SUPPLIER QUALITY MANUAL
and Reference
Guide including

Addendum: Weld Training Manual

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Revision History

Rev.	Date	Description of Change	Approver
A	9/7/2006	Initial Release	R. Muterspaw
B	10/23/06	Update 4.0 Gear stencil w/mate req.	M. Stoll
		Add weld 30deg bevel requirement	
C	1/15/07	Add sheet metal weld standards	M. Stoll
D	10/17/07	Add ATS plate tolerances, section 3	M. Stoll
E	02/13/08	Add Fastener requirement, remove welding requirements	K. Chilton
F	04/15/08	Added Welding Addendum	M. Stoll
G	10/25/2013	Added Concentricity	K.Chilton

QUALITY STANDARD

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QUALITY POLICY

The management of Aida-America is committed to the policy statement:

We will maintain and continuously improve our Quality Management System to meet our company's goals and to satisfy the needs of our customers

FORWARD

Purpose

To provide a common reference of quality standards for suppliers and subcontractors of all AIDA-AMERICA parts and products.

Scope

These Quality Standards are to be used to supplement existing requirements of drawings, process specifications, purchase orders and similarly controlled documents, which take precedence over these standards.

Policy

1. The material contained in this Quality Standards Manual may not be reproduced nor distributed.
2. Each holder of a Quality Standards Manual is responsible for ensuring that it is the current revision, and removing and destroying obsolete issues.
3. This manual is the property of AIDA-AMERICA and is to be returned upon request.
4. Any comments, questions or suggestions concerning these Quality Standards are to be directed to AIDA-AMERICA through appropriate Purchasing Department buyer.

1.0 QUALITY SYSTEM REQUIREMENTS

1.1 MANAGEMENT RESPONSIBILITIES

1.1.1 Supplier management at the executive level shall define and document its policy for quality including its commitment to quality.

1.1.2 The responsibility and authority of personnel who manage, perform, and verify work affecting quality shall be defined and documented.

1.1.3 The supplier shall identify requirements and provide adequate resources, and assign trained personnel for verification activities (including, test, inspection, and monitoring of the production and installation processes and/or product).

1.2 QUALITY SYSTEM

1.2.1 The Supplier shall establish document, and maintain a quality system as a means of ensuring that product conforms to specified requirements.

1.3 CONTRACT REVIEW

1.3.1 The Supplier shall establish and maintain documented procedures for contract review and for the coordination of these activities. Before submission of acceptance of a contract or order the Supplier shall review the order to ensure that:

a) The requirements are adequately defined.
b) Any differences between the order and the contract have been resolved.
c) The Supplier has the capability to meet the contract (including schedule requirements).

1.4 DOCUMENT CONTROL

1.4.1 The Supplier shall establish and maintain documented procedures to control all documents and data that relate to the Quality System requirements. Documentation shall be controlled to ensure that:

a) the documents are available at all locations where operations essential to the effective functioning of the quality system are performed;
b) invalid and / or obsolete documents are promptly removed from all points of issue or use, or otherwise assured against unintended use;
c) any obsolete documents retained for knowledge / legal purposes are suitably identified.

1.4.2

a) Submission of CAD electronic drawing data (hereafter CAD data) to suppliers shall be in accordance with the responsibilities and authority stipulated in AJS 20015.
b) AAC shall enter into a nondisclosure agreement with the supplier and shall provide language in the contract instructing the supplier to positively delete the data, etc. once the objective is reached.
c) Though the drawings and CAD data should strictly correspond, there might be differences depending on the date of creation. When providing CAD data, complete re-checking is not conducted, and so for AIDA the copy drawing is accurate; and we are to make it clear that if the CAD data is used as is and an error occurs, it will be the supplier's responsibility (or by negotiation).

Note: CAD data can easily be duplicated, etc., and so AIDA shall provide language in the contract instructing the supplier to delete the data after being used to prevent improper spreading.

1.5 PURCHASING

1.5.1 The Supplier shall maintain establish and maintain documented procedures to ensure that purchased product conforms to specified requirements.

1.6 CUSTOMER - SUPPLIED PRODUCT

1.6.1 The Supplier shall establish and maintain documented procedures for the control of verification, storage, and maintenance of customer - supplied product. Any such product lost, damaged, or unsuitable for use shall be recorded and reported to the customer.

1.7 IDENTIFICATION AND TRACEABILITY

1.7.1 The Supplier shall establish and maintain documented procedures for identifying product during all stages of production and delivery, see General Requirements for Parts and Materials, pg. 3 for specific AIDA-AMERICA requirements.

1.8 INSPECTION AND RECORDS

1.8.1 Supplier shall perform complete inspections and maintain adequate inspection and test records to substantiate that the required inspections have been performed and provide evidence, upon request, that the product is acceptable.

1.9 CALIBRATION

1.9.1 The Supplier shall establish and maintain a system insuring that all gauges, measuring devices, and testing equipment used for product acceptance are calibrated at specific intervals against certified standards which have known valid relationships to those of the National Bureau of Standards.

1.10 AIDA-AMERICA AUDIT/SOURCE INSPECTION

AIDA-AMERICA reserves the right of verification and audit at the Supplier's facilities. The Supplier shall make available all inspection equipment, records, and personnel necessary to determine product conformance to drawings, specifications, and purchase order requirements.

2.0 GENERAL REQUIREMENTS FOR PARTS AND MATERIALS

2.1 SCOPE

This standard covers the general requirements for parts manufactured both "in-house" and by vendors or subcontractors.

Note: Drawing dimensions, tolerances, notes etc. Always take precedence over any statements in this standard.

2.2 GENERAL REQUIREMENTS

2.2.1 Identification: All parts are to be marked with the part number and revision level. In the case of a Supplier, the vendor code shall be marked near the part number. The markings shall be on an un-machined or non-critical surface. The preferred application of such information is by engraving and/or stamping, however (legible) manually applied vibratory stenciling is acceptable. If this information is not on the parts, they will not be accepted. Where parts are too small to be individually marked, they may placed in a container, ie. bag/box of which shall be labeled with the information stated above. If a non-critical surface is not available for marking, the parts can be individually tagged, marked with a sticker or stamped with permanent ink reflecting the required information.

2.2.2 Packing and Preservation: Parts shipped to AIDA-AMERICA must be adequately packaged to prevent them from being damaged during transportation and handling. When skidding is required, parts are to be skidded to provide a safe zone and tip stability, and elevated from the floor 4" for forklift lifting. All ferrous sub-contract parts are to be coated with a rust inhibitor to protect the finish. Failure to do so may result in cosmetically and/or functionally unacceptable parts. The supplier may be liable for rework and other cost in such a case. Ref 2.2.5 (Authorized Rust Inhibitor Products)

2.2.2.1 Note #1 - Newspaper is not an acceptable wrap for parts which are subject to oxidation.

Using newspaper for wrapping Aida parts for protection during shipping or storage is NOT ALLOWED.

Newspaper or similar paper products which are not treated against moisture will absorbs moisture from the surrounding air, and can cause rust.

General Cleaning: All parts must be completely cleaned after machining and before shipment or acceptance by AIDA-AMERICA. The cleaning should include, but is not limited to, cutting oils, finishing compounds, plating solutions, grinding sludge, metal chips, drying or absorbing material, etc. Special attention should be given to holes (such as removing chips from tapped holes), recesses and cavities. NOTE: ALL NON-MACHINED SURACES MUST BE FREE OF SCALE, SLAG AND CORROSION!!

2.2.4 Parts must be complete to all drawing specifications including bushings, bolts and surface treatment.

2.2.5 Authorized Rust Inhibitor Products:

LPS #2 – Industrial Strength. Preferred for short term use. Multi-purpose lubricant, and penetrant with added corrosion protection. Non-drying oily film. Provides up to one-year protection. Indoor/Outdoor storage.

LPS #3 – Heavy-Duty Rust Inhibitor. Preferred for long term storage (up to 2 years) Forms a transparent, soft, waxy film for added protection and lubrication for outdoor equipment and tools, and overseas storage or shipments. Provides up to 2 years protection, indoor. Outdoor protection up to one-year.

Additional alternates which meet or exceed minimum requirement:
1 - **Cromac #429** – Rust preventative compound, solvent wax dispersion

2 - **DY100 -** Dripless Undercoating Oil, Clear

3 - **Tectyl 506 –** Rust preventative solvent based, microcrystalline wax**.**

Note: Remove Tectyl 506 using solventborne thinner, mineral spirit, vapor degreasing, hot alkaline wash, or low pressure steam.

2.2.6 Protection of components during shipping, handling and storage. The following examples are minimum guidelines for protection of product:

Type of Part	**Minimum Packaging Requirement**
Gears	Teeth dipped in protective plastisol coating or individually wrapped. Oil's must be approved
Threaded Parts (External)	Threads dipped in protective pastisol coating, individually wrapped, or protected by the mating part such as the nut.
Ground Bars / Ground & Polished (shafts & tubing)	Wrapped in rust preventative paper and secured in a wooden box. Where practical ship in the Mfg.'s original protective tubing.
Precision Ground Flats	Individually wrapped in a rust preventative paper and laminated to a board with the precision surface (s) protected.
Plastic Guards, Lenses	Where possible the Mfg.'s protective "skin" shall be left in place. Parts are to be individually wrapped so as to protect all surfaces from abrasive scratches.
Sheetmetal Guards	Surfaces to be wrapped in protective sheets. Parts are to be packaged so that no sharp corners damage adjacent parts. Parts are not to "over -hang" the skid on which they are shipped. Where practical sheet metal kits should be vertically oriented to minimize damage and to allow access to any one of the parts.
Machined Parts	Secured on / in a skid / box so as to prevent damage to adjacent parts. (Ref 2.2.5 Authorized Rust Inhibitor Products)
Resale Equipment (Domestic/Export)	Equipment is to be skidded, banded, and covered with a rust preventative barrier adequate to withstand the elements it will encounter in transit.
Ferrous material parts	Parts are to be coated with a rust inhibitor product to protect the finish. (Ref 2.2.5 Authorized Rust Inhibitor Products)

2.3 MACHINING REQUIREMENTS

2.3.1 Burrs: All machined edges and corners shall be completely and evenly deburred. Care should be taken to observe drawing cautions on requirements for sharp corners, etc. (See Section 3.4)

2.3.2 Break Edges: All machined edges shall be adequately and evenly broken unless drawings state otherwise.
(See Section 3.4)

2.3.3 Scratches, Dents, Marks: All machined surfaces and edges must be free from nicks, scratches and other marks. Ground finishes (when called for on the drawing) shall exhibit no marks that exceed the finish requirement for this area of the part.

2.4 WELDING (refer to Weld Training Manual)

2.5 Sheet Metal Welding Standard (ATS-3657-2005)

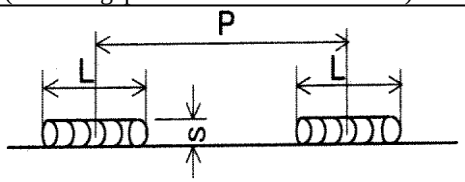
2.5.1 Scope of Application: This standard prescribes the welding of primarily sheet metal parts.
Sheet metal parts are defined as welded parts that are composed primarily of material with thicknesses of t9 or less, on which relatively little or no machining is performed.
Commentary: Because parts on presses are subject to the effects of vibration, as a general rule stitch welding is not allowed. However, this is a standard that is used as a countermeasure to prevent deformation, etc.
This is also used in cases where we don't want to make the leg lengths thinner yet the strength of a continuous weld is not required.

2.5.2 Stitch Fillet Weld Dimensions
(1) The size of the stitch welding is shown by the leg length of the fillet weld (S), the weld length (L), and the pitch (P).
(2) For stitch welds, the weld length (L) and the pitch (P) is now being stipulated (see below), and the leg length of the fillet weld (S) is to be Class 3.
(3) The standard dimensions for stitch welds are given in Table 1 below.
(4) If you judge that there are critical areas (mounting areas, etc.) of a sheet metal part (which otherwise falls within a category that could be stitch-welded), such areas are to have continuous welds. (This is to be called out on the drawing.)
(5) For sides or parts that are called out to be oil-tight, at least one side is to have a continuous weld. (This is to be called out on the drawing.)

Table 1: Standard Dimension of Stitch Fillet Welds (Unit: mm)

Thickness (t)	≥	1.6	2.3	3.2	4.5	6	8.1	9.1	For material thicker than t10, refer to ATS-3630 'Fillet Welding Dimension Standard'.
	≤	2.2	3.1	4.4	5.9	8	9	10	
Leg Length(S)	Class 3	3	3	4	4	6	6	6	For material thicker than t10, they are basically to have continuous welds (excluding pad blocks with low loads).

L-P	Welded Area Length	Refer to ATS-3610 'Welding Symbols (20) for notation examples.	
	Up to 150	15-30	30-60
	151~250	20-60	30-90
	251~800	20-80	30-120~40-150
	800+	20-100	30-150~40-200



Note 1: For plates with different thicknesses that are to be mated together, use the thickness of the thinner material for the plate thickness (t) value.

Note 2: L=weld length, P=Weld Pitch, and the standard is to weld on both sides. (Excluding areas where welding is not possible.)

Note 3: Regarding the size of the stitch welds when welding on both sides, for both parallel and staggered stitch welds the above table is to be used, and in either case a joint is to have parallel welds at the ends on both sides.
The manufacturer is to decide when to use parallel versus staggered welds as a countermeasure for deformation. (Unless this is called out on the drawing.)

Note 4: Corner areas and thick plate areas on pad blocks, etc., where it is easy for stress to be concentrated are to always be box-welded.

2.5.3 Calling out Fillet Stitch Welds on Drawings

(1) Add the notation "Sheet Metal Welding" to the lower right area of the drawing.

(2) Either provide welding symbols or instructions on the drawings for areas requiring continuous welds, areas outside of the parameters of the above table, and areas that require special notations.

2.6 PLATING AND COATINGS

2.6.1 General Requirements: All plating shall be uniform in appearance and deposition. The plating shall be free from stain caused by inadequate cleaning or drying of the various solutions on the part after plating. Thickness of the plating will be specified by AIDA-AMERICA documentation.

2.6.2 Chromium & Electroless Nickel: The plating shall be smooth, fine grained, adherent, uniform in appearance, free from blisters, pits, nodules, excessive edge build-up and other defects.

2.7 CASTINGS

2.7.1 All castings shall be free of defects such as cold shuts, porosity, surface scabs, dirt, slag, entrapped sands, cracks, etc. Pattern flaws on rough surfaces due to molding practices shall not exceed machining parameters. Refractory wash shall be applied in such a manner that the casting surface is smooth and free of haphazard brush strokes. All castings must be delivered in a clean condition so that they exhibit a uniform appearance. Castings which are warped such that they cannot be cleaned up during machining or will cause clearance problems in use will be cause for rejection.. Test bars shall be kept by the foundry for the applicable pour for two years, and may be requested to ascertain mechanical, physical and chemical properties.

All first piece articles produced on new patterns shall require a first piece inspection. The supplier shall be responsible for verification of the casting dimensions and shall forward them on the attached Inspections form AF89 or equivalent prior to part delivery.

2.8 THREADS and FASTENERS

2.8.1 Metric screw threads are identified by the letter (M) for the thread form profile, followed by the nominal diameter size and the pitch expressed in millimeters, separated by the sign (X) and followed by the tolerance class separated by a dash (-) from the pitch. The simplified universal practice for designating coarse pitch M threads is to leave off the pitch. Thus a M14 x 2 thread is designated as M14.

2.8.2 Rc taper threads noted are to comply with BSPT, British Standard Pipe Threads for (Pressure-tight Joints) unless otherwise specified.

2.8.3 Rp parallel threads are to comply with cylindrical Whitworth internal pipe threads (for pressure tight joints) according to BSPP.

2.8.4 The basis for acceptance of threads on parts shall be as follows: Thread form or profile must be uniform and free of marks / nicks. The pitch diameter must fall within the tolerance band applicable to the class of thread. Threads shall be inspected using calibrated gauging.

2.8.5 Metric and Inch Threaded Fastener Class used in the assembly of Aida-America product, unless otherwise specified on the drawing:
All Socket Head Cap Screws are required to be a property class of 12.9
All Hex Head Screws/Bolts are required to be a property class of 10.9 or higher
All Nuts and Washers used in conjunction with 10.9 and 12.9 fasteners are required to be a property class 10.9 or higher

3.0 DIMENSION, TOLERANCES AND SURFACE FINISH

3.1 DIMENSIONS: **When not specified on the drawing, the following dimensions shall be used.**

3.1.1 Drawing dimensions are finished dimensions, after the application of any plating and chemical finishes, unless specified otherwise on the drawing.

3.1.2 All external burrs, sharp edges and corners are to be broken to an appropriate radius of R=2.5mm (0.10) min. See section 3.4 for more detail on sharp edges.

3.2 TOLERANCES: **When not specified on the drawing, the following tolerances shall be used.**

3.2.1 AIDA-AMERICA utilizes ANSI Y14.5 - 1994 Dimensioning and Tolerancing, in all of its engineering drawings

3.2.2 Tolerances on dimensions measured between machined surfaces, excluding tolerances, when not specified on the drawing, shall be:

Unit: mm

Dimension	Tolerance
0.5 to 6	± 0.1
Over 6, 30 or less	± 0.2
Over 30, 120 or less	± 0.3
Over 120, 315 or less	± 0.5
Over 315, 1000 or less	± 0.8
Over 1000, 2500 or less	± 1.2

Note: Excluding items for which the upper limit of the dimension differs (JIS is 2000 or less), the above values conform to JIS B 0405-1991, intermediate class.

3.2.3 Parallelism and perpendicularity between machined surfaces shall not exceed 1/2 the total tolerance spread of the dimension between the measured surfaces.

3.2.4 Flatness and straightness of a machined surface shall not exceed 1/2 the total tolerance spread of the feature in question and must not extend beyond a boundary (envelope) of perfect form at Maximum Material Condition (MMC). Note: No variation is permitted if the feature is produced at its MMC limit of size.

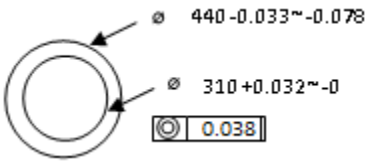
3.2.5 Runout of cylindrical features shall not exceed the total tolerance spread of the diameter in question.

3.2.6 Total runout of flat surfaces shall not exceed 1/2 the total tolerance spread of the feature in question.

3.2.7 Angularity (except 90^0) of a machines surface or axis from a datum plane or axis shall not exceed 30 min., or 0.5 ^{0} ; and must be within the total tolerance spread for size and location. All fabricated angles, including 90^0 angles, shall be within 30 min.

3.2.8 Cylindricity and circularity shall not exceed the total tolerance spread of the diameter in question.

3.2.9 Concentricity shall not exceed ½ of the added total tolerance spread of the common center diameters.
Example of common center diameters:
440 diameter and tolerance of -0.033 ~ -0.078mm
310 diameter and tolerance of +0.032 ~ 0mm
Calc., 0.078 – 0.033 = 0.045
Calc., 0.032 - 0 = 0.032
Calc., 0.045 + 0.032 = 0.077 (total tolerance spread) / 2 = 0.038
The concentricity of the common center on the 440 dia and 310 dia shall not exceed 0.038mm



3.3 Normal Tolerance of Cast Iron (1): ATS-6007-81

3.3.1 **Application:** This standard stipulates the normal tolerances for the dimensions (as cast) of length and thickness of spheroidal graphite **cast iron and gray cast iron** which have been made from sand molds (with the exception of precision casting molds and associated items).

Note: This normal tolerance is to be applied in situations where no other dimensions for particular precision or function are required or written on drawings, specification manuals etc.

3.3.2 **Normal Tolerance**

Normal Tolerance for Length **:** Normal tolerances for length are shown in Table 1 below.

Table 1 Normal tolerances for length

Units: mm

Dimension category	Tolerance
120 or less	±1
over 120, 400 or less	±1.5
over 400, 800 or less	±2
over 800, 1600 or less	±2.5
over 1600, 2500 or less	±3
over 2500, 3500 or less	±3.5

Normal Tolerances for Thickness: Normal tolerances for thickness are shown in Table 2 below.

Table 2 Normal tolerances for thickness

Units: mm

Dimension category	Tolerance
18 or less	±1
over 18, 30 or less	±1.5
over 30, 50 or less	±2
over 50, 80 or less	±3
over 80, 120 or less	±4

Related Materials: JIS B 0407 - Normal Tolerances for **Cast Iron**

3.4 Normal Tolerance of Cast Iron (2): ATS-6007-81

3.4.1 **Draft Angle** When not designated on the drawing etc., the draft angle can be determined, according to the requirements of casting, using the dimensions shown in Table 3.

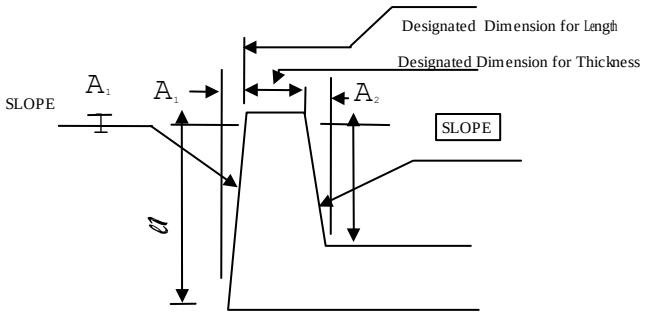


Table 3 Dimensions for Assigning a Draft Angle

Units: mm

Dimension category (l)	Dimension (*A*) (max.)
180 or less	1
over 180, 315 or less	1.5
over 315, 500 or less	2
over 500, 800 or less	3
over 800, 1250 or less	4
over 1250, 1600 or less	5

Note: Draft angle standards for crowns, columns, beds, slides, etc., which have problems with appearance, will be established separately.

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3.5 Normal Tolerance of Cast Steel (1): ATS-6008-82

3.5.1 Application: This standard stipulates the normal tolerances for the dimensions (as cast) of length and thickness of **cast steel** which has been made from sand mold

Note: This normal tolerance is to be applied in situations where no other dimensions for particular precision or function are required or written on drawings, specification manuals etc.

3.5.2 Normal Tolerance

Normal Tolerance for Length **:** Normal tolerances for length are shown in Table 1 below.

Table 1 Normal tolerances for length

Units: mm

Dimension category	Tolerance
120 or less	±2
over 120, 315 or less	±3
over 315, 630 or less	±4
over 630, 1250 or less	±5
over 1250, 2500 or less	±6
over 2500, 5000 or less	±7

Normal Tolerances for Thickness: Normal tolerances for thickness are shown in Table 2 below.

Table 2 Normal tolerances for thickness

Dimension Category	Tolerance
25 or less	+1.5 -1
over 25, 40 or less	+2 -1
over 40, 63 or less	+3 -1.5
over 63, 100 or less	+4 -2
over 100, 160 or less	+5 -2.5
over 160, 250 or less	+6 -3

Related Materials: JIS B 0412 - Normal Tolerances for Cast Steel

3.6 Normal Tolerance of Cast Steel (2): ATS-6008-82

3.6.1 Draft Angle When not designated on the drawing etc., the draft angle can be determined, according to the requirements of casting, using the dimensions shown in Table 3.

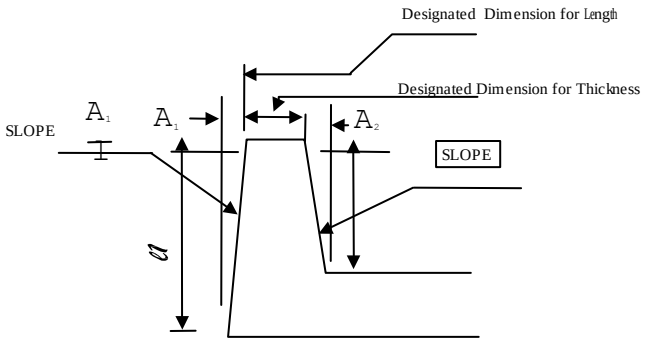


Table 3 Dimensions for Assigning a Draft Angle

Units: mm

Dimension category (l)	Dimension (*A*) (max.)
50 or less	1
over 50, 200 or less	2
over 200, 400 or less	3
over 400, 630 or less	4
over 630, 1000 or less	5
over 1000, 1600 or less	6

Note: Draft angle standards for crowns, columns, beds, slides, etc., which have problems with appearance, will be established separately.

3.7 SURFACE FINISH

3.7.1 The surface finish symbols. Are used to designate maximum permissible surface roughness. Surface roughness may be measured with a profilometer, comparison specimens or certified samples, or similarly accurate methods. **Caution:** Drawings created prior to 1982 may show (delta finish marks) which represent the applicable maximum height Rmax, (**Ry**) and subsequent drawings will show the mean roughness of the centerline **Ra** (µm). For additional information ref. ATS-1616-96

New ATS-1616 Ra reference Surface		Conventional ATS-1616 Rmax (Ry) reference	
roughness representation method	Surface roughness (μm)	σστ	Surface Roughness
No Representation	Smooth Material		Smooth Material
12.5	12.5		50S
12.5	12.5		50S
3.2	3.2		12.5S
3.2	3.2		12.5S
	1.6	S	6.3S
	Same as the representation of S		Same as the representation of S
0.2	0.2		0.8S
	Same as the representation of S	S	Same as the representation of S
BEFORE WELDING	12.5	or	50 S
BEFORE WELDING	3.2	or	12.5 S

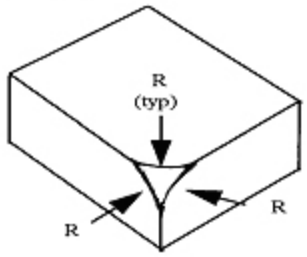
3.8 SHARPNESS, EDGES & CORNERS

3.8.1 Measurement Instrument - The sharpness of corners and edges shall be measured by using UL-1439 sharp edge tester. **(Technical Engineering Service, 140 Rumford Rd., Kingspark, NY 11754, (516) 265-4290)**

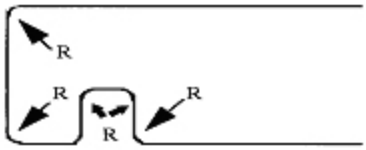
3.8.2 Definition - Most generally "sharpness" is burr. Burr is defined as roughness on the edge of a work piece formed during machining/fabrication/forming process. Generally burr has an undesirable degree of sharpness associated with it.

3.8.3 Criteria/Specifications - When not specifically superseded by the applicable drawing, components shall conform to the following guidelines:

Source	Area	Acceptance Criteria
Components: Ferrous/Non Ferrous Plastics (other than Sheet metal)	Corner	Radius R(type) =2.5mm (0.10") min. Rounded edges should blend to form smooth corner. Ref. Drawing "A".
Sheetmetal	Corner (3 edges meet)	Same



Sheet Metal	Corner (two edges meet) Punched/Sheared	Radius R (typ) = 0.5mm (0.02")min Ref. Drawing "B"



Source	Area	Acceptance Criteria
All Components	Edge	Break/Radius edges 0.010" - 0.020". Use sharp edge tester as per UL-1439

Note: To purchase a Sharp Edge Tester:
Technical Engineering Service
140 Rumford Rd.
Kingspark, NY 11754
(516) 265-4290

3.8.4 Prevent/Minimize Burr - Some of the general rules about prevention/minimization are:

- Sharp tools minimize all burr properties.
- Supporting the machined edges minimizes burr size.
- Ductile materials form larger burr than brittle materials.
- Work hardened materials produce thicker and hardened burr.
- Changing feeds and speeds will reduce burr size as will selecting appropriate cutters.
- Burr removal can be expedited by placing burr in a position they can easily be removed.
- Utilizing different machining sequences can also minimize the amount of deburring required.
- Laser cutting normally produces less burr.

3.8.5 Burr Removal - Low Cost Solutions

Process	Use For
Barrel Tumbling	Castings to remove abrasive metal projections
Hand/Pneumatic	
Knife Tools	Drilled holes, milled or machined edges
Files	Burr on edges and corners
Finishing Belts	Nylon/Lexon edges & corners
Sanders	Castings & steel components
Wire Brushes	Weld splatters

4.0 QUALITY REQUIREMENTS FOR GEARS

4.1 Aida-America gears produced are to comply with the specified AGMA quality number. Any exceptions are noted in the gear data chart, in the note section on the drawing.

4.2 Inspection reports are required (ref: 1.8 Inspection and Records)
For Packaging and Shipping (ref: 2.2 General Requirements, and 2.2.6 Gears).

4.3 Gears that are machined, inspected or disposition as a matched set must be identified and serialized as a set. Stamp the serial number on a visible non-working surface, (ref 2.2.1 Identification). The serial number must appear on both gears for matching purposes. As much as possible, package and ship as a matched set.

5.0 PAINTING

5.1 APPLICATIONS:

5.1.1 If a surface is painted, the coating must not interfere with the machine's normal operation or assembly. Where prints do not specify mask instructions the following guidelines shall be followed:

5.1.1.1 The parts shall require masking of functional machined surfaces and tapped or reamed holes.

5.1.2.1 If these areas are not identifiable contact the responsible Purchasing Agent.

5.1.2.2 For proper pre-cleaning of parts before painting, and to achieving a good adherence of PPG paint product, reference AAC-WI-MFG-06 (Painting) work process. See Quality/Purchasing management regarding painting procedure.

5.2 PAINT COLORS:

5.2.1 Where required, paint colors and type will be noted on the Purchase Order.

6.0 GEOMETRIC DIMENSIONING AND TOLERANCING

6.1 Purpose : To provide supplemental information in regard to Geometric Dimensioning and Tolerancing.

6.2 Scope : All AIDA-AMERICA drawings are dimensioned to ANSI Y14.5M - guidelines.

means that when **MMC** is shown modifying a particular tolerance, the stated tolerance applies only when the feature being controlled is at **MMC** size. **As the feature size departs from MMC size you may add the amount of departure directly to the original tolerance.**

Example:

⌀0.320 ±0.010

⌖	⌀0.005	Ⓜ	A	B

Actual = 0.313
−MMC = 0.310
Bonus = 0.003

A hole must be in position within a cylindrical tolerance zone of 0.005 diameter when at **MMC.** If the hole size were larger than MMC by 0.003 then you get 0.003 bonus tolerance. You can add this 0.003 bonus tolerance to the original 0.005 tolerance, and get a total of 0.008 zone. Using **MMC** gives you more tolerance.

−A− **Datum symbol:** this symbol represents physical features or surfaces that must be used for location in machining or inspection.

⌀ **Diameter symbol:** this symbol replaces the word "diameter." It should be used anywhere there is a diameter on the drawing, and when the tolerance zone is diametral. Example: ⌀0.500 ±0.002 OR

⊥	⌀0.005	A

C 1 **Datum target symbol:** This is the symbol for a datum on irregular parts such as castings and forgings. It can be a target point: (A1) which must be located by a rounded pin, or a target area: (⌀1 / C1) which must be located by a flat pin (which is the diameter specified in the upper portion of the symbol).

Ⓜ **MMC modifier:** meaning maximum material condition applies.

Ⓛ **LMC modifier:** meaning least material condition applies.

Ⓢ **RFS modifier:** meaning regardless of feature size.

Ⓟ **Projected tolerance zone modifier:** when the symbol is shown, it means that the stated tolerance zone is longer than the feature extending out in space. You must measure the feature compared to this extended zone, and in the proper direction.

0.500 **Basic dimension:** basic dimensions are located by position tolerances only (except basic angles). Basic dimensions have no tolerance—they simply locate a tolerance zone.

SYMBOL	AS SHOWN ON DRAWING	TOTAL TOL ZONE	MMC OR RFS?	DATUM USED ?	FUNC GAGE USED?	GOOD PART EXAMPLE	BAD PART EXAMPLE
PROFILE OF A LINE	⌒ .002	.002 WIDE AROUND TRUE PROFILE	A SURFACE HAS NO SIZE	DATUM CAN BE USED OR NOT	NO	.002	.002
PROFILE OF A SURFACE	BASIC DIMENSIONS ARE REQUIRED TO DEFINE THE TRUE PROFILE ⌓ .001	.001 WIDE ZONE AROUND TRUE PROFILE	A SURFACE HAS NO SIZE	DATUM CAN BE USED OR NOT	NO	ENTIRE SURFACE IS IN	PART OF SURFACE IS OUT
PROFILE UNILATERAL ZONE	BASIC DIMENSIONS ARE REQUIRED TO DEFINE THE TRUE PROFILE ⌓ .002 A, -A-	.002 ZONE ALL ON ONE SIDE	A SURFACE HAS NO SIZE	DATUMS CAN BE USED OR NOT	NO	ACTUAL ZONE, PERFECT	ACTUAL ZONE, PERFECT
RUNOUT (CIRCULAR)	⌀ .500 .496, ↗ .001 A, A	.001 .001 A, TECHNICALLY THE ZONES ARE TWO DOTS	A SURFACE HAS NO SIZE	YES ALWAYS	NO	SEE ZONE SKETCH	GREATER THAN .001
RUNOUT (TOTAL)	⌀ .500 .496, ⌰ .001 C, C	.001 TOTAL ZONE TWO PARALLEL LINES, AXIS, C	A SURFACE HAS NO SIZE	YES ALWAYS	NO		
CONCENTRICITY	⌀ .300 .296, ◎ ⌀.002 A, A	.002 CYLINDER DATUM AXIS A	Ⓢ IF YOU WANT Ⓜ USE	YES ALWAYS	NO	.001 OR LESS DATUM AXIS ⌀.002, FEATURE AXIS	OVER .001 DATUM AXIS, FEAT AXIS
POSITION	⌀.200 ± .003, ⌖ ⌀.002 Ⓜ C A B, B, .800, .950, C, A	⌀.002 ZONE AT MMC, PERFECT POSITON	Ⓜ OR Ⓢ MUST BE STATED	YES	YES IF Ⓜ IS STATED	BONUS ⌀.002 PERFECT, ACTUAL ℄ ANYWHERE INSIDE ZONE	ACTUAL ℄

—Feature control frame:

⌖	⌀0.005	Ⓜ	A	B	C

Tertiary datum (locate by 1 point min.)
Secondary datum (locate by 2 points min.)
Primary datum (locate by 3 points min.)
Modifier for the stated tolerance
Stated tolerance
Diameter symbol (cylindrical tolerance zone)
Geometric characteristics (position)

(0.500) Reference dimension: for computation only, not to be inspected.

Tolerance zones: All tolerance zones shown in the feature control frame are total. Example: position within a 0.005 cylindrical tolerance zone means that the tolerance zone is a 0.005 cylinder which the actual center line of the feature must lie within. The exact position lies in the center of the 0.005 zone.

Feature: A feature is a physical portion of a part such as a surface, hole or slot.

8.0 Material Cross Reference

Material	Origin	American Standard	Description
A1	(BS)	ASTM U-60-30, 60-31	steel casting
AC 7 A	(JIS)	ASTM 514.0	aluminum alloy casting
AC 7 B	(JIS)	ASTM 520.0	aluminum alloy casting
AlBC 2	(JIS)	ASTM C 95400	copper alloy casting
AlBC 3	(JIS)	ASTM C 95800	copper alloy casting
BM 2	(BS)	ASTM M 2	tool steel
C 3604 B	(JIS)	ASTM C 36000	copper alloy
C 60	(ISO)	AISI 1060	steel for machine structural use
FC 250	(JIS)	ASTM class No. 40	iron casting
FC 350	(JIS)	ASTM class No. 50	iron casting
FCD 400	(JIS)	ASTM 60-40-18	iron casting
FCD 500	(JIS)	none - approx. ASTM 80-55-06	iron casting
HITACHI	(JIS)		
LBC 2	(JIS)	ASTM C 93700	copper alloy casting
S 15 C	(JIS)	AISI 1015	steel for machine structural use
S 28 C	(JIS)	AISI 1025	steel for machine structural use
S 45 C	(JIS)	AISI 1045, 1046	steel for machine structural use
S 55 C	(JIS)	AISI 1055	steel for machine structural use
SC 410	(JIS)	ASTM U-60-30, 60-31	steel casting
SCM415	(JIS)	AISI A8620	steel for machining structural use
SCM 440	(JIS)	AISI 4140, 4142	steel for machine structural use
SCMn 2B	(JIS)	ASTM 90-60	steel casting
SNCM420	(JIS)	AISI A4320 , A8620	steel for machining structural use
SK 4	(JIS)	ASTM W 1-9	tool steel
SKD 61	(JIS)	ASTM H 13	tool steel
SS 400 / 41	(JIS)	ASTM 50 ASTM A36	general structure steel
SPH	(JIS)	AISI 1018 , 1020	miled steel
STKM 13A	(JIS)	ASTM 1020	structural steel pipe
CD-5	(Enomato)	ASTM D5	Ni-Resist Cast Iron
BC6	(JIS)	ASTM C 83600	red brass
SGP 6B	(JIS)	Schedule 40 gas pipe	Schedule 40 gas pipe

AISI	American Iron and Steel Institute
ASTM	American Society for Testing and Material
BS	British Standards
ISO	International Organization for Standardization
JIS	Japanese Industrial Standards

QUALITY STANDARD

	Minimum Yield Strength			Minimum Tensile Strength			Shear	Hardness	Thermal	Mass density	Mass density
	N/mm^2	kgf/mm2	(ksi)	N/mm^2	kgf/mm2	(ksi)	kgf/mm2	HB	mm/deg. C	g/cm3	kg/mm3
A1	205	21	(29.7)	415	42.3	(60.2)	8.1		1.1	7.8	0.0000078
AC 7 A	0	0	(0.0)	210	21.4	(30.5)	2.5		2.45	2.7	0.0000027
AC 7 B	0	0	(0.0)	0	0.0	(0.0)	2.5		2.45	2.7	0.0000027
AIBC 2	207-241	21.1-24.6	30-35	520-588	53-60	75-85	3.7	140-170	1.73	8.5	0.0000085
AIBC 3	276-303	28.1-30.9	40-44	588-657	60-67	85-95	3.7	180-200	1.73	8.5	0.0000085
BM 2	0	0	(0.0)	0	0.0	(0.0)					0
C 3604 B	0	0	(0.0)	335	34.2	(48.6)	4.2		1.65	8.96	0.00000896
C 60	0	0	(0.0)	0	0.0	(0.0)	8.5				0
FC 250	0	0	(0.0)	250	25.5	(36.3)	3.5	230	1.02	7.3	0.0000073
FC 350	0	0	(0.0)	350	35.7	(50.8)	4.4	250	1.02	7.3	0.0000073
FCD 400	250	26	(36.3)	415	40.8	(58.0)	4.4	140-190	1.1	7.3	0.0000073
FCD 500	320	33	(46.4)	500	51.0	(72.5)	4.4	190-225	1.7	7.3	0.0000073
HITACHI	0	0	(0.0)	0	0.0	(0.0)					0
LBC 2	100	10	(14.5)	177-245	18-25	25-35	2.8	55-70	1.78	8.8	0.0000088
S 15 C	200	20	(29.0)	345	35.2	(50.0)	8.5	133	1.12	7.85	0.00000785
S 28 C	221	23	(32.0)	400	40.8	(58.0)	8.5	116	1.12	7.85	0.00000785
S 45 C	407-621	41.5-63.3	59-90	677-696	69-72	98-103	8.5	212-217	1.12	7.85	0.00000785
S 55 C	390	40	(56.6)	650	66.3	(94.3)	8.5		1.12	7.85	0.00000785
SC 410	205	21	(29.7)	410	41.8	(59.5)	8.1		1.7	7.8	0.0000078
SCM415	466-610	45.7-59.8	65-85	618-696	63-72	89-102	8.5	192-212	1.12	7.85	0.00000785
SCM 440	428-621	43.6-63.3	62-90	618-696	63-72	89-102	8.5	187-223	1.12	7.85	0.00000785
SCMn 2B	440	45	(63.8)	640	65.3	(92.8)	8.1		1.7	7.8	0.0000078
SNCM420	434-586	44.3-59.8	63-85	588-696	60-71	85-101	8.5	183-207	1.12	7.85	0.00000785
SK 4	0	0	(0.0)	0	0.0	(0.0)	8.5		1.12	7.85	0.00000785
SKD 61	0	0	(0.0)	0	0.0	(0.0)	8.5		1.12	7.85	0.00000785
SS 400 41	248	25	(36.0)	343-549	35-56	50-80	8.5		1.12	7.85	0.00000785
SPH	296-455	30.2-46.4	43-66	451-490	46-50	65-71	8.5	143-156	1.12	7.85	0.00000785
STKM 13A	241-317	24.6-32.3	35-46	412-432	42-44	60-62	8.5		1.12	7.85	0.00000785
CD-5	216	22	(31.3)	393	40.1	(57.0)		130-170	2-3	0	0
BC6	97	10	(14.0)	207	21.1	(30.0)		50-65		8.78	0.00000878
SGP											

Thermal = Coefient of Thermal Expansion (x10e-6/deg c)

Hardness = Brinell

QUALITY POLICY

Purpose

To provide a common reference of the weld requirements, training and educational material for suppliers and subcontractors of all AIDA-AMERICA parts and products.

Scope

The information provided in this Weld Training Manual is to be used to supplement existing requirements of drawings, process specifications, purchase orders and similarly controlled documents, which take precedence over these standards.

Policy

1. The material contained in this Weld Training Manual may not be reproduced nor distributed.
2. Each holder of a Weld Training Manual is responsible for ensuring that it is the current revision, and removing and destroying obsolete issues.
3. This manual is the property of AIDA-AMERICA and is to be returned upon request.
4. Any comments, questions or suggestions concerning these Weld Standards are to be directed to AIDA-AMERICA through appropriate Purchasing Department buyer.

1.0 QUALITY SYSTEM REQUIREMENTS

1.1 MANAGEMENT RESPONSIBILITIES

2.0 GENERAL REQUIREMENTS FOR PARTS AND MATERIALS

2.1 SCOPE

This standard covers the general requirements for parts manufactured both "in-house" and by vendors or subcontractors.

This standard defines acceptable and unacceptable visual quality for welds in weldments having material thickness of (6.4 mm), 0.25 in. and over.

2.2 GENERAL:

2.2.1 All welds shall be located as specified on the engineering drawing.

2.2.2 Tack welds located in areas not requiring a weld are not permitted.

2.2.3 Welds located in areas not requiring a weld are not permitted.

2.2.4 Welds shall be made using a Qualified Welding Procedure Specification.

2.2.5 Welding sequence shall be made according to an approved Manufacturing Procedure Specification.

2.2.6 Welds shall conform to engineering drawing requirements for size and length.

2.2.7 Slugging or adding of shims is not allowed.

2.2.8 Slag and burrs on the cut surfaces and cut edges are to be removed.

2.2.9 Welds that require Hand Grinding, "G" as indicated on the drawing shall conform to fillet size and length AFTER grinding, removing all traces of stringer passes, thus yielding a smooth appearance. Typically done during fabricating unless otherwise specified.

2.2.10 Welds that require Machining, "M" as indicated on the drawing shall conform to fillet size and length AFTER machining, removing all traces of stringer passes, thus yielding a smooth appearance. Typically done after fabricating unless otherwise specified.

2.2.11 Welding in the vertical position is highly discouraged, and should be done only when there are no other options. Aida-Eng must be consulted **prior** to welding Aida fabrications in the vertical position.

2.2.12 All welders working on Aida fabrications with bevel (or groove) welds less then <45 degree, shall be tested and certified by America Weld Society (AWS), or Canadian Weld Bureau (CWB). (Ref: Fiqure #1)

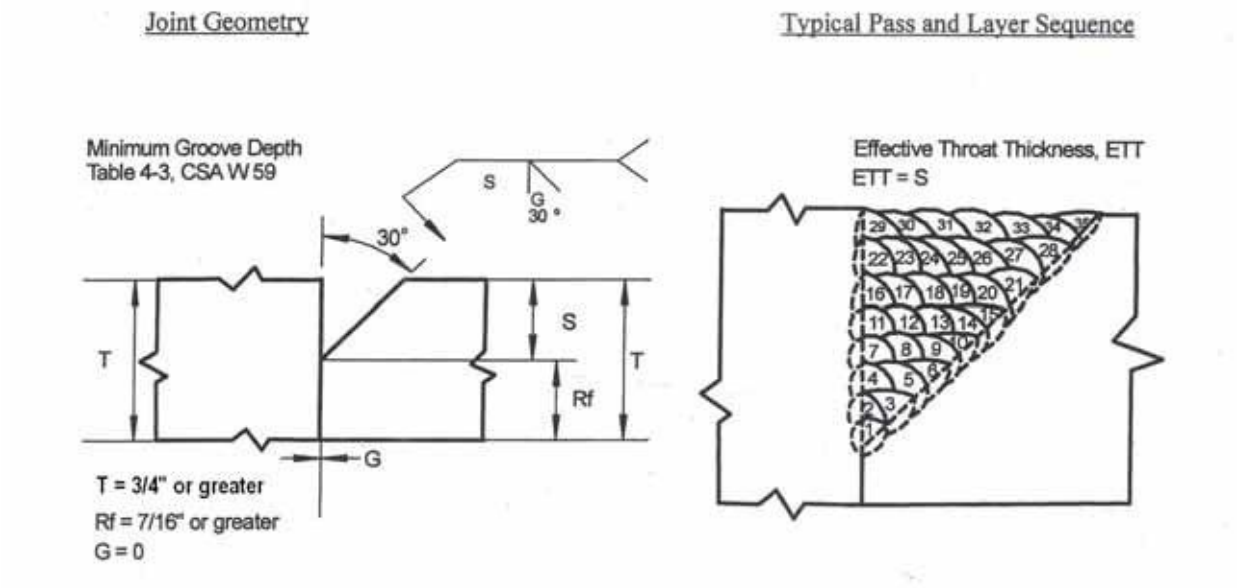


Figure #1

2.3 WELD POSITION REQUIREMENTS:

2.3.1 For 30 deg bevel welds:

In the Flat Position, the root pass must be made using a maximum diameter welding wire of 1/16" (1.6mm). (Ref: Figure #2a)

2.3.2 For fillet welds:

In the Horizontal Position, all passes must be made using a maximum diameter welding wire of 1/16" (1.6mm). (Ref: Figure #2b)

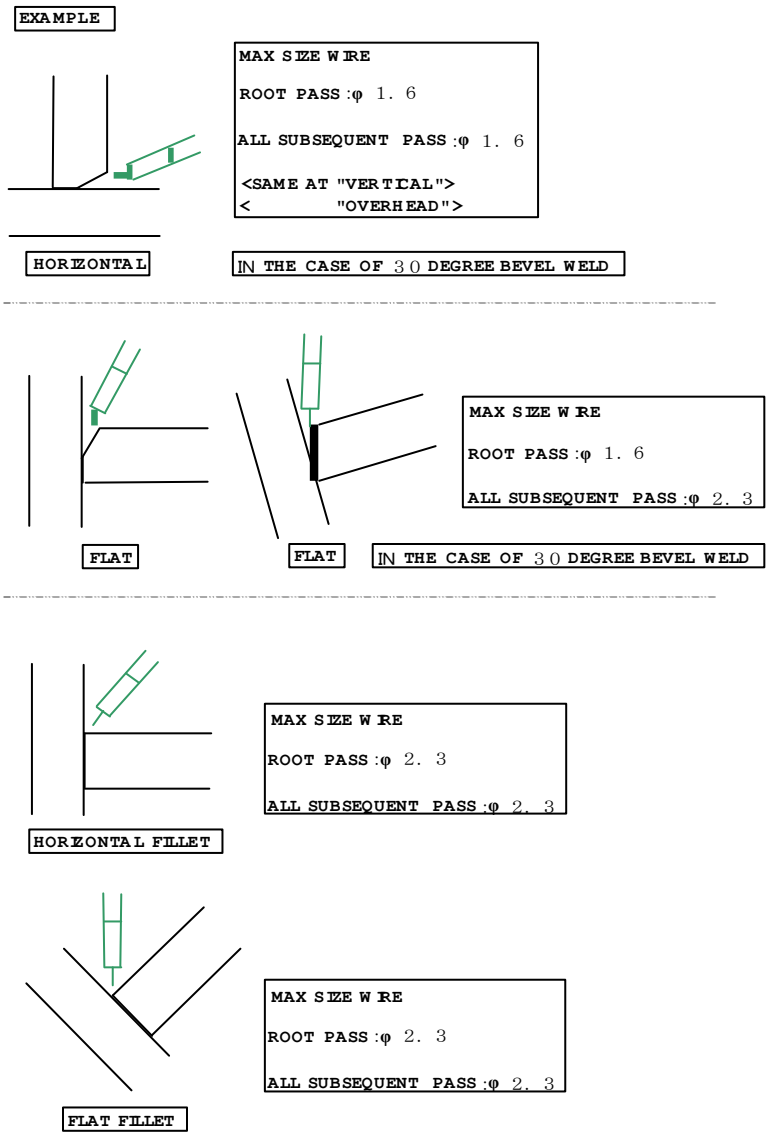


Figure #2a (top two examples), Figure #2b (bottom two examples)

2.4 WELD AND BASE METAL DISCONTINUITES:

2.4.1 Porosity or gas entrapment
2.4.1.1 Scattered porosity is unacceptable. Removing the weld is required.
2.4.1.2 Cluster porosity is unacceptable. Removing the weld is required.
Maximum hole diameter shall be (1.6 mm),1/16 in.
There shall be no more than two (2) holes in each (305 mm), 12 in of weld.
Exception: Regardless of minimum size, location is considered when judging this discontinuity severe enough to consider the porosity a defect in any Aida product. When in doubt, porosity in the weld should be repaired.

2.4.2 Incomplete or Lack of Fusion
Complete fusion shall exist between adjacent beads of weld metal.
Complete fusion shall exist between the weld metal and base metal.

2.4.3 Incomplete or Lack of Penetration
The weld metal shall completely penetrate the root of the weld.

2.4.4 Underfill or Depression of the Weld
Failure to completely fill the groove of the weld is unacceptable

2.4.5 Undercut
The maximum allowable depth of undercut is (0.8 mm), 1/32 in.
The maximum allowable width of undercut is (2.4 mm), 3/32 in.

2.4.6 Fillet Size
Fillets shall be equal leg lengths unless otherwise specified, and be no less then 1.5mm smaller than the weld specification.

2.4.7 Overlap
Welds shall be free from overlap. Overlap exists when the re-entrant angle is less than 90^0 as shown in Figure #3, and extends past the toe of the weld without fusion.

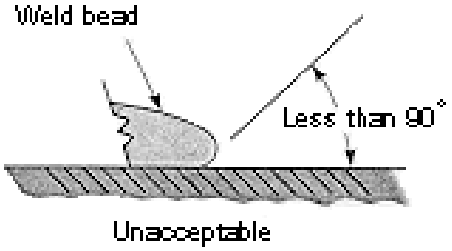


Figure #3

2.4.8 Cracks

Any crack in the weld or heat-affected zone of the weld is unacceptable.
Weld craters shall be filled to 85% of the specified cross-section of the weld.
Crater cracks are unacceptable.

2.4.9 Inclusions

2.4.9.1 Slag inclusions are acceptable provided their diameter does not exceed 1.6 mm, (1/16 in.) and there are no more than two (2) per 305 mm, (12 in.) of weld.
Exception: Regardless of the minimum size, location is considered when judging this discontinuity severe enough to consider the slag inclusion a defect in any Aida product. When in doubt, slag inclusion in the weld should be repaired.

2.4.9.2 Tungsten inclusions are acceptable provided their diameter does not exceed (1.6 mm), 1/16 in. and there are no more than two (2) per (305 mm), 12 in of weld.
Exception: Regardless of the minimum size, location is considered when judging this discontinuity severe enough to consider the tungsten inclusion a defect in any Aida product. When in doubt, Tungsten inclusions in the weld should be repaired.

2.4.10 Convexity and Concavity

The faces of fillet welds may be slightly convex, flat or slightly concave.
Except at outside corner joints, convexity shall not exceed 0.707 times actual weld size plus 0.0442 in. (1.1 mm). The following table (s) lists in inches (millimeters) the throat thickness of the weld for each size weld and the maximum throat thickness allowed.

Weld Size	Throat Thickness	Maximum Convexity	Maximum Throat
1/8”	0.09”	0.04”	0.13”
3/16”	0.13”	0.04”	0.18”
¼”	0.18”	0.04”	0.22”
5/16”	0.22”	0.04”	0.27”
3/8”	0.27”	0.04”	0.31”
7/16”	0.31”	0.04”	0.35”
½”	0.35”	0.04”	0.40”
9/16”	0.40”	0.04”	0.44”
5/8”	0.44”	0.04”	0.49”

2.4.10 Convexity and Concavity (continued)

Weld Size	Throat Thickness	Maximum Convexity	Maximum Throat
3.2 mm	2.2 mm	1.1 mm	3.4 mm
4.8 mm	3.4 mm	1.1 mm	4.5 mm
6.4 mm	4.5 mm	1.1 mm	5.6 mm
7.9 mm	5.6 mm	1.1 mm	6.7 mm
9.5 mm	6.7 mm	1.1 mm	7.9 mm
11.1 mm	7.9 mm	1.1 mm	9.0 mm
12.7 mm	9.0 mm	1.1 mm	10.1 mm
14.3 mm	10.1 mm	1.1 mm	11.2 mm
15.9 mm	11.2 mm	1.1 mm	12.3 mm

Note: Fillet weld concavity is acceptable provided throat thickness meets the values shown in the table for the weld sizes indicated.

2.4.11 Arc Strikes

Arc strikes outside areas requiring welds are unacceptable.

2.4.12 Spatter

Welds must be reasonably smooth and uniform in appearance. Excessive spatter is unacceptable. Exception: Any spatter on outside surfaces where visible, and inside oil reservoirs areas, is unacceptable.

2.4.13 Burn-Through

Burn-through or excessive melt-through in a weld joint is not acceptable.

2.4.14 Tie-In

2.4.15 Weld beads in the same layer shall have complete tie-in, including complete fusion and penetration with no underfill or overlap.

2.5 MATERIAL TOLERANCES:

2.5.0.1General Quality Standard for Flame-Cut Material (1)
(specifically for flame-cut plate used in fabrications): ATS-6009-79

Scope of Application: This standard stipulates the general quality standards for flame-cut hot-rolled steel plate of thicknesses between 6 ~ 300 mm. (ref: Table 1 Normal Allowable Tolerances for Cut Lengths)

Note 1:**These general quality standards are to apply in cases where there are no special function-related accuracy callouts on specification documents or drawings, etc., and where there are no tolerance callouts provided (on the drawing) for each separate location**.
Note 2:This standard does not apply to hardened or tempered steel plates and coil material.
Note 3:This standard does not apply to plates cut using a plasma cutter.
Note 4:Raw plate thickness and flatness tolerances, etc., are per ATS-2121 (*Shape and Dimensional Tolerances for Thick Steel Plates*).

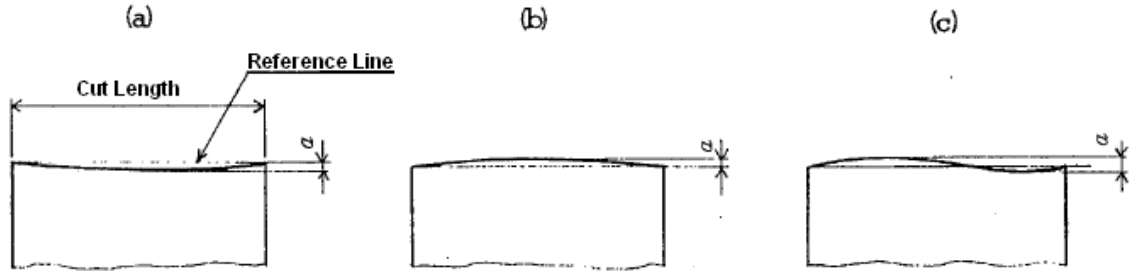
2.5.1 Cut Lengths:
Quality Standards
Normal Allowable Tolerances for Cut Lengths: The length of a cut is expressed as the distance between opposing ends along a cut edge,[1] and the normal allowable tolerances are given in Table 1 below.
Note [1]: The 'cut edge' is a line that connects the maximum protrusions on both sides of a plate.

Table 1: **Normal Allowable Tolerances for Cut Lengths (Units: mm)**

Plate Thickness Classification	Length Classification				
	≤ 1000	>1000, ≤2000	>2000, ≤4000	>4000, ≤8000	8000
≥6, ≤28	±1.0	±1.5	±2.0	±2.5	±3.0
>28, ≤45	±1.5	±2.0	±2.5	±3.0	±3.5
>45, ≤90	±2.0	±2.5	±3.0	±3.5	±4.0
>90, ≤160	±2.5	±3.0	±3.5	±4.0	±4.5
>160, ≤230	±3.0	±3.5	±4.0	±4.5	±5.0
>230, ≤300	±3.5	±4.0	±4.5	±5.0	±5.5

2.5.2 Normal Allowable Tolerances for Straightness: Straightness is the amount of variation from the reference line that connects both ends of the cut edge, and the standard tolerance values are given in Table 2 below.

Table 2: Normal Allowable Tolerances for Straightness



Units: mm

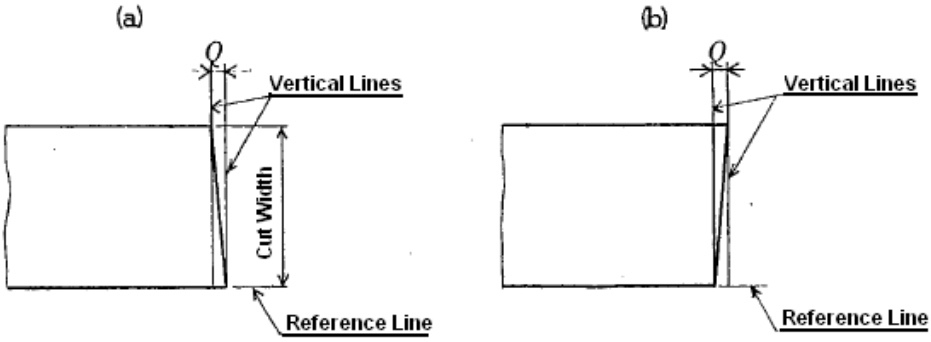
Cut Length Classification	≤500	>500, ≤1000	>1000, ≤2000	>2000, ≤4000	>4000, ≤8000	>8000
Tolerance Value '*a*'	1	1.5	2	2.5	3.2	4

Note 1: This does not apply in cases where the cut length exceeds the cut width by 10 times or more.

Related Materials: JIS B 0417: Normal Tolerances for Flame-Cut Steel Plate
JIS B 0601: Surface Roughness

2.5.3 Normal Allowable Tolerances for Perpendicularity: Perpendicularity is expressed as the distance between two vertical lines at the cut edge that are perpendicular to the reference lines on both sides of the long side of the plate, and the standard tolerance values are given in Table 3 below.

Table 3: Normal Allowable Tolerances for Perpendicularity

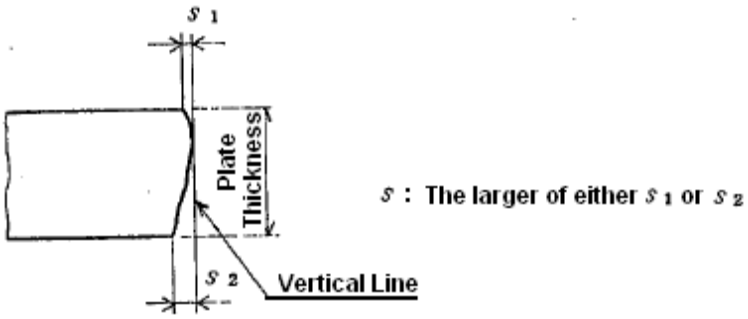


Units: mm

Cut Width (Short Edge) Classification	≤ 1000	>1000, ≤2000	>2000, ≤4000
Tolerance '*Q*'	1	1.5	2

2.5.4 Normal Allowable Tolerances for Taper: Taper is expressed as the distance between the cut edge of a plate and a straight vertical line at the edge of the plate, and the standard tolerance values are given in Table 4 below.

Table 4: Normal Allowable Tolerances for Taper:

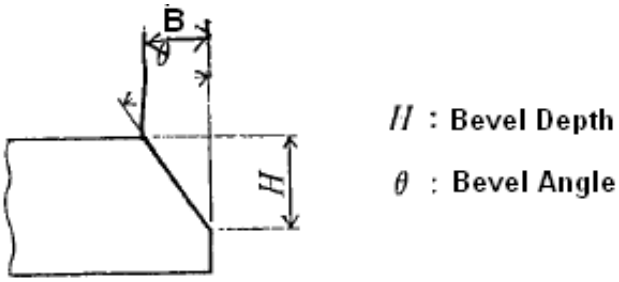


Units: mm

Plate Thickness Classification	Tolerance Value '*s*'
≥6, ≤28	0.5
>28, ≤45	1
>45, ≤90	1.5
>90, ≤160	2
>160, ≤230	2.5
>230, ≤300	3.0

2.5.5 Normal Bevel Accuracy Tolerances: Bevel accuracy is expressed as the allowable tolerances in the cut surface's bevel angle and bevel depth with respect to the specified bevel shape, and the normal allowable tolerances are shown in Table 5 below.

Table 5: Normal Allowable Tolerances for Bevels



Bevel Depth Classification	Allowable Tolerances for Bevel Width 'B' (Angle)	Bevel Depth Allowable Tolerances (*H*)
≤19	-1.0 ~ +2.5	-1.0 ~ +2
>19	-1.0 ~ +3.5	-1.0 ~ +3

2.5.6 Hole or Slot Accuracy: Hole accuracy is expressed by means of the normal allowable tolerances for the hole dimension and taper. The hole dimension is measured at the edge of the cut, and the normal allowable tolerances are the same as the 'Length Classification' tolerances given in Table 1 (consider the 'Hole Dimension Classification' to be the same as the 'Length Classification' given in Table 1).
Taper tolerances are given in Table 4.
NOTE: Use the hole circumference as the length when determining the Length Classification in Table 1. The values given for the specified length are classified by plate thickness, and these values will be the +/- tolerances for the flame-cut diameter of the hole.

2.5.7 Roughness: Roughness is defined as continuous irregularities in the cut surface, and is shown as the maximum height classifications given in JIS B0601 (Surface Roughness). The normal allowable tolerances are given in Table 6 below.

Table 6: Normal Allowable Tolerances for Roughness

Plate Thickness Classification (mm)	Cut Surfaces that will be Finished Products	Cut Surfaces that will be Weld Joints
≤130	50S	100S
>130	100S	200S

2.5.8 Notches: A notch is a sudden increase in roughness, and Table 7 below gives the number of allowable notches, and Table 8 below gives the allowable depth tolerances.
However, no notches are allowed in those areas on cut surfaces where R-chamfering on the edge of the plate is called out.

Table 7: Number of Notches

Classification	Number of Notches
Straight cut surfaces that will be a finished product	1 or less per any 1 meter length
Curved cut surfaces that will be a finished product	2 or less per any 100 mm length
Cut surfaces that will be a weld joint	No specification given.
Cut surfaces that will be machined	

Table 8: Allowable Notch Depth Tolerances

Units: mm

Plate Thickness Classification	Cut Surfaces that will be Finished Products	Cut Surfaces that will be Machined	Cut Surfaces that will be Weld Joints
≤130	0.5	1.5	2.5
>130	1	2.5	3.5

2.5.9 Tolerances for Shapes and Dimensions for Thick Steel Plates ATS-2121-85

Scope of Application:
This standard stipulates the tolerances for shapes and dimensions for structural steel plates that have a thickness of 50 mm to less than 230 mm.
Note: The steel grade is to be two grades (SS400) of JIS G3101 (Rolled Steel for General Structure).

2.5.9.1 Tolerances for Thickness:

The tolerance for thickness is shown in Chart 1:

Chart 1: Tolerance for Thickness (mm)

Thickness \ Width	1250 to less than 1600	1600 to less than 2000	2000 to less than 2500
50 to less than 63	± 0.9	± 1.0	± 1.2
63 to less than 100	± 1.1	± 1.2	± 1.4
100 to less than 160	± 1.3	± 1.4	± 1.6
160 to less than 230	± 1.6	± 1.7	± 1.9

Note: This chart is in accordance with JIS G3193.

2.5.10 Flatness:

Flatness is expressed by the amount of warp per length *e*, and the maximum values for flatness in the overall width and overall length are shown in Chart 2.

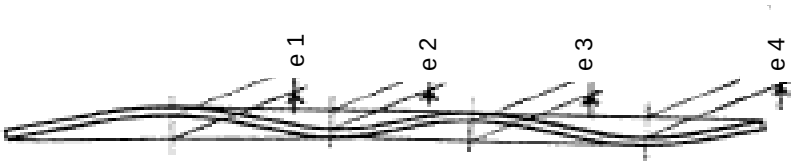
Chart 2: Flatness (mm)

Length \ Width	Less than 4000	4000 and over
Less than 1250	4	6
1250 to less than 1600	6	8
1600 to less than 2000	8	10
2000 to less than 2500	10	12
(2500 and over)	12	14

Note: A width of 2500 and over is a custom order.
Related Documents: JIS G3101 Rolled Steel for General Structure
G3193 Hot Rolled Steel Plates

The maximum values for small wavelike flatness are shown in Chart 3.

Chart 3: Small Wavelike Flatness (mm)



Width / Thickness	Less than 1600	1600 and over
50 to less than 85	1.5	2.0
85 to less than 135	2.0	2.5
135 to less than 230	3.0	3.0

2.5.11 Surface Defects:

Surface defect tolerance values for dents and scratches, etc. are shown in Chart 4.

Chart 4: Surface Defects from Scratches, etc. (mm)

Depth of Defective Area	Occurrence Area / Total Area
Less than 0.4	60% or less
0.4 to less than 0.5	30% or less
0.5 and over	Rejected

(2) Tolerance values for surface defects from non-attached residue such as porosity, etc. are shown in Chart 5.

Chart 5: Surface Defects from Porosity, etc. (mm)

Steel Plate Thickness	Greatest Length for One	Greatest Depth for One	Density
50 to less than 60		0.5	6 or less
60 to less than 80		0.7	
80 to less than 100	13	0.9	8 or less
100 to less than 150		1.2	10 or less
150 to less than 230		1.3	12 or less

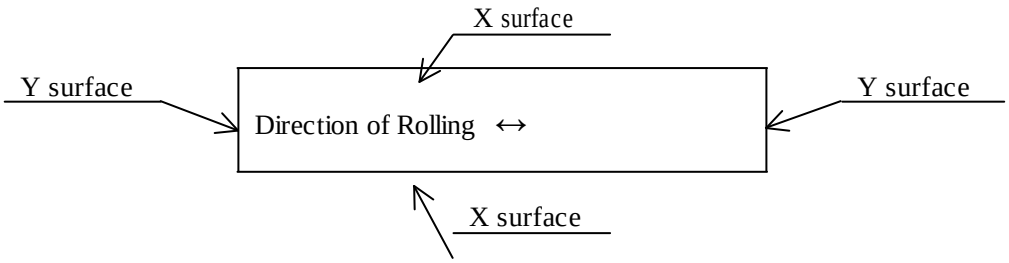
Note: Density is the total number of porosity defects within an area of 200 x 200 mm. However, it is acceptable that lengths of 3 mm or less are not counted.

(3) Surface defects in (1) and (2) can be repaired in accordance with JIS G3193 standard

2.5.12 Lamination:

(1) Lamination inspection is done visually, and as a rule the allowance values are per Chart 6.

Chart 6: Lamination



(mm)

Steel Plate Thickness	X Surface			Y Surface		
	Maximum Length for 1 *A*	Density (reference) *B*	Total Length *C*	Maximum Length for 1 *A*	Density (reference) *B*	Total Length *C*
50 to less than 75	25 (30)	4 pcs.	90	5 (10)	4 pcs.	20
75 to less than 100			100	7 (14)		25
100 to less than 150	30 (35)		120	9 (18)		30
150 to less than 230			150			35

Note: 1. The values in parentheses show the allowance values when performing a color check.
2. Density is the number of defects in a length of one meter that includes many areas with maximum defects. However, it is acceptable not to count defects that are less than 3 mm in length.
3. It is acceptable not to tally the defects less than 3 mm in the total length.

(2) Though one maximum length *A* exceeds the rule in (1) the allowance value, when the total tally C is within the allowable value, the manufacturer checks the size of those defects using a ultrasound flaw inspection, submits a test report, and determines if it is acceptable or not after consulting with the person in charge of purchasing.

2.6 NORMAL TOLERANCE OF WELDED PARTS (1): ATS-6010-85

Application: This standard stipulates the normal tolerances for welded parts composed mainly of rolled steel materials with a thickness of 9mm or more.

Note: This normal tolerance is to be applied in situations where no other dimensions for particular precision or function are required or written on drawings, specification manuals etc.

2.6.1 Length:

Normal tolerances for length are shown in Table 1 below.

Table 1 Normal tolerances for length

Units: mm

Dimension category	Tolerance
500 or less	±2
over 500, 1000 or less	±3
over 1000, 2000 or less	±4
over 2000, 4000 or less	±6
over 4000, 8000 or less	±8
over 8000	±10

2.6.2 Straightness and Perpendicularity:

Normal tolerances for straightness and perpendicularity are shown in Table 2 below.

Table 2 Normal tolerances for straightness and perpendicularity

Units: mm

Dimension category *L*	Tolerance α
500 or less	±1.5
over 500, 1000 or less	±2
over 1000, 2000 or less	±3
over 2000, 4000 or less	±4
over 4000, 8000 or less	±6
over 8000	±8

2.7 MACHINING STOCK

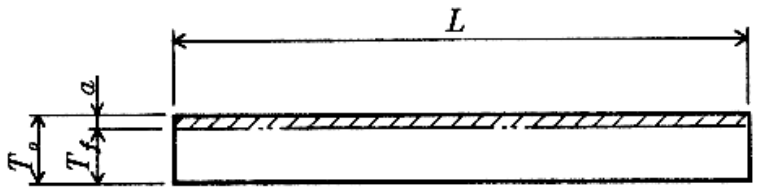
2.7.1 Machining Stock for Flame-Cut and Welded Structural Products(1): ATS-6020-86 (Thickness to Length)

Scope of Application: This standard stipulates the standard machining stock for flame-cut and welded structural parts of rolled steel of 9 mm thickness or greater which are used for structural purposes.

2.7.1.1 Machining Stock for Flame-Cut Steel

Machining Stock in the Plate Thickness Direction: The machining stock in the plate thickness direction is as shown in Table 1.

Table 1: Machining Stock in the Plate Thickness Direction



L : Machining Surface Length or O.D.

T_o : Original Plate Thickness

T_f : Finished Plate Thickness

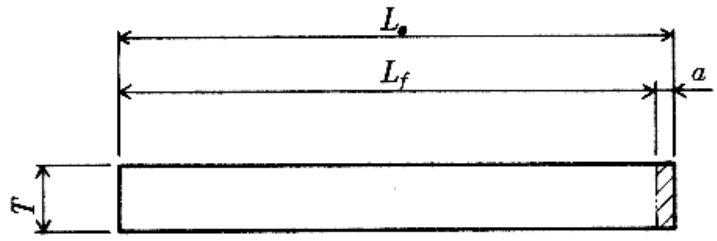
a : Machining Tolerance

Unit: mm

Length (L)	Machining Stock (a)
≤ 1000	3.5
> 1000 ≤ 4000	5.0
> 4000	7.5

Machining Stock in the Length Direction: The length direction machining stock is as shown in Table 2.

Table 2: Machining Stock in the Length Direction



L_o: Original Material Length or O.D.

L_f: Finished Length or O.D.

T : Plate Thickness

a : Machining Tolerance

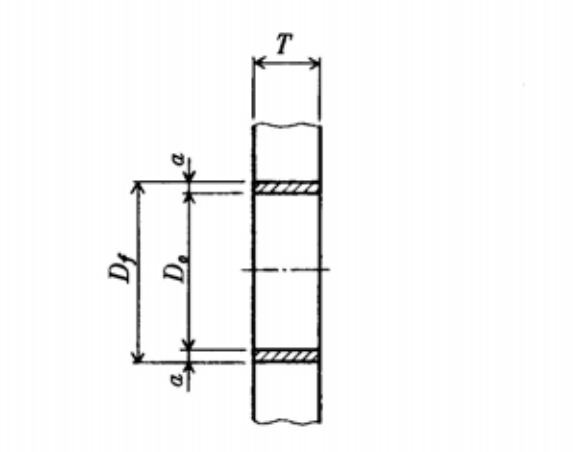
Unit: mm

Plate Thickness T	Finished Length L_f				
	≤ 1000	> 1000 ≤ 2000	> 2000 ≤ 4000	> 4000 ≤ 8000	>8000
≤ 45	3.5	3.5	3.5	5.0	5.0
> 45 ≤ 90			5.0		
> 90 ≤ 160		5.0			
> 160 ≤ 230	5.0		7.5	7.5	7.5
> 230 ≤ 300		7.5			

2.7.1.2 Machining Stock for Flame-Cut and Welded Structural Products(2): (Thickness/Hole) ATS-6020-86

Hole Machining Stock: Table 3 shows the machining stock for the interior surfaces in holes and the minimum diameters for flame-cut holes.

Table 3: Machining Stock on Parts with Flame-Cut Holes



D_e: Flame-Cut Diameter

D_f: Finish Diameter

T : Material Thickness

a : Machining Stock

Unit: mm

Plate Thickness *T*	Machining Stock (*a*)	Minimum Flame-Cut Hole Diameters
≤ 45	3.5	73 (finish dimension is 80)
> 45 ≤ 90	5.0	70 (finish dimension is 80)
> 90 ≤ 160		***T*** (plate thickness)
> 160 ≤ 230		160
> 230 ≤ 300	7.5	180

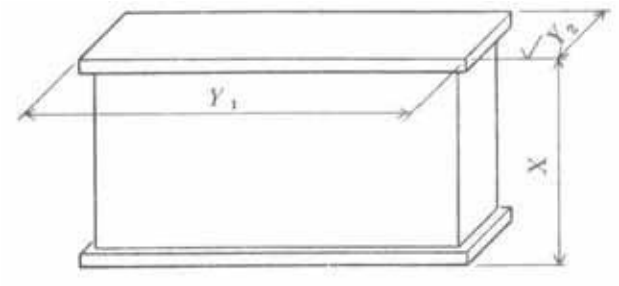
2.7.2 Machining Stock for Flame-Cut and Welded Structural Products (3): (Extremely Thick) ATS-6020-86

2.7.2.1 Machining Stocks for Weldments

Machining Stock on Common Weldments: Refer to Table 4.

However, for the machining stock on extremely thick materials such as material used for bolsters, add an additional 2.5 mm to the values shown in Table 4.

Table 4: Machining Stock for Common Weldments



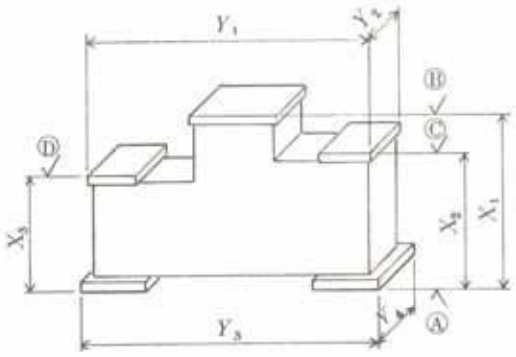
X: Maximum Dimension Perpendicular to the Machining Surface
Y: The Long Edge Length of All Surfaces Parallel with each Machining Surface that are Projected onto the Machining Surface

Unit: mm

Maximum Dimension of the Machining Plane in the Perpendicular Direction *X*	**Machining Surface Edge Length Y_f**					
	≤ 500	**> 500 ≤ 1000**	**> 1000 ≤ 2000**	**> 2000 ≤ 4000**	**> 4000 ≤ 8000**	**>8000**
≤ 500	5.0	5.0	5.0	5.0	7.5	7.5
> 500 ≤ 1000						
> 1000 ≤ 2000						
> 2000 ≤ 4000						
> 4000 ≤ 8000		7.5	7.5	7.5		
> 8000	7.5				10.0	10.0

Note 1: For the machining stock on extremely thick materials such as material used for bolsters, add an additional 2.5 mm to the values shown in the table above.

Note 2: If the welded part is like the one below, calculate the machining stock for each surface as shown below.



X_1 = 2300
X_2 = 1200
X_3 = 700
Y_1 = 5980
Y_2 = 2980
Y_3 = 6000
Y_4 = 3000

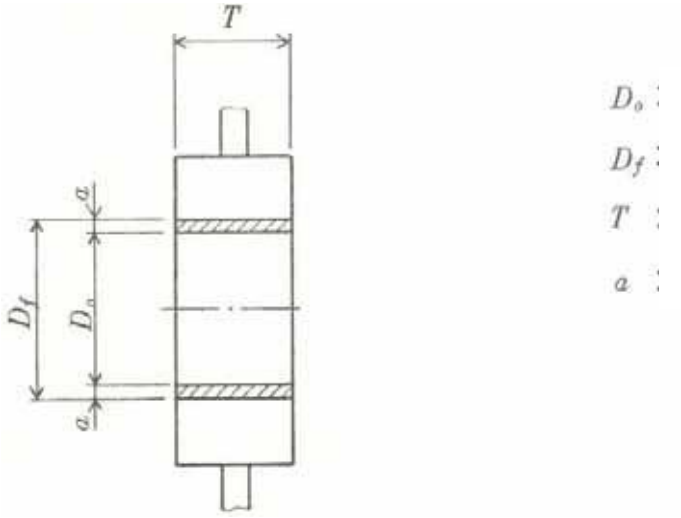
Machining Stock for Surfaces Ⓐ and Ⓑ: With Y=6000 & X=2300: 10

Machining Stock for Surface Ⓒ With Y=6000 & X=1200: 7.5

Machining Stock for Surface Ⓓ With Y=6000 & X=700: 7.5

2.7.2,2 Machining Stock for Holes: Table 5 shows the machining stock for the interior surfaces in holes and the minimum diameters for flame-cut holes.

Table 5: Machining Stock for Holes in Weldments



Unit: mm

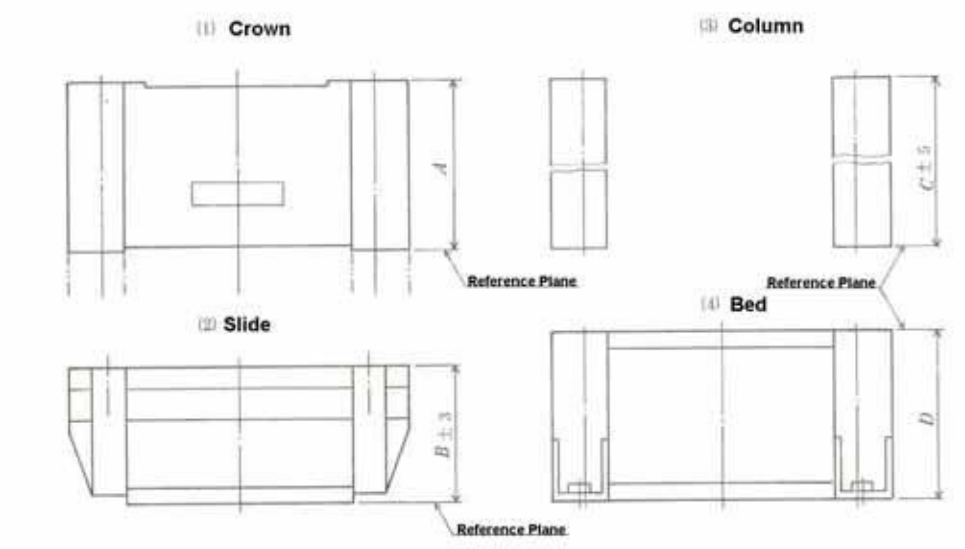
Material Thickness T	**Weldment Long Edge Length**				**Min. Flame-Cut Diameter**
	≤ 1000	**> 1000 ≤ 2000**	**> 2000 ≤ 5000**	**> 5000 ≤ 8000**	
≤ 90	5.0				70
> 90 ≤ 160					T (Mat'l Thickness)
> 160 ≤ 230				7.5	160
> 230 ≤ 300					180

Note 1: In the case of split bosses, add an additional 2.5 mm to the values shown in the table above.
Note 2: In cases where cast steel, forged steel, or rolled steel pipe is used for bosses, as a general rule they are to be machined to the machining stock values shown in the table before welding.

2.7.3 Machining Stock for Flame-Cut and Welded Structural Products (5): ATS-6020-86

Scope of Application: In order to keep the machining stock as small as possible on crowns, slides, columns, and beds, etc. (hereafter referred to as large weldments), this Appendix stipulates the reference planes and dimensional tolerances when performing welding and machining.

Reference Planes and Tolerances: The Appendix Table shows the reference planes and tolerances for large structural weldments.



Unit: mm

Part	Machining Reference Plane	Tolerance
Crown	The bottom surface is the reference plane (the surface that is in contact with the columns). As a general rule, the top surface is to be  . However, when the height dimension needs to be smaller than the tolerance given to the right, it is to be. 	Total Height ***A***: Per ATS-6010 (General Tolerances for Weldments)
Slide	The bottom surface is the reference plane.	Total Slide Height ***B***: ±3 Point Area Machined Surface Height: ±2 Variation between Each: 0.05
Column	The bottom surface is the reference plane.	Total Height ***C***: ±5 Variation between Each: 0.05
Bed	The top surface is the reference plane. As a general rule, the bottom surface is to be  . However, when the height dimension needs to be smaller than the tolerance given to the right, it is to be	Total Height ***D***: Per ATS-6010 (General Tolerances for Weldments)

3.0 WELD EXAMPLES

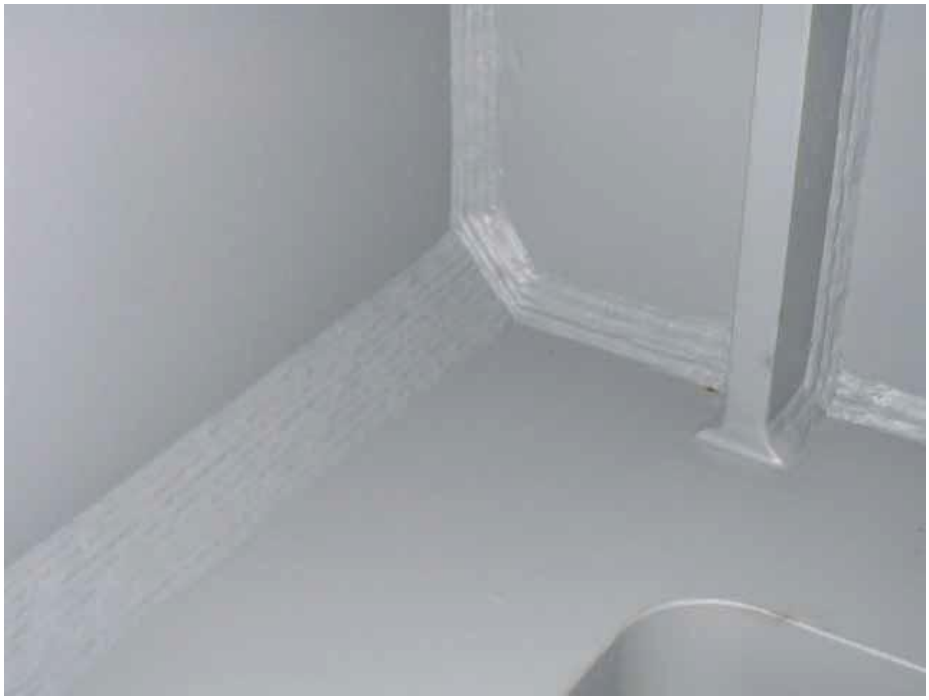
ACCEPTABLE WELDS:

Example of using a flux tab at end of the bevel groove welds, before (top) and after (bottom)

Example of an acceptable fillet weld and boxing/grinding

Example of an acceptable fillet weld, boxing/grinding and transitioning the fillet welds to the base metal. Note: typically the boxing length is equal to the plate thickness (t)

Example of an acceptable flush bevel weld, grinding the bevel weld flush G No visible weld seam.



Example of an acceptable fillet weld, over lapping each fillet weld and wrapping around the inside corner

Example of profile grinding a larger fillet weld, and transitioning to a smaller fillet weld

Example of using a run-off tap when welding a bevel

Vertical welding is highly **discouraged** and should be done only when there's no other option. Adia-Eng must be consulted prior to welding in the vertical position.

TOOLS AND MATERIALS:

Solid Wired used at Aida-America for all positions

Spatter Compound used at Aida-America

Air hammer for penning the weld

Air Needle Scaler for cleaning welds

An array of typical hand tools used in grinding and profiling welds

Carbide round end burr tool for profiling welds

4.0 QUALITY INSPECTION REQUIREMENTS

4.1 GENERAL INSPECTION CRITERIA FOR MAJOR WELDMENTS:

Before fit-up, visually inspect plate material looking for any weld repairs or laminations, pre-machined holes specific to the cut drawing or Purchase Order requirements, and material tolerance (ref: 2.5 Material Tolerances)

Check each weldment for the correct part number, and weight clearly and visually marked.

Check for any scale not removed from the surfaces of the plate material in the oil reservoirs, and outside/inside surfaces where visible, these areas must be free of scale. The scale should also be removed on non-visible surfaces. Difficult areas to clean must be free of any loose scale.
Note: Difficult areas to clean should be made scale free BEFORE welding these areas inaccessible.

Check the weld around all weld sockets for being oil, or air tight. No pin holes, or overlap of the weld is allowed. These welds must visually look sound and check oil tight.
Note: Checking is accomplished by using water.

Check all print linear dimensions for amble amount of machine stock (ref: 2.7 Machining Stock). In addition, diagonal measurements should be done to check squareness.

Check for no twist in an unrestrained position.

Check ALL welds for weld discontinuities or defects (ref: 2.4 Weld and Base Metal Discontinuities)

Check ALL grind profiles for a smooth transition to the base metal, and size as specified per print. (ref: 3.0 WELD EXAMPLES)

Check for gouges in the plate material, and in any holes not being machined. (Gouges are not allowed).

Check the plate surfaces for no hammer marks, tack welds, scale, weld spatter or other visible defects.

Check for any shot blast material not removed, especially the oil reservoirs, or where oil flows.

BED or Base specifics:

Check the oil trough for a continuous weld seam on the fluid side, all around. In some cases the print may require a continuous weld on both sides.

Check for any pre-machined holes such as in the plates for the scrap chute.

Check the position of any non-symmetric plates. Cutouts or access holes are where they should be.

Check optional rail pads for amble machining stock (3~5mm), and allow for any twist.

Check the top of the bed where the Columns mount for location (dim), and squareness.

Check all the oil reservoirs for no weld spatter, scale or any foreign material

PMX - Check the outside corner radius. Note: The Columns need to align flush with the edges of the Bed.

TMX- Check the Die Cushion opening for location, squareness, and the opening width/length.
Check for amble machining stock on the ends for total cleanup. Allow for any out of square amount.
Check all the air manifolds blocks in the oil trough for location and amble machining stock.
Note: Cleanup on these air manifolds blocks at the print location is required for an airtight seal.

Crown specifics:

Check All grind profile welds per print.

Check for oil tight welds along the inside edge of the oil channels connecting the main bearing plates.

Check for any scale on the inside walls of the plates where oil flows.

PMX- Check the cutouts for the weights on each end on the crown for location and the proper orientation.
Check the radius on the outside corners per print. Needs to match-up to the radius on the top guards or covers.
Check Wireway Duct slots, should be R50 (100mm wide), and in-line

TMX- Check the centerline location of the Balance Cylinder bores to the inside wall of the outer plate per print. A block for securing the nut on the Bal Cyl mounts on the inside surface of this outer plate, and a minimal amount of clearance is required.

NST- If oil drip trays are required on the drawing, check that all the oil drip trays are welded as shown.
Check the crossover air pipes are either welded or sealed to prevent leaking air.
Check for oil drains in the correct position and oil tight
Check clutch/brake pads for location and mill stock

Slide specifics:

Check All grind profile welds per print.

Check All plug welds on the inside area of the Slide are oil tight.

Check All the machined holes on the inside area of the Slide are oil tight where noted.

Check the gib oil reservoir, clean of all shot/grit and other foreign material.

PMX 400 – Check the overall width of the lifting lugs, should not exceed the print width.

4.2 VISUAL WELD INSPECTION CHECKLIST:

WORK ORDER #: _____ MATERIAL #: _____

DESCRIPTION: SERIAL #:

	Stage - **FIT-UP INSPECTION**	CONFORMS	NON -CONFORMS
1.	**Safety First,** Check Condition of Equipment, Power Source, Cables, Hand Tools, and Tools for Measuring, and Lifting Devices all meet Requirements.....		
2.	Check all Drawings for a Document Control Stamp, Revision		
3.	Welder Understands All the Drawing Requirements.....		
4.	Plate Material is Free of: Heavy Scale, Porosity, Gouges, Laminations, and Visual Weld Repairs, etc.....		
5.	Plate Material is Clearly Identified.....		
6.	Plate Material Checks per Drawing: Flatness, Square, Dimensional, Holes, Bevels, Radius, Chamfers, etc.....		
7.	Plate Weld Fit-Up meets Print Location Dimensions.....		
8.	Tacking is Sufficient for Moving.....		
9.	Weld Symbols, Grind Profiles, and Sizes are Marked at Weld Joints.....		
	Weld FIT-UP Inspected by, Signature: **Date:**		

	Stage - **WELD INSPECTION-ROOT/SUBSEQUENT PASSES**	CONFORMS	NON-CONFORMS
1.	**Safety First,** Check Condition of Equipment, Power Source, Cables, Hand Tools, and Tools for Measuring, and Lifting Devices all meet Requirements.....		
2.	All Weld Joints Have Spatter Compound Applied as Needed.....		
3.	Weld Symbols, Grind Profiles, and Sizes are Marked at Weld Joints.....		
4.	Check for **NO** Cracks in the Weld and Plate, Slag Inclusions, Undercuts, Overlap, Underfill, Porosity, Weld Spatter, Hammer Marks, Arc Strikes, Lamination of Material, Gouges (filled), Tack Welds (remove).....		
5.	Flux, or Run-Off Tabs, and Gouging Completed as Needed.....		
6.	Check All Oil Tight Areas, and Weld Sockets for NO Leaks.....		
7.	Weld Size, Uniformity of Weld, Correct Number of Weld Passes.....		
8.	Cleaning Between Weld Beads and Penning Completed as Needed.....		
9.	All Grinding and Profiling of the Welds Completed per Drawing.....		
10.	Weldment meets Print Location Dimensions.....		
11.	Preheat Temperature Where Required meets Specification.....		
12.	Welding Sequence Controlled to Avoid Distortion.....		
	WELD Inspected by, **Signature:** **Date:**		

* Non-Conformances and Comments Listed on Back
* Final Inspection and Results Listed on Back
* After Completing the Weld Inspection and No Rework Required, Forward the Checklist to Quality Control

Addendum-Welding Training Manual

Non-Conformance List

Stage, Item# F=Fit-up, W=Weld	Reason for Non-Conformance (explain)	Repaired Yes	Repaired No	Initial

Ex: W,4 Slag Inclusions found in the Bevel Weld at location xxx
Y J. Doe

1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

* If Repair is NO, explain why in COMMENTS
* After Completing the Rework, Forward the Checklist to Quality Control

COMMENTS: _____

_____

_____

REWORK
COMPLETED
QC Signature _____ DATE: _____

	Stage - **FINAL INSPECTION**	CONFORMS	NON-CONFORMS
1.	Check Prints to Current Revision Level…….		
2.	Check Weldment to Print Location Dimensions…….. ……..		
3.	Check Weld Sizes, Grind Profiles, Uniformity of Weld, and for the Correct Number of Weld Passes ……		
4.	Check for **NO** Cracks in the Weld and Plate, Slag Inclusions, Undercuts, Overlap, Underfill, Porosity, Weld Spatter, Hammer Marks, Arc Strikes, Lamination of Material, Gouges (are filled), Tack Welds (are removed)……..		
5.	Check for Any Loose and Excessive Scale that is not Removed…..…..……		
6.	Check that All Oil Tight Welds meet the NO LEAK Requirement…..……..		
7.	Check Thermal or Vibratory Stress Relief and meets Specification……..		
8.	Shot Blast Completed (all media removed) and meets Specification ……		
9.	Inspection Report, and all other related reports; such as Material Certs, Heat Treat Certs, etc... Filed in the Press Folder		
	FINAL Inspection Completed, Release from the Weld Department **QC Signature:**	**Date:**	