal welded. In addition:

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- a. For Categories AESS 1, 2 and 3, a smooth uniform weld will be acceptable. For Category AESS 4, the weld will be contoured and blended.
- b. For Categories AESS 1, 2, 3 and 4, all weld spatter is to be avoided/removed where exposed to view.
- c. For Categories AESS 1 and 2, weld projection up to 2 mm is acceptable for butt and plug welded joints. For Categories AESS 3 and 4, welds will be ground smooth/filled.

Note Refer to AS/NZS 1554.1 for general dressing of the surface of flash butt or butt, welds. For Category AESS 4 more stringent requirements may need to be specified.

**1.3.8 Weld Show-through.** It is recognized that the degree of weld show-through, which is any visual indication of the presence of a weld or welds on the opposite surface from the viewer, is a function of weld size and material thickness.

- a. For Categories AESS 1, 2 and 3, the members or components will be acceptable as produced.
- b. For Category AESS 4, the fabricator shall minimize the weld show-through.

Note Visual effects may arise from heating, distortion and weld profile.

**1.3.9 Surface Preparation for Painting.** Unless otherwise specified in the Contract Documents, the Fabricator will clean AESS members to meet the requirement of AS 1627 Sa2/Class 2 "Commercial Blast Cleaning" (sandblast or shotblast). Prior to blast cleaning:

- a. Any deposits of grease or oil are to be removed by solvent cleaning, AS 1627 Part 1;
- b. Weld spatter, slivers, surface discontinuities are to be removed;
- c. Sharp edges resulting from flame cutting, grinding and especially shearing are to be softened.

**1.3.10 Hollow Structural Sections (RHS and CHS) Seams.**

- a. For Categories AESS 1 and 2, seams of hollow structural sections shall be acceptable as produced.
- b. For Category AESS 3, seams shall be oriented away from view or as indicated in the Contract Documents.
- c. For Category AESS 4, seams shall be treated so they are not apparent.

## 1.4 DELIVERY OF MATERIALS

**1.4.1 General Delivery.** The Fabricator shall use special care to avoid bending, twisting or otherwise distorting the Structural Steel. All tie downs on loads will be either nylon strap or chains with softeners to avoid damage to edges and surfaces of members.

**1.4.2 Standard of Acceptance.** The standard for acceptance of delivered and erected members shall be equivalent to the standard employed at fabrication.

## 1.5 ERECTION

**1.5.1 General Erection.** The Erector shall use special care in unloading, handling and erecting the AESS to avoid marking or distorting the AESS. The Erector must plan and execute all operations in such a manner that allows the architectural appearance of the structure to be maintained.

- a. All slings will be nylon strap or chains with softeners.
- b. Care shall be taken to minimize damage to any shop paint or coating.
- c. If temporary braces or fixtures are required to facilitate erection, care must be taken to avoid and/or repair any blemishes or unsightly surfaces resulting from the use or removal of such temporary elements.
- d. Tack welds shall be ground smooth and holes shall be filled with weld metal or body filler and smoothed by grinding or filling to the standards applicable to the shop fabrication of the materials.

**ASI AESS DOCUMENT F**

- e. All backing bars will be removed and ground smooth.
- f. All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another.

**1.5.2 Erection Tolerances.** Unless otherwise specified in the Contract Documents, members and components are plumbed, leveled and aligned to a tolerance equal to the tolerance permitted for structural steel.

**1.5.3 Adjustable Connections.** Specifically designated more stringent erection tolerances for AESS require that the Owner's plans specify/allow adjustable connections between AESS adjoining structural elements, in order to provide the Erector with means for adjustment and/or specify the method to be used to achieve the desired dimensions. Any proposed adjustment details desired by the Erector shall be submitted to the Architect and Engineer for review.

**Table 1 – AESS Category Matrix**

<i>Category</i>		<b>AESS C</b> <i>Custom Elements</i>	<b>AESS 4</b> <i>Showcase Elements</i>	<b>AESS 3</b> <i>Feature Elements</i>  <i>Viewed at a Distance ≤ 6 m</i>	<b>AESS 2</b> <i>Feature Elements</i>  <i>Viewed at a Distance &gt; 6 m</i>	<b>AESS 1</b> <i>Basic Elements</i>	<b>SSS</b> <i>Standard Structural Steel</i>  AS 4100 and NZS 3404.1
<i>Characteristics</i>							
Id							
1.1	Surface preparation to AS1627 Sa2/Class 2		√	√	√	√	
1.2	Sharp edges ground smooth		√	√	√	√	
1.3	Continuous weld appearance		√	√	√	√	
1.4	Standard structural bolts		√	√	√	√	
1.5	Weld spatters removed		√	√	√	√	
2.1	Visual Samples		optional	optional	optional		
2.2	One-half standard fabrication tolerances		√	√	√		
2.3	Fabrication marks not apparent		√	√	√		
2.4	Welds uniform and smooth		√	√	√		
3.1	Mill marks removed		√	√			
3.2	Butt and plug welds ground smooth and filled		√	√			
3.3	RHS/CHS weld seam oriented for reduced visibility		√	√			
3.4	Cross sectional abutting surface aligned		√	√			
3.5	Joint gap tolerances minimized		√	√			
3.6	All welded connections		optional	optional			
4.1	RHS/CHS seam not apparent		√				
4.2	Welds contoured and blended		√				
4.3	Surfaces filled and sanded		√				
4.4	Weld show-through minimized		√				
C.1							
C.2							
C.3							
C.4							
C.5							

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### *Notes*

- 1.1 Prior to blast cleaning, any deposits of grease or oil are to be removed by solvent cleaning, AS1627 Part 1.
  - 1.2 Rough surfaces are to be deburred and ground smooth. Sharp edges resulting from flame cutting, grinding and especially shearing are to be softened.
  - 1.3 Intermittent welds are made continuous, either with additional welding, caulking or body filler. For corrosive environments, all joints should be seal welded. Seams of hollow structural sections shall be acceptable as produced.
  - 1.4 All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another.
  - 1.5 Weld spatter, slivers, surface discontinuities are to be removed. Weld projection up to 2 mm is acceptable for butt and plug welded joints.
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- 2.1 Visual samples are either a 3-D rendering, a physical sample, a first off inspection, a scaled mock-up or a full-scale mock-up, as specified in Contract Documents.
  - 2.2 These tolerances are required to be one-half of those of standard structural steel as specified in CSA S16.
  - 2.3 Members marked with specific numbers during the fabrication and erection processes are not to be visible.
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- 3.1 All mill marks are not to be visible in the finished product.
  - 3.2 Caulking or body filler is acceptable.
  - 3.3 Seams shall be oriented away from view or as indicated in the Contract Documents.
  - 3.4 The matching of abutting cross-sections shall be required.
  - 3.5 This characteristic is similar to 2.2 above. A clear distance between abutting members of 3 mm is required.
  - 3.6 Hidden bolts may be considered.
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- 4.1 RHS/CHS seams shall be treated so they are not apparent.
  - 4.2 In addition to a contoured and blended appearance, welded transitions between members are also required to be contoured and blended.
  - 4.3 The steel surface imperfections should be filled and sanded.
  - 4.4 The weld show through on backface of the welded element caused by the welding process can be minimized by hand grinding the backside of the weld. The degree of weld show-through is a function of weld size and material.
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- C. Additional characteristics may be added for custom elements.



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