QUALITY ASSURANCE SYSTEMS MANUAL

Henderson Fabrication, Inc.
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Mission Statement

Henderson Fabrication, Inc. was founded in November of 1987 with a few basic ideals. Although HFI has grown through the years the founding ideals have remain steadfast and true. These ideals have carried the company through the lean and difficult years and have paid dividends during the good years.

We, the management and employees of Henderson Fabrication, Inc., are now and will ever be committed to these ideals. We will never waiver in our commitment, nor will we allow circumstances or opinions to compromise our belief and adherence to these basic ideals:

1) Henderson Fabrication, Inc. will provide a quality product to our customers at a fair and equitable price. We will not sacrifice quality in order to make a larger profit; we prefer to suffer a loss on a project rather than compromise on the quality of our product.

2) Henderson Fabrication, Inc. will always put customer satisfaction first. We feel customer satisfaction takes priority over our own convenience or our "bottom line". A satisfied customer is an investment that will pay dividends far above the profits of a single job.

3) Henderson Fabrication, Inc. will always conduct business with the highest level of integrity possible. We will guard our integrity with a vigilance and resolve unequaled in today's competitive arena. There isn't any monetary gain, prestige or reward great enough to cause us to waiver on our commitment to integrity. Integrity is a moral conviction and if Henderson Fabrication, Inc. cannot remain true to it's moral convictions in today's business arena then we will nor participate in the marketplace.

4) Henderson Fabrication, Inc. is committed to professionalism. We realize we are a small company, but we feel one of our strongest assets is our ability to conduct our business on a professional level. We will always be courteous to our outside contacts and our fellow workers, we will strive to keep ourselves informed and educated on on matters affecting our industry, we will make sure that all written correspondences are of professional quality and we will guard against any conduct that would embarrass the company or it's employees.

5) Henderson Fabrication, Inc. is committed to providing a quality work place and a safe work environment for its employees. Our employees are one of our strongest assets; their safety and well being will always be a prime consideration for the company and it's leaders. We will not compromise on our employees safety or health considerations. We will always treat our employees as partners in the endeavors of the company.

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These ideals have been tried and tested over the years and proven to be faithful allies as we ever reach toward our goals. It is important for us to keep in mind that without our customers, our employees and most important, our integrity, our company would not survive.

As we enter into the next era of existence, the management of Henderson Fabrication, Inc. reaffirms our commitment to these ideals. It is our mission to continue to offer a quality product at a fair and equitable price, put customer satisfaction first, conduct business with integrity and in a professional manner, and to provide a quality and safe work environment for our employees. We call upon the employees of Henderson Fabrication, Inc. to commit themselves to these ideals and join us in reaching toward our goal of being a respected member of our industry.

Respectfully,

Owner
Lloyd Henderson

Owner
Theresa Henderson

General Manager
Bob Chase

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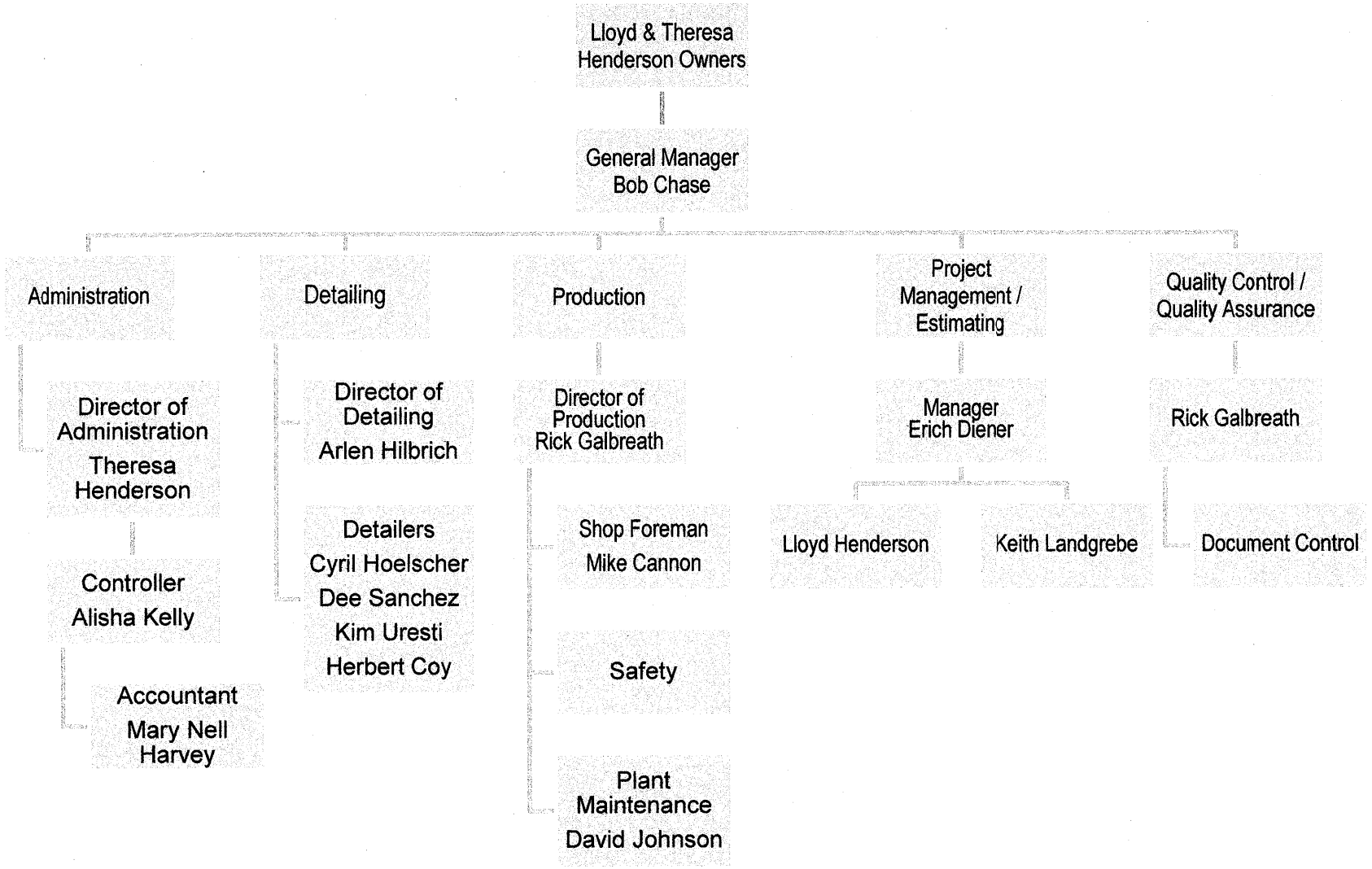
HENDERSON FABRICATION, INC.



FORWARD

Henderson Fabrication, Inc. is engaged in the fabrication of products used principally in the commercial and industrial building industry. This Quality Assurance Systems Manual has been developed to assure the discriminant customer that the fabricated products and prefabricated assemblies produced, conform to the stated requirements. These requirements are met through inspections and documented records.

The designed level of quality established in this manual is in conformance with national recognized standards of the industry, which are normally referenced in the pertinent building codes. When customer requirements are more restrictive than normal industry practice or national recognized standards customer requirements govern.

The management of this firm has taken the responsibility for assuring its clients that each work function performed, from the time the work enters this facility until the fabricated product is transported for erection, is performed to the declared quality standards.

INDIVIDUAL ACKNOWLEDGEMENT
DOCUMENTATION

This is an acknowledgement that the undersigned recipient has received this manual whose control number is 01. This is a standards and procedures manual of the Quality Assurance Systems Program. The contents of this manual have been discussed with the quality assurance program manager and as a recipient of this manual I will support the Quality Assurance Systems Program of Henderson Fabrication, Inc.

Lloyd Henderson
Recipient's Signature

PRESIDENT
Title

8/8/06
Date

Quality Assurance/Control Manager

Date

Record of this controlled manual assignment is logged in the Manual Distribution Log maintained in the Master Quality Assurance Systems Program file maintained by the QA/QC Manager.

CODE ENFORCEMENT AGENCY
ACKNOWLEDGEMENT DOCUMENTATION

This is an acknowledgement that the undersigned recipient has received this manual whose control number is:

01

This is a standards and procedures manual of the Quality Assurance Systems Program.

_____
Company Name

_____
Address

_____
City/State

Recipient for _____

By: _____
Recipient's Signature

Date: _____

_____
Quality Assurance/Control Manager

Date: _____

Record of this controlled manual assignment is logged in the Manual Distribution Log maintained in the Master Quality Assurance Systems Program file maintained by the QA/QC Manager.

REVISIONS AND AMENDMENTS LOG

DATE	REVISION NUMBER	SECTION NUMBER	STANDARDS/PROCEDURE AMENDED	OLD PAGE NOS.	NEW PAGE NOS.

QUALITY ASSURANCE SYSTEMS MANUAL REVIEW

The quality assurance systems manager or his designee performs a review of individually assigned and unassigned manuals on not less than an annual basis.

The Master Review Log is maintained in the master file or in the "master copy" of this

The "master copy" of this manual is maintained by the quality assurance systems manager or his designee and is in his office files. The master manual shall be reviewed first and used as the "most current" in case of conflict.

Manuals are reviewed to assure that all personnel are working to the same set of standards and that

After review of each manual, all changes and/or additions necessary to update the manual reviewed shall be made and documentation of the review shall be entered in the following log.

REVIEW LOG

DATE REVIEWED	QC MGR. INITIALS	CHANGES	DATE REVIEWED	QC MGR. INITIALS	CHANGES

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POLICY STATEMENT

0.1 Management declares that the policy of this firm is to produce fabricated products, which (1) conform to the requirements specified in the contract documents, (2) conform with national recognized standards of the industry (normally referenced in the pertinent building codes), (3) follows recognized industry practice and (4) satisfies the minimum standards established in this quality assurance systems program.

0.2 Management declares that sufficient standards and procedures are furnished to adequately control all functions to the desired level of quality for the work produced. This assures that the established level of quality is maintained throughout the overall fabrication process and to the above declared quality standards.

0.3 Management sees that adequate construction documents are provided for work received or estimated for a contract to assure products can be produced to the declared quality standards.

0.4 Management sees that detailed shop drawings, or computer printouts representing detailed shop drawings are provided. It also assures that erection drawings and any necessary instructions are provided which adequately interpret the owner's design drawings and specifications. This information and/or drawings may be provided from within this organization, by an approved outside source, or by the customer. The owner or his designated representative approves shop drawings, erection drawings and written instructions before fabrication is commenced.

0.5 Fabrication activities performed in the manufacture of the end product shall follow information obtained from approved detailed shop drawings or computer printouts using approved procedures so that the product conforms to the above declared quality standards.

0.6 Management sees that the procurement activities are performed to obtain materials, components and subassemblies to establish acceptable standards. This includes the procurement of the necessary services in a controlled and organized manner to assure conformance to the above declared quality standards.

0.7 Sufficient inspections are provided and documented before, during and after the fabrication process to assure that the fabricated product is in conformance with the declared quality standards.

0.8 Each employee is an active participant in the quality program and takes a direct individual responsibility in seeing that the work functions performed by them are continually performed in conformance with the declared quality standards.

0.9 All work functions performed in each of the fabrication processes are verified for conformance and documented by personnel involved, by production inspectors or supervisors and reviewed or audited by quality assurance personnel.

1.0 Management recognizes a separation of responsibility for the production supervision and the quality assurance supervision functions. It, therefore, authorizes the quality assurance systems manager to initiate, implement and to supervise the administration of the quality assurance program as set forth in this manual. Management also declares that the quality assurance manager has the responsibility, the authority and the organizational freedom to identify quality control problems and to initiate, recommend and to provide solutions.

1.1 When controversy arises during the fabrication process between production operations and quality control over a nonconformity item, a decision is made by the president, or in his absence, top management. The president or top management is assigned the responsibility of assuring that a quality product is delivered to the customer. The quality assurance systems manager is directly responsible to the president or plant manager for his performance.

1.2 When special requirements are necessary in the storage or handling of the finished product to prevent damage to it, such information shall be transmitted to the job site to assure that the fabricated product is in conformance with the contract documents.

1.3 Field modifications are not made to any product without written authority from the quality assurance manager. Any modification affecting the structural performance of any product must be approved by the design engineer and engineer of record. Any modification shall be witnessed by an approved agency to verify and document modifications performed to engineer approved details.

1.4 This policy statement and the information contained in this declaration shall be disseminated in such manner that each individual employee is aware of the quality assurance program and his/her responsibilities in assuring its success.

Signed By:_____

Title: _____

SECTION I
ORGANIZATION AND MANAGEMENT

1.0 Scope

1.0.1 This section establishes the organization and management functions necessary to perform the administrative and production functions and satisfy the quality assurance objectives.

1.1 General

1.1.1 The goal of this firm is to produce quality products that are in demand, will perform one or more necessary functions for our customers, will produce a profit for this firm's stockholders and an adequate livelihood for its employees. In order to achieve this goal, an organization is developed to direct and manage the operations and personnel of the firm.

1.2 Organization

1.2.1 Top management has established the key organization and management divisions for the firm. The organization established is illustrated on an organization chart (see sheet A1.7).

.1 Each key position listed on the organizational chart is described in the "Job Description of Key Personnel". Each management and supervisory position is provided with clearly defined functions, responsibilities and the authority over that work function. Each individual division is illustrated and this illustration indicates to whom they are directly responsible.

1.2.2 Organization Chart

.1 The organizational chart illustrates the key functions of the divisions used in the established organization (see sheet A1.7).

.2 The organizational chart illustrates general lines of authority, who the manager of a division reports to and is responsible to in an upper division.

.3 The organizational chart shows a clear separation of production activities and quality assurance activities.

.4 The organizational chart shows that the quality assurance manager is responsible to and reports to the president or plant manager.

.5 The organizational chart illustrates the quality assurance manager is on a level of authority and responsibility sufficient to perform his/her assigned duties in the primary divisions shown.

1.2.3 Qualified Personnel

.1 Key division and plant personnel positions are staffed with persons qualified to perform the prescribed operations.

a. Personnel qualifications and resumes are maintained in the personnel files and are available for review by authorized agencies as may be required.

b. Job descriptions for key positions are filed in the master quality assurance systems manual in the QA/QC manager's office and are available on request for review by authorized agencies.

1.3 Commitments

1.3.1 Management recognizes that its commitment is vital to a successful quality program and hereby pledges its commitment and its continued support.

.1 All fabrication processes on each job or work order shall conform to not less than the minimum requirements established in the quality assurance systems program.

.2 All irresolvable conflicts between production and quality control management are presented to and resolved by the president or plant manager.

.3 The quality assurance systems program is reviewed on an annual basis to assure the established objectives are maintained. Where necessary, appropriate changes are made in the system to meet the established goals.

.4 Management recognizes that there is a separation of responsibility of production supervision functions and goals and the primary functions and goals of quality assurance supervision. Every effort is and shall continue to be made to maintain that separation to achieve the quality standard goals.

1.4 Management of the Quality Assurance Systems Program

1.4.1 The President or plant manager hereby declares that the quality control manager has the responsibility along with the authority and organizational freedom to identify quality control problems and to initiate, recommend and to provide solutions.

.1 The quality control/assurance systems manager reports to and is directly responsible to the president or plant manager.

.2 The quality control/assurance systems manager has been assigned sufficient authority and the necessary responsibility so he can perform his assigned work at all levels of management.

.3 The quality control/assurance systems manager has the authority to:

a. Stop or alter the work in progress when it is not in conformance with the contract documents, the applicable codes or the minimum quality standards established in the quality assurance systems program.

b. Prevent the start of any work that cannot be fabricated or produced in conformance with the contract documents, the pertinent building codes, or the minimum established quality standards.

c. Supervise the operations of the quality assurance systems program, normal quality control operations and the quality control inspectors and personnel.

.4 Quality Control Inspectors

a. Quality control inspectors/personnel are under the supervision of and report to the quality assurance systems manager or the chief quality control inspector.

b. Quality control inspectors are given the authority and responsibility to perform their assigned duties in inspecting the work, informing the appropriate supervisors of detected nonconformities and documenting all inspections performed.

1.5 Responsibility of Management

1.5.1 Management is responsible for providing a quality product to the customer.

.1 Management in order to accomplish the above shall provide adequate facilities, competent personnel and the necessary services, utilities and equipment in a cost effective manner.

.2 Management's review of the quality program made on not more than an annual basis is documented on a review log only as satisfactory or unsatisfactory.

SECTION II
DOCUMENT CONTROL

2.0 Scope

2.0.1 This section establishes the standard for control of the pertinent documents utilized in the operation of the fabrication facility and in the verification and documentation of the quality assurance systems program.

2.1 General

2.1.1 This firm controls and documents the key work functions in its operations. Each key work function is verified and documented for record by production and quality assurance personnel. The documents developed or received and reviewed from test or inspections performed substantiate a level of quality. A control system provides a customer the assurance that fabricated products produced conform to the contract documents and to the minimum standards of the quality program.

2.2 Document Control

2.2.1 Quality Assurance Systems Manual

.1 Each QA/QC manual is controlled by an assigned number. Manuals are assigned to key personnel by the quality assurance systems manager. This is accomplished by use of a master file maintained by the QA/QC manager (see sample master file log titled, "Manual Distribution Log" on sheet A1.1.1). Each numbered manual issued is

recorded in the aforementioned log. This log is maintained and available for review at the office of the QA/QC manager. At the time the manual is issued, the QA/QC manager will review the quality program with the assignee and the form titled, "Acknowledgement Documentation" located near the front of each manual is filled in to complete manual assignment documentation (see sheet v, see also sheet A1.1.1).

2.2.2 Revisions and Amendments Record Log

.1 Each sheet of each section in the quality manual is controlled by a section and page identification mark. Revisions and amendments made to individual sheet are recorded in the "Revisions and Amendments Log". Revision numbers will be recorded on the pages revised.

This control will indicate the revision number starting with O for new additions to the manual and then using #1 for the first revision to the sheet in question, increasing one numerical increment for each revision or series of revisions to that sheet. An effective date that the section was accepted into the manual as a part of that section and/or procedure will also be indicated. Each page will be initialed by the QA/QC manager indicating the section/procedure has been approved for use in the quality program.

.2 When revisions are made to the QA/QC manual, the old sheets that have been revised are collected, accounted for and all but a master copy for permanent record are destroyed.

2.2.3 Master File Revisions and Amendments Log

.1 A master file of the revisions and amendments log is maintained and available for review at the office of the QA/QC manager. This form allows the QA/QC manager to maintain control of all changes made to each assigned and unassigned manual.

2.2.4 Quality Assurance Systems Manual Review Log

.1 A review of individual assigned and unassigned manuals is performed on not less than an annual basis by the QA/QC manager or his assignee. Documentation of this review is made on a manual review log in each manual (see sheet viii or sheet A1.1.4). This review is made to assure everyone is working to the same set of standard/procedures and that all manuals are up-to-date and contain all of the approved standards and/or procedures.

2.2.5 Control of Correspondence

.1 Correspondence received is stamped received and is marked with the date received and initials by the receiving party. When the correspondence pertains to a particular job under contract, it is identified to that work by application of the job identification mark. The correspondence is then directed to the individual or individuals who require the information or by whom action may be required. A copy of all correspondence is maintained in the job file for the referenced work (see sample receiving stamp on sheet A1.1.5).

2.2.6 Letter of Transmittal

.1 A letter of transmittal may be used to document an action taken, so long as complete information is collected and documented on the transmittal. A copy of all transmittals are filed in the job file for the work involved (see sheet A1.1.7).

2.2.7 Standard Receipt

.1 A standard receipt may be used to document that an outside and/or second party picked up a project document. Receipt should be filed in a special file and copies are maintained in the job file for the work.

2.2.8 Design Drawings, Specifications and Contract Document Control

.1 Section IV of this QA/QC manual establishes a standard for control of the design drawings, the specifications and the contract documents.

2.2.9 Shop Detailed Drawings

.1 Section V of this QA/QC manual establishes a standard for the control of the shop drawings (see sheet A1.1.6 for same control log).

SECTION III
PROJECT AND/OR STANDARD PRODUCT CONTROL

3.0 Scope

3.0.1 This section establishes the standard for the control of each job, project or work order for fabricated products produced.

3.1 General

3.1.1 Each job, project or work order is controlled. This control is achieved by conforming to the standards established in the Quality Assurance Systems Manual.

3.1.2 A special identification mark is assigned to each project or work order. This special identification mark is a job or work order number. All information received or sent pertaining to a particular job or work order, including correspondence is identified with this special identification mark. Correspondence and information received on a particular job is marked with the job or work order identification mark, the date and the correspondence is then addressed to concerned persons and filed in a controlled location for easy access.

3.1.3 Select pertinent information is collected and used to assist in the administration and production control for products or fabricated items. This information is collected and summarized on a job data sheet, or job, or project control form (see sheet A1.1.9 & A1.1.10).

3.1.4 Shop drawings and all construction documents on a job are marked with the special assigned job or project number.

3.1.5 Fabricated products for a particular job carry this job or work order number.

3.1.6 When the work on a particular project is completed, a permanent record is established where all collected information on a project is assembled and the file reference uses the special identification work order or job number as the file identification mark.

3.1.7 QA/QC personnel monitor production and control of individual projects to assure the documentation of tests performed and inspections made are collected and controlled in conformance with the requirements of the QA/QC manual. The results of the monitoring inspections and all observations made are recorded, documented and filed. These records are available for future reference (see Section XVI).

SECTION IV
CONTROL OF DESIGN DRAWINGS
AND APPROVED CONSTRUCTION DOCUMENTS

4.0 Scope

4.0.1 This section establishes the standard for the control of design drawings and the other approved construction documents.

4.1 General

4.1.1 This firm has established a method to be used for control, review and documentation for the records of the work activities required to receive and handle the approved construction documents. This includes the contract, the design drawings, the project specifications, the addenda to the specifications, change orders and revisions made to the contract documents. This is accomplished by use of the "Log for Design Drawings and Contract Documents" (see sheet A1.1.5).

4.1.2 The "Log for Design Drawings and Contract Documents" along with a transmittal and receipt file provide verification of documents and drawings received from and returned, and sent to the customer (see sheet A1.1.7 for a sample transmittal form).

4.1.3 This firm doesn't furnish engineering design or drafting services normally provided by the structural engineering profession. The structural drawings are a part of the contract documents furnished by the owner through his architect and his structural engineer. All engineering problems, design or otherwise, are referred to the engineer of record for review and resolution.

4.1.4 The construction documents are reviewed to an extent necessary to:

.1 Make a decision to bid or negotiate the work.

.2 Prepare an estimate for furnishing the materials and fabrication services.

.3 Assure the necessary engineering data is available to provide adequate connections for each item connected so the completed assembly carries the forces, shears and moments across the connect joint.

.4 Prepare or have prepared for owners review and approval, the detailed shop drawings (see Section V – Control of Shop Drawings).

4.1.5 This firm utilizes a consulting engineering firm familiar with this firm's standard fabrication practices to provide design services sometimes required for special details or for consultation when an engineering problem is apparent. A design review is not made of the construction documents.

4.2 Responsibilities

4.2.1 The manager of this firm or his designated assignee maintains and controls access to the contract for fabrication services.

4.2.2 The estimator controls the construction drawings and specifications doing the bidding phase of the work. If this fabricator is unsuccessful in bidding the work, the bid documents are returned following the established procedure. A pre-construction meeting is held once the project has awarded (see attachment) and all drawings and specifications are distributed to the appropriate departments.

SECTION V
CONTROL OF SHOP DRAWINGS

5.0 Scope

5.0.1 This section establishes the standard for the control of the shop drawings. The control includes documentation for the records of each shop detailed drawing from the time it is prepared and checked or received and checked by the fabricator until the items the detailed drawings represent have been fabricated, inspected, approved for shipment, shipped to the jobsite and erected.

5.1 General

5.1.1 This firm has established the method to be used for control, review and documentation for the records of the work, each activity required to obtain an approved detail to be used to manufacture the item detailed. This is accomplished by use of a "Shop Drawing Log" (see sheet A1.1.6)

5.1.2 This firm prepares detailed shop drawings for the fabrication of products produced.

5.1.3 This firm may use a subcontractor to produce detailed shop drawings. See paragraph 5.3 for selection of subcontractor by qualifications.

5.1.4 All detailed shop drawings are reviewed for adequacy and correctness before approved for release to a customer for approval.

5.2 Responsibilities

5.2.1 The drafting department/subcontractor is responsible for preparation, review for adequacy, correctness and release to customer for approval.

5.2.2 The chief draftsman/production manager is responsible for maintaining "The Shop Drawing Log" (Sheet A1.1.6) for each work order or project.

5.2.3 The quality control manager is responsible for monitoring the activities performed to assure the shop drawing logs are correct and up-to-date.

5.2.4 The chief draftsman/production manager is responsible for assuring that the latest approved shop drawings are used in production.

5.2.5 The chief draftsman/production manager is responsible for filing the completed shop drawing log in the permanent job file.

5.3 Qualification of Shop Drawing Subcontractors

5.3.1 Selection of the firm contracted to prepare the shop drawings is based on the following:

.1 Recommendations from select and responsible peers of this profession.
.2 Review of proven service record.
.3 Past and proven experience record with this firm.

5.4 The Shop Drawing Log

5.4.1 The shop drawing log is used to document and control each detailed drawing through each activity required to obtain an approved detail and the activities required to fabricate and erect the item at the jobsite as follows:

1. Each review
2. Each submittal
3. Re-submittals
4. Return dates for approvals
5. Corrections
6. Revisions
7. Change Orders

8. Distribution for fabrication
9. Check set of prints for inspectors
10. QC documentation of all processes
11. Date finished product sent to jobsite
12. Date file copy of each drawing sent to customer
13. Date log placed in permanent job file

5.5 Permanent Records

5.5.1 When work is completed, the shop drawing log is placed in the job file and it becomes part of the permanent record for the work.

5.5.2 The inspection set of the shop drawings referred to as the check set of prints along with the documented inspections performed is placed in the permanent records for the work as detailed in Section XVI titled, "Records – Objective Evidence of Quality."

SECTION VI
CONTROL OF MATERIAL AND SUBASSEMBLY PROCUREMENT

6.0 Scope

6.0.1 This section establishes the standard for the control of procuring materials, assemblies and subassemblies.

6.1 General

6.1.1 All materials, supplies, assemblies, subassemblies and services procured conform to the standards established by this firm, the approved construction documents and the applicable codes.

6.1.2 Supplier of materials, assemblies and subassemblies are evaluated and approved as acceptable as subcontractors or supply agents before they may become an approved supplier.

6.1.3 Procurement documents are prepared, reviewed, approved, issued and controlled in conformance with the established standards and written procedures.

6.2 Responsibilities

6.2.1 Purchasing agent is responsible for preparing the procurement document (see sheet A1.1.8 for purchase order).

6.2.2 Manager of division submitting purchase request is responsible to review for completeness and correctness.

6.2.3 QA/QC division is responsible for monitoring the system to assure compliance and documentation of compliance conforms to approved procedures.

6.2.4 QA/QC manager monitors supplier approval.

6.2.5 Accounting department is responsible for processing invoice after verification by receiving inspecting confirms material received is acceptable.

6.3 Supplier Selection

6.3.1 The evaluation, approval and selection of suppliers and supply source depends on the demonstrated capability of the supplier to comply with the technical requirements and his performance in illustrating documentation of the quality of materials, assemblies and subassemblies to this firm's established quality standards.

.1 The nature and extent of control to be exercised depends on the material, the uniformity of the material source and the material's use.

.2 Suppliers furnishing assemblies and subassemblies must conform to the same quality standards and procedures required of this firm and are required to conform to such standards and to be listed on this firm's approved supplier list.

6.4 Procurement Document

6.4.1 A standard purchase order form (sheet A1.1.8) is used for procurement of materials. Each of these documents is identified by a special identification mark that includes a consecutive numbering system for consecutive form units. Each form makes up a multi-copy system.

6.5 Action

6.5.1 Confirm materials on approved construction documents are specified to appropriate ASTM standards or other appropriate standards.

6.5.2 Materials to be purchased are procured to ASTM or other appropriate standards.

6.5.3 A purchase order is used to purchase material or to confirm a telephone order.

6.5.4 Mill certificates, material test reports or other approved means of material verification are required to document materials quality for permanent record.

6.5.5 Materials to be purchased shall be required to be identified and marked in accordance with minimum appropriate ASTM requirements.

6.5.6 Procurement document requires material test reports or mill certificates accompany material on delivery to this facility.

6.5.7 Materials ordered for replacement of in-house stock are controlled by a special assigned control number.

6.5.8 Specific or special process data, including source inspections required by the customer, are performed and documentary evidence of test results are furnished at customer's expense. Documentation and inspection verification must indicate conformance to contract documents to be acceptable.

6.5.9 A copy of the procurement document shall be sent to the receiving station for verification and documentation of materials/subassemblies received.

6.6 Review and Approval

6.6.1 The manager of the division, submitting the purchase request, or his designee must review the procurement document for completeness and correctness. Documentation of the review is made by initial approval and dating a copy for the purchase agent's file.

6.6.2 QA/QC division performs review audits of the purchase order and procurement documents as a compliance check. Procedures must conform to established standards.

6.7 Revisions and Approval

6.7.1 Revisions, change orders, additions, deletions or corrections which effect the quality, grade, quantity or materials requirements of the contract or the procurement of materials require immediate evaluation and action by management, production administration and quality assurance to revise, obtain re-approval and reschedule production.

6.8 Record

6.8.1 Copy of purchase order is filed in job file and becomes a part of the permanent record as required in Section XVI titled "Records – Objective Evidence of Quality."

SECTION VII
PROVISION FOR MATERIALS RECEIVING AND IDENTIFICATION CONTROL

7.0 Scope

7.0.1 This section establishes the standard for control of receiving and identification of materials, subassemblies and assemblies. This system assures that items or materials purchased are received and verified for conformance to the procurement documents. All items received are marked for identification. All markings conform to the established system. The receiving inspection is documented in the file for standard products and in the job file for each project or work order, which becomes part of the permanent record.

7.1 General

7.1.1 A receiving inspection is performed on all incoming materials, subassemblies and assemblies received.

7.1.2 Verification is made and documented that approved suppliers or fabricators provided materials received.

7.1.3 Verification is made and documented that materials, subassemblies and assemblies received conform to the approved construction documents, the related national standards and the minimum requirements of the quality assurance systems program.

7.2 Action

7.2.1 A copy of the purchase order, materials shipping list and a materials control form is provided for inspector performing the receiving inspection.

7.2.2 The materials, subassemblies and assemblies received at the plant are inspected for the following:

.1 All items received are within the acceptance tolerance for the material and fabrication tolerances for fabricated items.

.2 Acceptance tolerances for typical materials utilized in fabrication are illustrated in Appendix "A" (see sheet A2.1.1) and may be posted in the plant near the receiving station for convenience of the receiving inspector. They must be immediately available to the receiving inspector.

.3 Quantity, size, grade and quality of material, subassemblies and assemblies received are verified to be in conformance with that called for on the procurement documents.

.4 Mill certificates or material test reports are cross-checked to confirm material identification (i.e. heat numbers on material match heat numbers on mill certificates).

.5 Material and/or items received are accompanied with the proper mill certificates and/or material test reports.

.6 All items received from outside sources or from in-plant warehouse stock or cuts and drops from the production line are marked for identification in accordance to the established system.

a. Pertinent ASTM identification standards, approved industry standards or standards established in the quality program manual may be used for the material identification system.

b. Unidentified materials cannot be used in work performed utilizing the quality assurance systems program. Such material is "spot" color coded with spray paint "yellow" in color, in a designated location on each member. The identification mark, a yellow color-coded spot, is placed on the member. It should be about 2" in diameter. A tag system may be used where spot pain is an unacceptable identification system.

7.2.3 Assemblies and subassemblies that are part of the primary structural frame shall have the registration mark of the approved fabricator stenciled on the fabricated assembly in a location easily recognized by field inspector.

7.3 Inspection Documentation

7.3.1 The acceptance or rejection of materials, subassemblies, or assemblies inspected are documented for record as follows:

.1 A check mark (✓) placed by the item on a copy of the purchase order/materials list indicates that the material size, and quantity, has been verified and the grade and physical condition inspected and compared with material test reports and/or other substantive evidence provided and is acceptable.

.2 A circle mark "O" placed around the quantity indicated for a listed item on the purchase order/materials list indicates the material size, quality and substantive evidence provided has been inspected and is acceptable; but the quantity received does not tally with that listed on the procurement document (length of material circled on the procurement/delivery document indicate the lengths furnished do not conform to that listed on the procurement document and so on), acceptance is documented in the same manner as indicated in paragraph immediately above.

.3 An "X" mark placed by the item on the purchase order/materials list indicates that the listed material, subassembly or assembly was not delivered/received on this shipment.

.4 An (X) mark inside a circle as indicated and placed near the listed item on the purchase order form or material list indicates the material, subassembly or assembly was inspected and does not conform to the procurement document requirements or to the established acceptance standards.

.5 A check mark (✓) placed by the "X" marked item indicates the item was received. The supplier shall be immediately informed of the nonconformity and whether it is repairable. He shall also be informed of the cost to bring material into conformance. If material is unable to be repaired the supplier should be requested for method of disposition. Again, to complete documentation, the inspector's initials and date inspected should be on the receiving document.

SECTION VIII
PROVISION FOR HANDLING, TRANSPORTING AND STORAGE OF MATERIALS FABRICATED SUBASSEMBLIES AND ASSEMBLIES

8.0 Scope

8.0.1 This section establishes the standard for handling, transporting and storage control of materials, subassemblies and fabricated products. These processes are performed in such manner as to assure they conform to the requirements of the contract documents, industry standards, applicable codes and the minimum requirements of the quality assurance systems program.

8.1 General

8.1.1 Adequate work and inspection instructions are provided for the handling, storage and preservation of all materials, subassemblies and fabricated products to protect the quality of the materials or products and prevent damage, loss, deterioration, degradation or substitution. Handling or storage procedures and facilities are to include adequate equipment, special handling or storage transportation vehicles and any other facilities that may be required. Appropriate storage environments shall also be provided.

8.2 Responsibilities

8.2.1 The production manager is assigned the responsibility for the system utilized in handling and storage of each of the materials and subassemblies used in the production processes. This work must be performed in an efficient and safe manner. The method or system developed is performed in such a manner as to assure quality of material, subassembly or finished product is accepted as conforming to contract documents at the receiving inspection and is not altered or jeopardized by plant handling, transporting and storage procedures at any time in the receiving, fabrication, shipping and erection processes.

8.2.2 The QA/QC manager is assigned the responsibility of monitoring the effectiveness of the system, of assuring that the initiated system provides for the quality requirements and that the established procedures are implemented as a standard production activity.

8.3 Action

8.3.1 Adequate equipment and handling devices are furnished and used to safely handle materials, subassemblies and the fabricated products to prevent damage, loss, deterioration or degradation.

8.3.2 Storage areas for some materials have special identification marks documented on a site plan and are posted near the stockpile or stock bin.

8.3.3 Storage areas are provided with stabilized or suitable foundations to:

.1 Avoid contamination with sub-grade materials
.2 Prevent water pooling.
.3 Provide for positive drainage.
.4 Prevent differential settlement or movement that may cause twisting or racking of members being stored.
.5 Carry superimposed loads.

8.3.4 Overlapping of different materials of adjacent stockpiles are prevented by suitable walls or ample distance between stockpiles.

8.3.5 Storage facilities are such that material contamination does not occur when other material is transferred from receiving station or transferred into the production process.

8.3.6 Periodic checks and surveillance inspections are made of storage area, stored materials and stored fabricated products to assure adequate support at each designated location and ample material segregation is maintained. Documentation of all surveillance inspections is maintained in the QA/QC manager's office.

8.3.7 Stacked storage is supported, and blocked sufficiently to assure no damage or deterioration of finished products or subassemblies.

8.3.8 Detected nonconformities are tagged and documented in the log and immediately reported to production management for corrective action.

8.3.9 Once corrective action has been taken and documented, the nonconformity is re-inspected by QA/QC personnel. If re-inspection approves corrective action taken, the nonconformity tag is removed from the product and the re-inspection is documented.

SECTION IX
PROVISION FOR CONTROL OF NORMAL AND SPECIAL FABRICATION PROCESSES

9.0 Scope

9.0.1 This section establishes a standard for the preparation and control of each key production procedure or each properly sequenced combined group of work operations in the production of products fabricated to established quality standards. The products produced conform to a customer's contract documents; national recognized standards that are normally referenced in applicable codes and the minimum requirements of the Quality Assurance Systems Manual.

9.1 General

9.1.1 It is of prime importance that the events that make possible the fabrication of a product follow a systematic, unvarying sequence of work operations. The key work operations must be prescribed in clear and complete documented instruction of a type appropriate to the circumstances. Each job operation that makes up a production procedure is identified, sometimes with a number that is one of a sequence indicating previous and subsequent work operations.

9.1.2 The instructions and procedures should establish acceptance and rejection criteria.

9.2 Action

9.2.1 The production procedures and combined sequence of each group of work operations for a production function shall include the following:

.1 Provide the criteria for performing key work functions.

.2 Instructions must be prepared and readily available in the work area in which the work function is performed and in the Quality Assurance Systems Manual.

.3 The instruction must be kept current and complete.

.4 The instructions must provide detailed documented information for performing key work functions that are clear, concise and appropriate to the nature of the work to be performed. The instruction must be compatible with acceptance criteria for workmanship and tolerances. Each procedure should allow production and quality assurance monitoring of inspection and testing activities.

.5 Instructions may serve for supervising, inspecting and managing the work.

.6 Provide production and inspection forms that are simple complete and that assure all pre-established production observation pints are performed and documented by inspections.

.7 All established combined work functions should be developed into standard work procedures and must be performed by qualified personnel.

.8 When special information, skills, qualifications or certifications are required of personnel to perform some function or series of functions a list of the pertinent qualifications and certification standards are established, maintained and available for review. Procedures for maintaining certificates shall also be available for review.

.9 When certifications or special qualifications are required to perform some function or series of functions the personnel qualified to perform such functions are assigned a special identification symbol. A current list of the personnel qualified to perform such functions shall be maintained and available for review along with their assigned identification symbols.

.10 Personnel performing special functions shall place their special identification mark/marks on the work. When such documentation on the work is inappropriate, personnel performing special functions in the work are identified in the inspection reports by production or QC inspectors.

.11 Acceptance and rejection workmanship standards for each work function must be established and available for review.

.12 Acceptance and rejection tolerance standards have been established; these may be posted for easy access. The tolerances for materials, subassemblies and fabricated assemblies should be compatible with those prescribed in the receiving inspections and those established for finished product acceptance.

.13 Use the established identification and/or tagging system for observed nonconformities (see Section XIII titled, "Control of Nonconforming Materials and Fabricated Products") observed during the production process and these standards should be compatible with those shown in Section XIII.

.14 The instructions should use the established system for segregating nonconforming partially fabricated products that cannot be corrected in the production process as prescribed in Section XIII titled, "Control of Nonconforming Materials and Fabricated Products."

.15 The instructions should utilize the established system for disposition of all nonconforming, non-correctible partially fabricated products.

.16 The system must be monitored to assure that the preparation, implementation and use of work instructions as well as the verification and documentation for compliance with the fabrication procedures established are a function of the Quality Assurance Program.

.17 The production and audit system must provide for the inspection and maintenance of production facilities, tools and equipment on a regular scheduled basis to assure proper performance within acceptable established tolerances (see Section XV).

.18 The system should provide for review and analysis of records as a basis for corrective action by management of the production processes and quality assurance audit or inspection system.

SECTION X
PROVISIONS FOR INDIVUAL PIECE IDENTIFICATION

10.0 Scope

10.0.1 This section establishes a standard production procedure to provide for individual piece identification.

10.1 General

10.1.1 This section provides a method to provide adequate individual piece identification and a system to document the fabricated product conforms to the contract documents and the approved stop drawings.

10.1.2 Each individual fabricated product is marked with a job number and a distinct piece identification mark.

.1 The distinct piece identification mark used to identify each member references the piece to the particular detailed shop drawing sheet number containing details for the item fabricated and to the particular shop drawing detail mark used to identify the piece on the shop drawing sheet.

.2 This distinct piece identification mark is also shown on the erection drawings to indicate the location in the structure where this fabricated piece is to be erected.

10.1.3 The following information is required to be posted on each member fabricated.

.1 Approved fabricator name, assigned by the applicable governing code agency to individual fabricators, is applied to primary members.

SECTION XI
PROVISIONS FOR CONTROL OF INSPECTIONS

11.0 Scope

11.0.1 This section establishes the standards and controls for the procedures established by the fabricator for in-process production inspections.

11.1 General

11.1.1 In process production inspections are performed to assure that the fabrication procedures conform to the established production procedures allowing testing and visual verification that the fabricated product conforms to the requirements of the contract documents, applicable codes and the established quality program.

11.1.2 There are two types of in-process production inspections as follows:

.1 The typical inspection on a random basis to review the work already performed and that work no in progress.

.2 An inspection that is required at a particular production stage when work already performed needs to be inspected before it is covered up by an additional production work, which would make inspection of the covered work difficult or impossible.

11.2 Action

11.2.1 Each time an inspection is made on a particular item the results of the inspection are documented by the inspecting party. This is usually documented in a special predetermined location on the shop drawing for that item.

.1 The date of inspection and time in some instances,

.2 The work inspected and,

.3 The special identification symbol of the inspection party.

11.2.2 The following marks are used to document acceptable work, repair required and nonconforming un-repairable or rejected work:

.1 A check (✓) mark is documentation that work performed to that point in production is acceptable.

.2 A revision "cloud" mark () around the nonconforming item is documentation that repair or rework is required as noted on the work log (or inspectors' check set of shop drawings).

.3 An "X" mark used on the check set of prints adjacent to the piece mark of the item inspected is documentation that the work is "nonconforming" or "rejected". The part is tagged with a nonconforming or rejection tag.

11.2.3 The foreman of the section or line is immediately informed about any work which requires repair, rework, or is nonconforming or rejected.

11.2.4 Repair or rework of nonconforming fabrication that can be performed with only minor interruption of the production or assembly line is corrected immediately and inspected by the foreman. After repair the item is re-inspected by the quality control inspector and results of the inspection is marked in the work log.

11.2.5 Rework that will interfere with the progress of the work of the production line is tagged with a nonconforming tag. The job and piece mark are required to assure tag identification in case it is separated from the item tagged.

11.2.6 Repair and/or rework of an item is scheduled by the foreman. After the repair or rework has been performed the quality control inspector inspects the repaired item for conformance and follows the normal procedure for documentation of a repaired piece mentioned above.

11.2.7 Work marked "Rejected" or work that cannot be reworked to conform to the accepted quality standards will, after review and agreement by the production manager (or foreman) and the quality control manager, be set in a special area for rejected nonconforming items. (See Section XIII "Provision for Control of Nonconforming Materials and Fabricated Products").

SECTION XII
PROVISION FOR FINAL INSPECTION AND SHIPPING CONTROL

12.0 Scope

12.0.1 This section establishes the standards for control of the final inspection and for control of shipping of fabricated product to the site where it will be erected and to assure that these functions conform to the requirements of the contract documents, applicable codes as well as shipping standards and regulations.

12.1 General

12.1.1 The fabricator has adequate work and inspection instructions for the handling, blocking, bracing and securing of fabricated products for shipment to the erection site without damage, loss, or deterioration. Handling, loading and securing work instructions also require provisions for adequate equipment, the necessary transportation vehicles and sufficient inspections to protect the quality of the product.

12.2 Responsibility

12.2.1 The production manager is assigned the responsibility of developing procedures for: marking, handling, loading, securing, transporting and unloading for unloading for erection, the products fabricated. The procedures developed should be performed in an efficient and safe manner without damage or product deterioration.

12.2.2 The QA/QC Manager is assigned the responsibility of requiring sufficient production procedures to provide for safe shipment. He monitors the production operations to a degree necessary to confirm the system utilized is performed in such a manner as to prevent handling and shipment damage to the fabricated products.

12.2.3 The QA/QC personnel monitor shipping operations to assure that the products shipped are accompanied with the required shipping and technical documents, any special handling and/or erection instructions and that compliance with applicable shipping regulations are observed to provide for safe arrival and identification at its final destination. Documentation of each of the above named functions is verified by quality assurance personnel.

12.3 Action

12.3.1 Fabricated products are loaded following the scheduled loading sequence for items scheduled for shipping.

12.3.2 Loading operations shall use the equipment and loading procedure established by the production manager. QA/QC personnel review proposed loading procedures before loading is commenced.

12.3.3 Blocking, padding and securing operations are performed as scheduled and necessary to assure product is properly secured.

12.3.4 QA/QC personnel provide final inspection to assure product is in conformance with the contract documents, is properly labeled and identified. This final inspection is documented for permanent record.

12.3.5 Production personnel verify that proper shipping tickets, bills, technical documents are prepared and available for shipment with the fabricated product. QA/QC personnel verify that this paperwork is correct for the fabricated items to be shipped and that the proper paperwork accompanies the product to its destination.

12.3.6 QA/QC personnel confirm that products which are nonconforming are not shipped before all nonconformities have been corrected, re-inspected and approved for use in the work.

SECTION XII A
CONTROL OF FIELDMODIFICATION AND ERECTION TOLERANCES

12A.0 Scope

12A.0.1 This section establishes the standard for control of plant or field modifications to fabricated products. This section was developed to control any assembly modification. This assures that any approved assembly modification conforms to details approved by the design engineer, the engineer of record and the requirements established in this Quality Assurance Systems Program.

12A.1 General

12A.1.1 Structural assemblies fabricated by this firm shall not be modified without written permission of its president. Assemblies that require modification because of misfit due to field construction error or modification due to work by the erector shall be brought to the immediate attention of the fabricator and the engineer of record.

12A.1.2 This fabricator accepts no responsibility for modifications which affect the strength of the assembly, the strength of the connection, its bearing details or its adequacy in service.

12A.1.3 Any field modifications allowed shall have prior approval of the engineer of record and the engineer responsible for the structural design of the product.

.1 Modification drawings must be prepared by the engineer responsible for the design of the product and be reviewed and approved by the engineer of record.

12A.1.4 Field of plant modifications shall be made in the presence of the approval agency representing the owner or the design engineer.

12A.1.5 Assemblies that are modified must be identified by a special identification mark in addition to any other required marking. Documentation of repairs made shall be sent to this fabricator and becomes part of the permanent record for the work.

12A.2 Field Tolerances

12A.2.1 In place, positioned and secured acceptance tolerances are available for general information to erectors, assembling products produced by this fabricator.

12A.2.2 General acceptance tolerance information is sent to the field before delivery or at first delivery of the product. This information is sent for review and approved by the owner and his representatives at the time shop and erection drawings are submitted for approval. Information is available at the jobsite for dissemination to the contractor, the erector, inspection personnel and the owners representatives.

SECTION XIII
CONTROL OF NONCONFORMING MATERIAL AND FABRICATED PRODUCTS

13.0 Scope

13.0.1 This section establishes the standard used to maintain an effective and positive system for control of nonconforming materials, nonconforming fabrication processes or procedures, and nonconforming partially completed or completed products. This system includes methods of identification, separation or segregation as required and in some instances disposition of materials or fabricated products not incompliance with the level of quality established in the Quality Assurance Systems Program.

13.1 General

13.1.1 Production procedures have been established to provide an effective and positive system for detection of nonconforming materials, fabrication processes, particularly completed and completed products to prevent:

.1 use of nonconforming material in the fabrication processes,

.2 further fabrication without repair of detected nonconformities,

.3 further fabrication of un-repairable partially completed products and,

.4 completion or delivery of products already determined to be nonconforming.

13.1.2 Procedures have been implemented to identify all nonconformity items detected and to either mark for repair and repair, or tag and pull from the production line to be repaired later or rejected and set for review and possible disposal. (See Section XIV for corrective action).

13.2 Responsibility

13.2.1 The production manager has been assigned the responsibility of implementing an effective system for identifying and marking nonconforming items detected.

13.2.2. The QA/QC manager has the responsibility of monitoring the effectiveness of the system and the authority of seeing that the initiated system provides for the established quality requirements and the system is implemented as a standard production activity.

13.3 Action

13.3.1 Nonconforming materials, partially completed and completed fabricated products are:

.1 identified by clearly marking or tagging defective materials, partially fabricated products and fabricated products,

.2 removed and segregated when appropriate, from the production line to a special identified holding area,

.3 reviewed to determine if the nonconformity is correctable or non-correctable, and

.4 effectively controlled and documented following established procedures for reworking, repair or disposition of defective materials or products.

13.3.2 Defective material or product can be processed by reworking, repairing or scrapping. Scrapped non-conformances shall be placed for immediate disposition.

13.3.3 Nonconformity defects shall be classified into one of the following four categories:

.1 "use as is", following established approved written acceptable criteria,

.2 correct minor nonconformities by reworking in normal production line operations,

.3 correct major nonconformities when possible by pre-approved rework procedures and

.4 non-correctible material or product shall be rejected for use in the work and scrapped.

13.3.4 Sometimes superficially nonconforming items may be accepted; but, acceptance is always under the controlled and prescribed conditions acceptable to the QA/QC manager, the customer and his approved representatives. Serious nonconformance items shall not be submitted for acceptance.

13.3.5 A nonconformity log is used to control major nonconformities. This log is reviewed by management on a regular basis as a management production review tool.

13.3.6 All suppliers and subcontractors furnishing assemblies and subassemblies shall have a like system for control of nonconforming materials and fabricated subassemblies or assemblies.

13.4 Prevention of Nonconformities

13.4.1 Specific methods utilized for early detection and corrections of defects save time as follows:

.1 Early detection of defective work prevents wasted work effort which in many instances will have to be performed a second time.

.2 Self check systems help eliminate mistakes.

.3 Inspection by production personnel after each work operation or by moving inspectors reviewing one or a small group of work operations helps to assure work schedule is maintained and provides for early detection and correction of mistakes.

SECTION XIV
PROVISIONS FOR CORRECTIVE ACTION

14.0 Scope

14.0.1 This section establishes the standards used to correct detected nonconformities in material, partially complete and completed assemblies which are correctable and a system for disposing of material and assemblies which cannot be corrected. This section also establishes a system for correcting the conditions or procedures that caused the detected nonconformity.

14.1 General

14.1.1 The quality program was established to promptly detect and correct assignable conditions adverse to quality. This includes detailing, purchasing, manufacturing, testing and any other operations which may result in or has resulted in defective materials, production functions or services provided. Each work function resulting in a nonconformity must be identified, reviewed, examined and where appropriate the work process should be changed through corrective action.

14.2 Responsibility

14.2.1 The QA/QC manager is charged with the responsibility of identifying deficiencies, determining their cause and maintaining a running log of the nonconformity items, their cause and solution for review and study by top management (see attached Master Nonconformity Corrective Action Log).

14.2.2 The QA/QC manager and the production manager are charged with a joint responsibility of providing corrective action to the fabrication processes when necessary.

14.2.3 Top management is charged with the responsibility of reviewing the Nonconformity Corrective Action Log at least on an annual basis to assure that the necessary modifications to secure an end product conforming to the contract documents and applicable codes is achieved on a routine basis.

14.3 Action

14.3.1 All corrective action made through repair or network is controlled by production and audited by QA/QC personnel.

14.3.2 Initial action taken after detecting a nonconformity is to review the problem, classify the nonconformity, obtain or prepare the network or repair instructions and key this information on the hold tag.

14.3.3 Rework instructions are available to production, inspection and QA/QC personnel.

14.3.4 Nonconformities that are correctible without interruptions of the normal production operations shall be identified by marking or circling the nonconformity on the material or the partially fabricated item. These markings shall remain until the item has been corrected and QA/QC personnel have re-inspected and accepted the piece for use in the work. Marks shall be removed or cancelled by QA/QC personnel once the nonconformity has been corrected and the correction has been documented in the record for the work.

14.3.5 All repair or rework follows procedure instructions keyed on the hold tag attached to the piece to be repaired.

14.3.6 When the repair or rework has been completed, the piece is re-inspected by QA/QC personnel. This inspection is documented for record.

14.3.7 Inspection acceptance criteria for repair or rework of fabricated products is the same acceptance criteria used for normal in-process inspections.

14.3.8 If the reworked piece has been inspected and approved, the hold tag is removed from the piece by QA/QC personnel.

14.3.9 A nonconformity log is maintained by the QA/QC manager.

14.3.10 This log is used as a tool and is reviewed by management on a scheduled basis at least annually to check the operations of the fabricator.

14.3.11 All suppliers and subcontractors furnishing assemblies and subassemblies shall have a like system for control of nonconforming materials and fabricated subassemblies or assemblies

14.4 Procedure or Processing Corrective Action When Appropriate

14.4.1 List of items to be considered for corrective action:

.1 A review of the action taken under Section XIII "Control of Nonconforming Materials and Fabricated Products" should be performed.

.2 Analyze data and review the examination made of the scrapped product.

.3 Analyze data of product reworked and that to be reworked.

.4 Analyze trends in work functions and processes including work performance to prevent nonconforming product or reoccurrence of nonconformities.

a. Check work methods used, to assure they follow established work instructions.
b. Change unsatisfactory work methods or enforce compliance of satisfactory work methods incorrectly performed.

.5 Introduce required improvements and corrections to the system and provide for early review to check adequacy of corrective measures taken and include monitoring of overall production processes to determine effectiveness of corrective action taken.

SECTION XV
PROVISION FOR CONTROL OF PRODUCTION, GAGING, MEASURING AND TEST EQUIPMENT

15.0 Scope

15.0.1 This section establishes a standard for control and maintenance of all measuring and test equipment used in production and quality assurance functions.

15.1 Purpose

15.1.1 To assure that production and test equipment are accurate or adjusted, repaired or replaced before they become inaccurate.

15.2 General

15.2.1 Gages and other measuring and testing devices which are used to assure quality, performance, dimensions and other technical requirements of production equipment, materials and supplies are inspected, checked and where appropriate, calibrated on a regularly scheduled basis to prevent inaccuracies or to detect them as early as possible (see sheet A1.17).

15.2.2 All equipment used in production or in quality functions are identified by special assigned symbols (see sheet A1.18) and are maintained to perform to an accuracy appropriate to the circumstances. Certain gages and measuring devices require calibration against certified measurement standards which have a known valid relationship to national standards. The devices are checked at established frequencies to assure continued accuracy.

15.3 Responsibility

15.3.1 The QA/QC Manager has been given the authority and assigned the responsibility to establish and implement a controlled maintenance and comprehensive calibration system for this fabrication facility as follows:

.1 Each piece of equipment or test apparatus is assigned an identification symbol.

.2 Accurate records are kept on each piece of production and measuring equipment. A log is used to record and control calibrations, adjustments, repairs and estimate equipment wear (see Calibration Log on sheet A1.17)

.3 The frequency of calibration of measuring devices and gages has been established. This frequency of calibration was determined on the basis of type, purpose, usage rate and degree of accuracy required of the equipment involved.

.4 A policy has been established for non-use and replacement of obsolete production equipment or measuring and test devices and any production or test equipment that continually provides inaccurate production measurements as follows:

a. A "not for use" tag system is used for equipment, gages and measuring devices which are out of order, out of calibration or are not to be used in the production or quality control functions.
b. Gages and equipment are segregated when tagged for disposal;

.5 All gages are numbered, labeled and have Certificates of Calibration.

a. Labels for calibrated items indicate:
    1. date of calibration; and
    2. calibration source
b. Certificates of Calibration show calibration source, method used.

15.4 Test Equipment Control

15.4.1 The QA/QC Manager maintains the set of check test gages and equipment that are only used to verify production gages, measuring devices, tools, calipers, and equipment. The check set of test equipment is maintained in a special assigned and secure location controlled by the QA/QC Manager. Their use is restricted and limited to checking production and quality control measuring devices.

15.5 Suppliers & Subcontractors

15.5.1 All suppliers and subcontractors furnishing materials, assemblies and subassemblies must have a like control over production and test equipment. The calibration and control system over their measuring and test devices shall effectively control the accuracy of their measuring and test equipment.

SECTION XVI
RECORDS – OBJECTIVE EVIDENCE OF QUALITY

16.0 Scope

16.0.1 Management has the responsibility for controlling the quality of the work performed in its facility. It must be able to assure the quality of workmanship in the end product conforms to the contract documents and applicable codes. It must be able to provide to the purchaser objective evidence that this control of quality and the assurance of a quality end product has been maintained and does exist. Properly maintained records, of the extent necessary to assure the customer of compliance with the quality program, is one economical system of providing the necessary objective evidence. This section provides such a system.

16.1 General

16.1.1 Management maintains and uses any records or data essential to the verification of the quality of production operations and confirmation of the operation of the quality program. These records are available for review by authorized individuals representing the customer and/or governing code bodies.

16.1.2 Inspection and testing records, as a minimum, indicate the nature of the observations together with the number of observation made and should indicate the number and type of deficiencies observed. Records for monitoring work performance and for inspection and testing indicate acceptability of work observed on products produced and the action taken in connection with deficiencies observed. The system is sufficient to identify material utilized in assemblies and subassemblies.

16.2 Responsibilities

16.2.1 The production manager has the responsibility to establish production procedures to produce the fabricated product in an efficient and economical manner. The fabrication processes follow normal acceptable production procedures that conform to the established quality standards. The production manager is charged with the responsibility of establishing a production sequence that can be monitored and inspected by production personnel. Each key activity is to be verified, checked and tested as necessary. Each of these production activities is documented on a series of forms established to aid the production process and to assure each work function is performed, checked or verified for compliance and all observations are documented for the records.

16.2.2 The QA/QC Manager has the responsibility of auditing or complete review and observation of the production processes and documenting results of reviews and observations. Special inspection forms have been prepared to assist the inspection and quality assurance personnel in performing these inspection activities and of documenting the observations, measurements and check tests performed. This assures the fabrication processes and the end products conform to the contract documents and applicable codes.

16.2.3 The QA/QC personnel review the record keeping policies, systems and procedures and evaluate specific records for currency, completeness, accuracy and pertinence. They verify reviewed records by independent examinations of the fabrication processes, the fabricated product and calibration of test and measuring equipment.

16.3 Records

16.3.1 Records are prepared in a systematic manner so that they may be readily analyzed and used as a management tool to indicate the state of the overall quality program and to assist in altering production processes where necessary to provide a more cost efficient production flow or to solve quality nonconformities encountered in the production system.

16.3.2 Inspection records indicate work accomplished is in compliance or in noncompliance with work instructions and acceptance tolerances. These inspection records indicate action taken to remedy noncompliance or nonconformity items observed.

16.4 Record Retention

16.4.1 The work records on any particular project are maintained for a minimum of two years after fabrication has been completed.

16.4.2 The forms used to accomplish the evidence necessary to demonstrate fabrication quality are illustrated in Appendix A.

SECTION XVII
PROVISIONS FOR REVIEW OF THE QUALITY ASSURANCE SYSTEM PROGRAM

17.0 Scope

17.0.1 This section establishes a standard for the review of the overall quality systems program to assure it is performing its intended functions.

17.1 General

17.1.1 Review of the quality assurance systems program is to be made to review the operation of each department of the fabricator as indicated below:

.1 At intervals not exceeding twelve (12) months, the QA/QC manager performs a review of each department's operations to verify that documentary evidence is readily available indicating each key function of the management, production and inspection system concerning each project is properly performed and documented.

.2 At intervals not exceeding twelve (12) months, top management performs a review of each phase of the overall quality program. This review with input from the production manager and the QA/QC manager, is performed to consider if there is sufficient cause to initiates a revision to any of the key management, production or inspection activities. If the present standard is sufficient as is, it may require more vigorous enforcement.

.3 All reviews of the Quality Assurance Systems Program Manual and its operation are documented in the Master Review Log which is kept on file by the QA/QC Manager in the master Quality Assurance Systems Program file. A sample copy of the master file for regular scheduled review of the Quality Assurance Systems Program may be found on sheet A1.19.

.4 Changes made to the standards, procedures or individual work instructions are a joint effort of the president, the manager of the departments involved and the QA/QC manager.

APPENDIX A

SAMPLE OF FORMS USED

MANUAL DISTRIBUTION LOG

MANUAL IDENTIFICATION NUMBER	ISSUE DATE	MANUAL ASSIGNED TO	SIGNATURE OF RECIPIENT	DATE MANUAL RETURNED	RECEIVED BY

MASTER NON CONFORMITY CORRECTIVE ACTION LOG

DATE	DESCRIPTION OF NON-CONFORMITY	JOB NUMBER	WORK STATION	CORRECTIVE ACTION TAKEN	COMMENTS

CALIBRATION LOG

DESCRIPTION OF TOOL, GAUGE EQUIPMENT AND/OR MEASURING DEVICES	CONTROL NUMBER	MAKE & MODEL NO.	CALIBRATION BY	DATE OF CALIBRATION	RESULTS	APPROVED FOR USE	SCHEDULED DATE OF NEXT CALIBRATION

REGULAR SCHEDULED AUDIT/REVIEW OF QUALITY ASSURANCE SYSTEMS PROGRAM

DATE OF REVIEW	SCHEDULED DATE FOR NEXT REVIEW	REVIEWED			DEPARTMENTS REVIEWED					QA/QC DEPARTMENT	ACCEPTED AS IS	CHANGES REQUIRED	REMARKS
			BY	INITIAL	SALES ESTIMATING	ENGINEERING DEPARTMENT	DRAFTING DEPARTMENT	PURCHASING DEPARTMENT	PRODUCTION DEPARTMENT				
			QA/QC										
			PRES.										
			QA/QC										
			PRES.										
			QA/QC										
			PRES.										
			QA/QC										
			PRES.										
			QA/QC										
			PRES.										
			QA/QC										
			PRES.										
			QA/QC										
			PRES.										

LOG FOR DESIGN DRAWINGS AND CONTRACT DOCUMENTS

CUSTOMER: Bartlet Cocke

PROJECT: Del Mar College

JOB # : 3370

DOCUMENT DESCRIPTION	IDENTIFICATION MARK	DATE REC'D /FILED		REVIEWED BY	ADDITIONAL INFORMATION REQUIRED	REVISION # & DATE	DATE TO DETAILER	DETAIL SHOP DRAWING PREPARATION	SCHEDULE FOR SHOP DRAWING	TO PRODUCTION

SHOP DRAWING LOG

CUSTOMER: Bartlet Cocke
PROJECT: Del Mar College

JOB# : 3370

SHEET MARK	DESCRIPTION	DRAWN BY / DATE		CHECKED BY / DATE		FOR APPROVAL	RETURN DATE	PRIORITY SCHEDULE	REVISED FOR APPROVAL	RETURN DATE	TO SHOP	TO CONTRACTOR

☐ Overnight / Next Day ☐ Priority (2 - 3 Days) (Next day for Houston Area) ☐ Regular Mail

Henderson Fabrication, Inc.
P.O. Box 659
Bay City, TX 77404

(979) 245-5350
FAX 245-5000

LETTER OF TRANSMITTAL

DATE:	JOB NO:
ATTENTION:	
RE:	

TO: _____

WE ARE SENDING YOU

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change Order ☐ _____

COPIES	DATE	NO.	DESCRIPTION

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☐ As Requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review/comment ☐ _____

☐ FOR BIDS DUE _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO file SIGNED _____

If enclosures are not as noted, kindly notify us at once.

HENDERSON FABRICATION, INC.
PO BOX 659
BAY CITY, TX 77404-0659
PHONE: 979-245-5350
FAX: 979-245-5000

To: Metal Supply Co.

Attn: Valerie Myrick

PURCHASE ORDER NUMBER
06024 -009 4020

DATE	COST CODE
7/24/2006	4020 Materials

SHIP TO

HENDERSON FABRICATION, INC.
3107 NICHOLS AVE.
BAY CITY, TX 77414

DESCRIPTION	FOB POINT	TERMS
Charpy and Non Charpy Material	BAY CITY, TX	

QTY ORDERED	STOCK NO/DESCRIPTION	CWT/FT	UNIT PRICE	EXTENDED
	ALL WIDE FLANGE MATL TO BE ASTM A992 GR 50			-
	ALL CHANNEL/ANGLE TO BE ASTM A36 OR A529			-
	GR. 50			-
	ALL PLATES AND BARS TO BE ASTM A36 OR A529			-
	GR. 50			-
	COUNTRY OF ORIGIN MUST BE US, CANADA,			-
	WESTERN EUROPE, OR JAPAN			-
	ALL NOTED MATERIALS TO BE CHARPY IMPACT			-
	TESTED TO 25 ft/lb AT 10 DEGREES FAHRENHEIT			-
				-
	CHARPY TESTED MATERIALS			-
1	W 8 x 24 x 50-0	12.000		-
2	W 8 x 18 x 20-0	7.200		-
1	W 8 x 18 x 25-0	4.500		-
3	C 8 x 11.5 x 20-0	6.900		-
2	L 4 x 4 x 3/8 x 20-0	3.920		-
1	Bar 10 x 3/8 x 20-0	2.550		-
1	Bar 5 1/2 x 3/8 x 20-0	1.403		-
				-
	NON CHARPY TESTED MATERIALS			-
1	Bar 6 x 1/4 x 20-0	1.020		-
1	Bar 5 1/2 x 1/4 x 20-0	0.935		-
4	Bar 2 x 1/4 x 20-0	1.360		-
1	L 3 x 3 x 3/8 x 20-0	1.440		-
5	L 2 1/2 x 2 1/2 x 1/4 x 20-0	4.100		-
1	1 1/4" x 3/16" Bar Grating x 36" x 20-0 (Serrated/Black)	60.000		-
				-
	Please place this material on order and send pricing as soon as			-
	you get a chance.			-
	THANKS.			-
	TOTALS	107.328		$0.00

APPROVED BY: _____

By: _____ Approved: _____ Effective Date: _____ Rev. No. _____ Page A1.1.8

HENDERSON FABRICATION, INC.

JOB DATA SHEET

Date of Data Sheet_____ Work or Job #_____

1. Project:_____ Contract Date: _____

2. Location:_____ Est By:_____

3. Customer:_____

4. Architect:_____

5. Engineer:_____

6. Shop Drawings By:_____

7. Material Specifications:
   a) WF, WT, CH.: ASTM_____
   b) TUBE: ASTM_____
   c) PIPE: ASTM_____
   d) PLATE & ANGLE: ASTM_____

8. Special Mill and/or Material Testing Required:_____

9. Field Bolts:
   a) Bolt, Nut & Washer Type:
      1) Tension Control ASTM_____( ) Black or ( ) Galvanized
      2) Bolts ASTM_____( ) Black or ( ) Galvanized
      3) Nuts ASTM _____( ) Black or ( )Galvanized
      4) Washers ASTM_____( ) Black or ( ) Galvanized

10. Special Finishes:_____

11. Galvanizing: ASTM_____

12. Projected Delivery Schedule: Start Date:_____Completed Date:_____

13. Erection By:_____

14.Remarks:_____

_____

_____

By: _____ Approved: _____ Effective Date: _____ Rev. No. _____ Page A1.1.9

P.O. Box 659 3107 Nichols Ave. Bay City, TX 77404-0659 (979) 245-5350 Fax (979) 245-5000
hfi@hendersonfabrication.com

HENDERSON FABRICATION, INC.

Date:_____ W.O.#_____

Customer:_____

Project:_____
Site Address:_____
_____
Field Contact:_____
Field Phone & Fax:_____
Erector:_____
Erector Contact Phone:_____

Shipping Seq:_____ Delivery Date:_____
Type of Paint:_____ Galvanizer:_____

_____ Give all Design Drawings, Specs. and Addendums to Detailer.
_____ Give Scope List to Detailer.
_____ Give Advanced Material List & Specifications to Purchasing.
_____ Give Drawing to Purchasing for Buyouts. (ie. Joist, Deck)
_____ Is there any special material Foreign or Domestic.
_____ Weld Inspection by Henderson or Owner if any.
_____ Structural Drawings required for Approval _____.
_____ Misc. Drawings required for Approval_____.
_____ Drawings required to Shop Struct._____ Misc_____.
_____ Field Bolt list to Purchasing_____.
_____ Field Prints to Customer_____.
_____ Special Trucking Wide or Length.
_____ Review Scope.
_____ Review Drawings, Connections, Shop Welds, Field Welds, Ship Loose Material,
_____ Shop Friendly, & Erector Friendly Connections.
_____ Review any RFI's that may need to be submitted.
_____ Review any Fireproofing or Special Paint requirements.
_____ Review any Arch. Exposed material and cleaning requirements.
_____ In-House or Sub-out Detailing.

3107 Nichols Ave. P. O. Box 659 Bay City, TX 77404-0659 (979) 245-5350 Fax (979) 245-5000
hfi@hendersonfabrication.com

STANDARD PRODUCTION TOLERANCES

Dimensional Tolerances

I. INTRODUCTION

The structural steel fabricating industry has traditionally achieved a remarkable degree of dimensional accuracy in the fabrication and erection of steel structures. This is particularly evident when considering the variety and levels of skills that are essential to coordinate and perform the planning, detailing, fabricating, and erecting of many unique and complex buildings, bridge, and special structures that have been built in steel.

The basis for individual member and overall erected structure tolerances is largely set forth in the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, the AISC Code of Standard Practice, and other existing codes and specifications for steel structures. The tolerances stated in these documents have evolved over more than a half-century. Although these standards generally present a workable format for the fabricator, they tend to direct attention to an individual member, rather than to the role of that member in the completed structure.

With the advent of more imaginative and sophisticated steel structures, a great need has developed for a review of existing standard dimensional tolerances to determine how they affect the overall structure. There are many instances in which deviations that exceed the presently permissible tolerances will have no adverse effect on the overall completed structure. However, there are instances in which permissible tolerances for individual members may accumulate to cause the erected structure to substantially exceed the overall permissible tolerances for plumb, level, and line.

It is essential that the importance of individual member tolerances and their effect on complete structure tolerances be recognized, and that emphasis be placed on practical detailing and fabricating techniques that will permit compliance with overall tolerances.

Special clearances or tolerances, when required, must be identified on the engineering drawings, and specific reference must be included in the bid documents.

II. COMPLETED STRUCTURE TOLERANCES

A.. Establishing member working lines

In ordinary framing, deviations from true straightness and dimension of individual members, within allowable straightness tolerances, may be compensated for during erection, because of the flexibility of the columns relative to the total frame of which they are elements. In some structures using heavy column cross sections, the stiffness of the column may preclude any adjustment of camber or sweep which, although within allowable limits, can prevent tight fit-up of connections.

This situation frequently occurs in multistory building columns and may cause difficulty In erecting the floor framing members. Normal detailing practices may compensate in part for this problem; however, special shop layout practices are essential for heavy, rigid framing.

AISC Recommendations:

In order to compensate for allowable camber or sweep in heavy rigid framing, special shop layout techniques such as shop layout to working lines should be used.

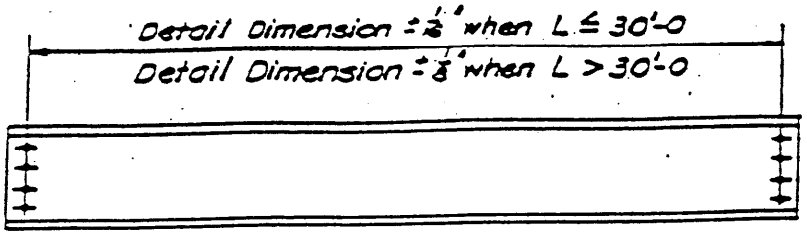
B. Accumulation of Individual Member Tolerances

While individual member tolerances are usually self-compensating and of minor significance in the overall structure, the possibility exists that these tolerances may accumulate and lead to misalignment that are difficult to correct in the field.

As an example of the effect individual member tolerance may have on the total structure, consider the tolerances on columns and beams. Figure DT-1 shows individual column and beam members with their respective permissible tolerances. These tolerances come from several sources: ASTM, A6 and AWS D1.1-2006 specify permissible camber and sweep: AISC specifies the permissible variation from detail length for members framed to other steel parts; Fig. 1 of the commentary on the AISC Code of Standard Practice (9/1/76) Illustrates mill tolerances on cross-sectional dimensions.

Figure DT-2 illustrates a case where individual members fabricated within permissible tolerances could make it impossible to erect a heavy two-story column within the allowable plumbness tolerance of = 1:500, or 0.72", for a 30-foot long column. Although the condition shown would be unusual, and is the worst that could occur if all permissible member tolerances accumulated in one direction, leading to an unworkable situation, it is evident the accumulation of tolerances is a real problem requiring special consideration. Special detailing, fabrication and erection techniques may be used to minimize the effects, but details for material supported by the steel framing must provide for tolerances.

Other possible examples are: end plate connections to columns, framing angle connections to columns, attached shelf or spandrel angles, and other similar conditions.



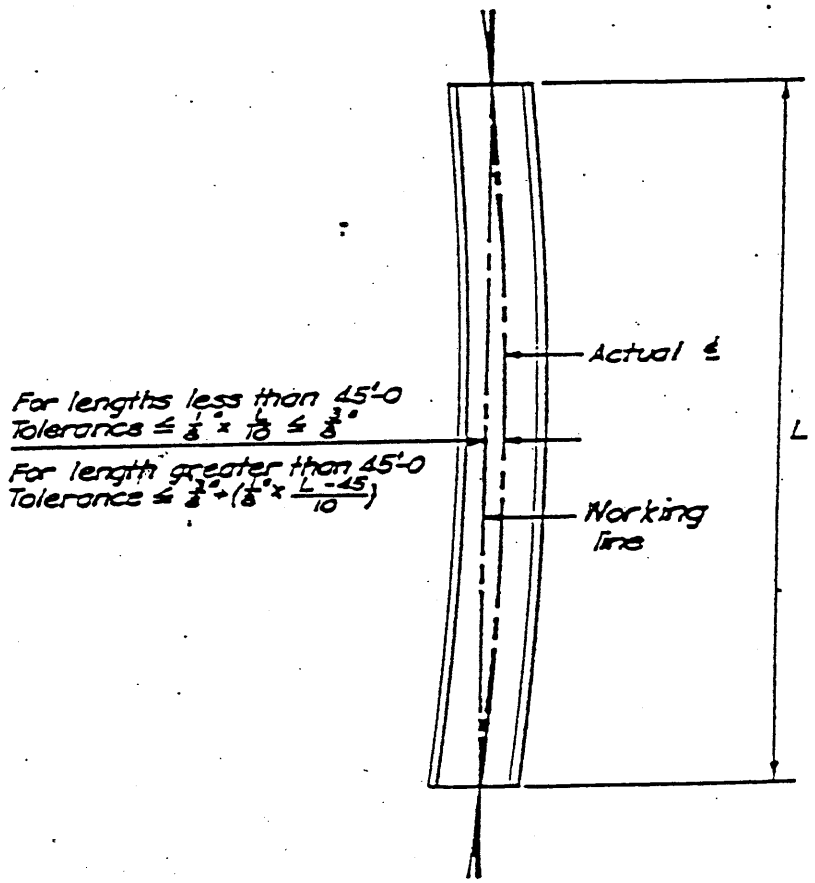


Fig. DT-1. AISC fabrication tolerances for beams and columns.

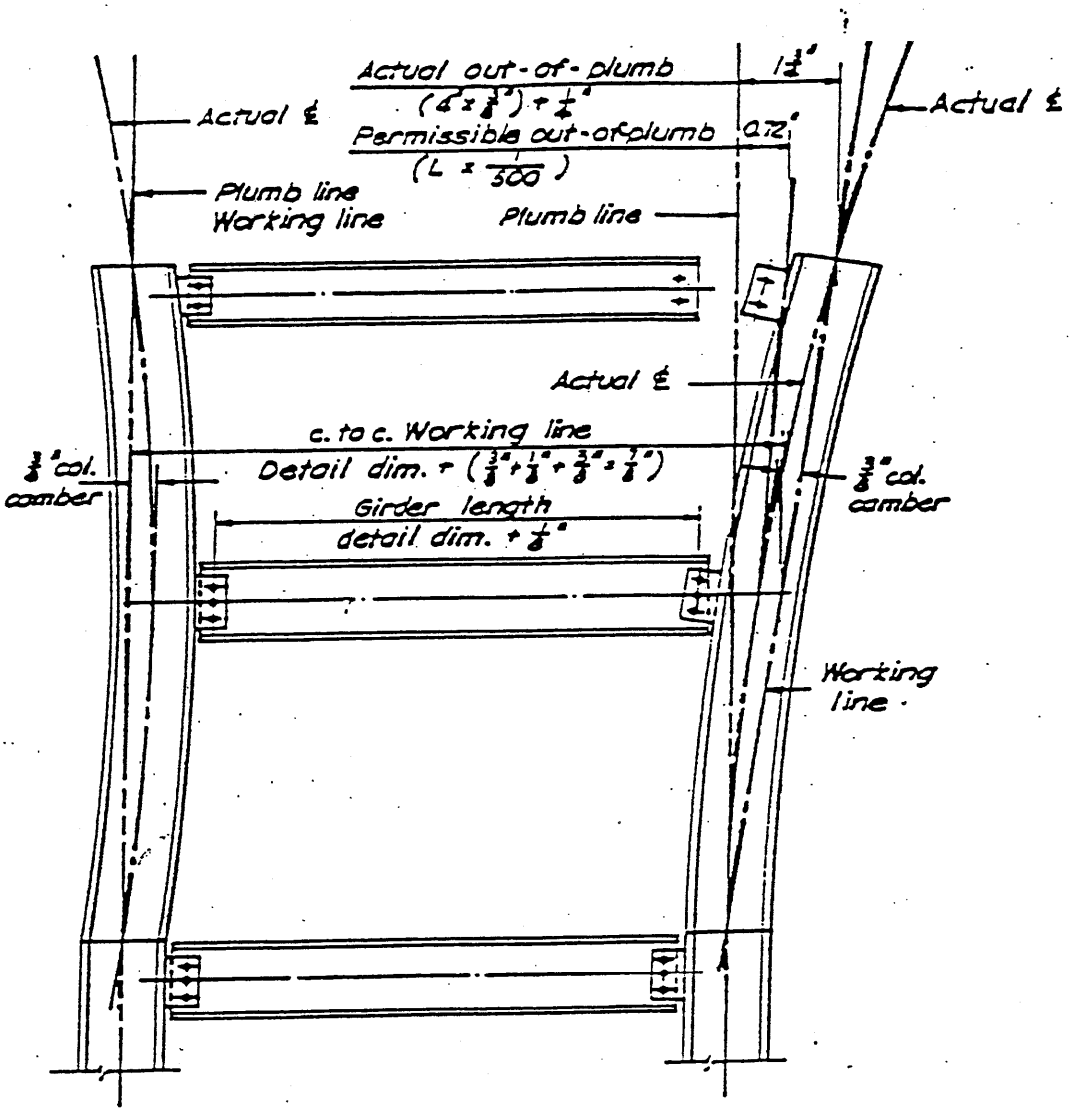


Fig. DT-2. Possible effect of accumulation of allowable member tolerances when details are located from actual center lines.

AISC Recommendation:

The use of oversized holes, short-slotted holes and long-slotted holes, as provided for by the AISC Specification, is a satisfactory method for achieving erection within tolerances (see Figs. DT-3 and DT-4). Finger shims, shop layout to working lines and recognition of accumulation in details for collateral material, such as stonework, etc, are also satisfactory methods.

The = 1/16 in. tolerance, where applicable on overall length of members framed to other steel parts, or the 1/16 in. clearance on size of standard holes, shall not be construed as implying that the tolerance = 1/16 in. also applies to the maximum tolerance on hole location within a pattern of holes, the position of intermediate connections, the position of intermediate stiffeners, the depths of girders and trusses, etc.

III. Individual Member Tolerances (Welded Members)

A. Flatness of Girder Webs

Under static loading conditions, web flatness does not affect the structural integrity of a girder. Therefore, in buildings and other statically loaded structures, the 1978 AISC Specification takes exception to AWS D1.1. Art. 8.13.2. and does not provide a limitation on maximum out-of-flatness of girder webs (see the Commentary to the AISC Specification. Sect. 1.17).

Problems arise when these tolerances are applied to thin girder webs. In girder webs less than 5/16 in. thick, the provisions of Art. 8.13.2 do not account realistically for operational difficulties caused by shrinkage resulting from web-to-flange welds and/or welds that attach stiffeners to the web. In some cases flatness within required tolerances cannot be practically provided.

AISC Recommendation:

Under static loading, the dimensional tolerance for deviation from flatness of a girder web less than 5/16 in. thick, with stiffeners one side, both sides or no stiffeners, shall be as determined by AWS D1.1 Art. 8.13.2. or ½ in., whichever is greater.

If architectural considerations require special flatness tolerances, such special requirements must be identified on the engineering drawings and stipulated in the bid documents.

B. Curved Girders

Article 3.5.1.4 of AWS D1.1 stipulates the permissible variation in sweep for horizontally curved welded girders, but does not clearly define how the sweep dimension is to be measured. As a result, tolerance is sometimes applied to the wrong dimension.

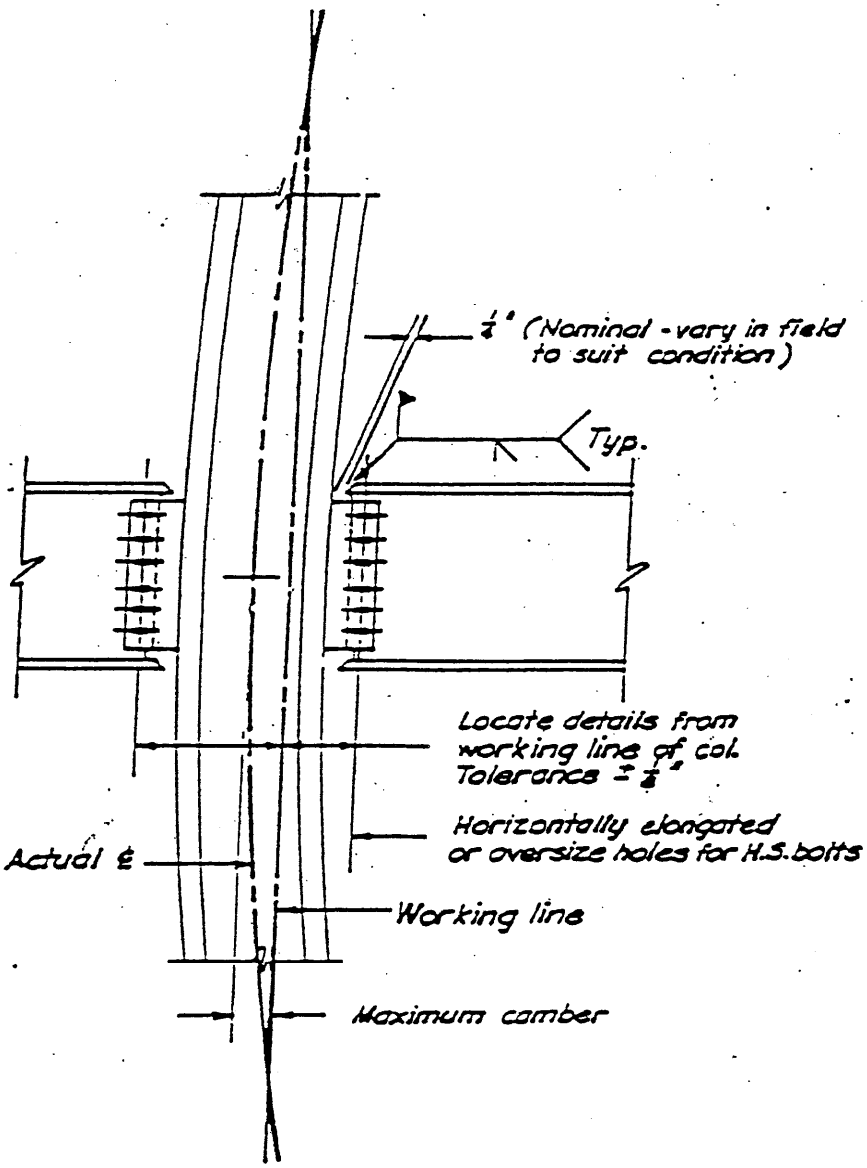


Fig. DT-3. Adjustments for column camber in beam-to-column connections.

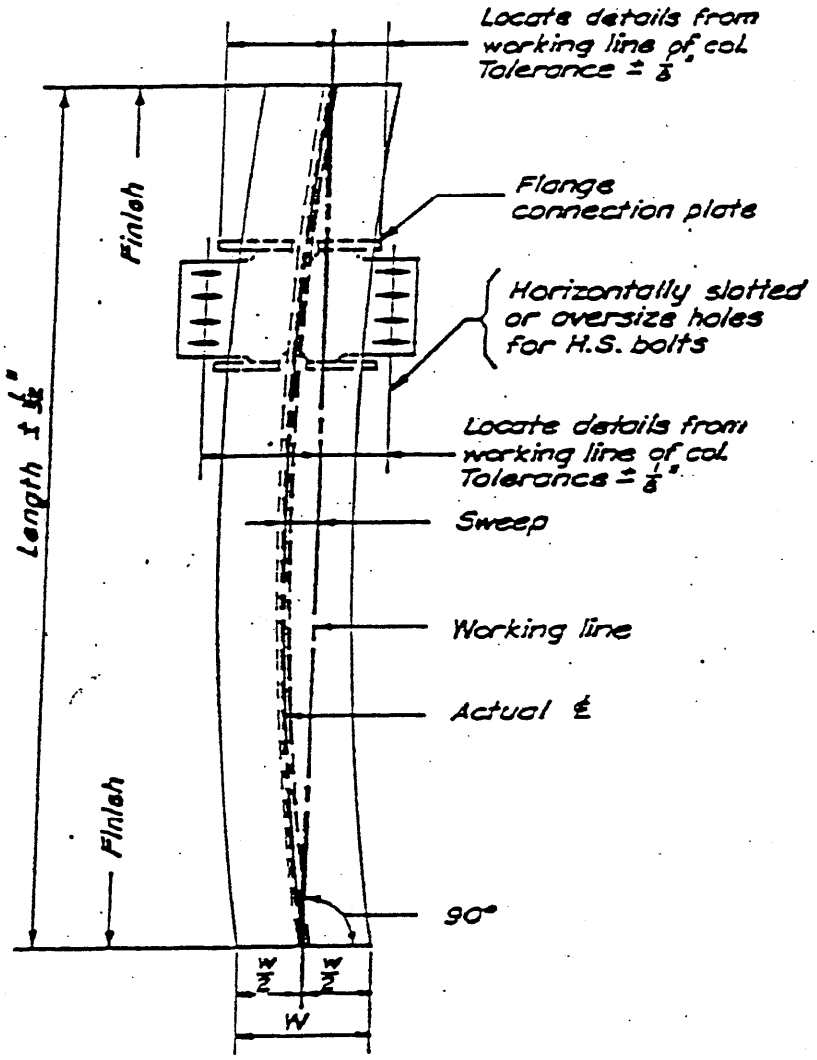


Fig. DT-4. Adjustments for column sweep in beam-to-column connections.

AISC Recommendation

The permissible variation indicated in Art. 3.5.1.4 is the deviation of the theoretical mid-ordinate from a chord through the ends of a single fabricated girder section.

It should be remembered that most girders have sufficient lateral flexibility to easily permit the attachment of diaphragm, lateral bracing etc., even if this tolerance is exceeded.

C. Girder Depth at Bolted Splices

Article 3.5 of AWS D1.1-79 is silent on girder depth at bolted splices. The following recommendation is made to establish a standard tolerance.

AISC Recommendation

The permissible deviation for depths of girders as described in AWS D1.1-2006, Art. 3.5 shall also specifically include the depth of girder at bolted splices. Any difference within the prescribed tolerances at such a bolted joint shall be taken up, if necessary, by fill plates.

D. Spacing of Stiffeners

Article3.5 of AWS D1.1-79 is silent in regard to permissible variations in the location of intermediate and longitudinal stiffeners.

When intermediate stiffeners are spaced at a distance approximately equal to the girder depth, welding shrinkage up 3/8 in. a 100-foot length of girder is not uncommon. Further, thermal expansion or contraction in a like length of girder, due to a temperature differential of 50 deg. F, can cause changes in length up 3/8 in.
Similarly, there is need for an allowable variation in the location of longitudinal stiffeners.

AISC Recommendation

Intermediate stiffeners and diaphragm connection stiffeners may deviate from their theoretical location =2 in. (as measured from the girder end).

Longitudinal stiffeners may deviate from their theoretical location by a distance equal to of the girder depth. If longitudinal stiffeners are interrupted by vertical stiffeners, the ends shall not be offset more than ½ the thickness of the stiffeners.

E. Welded Box Members and Other Members not covered in AWS D1.1, Art. 3.5.

Article 3.5.1.13 of AWS D1.1-79 requires that dimensional tolerances not covered in Art. 3.5 must be individually determined and mutually agreed upon by the fabricator and the owner, with proper regard for erection requirements. Despite this specification requirement, dimensional tolerances are sometimes arbitrarily applied, without prior agreement.

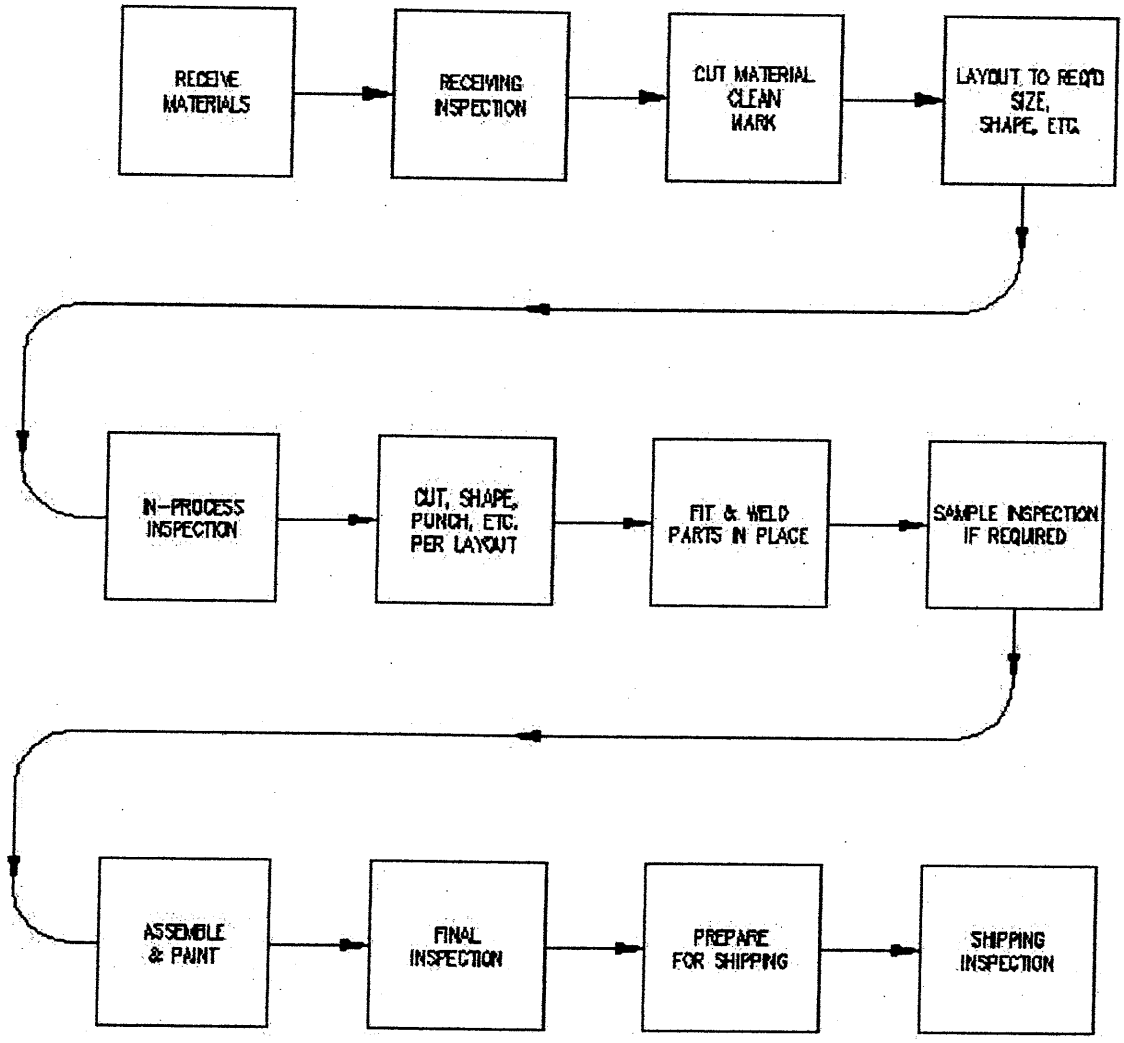
For example, Art. 3.5 does not provide specific rules for determining twist tolerances for welded box columns or box girders. However, despite the requirements of Art. 3.5.1.13, inspectors sometimes apply twist tolerance criteria from ASTM A500 or impose their own arbitrary requirements to these members.

The provision of STM A6 and ASTM A500 cannot be applied directly or indirectly to the twist of box members to assure members that are reasonably suitable for intended use.

AISC Recommendation:

Because it is nearly impossible to correct twist in closed box members, the twist tolerance for box columns and girders must be clearly stipulated and mutually agreed upon by the owner and fabricator representatives prior to fabrication.

MANUFACTURING FLOW CHART



WELDER CONTINUITY CALENDAR - 2006

WELDER NAME	ID	FCAW / SMAW	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

JOB DESCRIPTION
OF
KEY PERSONNEL

The size of this fabrication facility requires that one individual perform and be directly responsible for one or more functions. When an individual performs any one delegated function, it is his/her responsibility to see that function is performed in conformance with the established standards of the Quality Assurance Systems Manual, the requirements of the contract documents and the applicable building codes.

President – The president has the overall responsibility for the operation of the company. He/she has delegated the operational authority to department managers of production, quality control, sales, purchasing and administration.

Production Manager – The production manager reports directly to the president. He/she is responsible for the following:

1. Review of drawings and specifications for material necessary to perform the work on a predetermined schedule,
2. for directing, documenting and coordinating material receiving and storage,
3. for coordinating, documenting and directing the production processes and techniques of fabrication, and
4. for review of the completed product, its storage, handling and shipment to the jobsite.

Quality Control Manager – The quality control manager is directly responsible to the president of the company. He/she directs the quality assurance inspectors and the contract testing laboratory personnel. He/she is responsible for auditing the administration and production operations to assure adequate implementation and compliance of the Quality Assurance System Program.

Sales Manager – The sales manager reports directly to the president. He/she is responsible for client contact, cost estimates, initiating contracts and obtaining work for the company.

Purchasing – The manager of this department reports directly to the president. He/she is responsible for the purchasing of all material and services required to perform the work in accordance with the contract documents, specifications and applicable work for sound fabricating practices.

Administration – The manager of this department reports directly to the president. He/she is responsible for performing as an assistant to the president by administrating the daily routine business functions of the company.

APPENDIX B

MILL TOLERANCES

STANDARD MILL PRACTICE
General Information

Rolling structural shapes and plates involves such factors as roll wear, subsequent roll dressing, temperature variations, etc., which cause the finished product to vary from published profiles. Such variations are limited by the provisions of the American Society for Testing and Materials Specification A6. Contained in this section is a summary of these provisions, not a reproduction of the complete specification. In its entirety, A6 covers a group of common requirements, which, unless otherwise specified in the purchase order or in an individual specification, shall apply to rolled steel plates, shapes, sheet piling and bars.

In accordance with Table 1, *carbon steel* refers to ASTM Designations A36 and A529; *high-strength, low-alloy steel* refers to Designations A242, A572, and A588; *alloy steel* refers to Designation A514; and low-alloy steel refers to A852.

For further information on mill practices, including permissible variations for rolled tees, zees and bulb angles in structural and bar sizes, pipe, tubing, sheets and strip, and for other grades of steel, see ASTM A6, A53, A500, A568 and A618, and the AISI Steel Products Manuals and Producers' Catalogs.

The data on spreading rolls to increase areas and weights, and mill cambering of beams, is not a part of A6.

Additional material on mill practice is included in the descriptive material preceding the "Dimensions and Properties" tables for shapes and plates.

Letter symbols representing dimensions on sketches shown herein are in accordance with ASTM A6, AISI and mill catalogs and *not necessarily as defined by the general nomenclature of this manual.*

STANDARD MILL PRACTICE
Methods of increasing areas and weights by spreading rolls

W SHAPES

To vary the area and weight within a given nominal size, the flange width, the flange thickness and the web thickness are changed, as shown in Fig. 1.

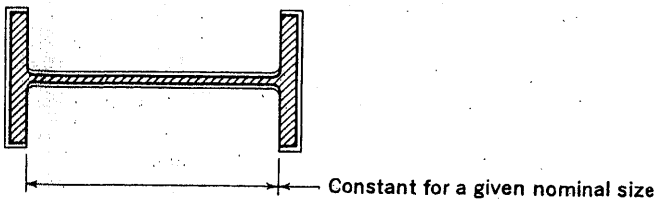


Figure 1

S SHAPES AND AMERICAN STANDARD CHANNELS

To vary the area and weight within a given nominal size, the web thickness and the flange width are changed by an equal amount, as shown in Figs. 2 and 3.

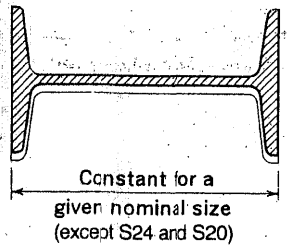


Figure 2

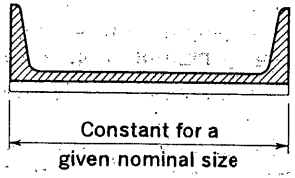


Figure 3

ANGLES

To vary area and weight for a given leg length, the thickness of each leg is changed. Note that leg length is changed slightly by this method (Fig. 4).

STANDARD MILL PRACTICE
Cambering of rolled beams

All beams are straightened after rolling to meet permissible variations for sweep ar camber listed hereinafter for W shapes and S shapes. The following data refers to th subsequent cold cambering of beams to produce a predetermined dimension.

The maximum lengths that can be cambered depend on the length to which given section can be rolled, with a maximum of 100 ft. The following table outline the maximum and minimum induced camber of W shapes and S shapes.

MAXIMUM AND MINIMUM INDUCED CAMBER

Sections Nominal Depth In.	Specified Length of Beam, Ft.				
	Over 30 to 42, incl.	Over 42 to 52, incl.	Over 52 to 65, incl.	Over 65 to 85, incl.	Over 85 to 100, incl.
	Max. and Min. Camber Acceptable, In.				
W shapes, 24 and over	1 to 2, incl.	1 to 3, incl.	2 to 4, incl.	3 to 5, incl.	3 to 6, incl.
W shapes, 14 to 21, incl. and S shapes, 12 in. and over	¾ to 2½, incl.	1 to 3, incl.	2 to 4, incl.	2½ to 5, incl.	Inquire

Consult the producer for specific camber and/or lengths outside the above listed available lengths and sections.

Mill camber in beams of less depth than tabulated should not be specified.

A single minimum value for camber, within the ranges shown above for the length ordered, should be specified.

Camber is measured at the mill and will not necessarily be present in the same amount in the section of beam as received due to release of stress induced during the cambering operation. In general, 75% of the specified camber is likely to remain.

Camber will approximate a simple regular curve nearly the full length of the beam, or between any two points specified.

Camber is ordinarily specified by the ordinate at the mid-length of the portion of the beam to be curved. Ordinates at other points should not be specified.

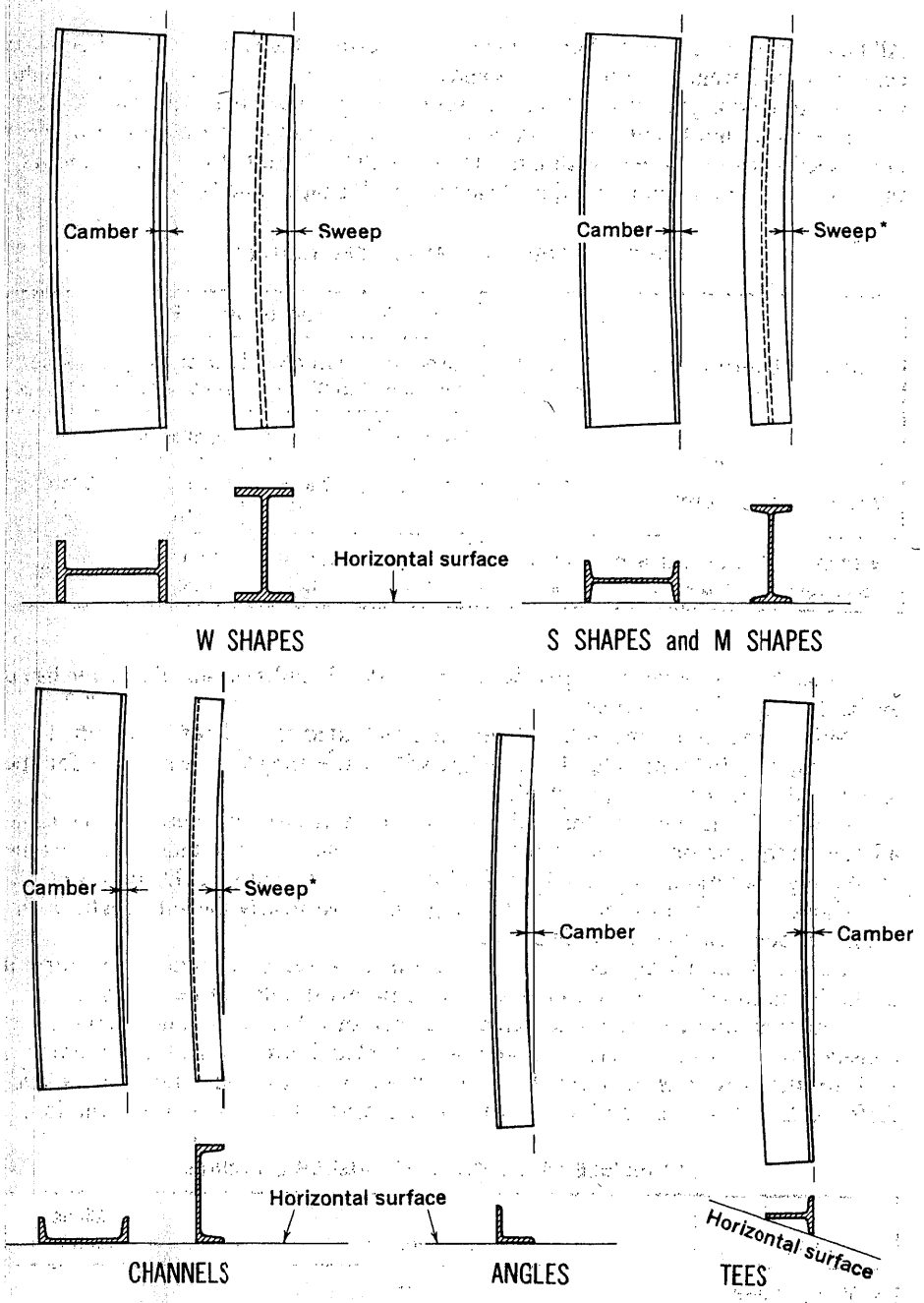
Although mill cambering to achieve reverse or other compound curves is not considered practical, fabricating shop facilities for cambering by heat can accomplish such results as well as form regular curves in excess of the limits tabulated above. Refer to Effect of Heat on Steel, Part 6 of this Manual, for further information.

PERMISSIBLE VARIATIONS FOR CAMBER ORDINATE

Lengths	Plus Variation	Minus Variation
50 ft and less	½ inch	0
Over 50 ft	½ in. plus ⅛ in. for each 10 ft or fraction thereof	0

STANDARD MILL PRACTICE

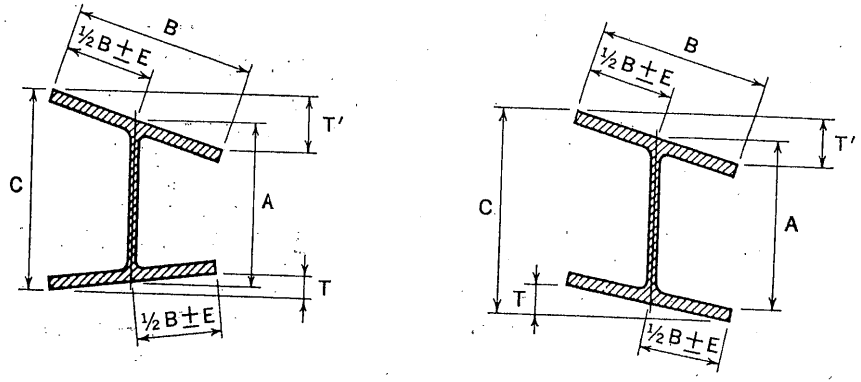
Positions for measuring camber and sweep



* Due to the extreme variations in flexibility of these shapes, straightness tolerances for sweep are subject to negotiations between manufacturer and purchaser for individual sections in-

STANDARD MILL PRACTICE

W Shapes
HP Shapes



PERMISSIBLE VARIATIONS IN CROSS SECTION

Section Nominal Size, In.	A, Depth, In.		B, Flg. Width, In.		T + T′, Flanges, Out of Square, Max, In.	E,[a] Web off Center, Max, In.	C, Max, Depth at any Cross-Section over Theoretical Depth, In.
	Over Theo-retical	Under Theo-retical	Over Theo-retical	Under Theo-retical			
To 12, incl.	1/8	1/8	1/4	3/16	1/4	3/16	1/4
Over 12	1/8	1/8	1/4	3/16	5/16	3/16	1/4

[a]Variation of 5/16-in. max. for sections over 426 lb./ft.

PERMISSIBLE VARIATIONS IN LENGTH

W Shapes	Variations from Specified Length for Lengths Given, In.			
	30 ft and Under		Over 30 ft	
	Over	Under	Over	Under
Beams 24 in. and under in nominal depth	3/8	3/8	3/8 plus 1/16 for each additional 5 ft or fraction thereof	3/8
Beams over 24 in. nom. depth; all columns	1/2	1/2	1/2 plus 1/16 for each additional 5 ft or fraction thereof	1/2

OTHER PERMISSIBLE VARIATIONS

Area and Weight Variation: ±2.5% theoretical or specified amount.

Ends Out-of-Square: ¼ in. per in. of depth, or of flange width if it is greater than the depth.

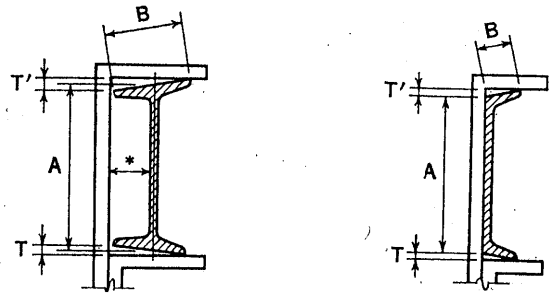
Camber and Sweep:

Sizes	Length	Permissible Variation, In.	
		Camber	Sweep
Sizes with flange width equal to or greater than 6 in.	All	$\frac{1}{8}$ in. × $\frac{\text{(total length, ft)}}{10}$	
Sizes with flange width less than 6 in.	All	$\frac{1}{8}$ in. × $\frac{\text{(total length, ft)}}{10}$	$\frac{1}{8}$ in. × $\frac{\text{(total length, ft)}}{5}$
Certain sections with a flange width approx. equal to depth & specified on order as columns[b]	45 ft and under	$\frac{1}{8}$ in. × $\frac{\text{(total length, ft)}}{10}$ with $\frac{3}{8}$ in. max.	
	Over 45 ft	$\frac{3}{8}$ in. + $\left[\frac{1}{8}\text{ in.} \times \frac{\text{(total length, ft} - 45)}{10}\right]$	

[b]Applies only to: W 8 × 31 and heavier, W 10 × 49 and heavier, W 12 × 65 and heavier, W 14 × 90 and heavier. If other sections are specified on the order as columns, the tolerance will be subject to negotiation with the manufacturer.

STANDARD MILL PRACTICE
S shapes, M shapes and channels

PERMISSIBLE VARIATIONS IN CROSS-SECTION



Section	Nominal Size, in.	A, Depth, In.[a]		B, Flange Width, In.		T + T′, Out of Square per Inch of B, In.
		Over Theo-retical	Under Theo-retical	Over Theo-retical	Under Theo-retical	
S shapes and M shapes	3 to 7, incl.	$\frac{3}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{32}$
	Over 7 to 14, incl.	$\frac{1}{8}$	$\frac{3}{32}$	$\frac{5}{32}$	$\frac{5}{32}$	$\frac{1}{32}$
	Over 14 to 24, incl.	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{1}{32}$
Channels	3 to 7, incl	$\frac{3}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{32}$
	Over 7 to 14, incl.	$\frac{1}{8}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{1}{32}$
	Over 14	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{32}$

[a]A is measured at centerline of web for beams; and at back of web for channels.
[b]T + T applies when flanges of channels are tied in or out.

PERMISSIBLE VARIATIONS IN LENGTH

Section	Variations from Specified Length for Lengths Given, In.									
	To 30 Ft, incl.		Over 30 to 40 Ft, incl.		Over 40 to 50 Ft, incl.		Over 50 to 65 Ft, incl.		Over 65 Ft	
	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under
S shapes, M shapes and Channels	½	¼	¾	¼	1	¼	1⅛	¼	1¼	¼

OTHER PERMISSIBLE VARIATIONS

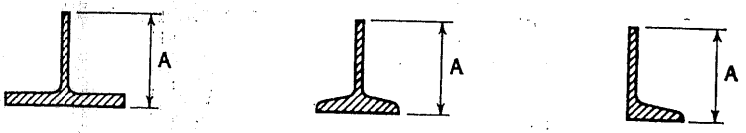
Area and Weight Variation: ±2.5% theoretical or specified amount.

Ends Out-of-Square: S shapes and channels $\frac{1}{64}$ in. per in. of depth.

total length, ft

STANDARD MILL PRACTICE
Tees split from W, M and S shapes
Angles split from channels

PERMISSIBLE VARIATIONS IN DEPTH



Dimension A may be approximately ½ beam or channel depth, or any dimension resulting from off-center splitting, or splitting on two lines as specified on the order.

Depth of Beam from which Tees or Angles are Split	Variations in Depth A Over and Under	
	Tees	Angles
To 6 in., excl.	1/8	1/8
6 to 16, excl.	3/16	3/16
16 to 20, excl.	1/4	1/4
20 to 24, excl.	5/16	...
24 and over	3/8	...

The above variations for depths of tees or angles include the permissible variations in depth for the beams and channels before splitting.

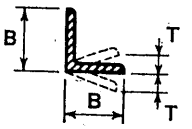
OTHER PERMISSIBLE VARIATIONS

Other permissible variations in cross section, as well as permissible variations in length, area and weight variation and ends out-of-square, will correspond to those of the beam or channel before splitting, except

$$\text{camber} = \tfrac{1}{8}\text{ in.} \times \frac{\text{total length, ft}}{5}$$

STANDARD MILL PRACTICE
Angles, structural size

PERMISSIBLE VARIATIONS IN CROSS SECTION



Section	Nominal Size, in.[a]	B Length of Leg, in.		T, Out of Square per In. of B, In.
		Over Theoretical	Under Theoretical	
Angles	3 to 4, incl.	1/8	3/32	3/128[b]
	Over 4 to 6, incl.	1/8	1/8	3/128[b]
	Over 6	3/16	1/8	3/128[b]

[a] For unequal leg angles, longer leg determines classification.
[b] 3/128 in. per in. = 1½ deg.

PERMISSIBLE VARIATIONS IN LENGTH

Section	Variations from Specified Length for Lengths Given, In.									
	To 30 Ft, incl.		Over 30 to 40 Ft, incl.		Over 40 to 50 Ft, incl.		Over 50 to 65 Ft, incl.		Over 65 Ft	
Angles	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under
	1/2	1/4	3/4	1/4	1	1/4	1 1/8	1/4	1 1/4	1/4

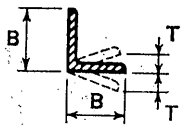
OTHER PERMISSIBLE VARIATIONS

Area and weight variation: ±2.5% theoretical or specified amount.
Ends out-of-square: 3/128 in. per in. of leg length, or 1½ deg. Variations based on the longer leg of an unequal angle.

total length, ft

STANDARD MILL PRACTICE
*Angles, bar size

PERMISSIBLE VARIATION IN CROSS SECTION



[a]Specified Length of Leg, In.	Variations from Thickness for Thickness Given, Over and Under, In.			B Length of Leg, Over and Under, In.	T, Out of Square per Inch of B, In.
	3/16 and Under	Over 3/16 to 3/8, incl.	Over 3/8		
1 and under	0.008	0.010		1/32	3/128[b]
Over 1 to 2, inc.	0.010	0.010	0.012	3/64	3/128[b]
Over 2 to 3, excl.	0.012	0.015	0.015	1/16	3/128[b]

[a]The longer leg of an unequal angle determines the size for permissible variations.
[b]3/128-in. per in. = 1½ degrees.

PERMISSIBLE VARIATIONS IN LENGTH

Section	Variations Over Specified Length for Lengths Given No Variation Under				
	5 to 10 Ft excl.	10 to 20 Ft excl.	20 to 30 Ft excl.	30 to 40 Ft excl.	40 to 65 Ft incl.
All sizes of bar-size angles	5/8	1	1½	2	2½

OTHER PERMISSIBLE VARIATIONS

Camber: ¼ in. in any 5 ft, or ¼ in. $\times \frac{\text{total length, ft}}{5}$

Straightness: Because of warpage, permissible variations for straightness do not apply to bars if any subsequent heating operation has been performed.

Ends Out-of-Square: 3/128-in. per in. of leg length or 1½ degrees. Variation based on longer leg of an unequal angle.

[a]A member is "bar size" when its greatest

STANDARD MILL PRACTICE
Steel pipe and tubing

DIMENSIONS AND WEIGHT TOLERANCES
Round Tubing and Pipe

ASTM A53

Weight—The weight of the pipe as specified in Table X2 and Table X3 (ASTM Specification A53) shall not vary by more than ±10 percent.

Note that the weight tolerance of ±10 percent is determined from the weights of the customary lifts of pipe as produced for shipment by the mill, divided by the number of feet of pipe in the lift. On pipe sizes over 4 in. where individual lengths may be weighed, the weight tolerance is applicabe to the individual length.

Diameter—For pipe 2 in. and over in nominal diameter, the outside diameter shall not vary more than ±1 percent from the standard specified.

Thickness—The minimum wall thickness at any point shall be not more than 12.5 percent under the nominal wall thickness specified.

ASTM A618

Outside Dimensions—For round hot formed structural tubing 2 in. and over in nominal size, the outside diameter shall not vary more than ±1 percent from the standard specified.

Mass (A618 only)—The mass of structural tubing shall not be less than the specified value by more than 3.5 percent.

Length—Structural tubing is commonly produced in random mill lengths, in multiple lengths, and in definite cut lengths. When cut lengths are specified for structural tubing, the length tolerances shall be in accordance with the following table:

	22 ft and under		Over 22 to 44 ft, incl.	
	Over	Under	Over	Under
Length tolerance for specified cut lengths, in.	½	¼	¾	¼

Straightness—The permissible variation for straightness of structural tubing shall be ⅛ in. times the number of feet of total length divided by 5.

Square and Rectangular Tubing

ASTM A500 and ASTM A618

Outside Dimensions—The specified dimensions, measured across the flats at positions at least 2 in from either end of square or rectangular tubing and including an allowance for convexity or concavity, shall not exceed the plus and minus tolerance shown in the following table:

Largest Outside Dimension, Across Flats, in.	Tolerance[a] Plus and Minus, in.
2½ and under	0.020
Over 2½ to 3½, incl.	0.025
Over 3½ to 5½, incl.	0.030
Over 5½	1 percent

[a]The respective outside dimension tolerances include the allowances for convexity and concavity.

Lengths—Structural tubing is commonly produced in random lengths, in multiple lengths, and in definite cut lengths. When cut lengths are specified for structural tubing, the length tolerances shall be in accordance with the following table:

	22 ft and under		Over 22 to 44 ft, incl.	
	Over	Under	Over	Under
Length tolerance for specified cut lengths, in.	½	¼	¾	¼

Mass (A618 only)—The mass of structural tubing shall not be less than the specified value by more than 3.5 percent.

Straightness—The permissible variation for straightness of structural tubing shall be ⅛ in. times the number of feet of total length divided by 5.

Squareness of Sides—For square or rectangular structural tubing, adjacent sides may deviate from 90 degrees by a tolerance of plus or minus 2 degrees max.

Radius of Corners—For square or rectangular structural tubing, the radius of any outside corner of the section shall not exceed three times the specified wall thickness.

Twist—The tolerances for twist or variation with respect to axial alignment of the section, for square and rectangular structural tubing, shall be as shown in the following table:

Specified Dimension of Longest Side, in.	Maximum Twist per 3 ft of Length, in.
1½ and under	0.050
Over 1½ to 2½, incl.	0.062
Over 2½ to 4 incl.	0.075
Over 4 to 6, incl.	0.087
Over 6 to 8, incl.	0.100
Over 8	0.112

Twist is measured by holding down one end of a square or rectangular tube on a flat surface plate with the bottom side of the tube parallel to the surface plate and noting the height that either corner, at the opposite end of the bottom side of the tube, extends above the surface plate.

Wall Thickness (A500 only)—The tolerance for wall thickness exclusive of the weld area shall be plus and minus 10 percent of the nominal wall thickness specified. The wall thickness is to be measured at the center of the flat.

STANDARD MILL PRACTICE
Rectangular sheared plates and Universal mill plates

PERMISSIBLE VARIATIONS IN WIDTH AND LENGTH FOR SHEARED PLATES
(1½ in. and under in thickness)

PERMISSIBLE VARIATIONS IN LENGTH ONLY FOR UNIVERSAL MILL PLATES
(2½ in. and under in thickness)

Specified Dimensions, In.		Variations over Specified Width and Length for Thickness, In., and Equivalent Weights, Lb. Per Sq. Ft, Given							
		To ⅜, excl.		⅜ to ⅝, excl.		⅝ to 1, excl.		1 to 2, incl.*	
Length	Width	To 15.3, excl.		15.3 to 25.5, excl.		25.5 to 40.8, excl.		40.8 to 81.7, incl.	
		Width	Length	Width	Length	Width	Length	Width	Length
To 120, excl.	To 60, excl.	⅜	½	7/16	⅝	½	¾	⅝	1
	60 to 84, excl.	7/16	⅝	½	11/16	⅝	⅞	¾	1
	84 to 108, excl.	½	¾	⅝	⅞	¾	1	1	1⅛
	108 and over	⅝	⅞	¾	1	⅞	1⅛	1⅛	1¼
120 to 240, excl.	To 60, excl.	⅜	¾	½	⅞	⅝	1	¾	1⅛
	60 to 84, excl.	½	¾	⅝	⅞	¾	1	⅞	1¼
	84 to 108, excl.	9/16	⅞	11/16	15/16	13/16	1⅛	1	1⅜
	108 and over	⅝	1	¾	1⅛	⅞	1¼	1⅛	1⅜
240 to 360, excl.	To 60, excl.	⅜	1	½	1⅛	⅝	1¼	¾	1½
	60 to 84, excl.	½	1	⅝	1⅛	¾	1¼	⅞	1½
	84 to 108, excl.	9/16	1	11/16	1⅛	⅞	1⅜	1	1½
	108 and over	11/16	1⅛	⅞	1¼	1	1⅜	1¼	1⅜
360 to 480, excl.	To 60, excl.	7/16	1⅛	½	1¼	⅝	1⅜	¾	1⅝
	60 to 84, excl.	½	1¼	⅝	1⅜	¾	1½	⅞	1⅝
	84 to 108, excl.	9/16	1¼	¾	1⅜	⅞	1½	1	1⅞
	108 and over	¾	1⅜	⅞	1½	1	1⅝	1¼	1⅞
480 to 600, excl.	To 60, excl.	7/16	1¼	½	1½	⅝	1⅝	¾	1⅞
	60 to 84, excl.	½	1⅜	⅝	1½	¾	1⅝	⅞	1⅞
	84 to 108, excl.	⅝	1⅜	¾	1½	⅞	1⅝	1	1⅞
	108 and over	¾	1½	⅞	1⅝	1	1¾	1¼	1⅞
600 to 720, excl.	To 60, excl.	½	1¾	⅝	1⅞	¾	1⅞	⅞	2¼
	60 to 84, excl.	⅝	1¾	¾	1⅞	⅞	1⅞	1	2¼
	84 to 108, excl.	⅝	1¾	¾	1⅞	⅞	1⅞	1⅛	2¼
	108 and over	⅞	1¾	1	2	1⅛	2¼	1¼	2½
720 and over, excl.	To 60, excl.	9/16	2	¾	2⅛	⅞	2¼	1	2¾
	60 to 84, excl.	¾	2	⅞	2⅛	1	2¼	1⅛	2¾
	84 to 108, excl.	¾	2	⅞	2⅛	1	2¼	1¼	2¾
	108 and over	1	2	1⅛	2⅜	1¼	2½	1⅜	3

Permissible variations in length apply also to Universal Mill plates up to 12 in. width for thicknesses over 2 to 2½ in. incl. except for alloy steels up to 1¾ in. thick.

Notes: Permissible variations under specified width and length, ¼ in.

Table applies to all steels listed in ASTM A6.

STANDARD MILL PRACTICE
Rectangular sheared plates and Universal mill plates

PERMISSIBLE VARIATIONS FROM FLATNESS
(Carbon Steel Only)

Specified Thickness, In.	Variations from Flatness for Specified Widths, In.							
	To 36, excl.	36 to 48, excl.	48 to 60, excl.	60 to 72, excl.	72 to 84, excl.	84 to 96, excl.	96 to 108, excl.	108 to 120, excl.
To ¼, excl.	9/16	¾	15/16	1¼	1⅜	1½	1⅝	1¾
¼ to ⅜, excl.	½	⅝	¾	15/16	1⅛	1¼	1⅜	1½
⅜ to ½, excl.	½	9/16	⅝	⅝	¾	⅞	1	1⅛
½ to ¾, excl.	7/16	½	9/16	⅝	⅝	¾	1	1
¾ to 1, excl.	7/16	½	9/16	⅝	⅝	⅝	¾	⅞
1 to 2, excl.	⅜	½	½	9/16	9/16	⅝	⅝	⅝
2 to 4, excl.	5/16	⅜	7/16	½	½	½	½	9/16
4 to 6, excl.	⅜	7/16	½	½	9/16	9/16	⅝	¾
6 to 8, excl.	7/16	½	½	⅝	11/16	¾	⅞	⅞

General Notes:

1. The longer dimension specified is considered the length, and permissible variations in flatness along the length shcuid not exceed the tabular amount for the specified width in plates up to 12 ft. in length.
2. The flatness variations across the width should not exceed the tabular amount for the specified width.
3. When the longer dimension is under 36 in., the permissible variation should not exceed ¼ in. When the longer dimension is from 36 to 72 in., incl., the permissible variation should not exceed 75% of the tabular amount for the specified width, but in no case less than ¼ in.
4. These variations apply to plates which have a specified minimum tensile strength of not more than 60,000 psi or compatible chemistry or hardness. The limits in the table are increased 50% for plates specified to a higher minimum tensile strength or compatible chemistry or hardness.

PERMISSIBLE VARIATIONS IN CAMBER FOR CARBON STEEL SHEARED AND GAS CUT RECTANGULAR PLATES

Maximum permissible camber, in. (all thicknesses) = ⅛ in. × (total length, ft/5)

PERMISSIBLE VARIATIONS IN CAMBER FOR CARBON STEEL UNIVERSAL MILL PLATES, HIGH-STRENGTH AND HIGH-STRENGTH LOW-ALLOY STEEL SHEARED AND GAS CUT RECTANGULAR PLATES, UNIVERSAL MILL PLATES, SPECIAL CUT PLATES

Dimension, In.		Camber for Thicknesses and Widths Given
Thickness	Width	
To 2, incl.	All	⅛ in. × (total length, ft/5)
Over 2 to 15, incl.	To 30, incl.	3/16 in. × (total length, ft/5)
Over 2 to 15, incl.	Over 30 to 60, incl.	¼ in. × (total length, ft/5)

STANDARD MILL PRACTICE
Rectangular sheared plates and Universal mill plates

PERMISSIBLE VARIATIONS FROM FLATNESS
(High-Strength Low-Alloy and Alloy Steel, Hot Rolled or Thermally Treated)

Specified Thickness, In.	Variations from Flatness for Specified Widths: In.							
	To 36, excl.	36 to 48, excl.	48 to 60, excl.	60 to 72, excl.	72 to 84, excl.	84 to 96, excl.	96 to 108, excl.	108 to 120, excl.
To ¼, excl.	13/16	1⅛	1⅜	1⅞	2	2¼	2⅜	2⅝
¼ to ⅜, excl.	¾	15/16	1⅛	1⅜	1¾	1⅞	2	2¼
⅜ to ½, excl.	¾	⅞	15/16	15/16	1⅛	1 5/16	1½	1⅝
½ to ¾, excl.	⅝	¾	13/16	⅞	1	1⅛	1¼	1⅜
¾ to 1, excl.	⅝	¾	⅞	⅞	15/16	1	1⅛	1 5/16
1 to 2, excl.	9/16	⅝	¾	13/16	⅞	15/16	1	1
2 to 4, excl.	½	9/16	11/16	¾	¾	¾	¾	⅞
4 to 6, excl.	9/16	11/16	¾	¾	⅞	⅞	15/16	1⅛
6 to 8, excl.	⅝	¾	¾	15/16	1	1⅛	1¼	1 5/16

General Notes:

1. The longer dimension specified is considered the length, and variations from a flat surface along the length should not exceed the tabular amount for the specified width in plates up to 12 ft. in length.
2. The flatness variation across the width should not exceed the tabular amount for the specified width.
3. When the longer dimension is under 36 in., the variation should not exceed ⅜ in. When the longer dimension is from 36 to 72 in., incl. the variation should not exceed 75% of the tabular amount for the specified width.

PERMISSIBLE VARIATIONS IN WIDTH FOR UNIVERSAL MILL PLATES
(15 in. and under in thickness)

Specified Width, In.	Variations Over Specified Width for Thickness, in., and Equivalent Weights, lb. per sq. ft., Given					
	To ⅜, excl.	⅜ to ⅝, excl.	⅝ to 1, excl.	1 to 2, incl.	Over 2 to 10, incl.	Over 10 to 15, incl.
	To 15.3, excl.	15.3 to 25.5, excl.	25.5 to 40.8, excl.	40.8 to 81.7, incl.	81.7 to 409.0, incl.	409.0 to 613.0, incl.
Over 8 to 20, excl.	⅛	⅛	3/16	¼	⅜	½
20 to 36, excl.	3/16	¼	5/16	⅜	7/16	9/16
36 and over	5/16	⅜	7/16	½	9/16	⅝

Notes: Permissible variation under specified width, ⅛ in.
Table applies to all steels listed in ASTM A6.

PREQUALIFIED WELDED JOINTS DETAIL

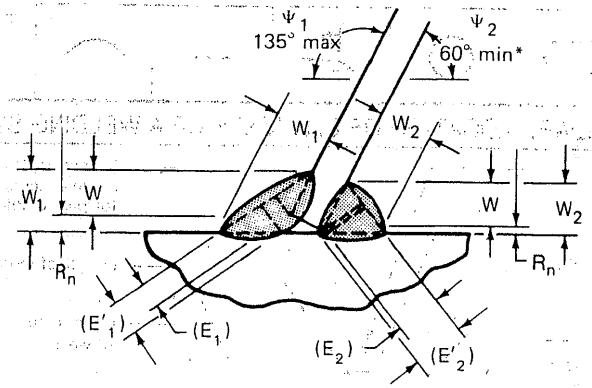
PREQUALIFIED WELDED JOINTS
Fillet welds

Base metal less than 1/4 thick

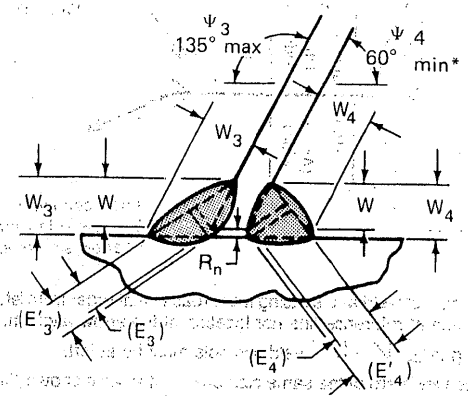
Base metal 1/4 or more in thickness

(A) (B)

Maximum detailed size of fillet weld along edges



(C)



(D)

Skewed T-joints

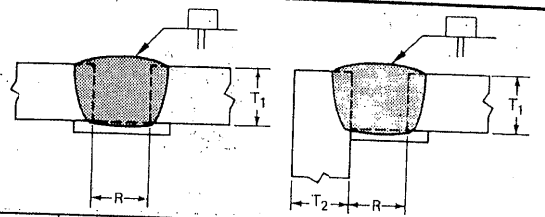
lote: $(E)_{(n)}$, $(E')_{(n)}$ = effective throats dependent on magnitude of root opening (R_n). See AWS 3.3.1. Subscript (n) represents 1, 2, 3 or 4.

Angles smaller than 60 degrees are permitted; however, in such cases, the weld is considered to be a partial joint penetration groove weld.

or additional requirements for skewed T-joints, see 2.9.2.4 of AWS D1.1:98

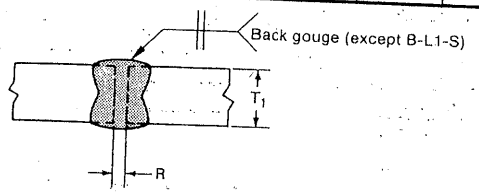
PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

Square-groove weld (1)
Butt joint (B)
Corner joint (C)



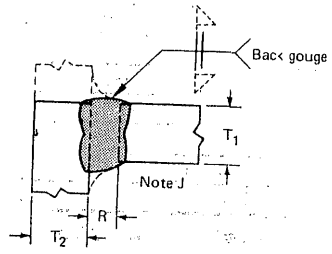
Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation Root Opening	Tolerances As Detailed	Tolerances As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-L1a	¼ max	—	$R=T_1$	+1/16, −0	+¼, −1/16	All	—	N
	C-L1a	¼ max	U	$R=T_1$	+1/16, −0	+¼, −1/16	All	—	—
GMAW FCAW	B-L1a-GF	⅜ max	—	$R=T_1$	+1/16, −0	+¼, −1/16	All	Not required	A,N

Square-groove weld (1)
Butt joint (B)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation Root Opening	Tolerances As Detailed	Tolerances As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-L1b	¼ max	—	$R=T_1/2$	+1/16, −0	+1/16, −⅛	All	—	C,N
GMAW FCAW	B-L1b-GF	⅜ max	—	R=0 to ⅛	+1/16, −0	+1/16, −⅛	All	Not required	A,C, N
SAW	B-L1-S	⅜ max	—	R=0	±0	+1/16, −0	F	—	N
SAW	B-L1a-S	⅝ max	—	R=0	±0	+1/16, −0	F	—	C,N

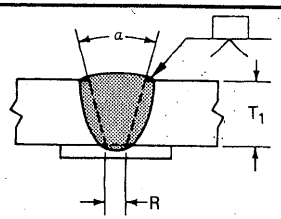
Square-groove weld (1)
T-joint (T)
Corner joint (C)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation Root Opening	Tolerances As Detailed	Tolerances As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	TC-L1b	¼ max	U	$R=T_1/2$	+1/16, −0	+1/16, −⅛	All	—	C,J
GMAW FCAW	TC-L1-GF	⅜ max	U	R=0 to ⅛	+1/16, −0	+1/16, −⅛	All	Not req.	A,C,J
SAW	TC-L1-S	⅜ max	U	R=0					

PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

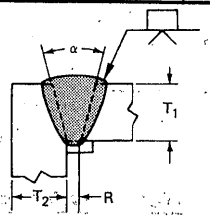
Single V-groove weld (2)
Butt joint (B)



Tolerances	
As detailed	As fit up
R=+1/16,−0	+1/4,−1/16
α=+10°,−0°	+10°,−5°

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U2a	U	—	R=1/4	α=45°	All	—	N
				R=3/8	α=30°	F,V,OH	—	N
				R=1/2	α=20°	F,V,OH	—	N
GMAW FCAW	B-U2a-GF	U	—	R=3/16	α=30°	F,V,OH	Required	A,N
				R=3/8	α=30°	F,V,OH	Not req.	A,N
				R=1/4	α=45°	F,V,OH	Not req.	A,N
SAW	B-L2a-S	2 max	—	R=1/4	α=30°	F	—	N
SAW	B-U2-S	U	—	R=5/8	α=20°	F	—	N

Single V-groove weld (2)
Corner joint (C)



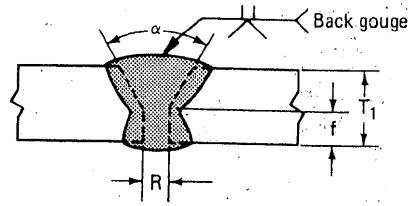
Tolerances	
As detailed	As fit up
R=+1/16,−0	+1/4,−1/16
α=+10°,−0°	+10°,−5°

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	C-U2a	U	U	R=1/4	α=45°	All	—	Q
				R=3/8	α=30°	F,V,OH	—	Q
				R=1/2	α=20°	F,V,OH	—	Q
GMAW FCAW	C-U2a-GF	U	U	R=3/16	α=30°	F,V,OH	Required	A
				R=3/8	α=30°	F,V,OH	Not req.	A,Q
				R=1/4	α=45°	F,V,OH	Not req.	A,Q
SAW	C-L2a-S	2 max	U	R=1/4	α=30°	F	—	Q
SAW	C-U2-S	U	U	R=5/8	α=20°	F	—	Q

See notes on page preceding Prequalified Weld Joint Tables.

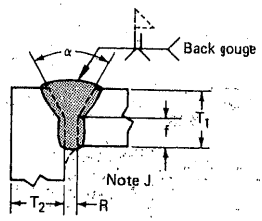
PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

Single V-groove weld (2)
Butt joint (B)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening Root face Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U2	U	—	R = 0 to 1/8 f = 0 to 1/8 α = 60°	+1/16,−0 +1/16,−0 +10°,−0°	+1/16,−1/8 Not limited +10°,−5°	All	—	C,N
GMAW FCAW	B-U2-GF	U	—	R = 0 to 1/8 f = 0 to 1/8 α = 60°	+1/16,−0 +1/16,−0 +10°,−0°	+1/16,−1/8 Not limited +10°,−5°	All	Not required	A,C,N
SAW	B-L2c-S	Over 1/2 to 1	—	R = 0, α = 60° f = 1/4 max	R = ±0 f = +0,−f α = +10°,−0°	+1/16,−0 ±1/16 +10°,−5°	F	—	C,N
		Over 1 to 1 1/2	—	R = 0, α = 60° f = 1/2 max					
		Over 1 1/2 to 2	—	R = 0, α = 60° f = 5/8 max					

Single V-groove weld (2)
Corner joint (C)

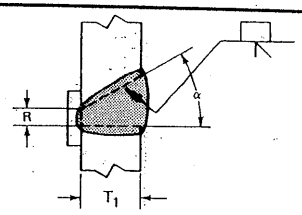


Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening Root face Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	C-U2	U	U	R = 0 to 1/8 f = 0 to 1/8 α = 60°	+1/16,−0 +1/16,−0 +10°,−0°	+1/16,−1/8 Not limited +10°,−5°	All	—	C,J,R
GMAW FCAW	C-U2-GF	U	U	R = 0 to 1/8 f = 0 to 1/8 α = 60°	+1/16,−0 +1/16,−0 +10°,−0°	+1/16,−1/8 Not limited +10°,−5°	All	Not required	A,C,J,R
SAW	C-U2b-S	U	U	R = 0 f = 1/4 max α = 60°	±0 +0,−1/4 +10°,−0°	+1/16,−0 ±1/16 +10°,−5°	F	—	C,J,R

See notes on page preceding Prequalified Weld Joint Tables.

PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

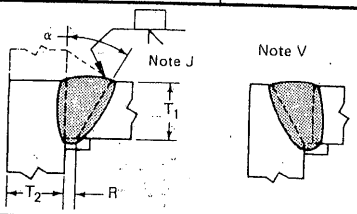
Single bevel-groove weld (4)
Butt joint (B)



Tolerances	
As Detailed	As Fit U
$R = +1/16, -0$	$+1/4, -1/$
$\alpha = +10°, -0°$	$+10°, -$

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U4a	U	—	$R = 1/4$	$\alpha = 45°$	All	—	Br,N
				$R = 3/8$	$\alpha = 30°$	All	—	Br,N
GMAW FCAW	B-U4a-GF	U	—	$R = 3/16$	$\alpha = 30°$	All	Required	A,Br,N
				$R = 1/4$	$\alpha = 45°$	All	Not req.	A,Br,N
				$R = 3/8$	$\alpha = 30°$	F	Not req.	A,Br,N

Single bevel-groove weld (4)
T-joint (T)
Corner joint (C)



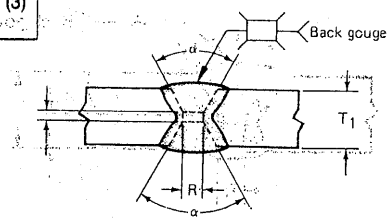
Tolerances	
As Detailed	As Fit Up
$R = +1/16, -0$	$+1/4, -1/16$
$\alpha = +10°, -0°$	$+10°, -5°$

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	TC-U4a	U	U	$R = 1/4$	$\alpha = 45°$	All	—	J,Q,V
				$R = 3/8$	$\alpha = 30°$	F,OH,H	—	J,Q,V
GMAW FCAW	TC-U4a-GF	U	U	$R = 3/16$	$\alpha = 30°$	All	Required	A,J,Q,V
				$R = 3/8$	$\alpha = 30°$	F	Not req.	A,J,Q,V
				$R = 1/4$	$\alpha = 45°$	All	Not req.	A,J,Q,V
SAW	TC-U4a-S	U	U	$R = 3/8$	$\alpha = 30°$	F	—	J,Q,V
				$R = 1/4$	$\alpha = 45°$			

See notes on page preceding Prequalified Weld Joint Tables.

EQUALIFIED WELDED JOINTS
Complete-penetration groove welds

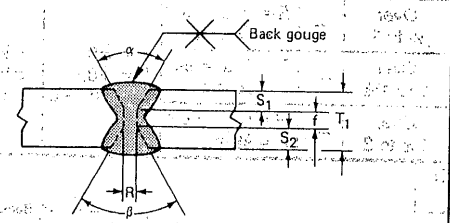
Double V-groove weld (3)
Butt joint (B)



Tolerances			
		As Detailed	As Fit Up
$R = \pm 0$			$+1/4, -0$
$f = \pm 0$			$+1/16, -0$
$\alpha = +10°, -0°$			$+10°, -5°$
Spacer	SAW	± 0	$+1/16, -0$
	SMAW	± 0	$+1/8, -0$

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Root Face	Groove Angle	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U3a	U Spacer = $1/8 \times R$	—	$R = 1/4$	$f = 0$ to $1/8$	$\alpha = 45°$	All	—	C,M, N
				$R = 3/8$	$f = 0$ to $1/8$	$\alpha = 30°$	F,OH,V	—	
				$R = 1/2$	$f = 0$ to $1/8$	$\alpha = 20°$	F,OH,V	—	
SAW	B-U3a-S	U Spacer = $1/4 \times R$	—	$R = 5/8$	$f = 0$ to $1/4$	$\alpha = 20°$	F	—	C,M,N

Double V-groove weld (3)
Butt joint (B)



For B-U3c-S only

T_1		S_1
Over	to	
2	2½	1⅜
2½	3	1¾
3	3⅝	2⅛
3⅝	4	2⅜
4	4¾	2¾
4¾	5½	3⅛
5½	6¼	3¾

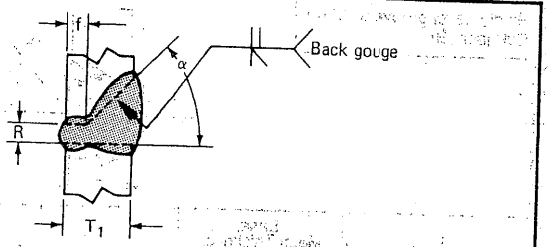
For $T_1 > 6\frac{1}{4}$, or $T_1 \leq 2$
$S_1 = \frac{2}{3}(T_1 - 1/4)$

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U3b	U	—	$R = 0$ to $1/8$ $f = 0$ to $1/8$ $\alpha = \beta = 60°$	$+1/16, -0$ $+1/16, -0$ $+10°, -0$	$+1/16, -1/8$ Not limited $+10°, -5°$	All	—	C,M,N
GMAW FCAW	B-U3-GF						All	Not Required	A,C,M, N
SAW	B-U3c-S	U	—	$R = 0$ $f = 1/4$ min $\alpha = \beta = 60°$ To find S_1 see table above; $S_2 = T_1 - (S_1 + f)$	$+1/16, -0$ $+1/4, -0$ $+10°, -0°$	$+1/16, -0$ $+1/4, -0$ $+10°, -5°$	F	—	C,M, N

See notes on page preceding Prequalified Weld Joint Tables.

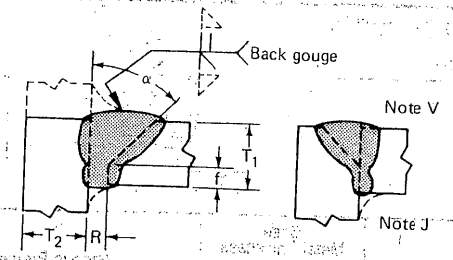
PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

Single bevel-groove weld (4)
Butt joint (B)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U4b	U	—	R = 0 to 1/8 f = 0 to 1/8 α = 45°	+1/16, −0	+1/16, −1/8	All	—	Br,C,N
GMAW FCAW	B-U4b-GF	U	—		+1/16, −0 ±10°, −0°	Not limited +10°, −5°	All	Not Required	A,Br,C,N

Single-bevel-groove weld (4)
T-joint (T)
Corner joint (C)

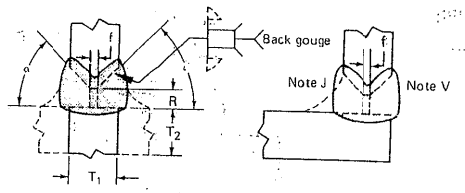


Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	TC-U4b	U	U	R = 0 to 1/8 f = 0 to 1/8 α = 45°	+1/16, −0 +1/16, −0 +10°, −0°	+1/16, −1/8 Not limited +10°, −5°	All	—	C,J,R,V
GMAW FCAW	TC-U4b-GF	U	U				All	Not req.	A,C,J,R,V
SAW	TC-U4b-S	U	U	R = 0 f = 1/8 max α = 60°	±0 +0, −1/8 +10°, −0°	+1/4, −0 ±1/16 +10°, −5°	F	—	C,J,R,V

See notes on page preceding Prequalified Weld Joint Tables.

PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

Double-bevel-groove weld (5)
Butt joint (B)
T-joint (T)
Corner joint (C)



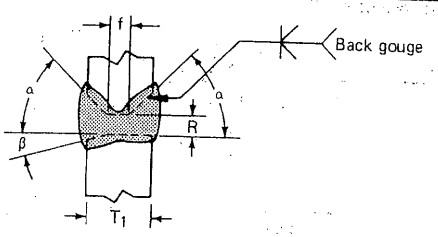
Tolerances: As Detailed	Tolerances: As Fit U
R = ±0	+1/16, −0
f = +1/16, −0	±1/16
α = +10°, −0°	+10°, −5
Spacer = +0	+1/16, −0

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Root Face	Groove Angle	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U5b	U, Spacer = 1/8 × R	U	R = 1/4	f = 0 to 1/8	α = 45°	All	—	Br,C,M,N
	TC-U5a	U, Spacer = 1/8 × R	U	R = 1/4	f = 0 to 1/8	α = 45°	All	—	C,J,M,R,V
				R = 3/8	f = 0 to 1/8	α = 30°	F,OH	—	C,J,M,R,V

See notes on page preceding Prequalified Weld Joint Tables.

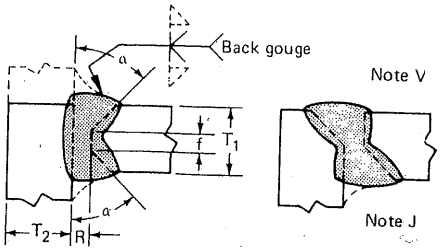
PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

Double bevel-groove weld (5)
Butt joint (B)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U5a	U	—	R = 0 to 1/8 f = 0 to 1/8 α = 45° β = 0° to 15°	+1/16, −0 +1/16, −0 $\alpha+\beta$, +10°, −0°	+1/16, −1/8 Not limited $\alpha+\beta$, +10°, −5°	All	—	Br, C,M,N
GMAW FCAW	B-U5-GF	U	—	R = 0 to 1/8 f = 0 to 1/8 α = 45° β = 0° to 15°	+1/16, −0 +1/16, −0 $\alpha+\beta$=+10°, −0°	+1/16, −1/8 Not limited $\alpha+\beta$=+10°, −5°	All	Not req.	A,Br,C, M,N

Double bevel-groove weld (5)
T-joint (T)
Corner joint (C)

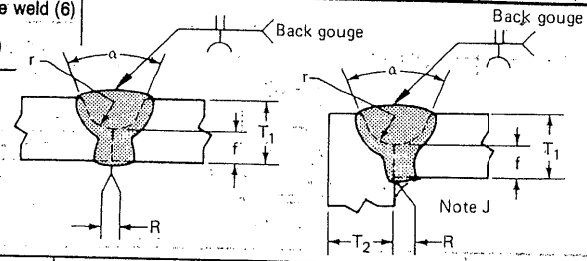


Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	TC-U5b	U	U	R = 0 to 1/8 f = 0 to 1/8 α = 45°	+1/16, −0 +1/16, −0 +10°, −0°	+1/16, −1/8 Not limited +10°, −5°	All	—	C,J,M R,V
GMAW FCAW	TC-U5-GF	U	U				All	Not required	A,C,J, M,R,V
SAW	TC-U5-S	U	U	R = 0 f = 3/16 max α = 60°	±0 +0, −3/16 +10°, −0°	+1/16, −0 ±1/16 +10°, −5°	F	–	C,J,M R,V

See notes on page preceding Prequalified Weld Joint Tables.

PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

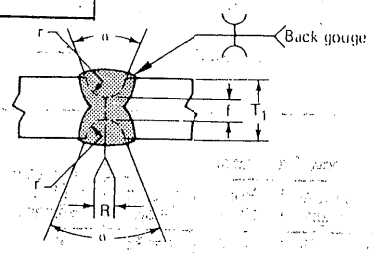
Single U-groove weld (6)
Butt joint (B)
Corner joint (C)



Tolerances: As Detailed	Tolerances: As Fit Up
R=+1/16, −0	+1/16, −1/8
α=+10°, −0°	+10°, −5°
f =±1/16	Not limited
r =+1/8, −0	+1/8, −0

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Root Face	Groove Radius	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U6	U	U	R = 0 to 1/8	α = 45°	f = 1/8	r = 1/4	All	—	C,N
				R = 0 to 1/8	α = 20°	f = 1/8	r = 1/4	F,OH	—	C,N
	C-U6	U	U	R = 0 to 1/8	α = 45°	f = 1/8	r = 1/4	All	—	C,J,R
				R = 0 to 1/8	α = 20°	f = 1/8	r = 1/4	F,OH	—	C,J,R
SMAW FCAW	B-U6-GF	U	U	R = 0 to 1/8	α = 20°	f = 1/8	r = 1/4	All	Not req.	A,C,N
	C-U6-GF	U	U	R = 0 to 1/8	α = 20°	f = 1/8	r = 1/4	All	Not req.	A,C,J,R

Double U-groove weld (7)
Butt joint (B)



Tolerances: For B-U7 and B-U7-GF — As Detailed	Tolerances: For B-U7 and B-U7-GF — As Fit Up
R = +1/16, −0	+1/16, −1/8
α = +10°, −0°	+10°, −5°
f = +1/16, −0	Not limited
r = +1/4, −0	±1/16

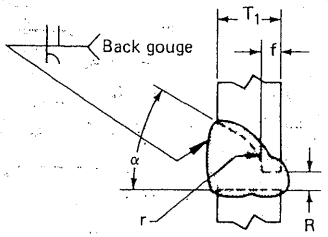
Tolerances: For B-U7-S — As Detailed	Tolerances: For B-U7-S — As Fit Up
R=±0	+1/16, −0
f=+0, −1/4	±1/16

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Root Face	Groove Radius	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U7	U	—	R = 0 to 1/8	α = 45°	f = 1/8	r = 1/4	All	—	C,M,N
				R = 0 to 1/8	α = 20°	f = 1/8	r = 1/4	F,OH	—	C,M,N
GMAW FCAW	B-U7-GF	U	—	R = 0 to 1/8	α = 20°	f = 1/8	r = 1/4	All	Not Required	A,C M,N
SAW	B-U7-S	U	—	R = 0	α = 20°	f = 1/4 max	r = 1/4	F	—	C,M,N

See notes on page preceding Prequalified Weld Joint Tables.

EQUALIFIED WELDED JOINTS
Complete-penetration groove welds

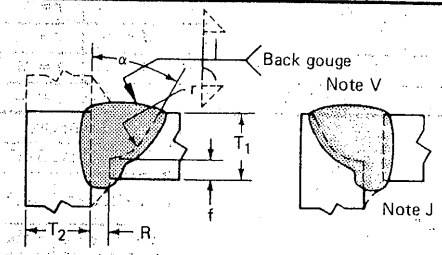
Single-J-groove weld (8)
Butt joint (B)



Tolerances	
As Detailed	As Fit Up
R=+1/16, −0	+1/16, −1/8
α=+10°, −0°	+10°, −5°
f=+1/16, −0	Not limited
r=+1/4, −0	±1/16

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Root Face	Groove Radius	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U8	U	—	R = 0 to 1/8	α = 45°	f = 1/8	r = 3/8	All	—	Br,C,N
GMAW FCAW	B-U8-GF	U	—	R = 0 to 1/8	α = 30°	f = 1/8	r = 3/8	All	Not required	A,Br, C,N

Single-J-groove weld (8)
T-joint (T)
Corner joint (C)



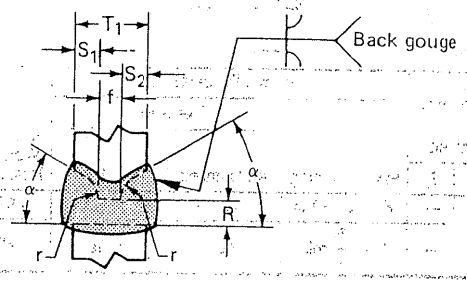
Tolerances	
As Detailed	As Fit Up
R=+1/16, −0	+1/16, −1/8
α=+10°, −0°	+10°, −5°
f=+1/16, −0	Not limited
r=+1/4, −0	±1/16

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Root Face	Groove Radius	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	TC-U8a	U	U	R = 0 to 1/8	α = 45°	f = 1/8	r = 3/8	All	—	C,J,R,V
				R = 0 to 1/8	α = 30°	f = 1/8	r = 3/8	F,OH	—	C,J,R,V
GMAW FCAW	TC-U8a-GF	U	U	R = 0 to 1/8	α = 30°	f = 1/8	r = 3/8	All	Not required	A,C,J, R,V

See notes on page preceding Prequalified Weld Joint Tables.

PREQUALIFIED WELDED JOINTS
Complete-penetration groove welds

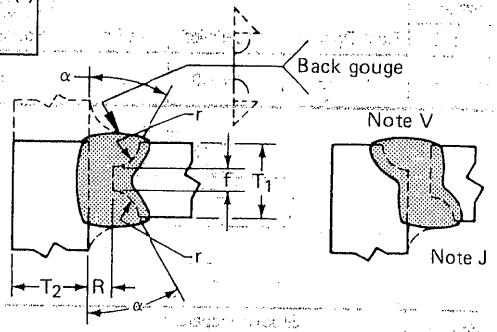
Double-J-groove weld (9)
Butt joint (B)



Tolerances	
As Detailed	As Fit Up
R=+1/16, −0	+1/16, −1/8
α=+10°, −0°	+10°, −5°
f=+1/16, −0	Not limited
r=+1/8, −0	±1/16

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Root Face	Groove Radius	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	B-U9	U	—	R = 0 to 1/8	α = 45°	f = 1/8	r = 3/8	All	—	Br,C, M,N
GMAW FCAW	B-U9-GF	U	—	R = 0 to 1/8	α = 30°	f = 1/8	r = 3/8	All	Not required	A,Br,C, M,N

Double-J-groove weld (9)
T-joint (T)
Corner joint (C)



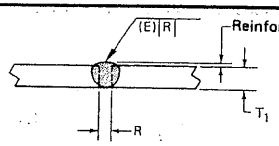
Tolerances	
As Detailed	As Fit Up
R=+1/16, −0	+1/16, −1/8
α=+10°, −0°	+10°, −5°
f=+1/16, −0	Not limited
r=+1/8, −0	±1/16

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Groove Angle	Root Face	Groove Radius	Permitted Welding Positions	Gas Shielding for (FCAW)	Notes
SMAW	TC-U9a	U	U	R = 0 to 1/8	α = 45°	f = 1/8	r = 3/8	All	—	C,J,M, R,V
				R = 0 to 1/8	α = 30°	f = 1/8	r = 3/8	F,OH	—	C,J,M, R,V
GMAW FCAW	TC-U9a-GF	U	U	R = 0 to 1/8	α = 30°	f = 1/8	r = 3/8	All	Not required	A,C,J, M,R,V

See notes on page preceding Prequalified Weld Joint Tables.

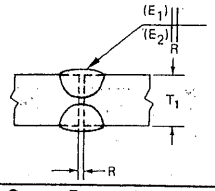
PREQUALIFIED WELDED JOINTS
Partial-penetration groove welds

Square-groove weld (1)
Butt joint (B)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	B-P1a	1/8 max	—	R = 0 to 1/16	+1/16, −0	±1/16	All	T_1 − 1/32	B
	B-P1c	1/4 max	—	$R = \frac{T_1}{2}$ min	+1/16, −0	±1/16	All	$\frac{T_1}{2}$	B

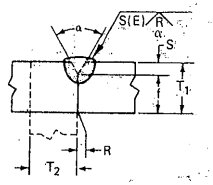
Square-groove weld (1)
Butt joint (B)



$E_1 + E_2$ Must not exceed $\frac{3T_1}{4}$

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	B-P1b	1/4 max	—	$R = \frac{T_1}{2}$	±1/16, −0	±1/16	All	$\frac{3T_1}{4}$	

Single-V-groove weld (2)
Butt joint (B)
Corner joint (C)

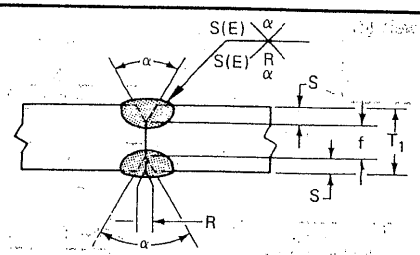


Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	BC-P2	1/4 min	U	R = 0 f = 1/32 min α = 60°	0, +1/16 unlimited +10°, −0°	+1/8, −1/16 ±1/16 +10°, −5°	All	S	B,E, Q2
GMAW FCAW	BC-P2-GF	1/4 min	U	R = 0 f = 1/8 min α = 60°	0, +1/16 unlimited +10°, −0°	+1/8, −1/16 ±1/16 +10°, −5°	All	S	A,B, E,Q2
SAW	BC-P2-S	7/16 min	U	R = 0 f = 1/4 min α = 60°	±0 unlimited +10°, −0°	+1/16, −0‡ ±1/16 +10°, −5°	F	S	B,E, Q2

See notes on page preceding Prequalified Weld Joint Tables.

‡Fit-up tolerance, SAW: See AWS 3.3.2; for rolled shape R may be 5/16 in. in thick plates if backing is provided.

Double V-groove weld (3)
Butt joint (B)



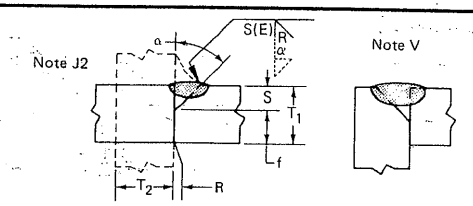
Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	B-P3	1/2 min	—	R = 0 f = 1/8 min α = 60°	+1/16, −0 unlimited +10°, −0°	+1/8, −1/16 ±1/16 +10°, −5°	All	S	E,Mp, Q2
GMAW FCAW	B-P3-GF	1/2 min	—	R = 0 f = 1/8 min α = 60°	+1/16, −0 unlimited +10°, −0°	+1/8, −1/16 ±1/16 +10°, −5°	All	S	A,E, Mp, Q2
SAW	B-P3-S	3/4 min	—	R = 0 f = 1/4 min α = 60°	±0 unlimited +10°, −0°	+1/16, −0‡ ±1/16 +10°, −5°	F	S	E,Mp, Q2

‡Fit-up tolerance, SAW: See AWS 3.3.2; for rolled shapes R may be 5/16 inches in thick plates if backing is provided.

See notes on page preceding Prequalifed Weld Joint Tables.

PREQUALIFIED WELDED JOINTS
Partial-penetration groove welds

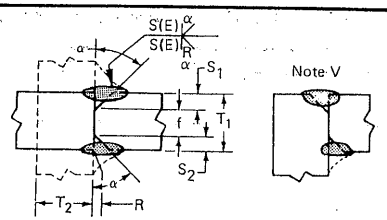
Single-bevel-groove weld (4)
Butt joint (B)
T-joint (T)
Corner joint (C)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	BTC-P4	U	U	$R = 0$ $f = \frac{1}{8}$ min $\alpha = 45°$	$+\frac{1}{16}, -0$ unlimited $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	All	$S - \frac{1}{8}$	B,E,J2, Q2,V
GMAW FCAW	BTC-P4-GF	¼ min	U	$R = 0$ $f = \frac{1}{8}$ min $\alpha = 45°$	$+\frac{1}{16}, -0$ unlimited $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	F,H	S	A,B,E, J2,Q2, V
							V,OH	$S - \frac{1}{8}$	
SAW	TC-P4-S	$\frac{7}{16}$ min	U	$R = 0$ $f = ¼$ min $\alpha = 60°$	±0 unlimited $+10°, -0°$	$+\frac{1}{16}, -0$‡ $\pm\frac{1}{16}$ $+10°, -5°$	F	S	B,E,J2, Q2,V

‡Fit-up tolerance, SAW: See AWS 3.3.2; for rolled shapes, R may be $\frac{5}{16}$ inches in thick plates if backing is provided.

Double-bevel-groove weld (5)
Butt joint (B)
T-joint (T)
Corner joint (C)



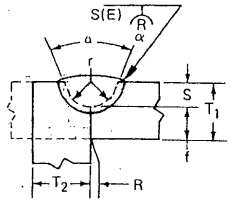
Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	BTC-P5	$\frac{5}{16}$ min	U	$R = 0$ $f = \frac{1}{8}$ min $\alpha = 45°$	$+\frac{1}{16}, -0$ unlimited $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	All	$(S_1 + S_2) - \frac{1}{4}$	E,J2, L,Mp, Q2,V
GMAW FCAW	BTC-P5-GF	½ min	U	$R = 0$ $f = \frac{1}{8}$ min $\alpha = 45°$	$+\frac{1}{16}, -0$ unlimited $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	E,H	$(S_1 + S_2)$	A,E,J2, L,Mp, Q2,V
							V,OH	$(S_1 + S_2) - \frac{1}{4}$	
SAW	TC-P5-S	¾ min	U	$R = 0$ $f = ¼$ min $\alpha = 60°$	±0 unlimited $+10°, -0°$	$+\frac{1}{16}, -0$‡ $\pm\frac{1}{16}$ $+10°, -5°$	F	$S_1 + S_2$	E,J2, L,MP, Q2,V

‡Fit-up tolerance, SAW: See AWS 3.3.2; for rolled shapes, R may be $\frac{5}{16}$ inches in thick plates if backing is provided.

See notes on page preceding Prequalified Weld Joint Tables.

PREQUALIFIED WELDED JOINTS
Partial-penetration groove welds

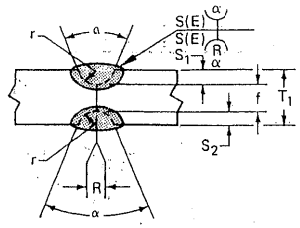
Single-U-groove weld (6)
Butt joint (B)
Corner joint (C)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Groove face, Groove radius, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	BC-P6	¼ min	U	$R = 0$ $f = \frac{1}{32}$ min $r = ¼$ $\alpha = 45°$	$+\frac{1}{16}, -0$ unlimited $+¼, -0$ $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	All	S	B,E,Q2
GMAW FCAW	BC-P6-GF	¼ min	U	$R = 0$ $f = \frac{1}{8}$ min $r = ¼$ $\alpha = 20°$	$+\frac{1}{16}, -0$ unlimited $+¼, -0$ $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	All	S	A,B, E,Q2
SAW	BC-P6-S	$\frac{7}{16}$ min	U	$R = 0$ $f = ¼$ min $r = ¼$ $\alpha = 20°$	±0 unlimited $+¼, -0$ $+10°, -0°$	$+\frac{1}{16}, -0$‡ $\pm\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	F	S	B,E,Q2

‡Fit-up tolerance, SAW: See AWS 3.3.2; for rolled shapes, R may be $\frac{5}{16}$ inches in thick plates if backing is provided.

Double-V-groove weld (7)
Butt joint (B)



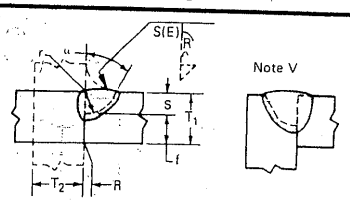
Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Groove face, Groove radius, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	B-P7	½ min	—	$R = 0$ $f = \frac{1}{8}$ min $r = ¼$ $\alpha = 45°$	$+\frac{1}{16}, -0$ unlimited $+¼, -0$ $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	All	$S_1 + S_2$	E, Mp, Q2
GMAW FCAW	B-P7-GF	½ min	—	$R = 0$ $f = \frac{1}{8}$ min $r = ¼$ $\alpha = 20°$	$+\frac{1}{16}, -0$ unlimited $+¼, -0$ $+10°, -0°$	$+\frac{1}{8}, -\frac{1}{16}$ $\pm\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	All	$S_1 + S_2$	A,E, Mp, Q2
SAW	B-P7-S	¾ min	—	$R = 0$ $f = ¼$ min $r = ¼$ $\alpha = 20°$	±0 unlimited $+¼, -0$ $+10°, -0°$	$+\frac{1}{16}, -0$‡ $\pm\frac{1}{16}$ $\pm\frac{1}{16}$ $+10°, -5°$	F	$S_1 + S_2$	E, MP, Q2

‡Fit-up tolerance, SAW: See AWS 3.2.2; for rolled shapes, R may be $\frac{5}{16}$ inches in thick plates if backing is provided.

See notes on page preceding Prequalified Weld Joint Tables.

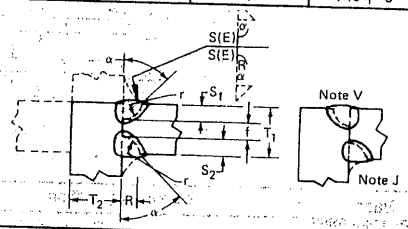
EQUALIFIED WELDED JOINTS
Partial penetration groove welds

Single-J-groove weld (8)
Butt joint (B)
T-joint (T)
Corner joint (C)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove radius, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	TC-P8*	¼ min	U	$R=0$ $f=⅛$ min $r=⅜$ $\alpha=45°$	$+1/16, -0$ Not limited $+¼, -0$ $+10°, -0°$	$+⅛, -1/16$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	All	S	E,J2, Q2,V
SMAW	BC-P8**	¼ min	U	$R=0$ $f=⅛$ min $r=⅜$ $\alpha=30°$	$+1/16, -0$ Not limited $+¼, -0$ $\pm 10°, -0°$	$+⅛, -1/16$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	All	S	E,J2, Q2,V
GMAW FCAW	TC-P8-GF*	¼ min	U	$R=0$ $f=⅛$ min $r=⅜$ $\alpha=45°$	$+1/16, -0$ Not limited $+¼, -0$ $+10°, -0°$	$+⅛, -1/16$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	All	S	A,E, J2,Q2, V
GMAW FCAW	BC-P8-GF**	¼ min	U	$R=0$ $f=⅛$ min $r=⅜$ $\alpha=30°$	$+1/16, -0$ Not limited $+¼, -0$ $+10°, -0°$	$+⅛, -1/16$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	All	S	A,E, J2,Q2, V
SAW	TC-P8-S*	7/16 min	U	$R=0$ $f=¼$ min $r=½$ $\alpha=45°$	± 0 Not limited $+¼, -0$ $+10°, -0°$	$+1/16, -0‡$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	F	S	E,J2, Q2,V
SAW	C-P8-S**	7/16 min	U	$R=0$ $f=¼$ min $r=½$ $\alpha=20°$	± 0 Not limited $+¼, -0°$ $+10°, -0°$	$+1/16, -0‡$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	F	S	E,J2, Q2,V

Double-J-groove weld (9)
Butt joint (B)
T-joint (T)
Corner joint (C)

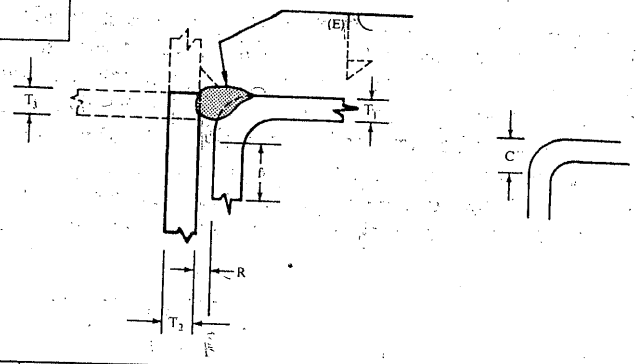


Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	Groove Preparation: Root Opening, Root face, Groove radius, Groove angle	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	BTC-P9*	½ min	U	$R=0$ $f=⅛$ min $r=⅜$ $\alpha=45°$	$+1/16, -0$ -0 $+¼, -0$ $+10°, -0°$	$+⅛, -1/16$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	All	$S_1 + S_2$	E,J2, Mp,Q2, V
GMAW FCAW	BTC-P9-GF*	½ min	U	$R=0$ $f=⅛$ min $r=⅜$ $\alpha=30°$	$+1/16, -0$ Not limited $+¼, -0$ $+10°, -0°$	$+⅛, -1/16$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	All	$S_1 + S_2$	A,J2, Mp,Q2, V
SAW	C-P9-S*	¾ min	U	$R=0$ $f=¼$ min $r=½$ $\alpha=45°$	± 0 Not limited $+¼, -0$ $+10°, -0°$	$+1/16, -0‡$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	F	$S_1 + S_2$	E,J2, Mp,Q2 V
SAW	C-P9-S**	¾ min	U	$R=0$ $f=¼$ min $r=½$ $\alpha=20°$	± 0 Not limited $+¼, -0°$ $+10°, -0°$	$+1/16, -0‡$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	F	$S_1 + S_2$	E,J2, Mp,Q2, V
SAW	T-P9-S	¾ min	U	$R=0$ $f=¼$ min $r=½$ $\alpha=45°$	± 0 Not limited $+¼, -0$ $+10°, -0°$	$+1/16, -0‡$ $\pm 1/16$ $\pm 1/16$ $+10°, -5°$	F	$S_1 + S_2$	E,J2, Mp,Q2

*Applies to inside corner joints.
*Applies to outside corner joints.

PREQUALIFIED WELDED JOINTS
Partial-penetration groove welds

Flare-bevel-groove weld (10)
Butt joint (B)
T-joint (T)
Corner joint (C)



Welding Process	Joint Designation	Base Metal Thickness (U = unlimited) T_1	T_2	T_3	Groove Preparation: Root Opening, Root face, Bend Radius*	Tolerances: As Detailed	Tolerances: As Fit Up	Permitted Welding Positions	Effective Throat (E)	Notes
SMAW	BTC-P10	3/16 min	U	T_1 min	$R = 0$ $f = 3/16$ min $C = 3\ T_1$ min 2	$+1/16, -0$ Not Limited -0, +Not Limited	$+⅛, -1/16$ $+U, -1/16$ -0, +Not Limited	All	5/8 T_1	J2 Q2 Z
GMAW FCAW	BTC-P10-GF	3/16 min	U	T_1 min	$R = 0$ $f = 3/16$ min $C = 3\ T_1$ min 2	$+1/16, -0$ Not Limited -0, +Not Limited	$+⅛, -1/16$ $+U, -1/16$ -0, +Not Limited	All	5/8 T_1	A J2 Q2 Z
SAW	T-P10-S	½ min	½ min	N/A	$R = 0$ $f = ½$ min $C = 3\ T_1$ min 2	± 0 Not Limited -0, +Not Limited	$+1/16, -0$ $-U, -1/16$ Limited	F	5/8 T_1	J2 Q2 Z

* For cold formed (A500) rectangular tubes, C dimension is not limited (see AWS commentary).

FABRICATOR'S PRACTICES

BENT PLATES

Minimum radius for cold bending

The following table gives the generally accepted minimum inside radii of bends in terms of thickness *t* for various steels listed. Values are for bend lines transverse to the direction of final rolling. When bend lines are parallel to the direction of final rolling, the values may have to be approximately doubled. When bend lines are longer than 36 in., all radii may have to be increased if problems in bending are encountered.

Before bending, special attention should be paid to the condition of plate edges transverse to the bend lines. Flame-cut edges of hardenable steels should be machined or softened by heat treatment. Nicks should be ground out. Sharp corners should be rounded.

ASTM Designation		Thickness, in.				
		Up to ¼	Over ¼ to ½	Over ½ to 1	Over 1 to 1½	Over 1½ to 2
A36		1½*t*	1½*t*	2*t*	3*t*	4*t*
A242		2*t*	3*t*	5*t*	—[a]	—[a]
A441		2*t*	3*t*	5*t*	—[a]	—[a]
A529		2*t*	2*t*	—	—	—
A572[c]	Gr. 42	2*t*	2*t*	3*t*	4*t*	5*t*
	Gr. 50	2½*t*	2½*t*	4*t*	—[a]	—[a]
	Gr. 60	3½*t*	3½*t*	6*t*	—[a]	—
	Gr. 65	4*t*	4*t*	—[a]	—[a]	—
A588		2*t*	3*t*	5*t*	—[a]	—[a]
A852[b]		2*t*	2*t*	3*t*	3*t*	3*t*
A514[b]		2*t*	2*t*	2*t*	3*t*	3*t*

[a]It is recommended that steel in this thickness range be bent hot. Hot bending, however, may result in a decrease in the as-rolled mechanical properties.

[b]The mechanical properties of A852 and ASTM A514 steel results from a quench-and-temper operation. Hot bending may adversely affect these mechanical properties. If necessary to hot-bend, fabricator should discuss procedure with the steel supplier.

[c]Thickness may be restricted because of columbium content. Consult supplier.

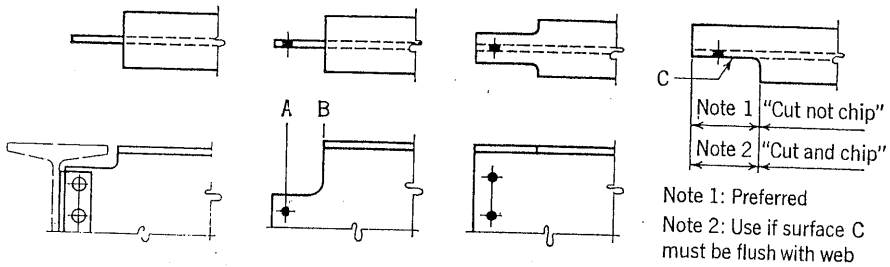
FABRICATING PRACTICES

Maximum efficiency in the fabrication of structural steel by modern shops is entire dependent upon close cooperation between designing office, drafting room ar shop. Designs should be favorable to, the drafting room should recognize and ca for, and the shop should adapt its equipment to, the use of recurrent details whic have been standardized.

Consideration should be given to duplication of details and multiple punching c drilling. Utilization of standard jigs and machine set-ups eliminates unnecessary har dling of material and facilitates the drilling or punching of holes. Gage lines shoul conform to standard machine set ups. Once determined, they should be duplicate as far as possible throughout any one job. Gages and hole sizes on an individu member should not be varied throughout the length of that member.

Keep gages and longitudinal spacing alike to permit maximum economy in e ther drilling or punching operations. Longitudinal spacing should preferably be 3 in. or multiples of 3 in., since most shops consider this to be standard.

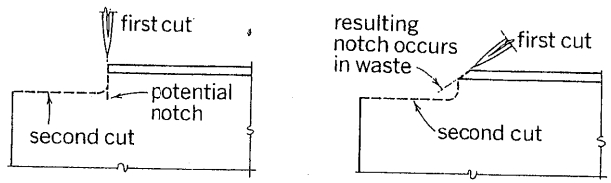
Copes, blocks and cuts



Note 1: Preferred
Note 2: Use if surface C must be flush with web

All re-entrant corners shall be shaped, notch-free, to a radius.

The above sketches indicate standard methods of providing clearance for beams connecting to beams or columns. Where possible, a minimum clearance of ½ in. is to be provided. Fabricators may vary in designation and dimensions of copes and blocks. Some fabricators designate all of the operations pictured above by the term "cuts." Note recommended cutting practice in sketch below.



For economy, coping or blocking of beams should be avoided if possible. When construction will permit, the elevation of the top of filler beams should be established a sufficient distance below the top of girders to clear the girder fillet. Unusually long or deep copes and blocks, or blocks in beams with thin webs, may materially affect the capacity of the beam. Such beams must be investigated for both shear and

FABRICATOR'S TOLERANCES

Compression members shall not deviate from straightness by more than 1000^{th}. of the axial length between points where member is laterally supported.

Horizontal members carrying transverse loads which are framed to other members of the frame may vary by 1/16" for members 30 feet in length or less, and 1/8" for members over 30 feet in length.

For stairs, the largest tread is not to exceed the smallest by more than 3/8", and the greatest riser is not to exceed the smallest by more than 3/8".

FABRICATOR'S PROCEDURE FOR CLEANING & PAINTING STEEL

All structural steel other than that specified to be shipped as unpainted shall be given a coat of shop primer no less than 1 mil dry in. thickness after being prepared as follows:
This paint shall be applied evenly and thoroughly to dry surfaces which have been cleaned, in accordance with means stated in the following paragraph, by brush, spraying, roller coating, flow coating or dipping.

After the member has been inspected and approved, the member will be wire brushed by hand to remove loose mill scale, loose rust, weld slag or flux deposit, dirt or other foreign matter. Oil and grease deposits shall be removed by solvent. If steel is not to receive paint, it is to have the oil and grease removed as above, and other foreign matter is to be removed by use of fiber brush.

This primer is to protect the steel for a short period of exposure. For extended exposure, field finish painting must be provided.

CITY OF HOUSTON

Public Works and Engineering Department

Annise D. Parker
Mayor

Daniel W. Krueger, P.E.
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P.O. Box 2688
Houston, Texas 77252-2688
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T – 832-394-9000

January 21, 2014

Henderson Fabrication Inc.
P. O. Box 659
Bay City, Texas 77404-0659

Registration No.:	586
Valid Date:	02/02/2014
Expiration Date:	02/02/2015
Plant Location:	Bay City, Texas
Limitations:	Structural Steel

Attention: Bob Chase

RE: REGISTRATION AS AN APPROVED FABRICATOR

This letter acknowledges the receipt and review of the information and recommendations of an approved agency that inspected your facility, which were submitted for acceptance and approval as Fabricator under Section 1704.2.2 of the Houston Building Code.

Based on the information submitted and the recommendations of the approved agency, your facility at the location listed above, is hereby approved.

This approval is good from the valid date until the expiration date noted above, unless revoked earlier. Your approval is subject to the rules contained in the Procedure for Approval of Fabricators. It is the fabricator's responsibility to re-certify within thirty (30) days of the expiration date. This approval is further subject to your plant following strict quality control procedures to fabricate building components meeting all requirements of the Houston Building code and to satisfy all of the conditions of approval during the time your firm is registered as an "Approved Fabricator."

Your Certificate of Approval is enclosed and the certificate should be posted in your facility.

If this office can be of further assistance to you or if you need additional information, please contact Mr. Maher Khansa of my staff at 832-394-9043 or email him at maher.khansa@houstontx.gov.

Thomas Hosey
Building Official – Sr. Assistant Director
Code Enforcement

TH:MK:bjs
Enclosure: Certificate of Approval

CITY OF HOUSTON

Department of Public Works and Engineering

Planning and Development Services Division

CERTIFICATE OF APPROVAL

THIS CERTIFIES THAT HENDERSON FABRICATION INC. LOCATED AT Bay City, Texas IS APPROVED BY THE CITY BUILDING OFFICIAL, CITY OF HOUSTON UNDER THE PROVISIONS OF SECTION 1704.2.2 OF THE HOUSTON BUILDING CODE AS A Fabricator of Structural Steel

DATE: 02/02/2014

VALID UNTIL: 02/02/2015

ANNUAL RENEWAL REQUIRED TO BE VALID AFTER DATE OF ISSUE:

Thomas Tobey
CITY BUILDING OFFICIAL

THIS CERTIFICATE IS THE PROPERTY OF THE CITY OF HOUSTON AND MAY BE REVOKED FOR ANY OF THE CAUSES SET FORTH IN THE RULES AND PROCEDURES FOR APPROVAL OF FABRICATORS AND CERTIFYING AGENCIES.

REGISTRATION NUMBER 586

PW&E 212