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1. Purpose

Robinson Inc. has developed the following General Workmanship Standard to supplement Industry Standards, purchase contracts, assembly drawings, engineering, or customer specification, and reference additional specific company workmanship requirements. All suppliers to Robinson Inc. must comply with this Standard, unless otherwise specified.

2. Safety

- 2.1. The prevention of job-related accidents, incidents, injuries, and illnesses will be given precedence over any other activities whenever necessary.
- 2.2. Everyone is responsible for performing their task as not to endanger themselves, other workers, members of the public, or environment.
- 2.3. Robinson is committed to Safety and Environmental Excellence and the goal of Zero Accidents. The same commitment is expected of all employees, temporary employees, and sub-contractors.

3. Reference Documents

- 3.1. Industry Standards (ANSI/ASME/ASTM/NACE/PFI/SSPC)
 - 3.1.1. ASTM A380
 - 3.1.2. ASME B31.1 Power Piping (non-boiler external)
 - 3.1.3. ASME B31.3 Process Piping
 - 3.1.4. ASME Boiler and Pressure Vessel Code
 - 3.1.5. AWS D1.1 Structural Welding Code – Steel
 - 3.1.6. AWS D1.2 Structural Welding Code – Aluminum
 - 3.1.7. AWS D1.3 Structural Welding Code – Sheet Steel
 - 3.1.8. AWS D1.6 Structural Welding Code – Stainless Steel
 - 3.1.9. ISO 2859, ANSI/ASQC Z1.4 Sampling Methodology
 - 3.1.10. NACE 1/SSPC-SP5 White Metal Blast Cleaning
 - 3.1.11. NACE 2/SSPC-SP10 Near-White Metal Blast Cleaning
 - 3.1.12. NACE 3/SSPC-SP6 Commercial Blast Cleaning
 - 3.1.13. NACE 4/SSPC-SP7 Brush-Off Blast Cleaning
 - 3.1.14. NACE Standard RP0287 Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape
 - 3.1.15. PFI ES3 Pipe Fabrication Institute Standard – Fabricating Tolerances
 - 3.1.16. PFI ES-24 Pipe Fabrication Institute Standard – Pipe Bending Methods, Tolerances, Process and Material Requirements
 - 3.1.17. SSPC-PA-1 Shop, Field, and Maintenance Painting of Steel
 - 3.1.18. SSPC PA-2 Dry Film Thickness
 - 3.1.19. SSPC-SP 3 Power Tool Cleaning
- 3.2. Robinson Inc.
 - 3.2.1. Robinson Crimp Standard
 - 3.2.2. Robinson Paint Standard
 - 3.2.3. Robinson Torque Standard
 - 3.2.4. Safety Commitment
 - 3.2.5. Shipping Standards

4. Deviations

- 4.1. Alternative or nonstandard configurations, processes, parts, materials, and rework of nonconforming product shall be reviewed and approved prior to use.
- 4.2. The supplier's request for approval of use of configurations, processes, materials, or parts not covered by this standard shall include:
 - 4.2.1. Details of fabrication and inspection methods, including acceptance and rejection criteria.
 - 4.2.2. Any evidence asked of by Robinson Inc. to demonstrate the alternate or non-standard processes, materials, or parts now satisfy requirements.

5. Documentation

- 5.1. Provide all required documentation as stated by customer or purchase order, including but not limited to pack slip, certificate of compliance (COC), material certification (MTR), inspection reports, date, quantity, job number, and any other documentation stated.
- 5.2. Documentation must be legible and readable by recipient.
- 5.3. Documentation must follow the newest revision, standard, or reference.

6. Electrical

- 6.1. All wires and cables shall be positioned and/or protected to avoid contact with rough or irregular surfaces and sharp edges to avoid damage to conductors and/or adjacent parts.
- 6.2. Shielding on wires and cables should be secured in a manner that will prevent shielding from contacting or shorting exposed current-carrying parts. Ends should be secured to prevent fraying.
- 6.3. The harness and cable containment means should be neat in appearance, uniformly applied, and positioned to retain critical form factors and breakout locations.
- 6.4. The containment means (lacing, ties, tie wraps, etc.) should not cause wire or cable insulation to deform such that performance characteristics are adversely affected.
- 6.5. There should be no evidence of burns, abrading, or pinch marks in insulation that could cause short circuits or leakage.
- 6.6. Strip and Properly Prepare Wire
 - 6.6.1. Strip insulation carefully to avoid nicking strands.
 - 6.6.2. Strip to proper length so conductor can be fully inserted.
 - 6.6.3. Refer to manufacturer's instruction for strip length.
 - 6.6.4. Most connectors are suitable for one conductor. Never install more than one conductor unless specifically allowed by manufacturer's instruction.
 - 6.6.4.1. Follow proper procedure for aluminum conductors as stated in Robinson Crimp Standard.
- 6.7. All crimps shall abide by Robinson Crimp Standard, and examples of acceptable crimps.

7. General Fabrication

- 7.1. The following are minimum requirements for General Fabrication. Additional requirements, specific to an individual project, shall be communicated via traveler notes, drawings, parts lists and/or purchase order.
- 7.2. All flux, weld spatter and slag shall be removed from surfaces, welds and thermally cut edges.
 - 7.2.1. Acceptable methods of removal include chipping, chiseling, brushing, power wire wheel or chemical (Anti-spatter). Surface finish shall not be affected.
- 7.3. All sharp edges and burrs shall be removed.

- 7.3.1. Remove by way of deburring tools, leaving no grinding marks on adjacent areas.
- 7.4. All thermally cut surfaces shall be free of notches in base metal and weld metal.
- 7.5. If freehand thermal cutting is used, it shall be followed by grinding surfaces to a smooth, accurate profile.
- 7.6. Unsightly marks and gouges caused by hammering, grinding or rough handling shall be ground (where necessary for deeper marks and gouges) and sanded smooth, to blend with adjacent material without loss of specified base material thickness.
- 7.7. Do not write or mark on surfaces that are not to be painted, or on machined, polished, or stainless-steel.
 - 7.7.1. If it is necessary for identification, use tape or tagging.
- 7.8. No splices are permitted unless specifically shown on drawings or prior written approval (Waiver/Deviation) has been given by Robinson Inc. engineering.
- 7.9. Dimensional Tolerances when not specified by Engineering drawings, parts lists, or purchase order documents shall be as follows:
 - 7.9.1. Fabrication dimensions, non-locating
 - 7.9.1.1. +/- 1/8 in., 0 to 40 ft (+/- 3 mm, 0 to 12.2 M)
 - 7.9.1.2. +/- 1/4 in. over 40 ft (+/- 6 mm over 12.2 M)
 - 7.9.2. Fabrication dimensions, positioning and/or locating:
 - 7.9.2.1. +/- 1/16 in. (+/- 1.5 mm)
 - 7.9.3. Bolt Circles – diameters
 - 7.9.3.1. Solid flanges +/- 1/32 in., 0 to 4 ft (+/- 1 mm, 0 to 1.2 M)
 - 7.9.3.2. Rim flanges +/- 1/16 in., 0 to 20 ft (+/- 1.5 mm, 0 to 6.0 M)
 - 7.9.4. Bolt Spacing, Locating Chord or Mating Dimensions
 - 7.9.4.1. +/- 1/32 in. to 2 ft.-0 in. (+/- 1 mm, 0 to 610 mm) non-accumulative
 - 7.9.4.2. +/- 1/16 in. for 2 ft.-0 1/16 in. and over (+/- 1.5 mm for greater than 610 mm) non-accumulative
 - 7.9.5. Fabrication camber or sweep and flatness tolerance
 - 7.9.5.1. Permissible variation (in.) = 0.13 x Length (ft.) / 10
 - 7.9.5.2. Permissible variation (mm) = 10.8 x Length (M) / 10
 - 7.9.6. Butt Joint Alignment:
 - 7.9.6.1. Offset shall not exceed 10% of the thickness of the thinner material being joined to an absolute maximum of 1/8 in. (3 mm) see Figure 1.

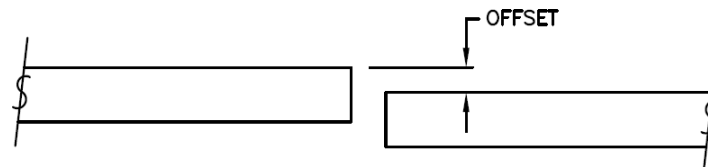


Figure 1

- 7.10. Dimensional Tolerances When Not Specified for Fabrication
 - 7.10.1. Dimensions up to and including 60.”

Table 1: Fabrication Dimensional Tolerances

STANDARD	METRIC	FRACTIONAL
X = +/- 0.120”	X = +/- 3 MM	Over 12” = +/- 1/8”
X.X = +/- 0.090”	X.X = +/- 2.28 MM	Under 12” = +/- 1/16”
X.XX = +/- 0.060”	X.XX = +/- 1.52 MM	
X.XXX = +/- 0.045”	X.XXX = +/- 1.15 MM	

- 7.10.2. Dimensions 60" to 120" = +/- 0.120"
- 7.10.3. Dimensions 10' to 25' = +/- 0.25
- 7.10.4. Dimensions over 25' add +/- 0.25" per 25.'
- 7.10.5. Fabrication dimensions, positioning and/or locating = +/- 1/16"
- 7.11. Dimensional Tolerances When Not Specified for Forming
 - 7.11.1. Material up to 0.120" thick
 - 7.11.2. 0' to 3' = +/- 1°
 - 7.11.3. Over 3' = +/- 2°
 - 7.11.4. Material 0.120" to 0.25" thick = +/- 2°
- 7.12. Flatness tolerance is per mill standards for that material, unless otherwise specified.
- 7.13. Bolt spacing or mating dimensions.
 - 7.13.1. 2' and under = +/- 1/32"
 - 7.13.2. Over 2' = +/- 1/16"

8. Machining

- 8.1. Follow requirements on print and/or traveler for customer specifications, including but not limited to use of certain chemicals, coolants, deburring tools, or special precautions for protecting parts and labelling.
- 8.2. Ensure the revision and requirements on the traveler match the prints.
- 8.3. Verify the material type, thickness, quantity, program, key points, tooling, and sizes.
- 8.4. Deburr and clean parts before sending to inspection.
- 8.5. Standard surface finish if not specified:
 - 8.5.1. Machine surfaces: 125 RMS (3.0 μm)
 - 8.5.2. Threads: 63 RMS (1.5 μm)
 - 8.5.3. Thread reliefs: 250 RMS (6.0 μm)
 - 8.5.4. Seal surfaces: 63 RMS (1.5 μm)
 - 8.5.5. Non-standard finishes shown on drawing: 250 RMS (6.0 μm)
- 8.6. Dimensional tolerances if not specified:
 - 8.6.1. Angle tolerance: ±1 Degree
 - 8.6.2. Fillet radius: 0.030 inches (1mm) min.

Table 2: Machining Dimensional Tolerances in Inches

OVER	0.000	1.500	5.000	15.000	40.000	80.000
UP TO	1.500	5.000	15.000	40.000	80.000	*****
TOLERANCE ±	0.005	0.010	0.015	0.030	0.040	0.080

Table 3: Machining Dimensional Tolerances in Millimeters

OVER	0.000	40.00	150.00	400.00	1000.00	2000.00
UP TO	40.00	150.00	400.00	1000.00	2000.00	*****
TOLERANCE ±	0.10	0.30	0.40	0.80	1.00	2.00

9. Material Traceability

- 9.1. The purchase order and line number is written on all material when it is received.
- 9.2. All certifications are filed by receiving department.
- 9.3. If material has been used in production and remaining is restocked; purchased order number is to again be written on remaining material insuring traceability of the material and its correct certification.

- 9.4. The purchase order and line number from the material is recorded on all material cut list and laser tags by operator.
- 9.5. All purchase order numbers are recorded into data base. This will allow all certifications to be always accessible using Traveler number.
- 9.6. The traveler is used to identify product during production. Traveler number will be used to identify any material information concerning that part.
- 9.7. If material requires identification during production process the parts shall be physically identified with material purchase order and line number and/or heat number through all operations of production. This is to be done using tags, labeling by tape or marker, bins for high quantity, or labeled pallets.
- 9.8. Materials that do not have a purchase order and line number on it may only be used on jobs that do not require material traceability.
- 9.9. It is the responsibility of every employee that is involved in production of product to ensure that all parts stay with correct means of material identification.

10. Paint and Coating

- 10.1. Painting/Coating application shall be in accordance with SSPC-PA-1 "Shop, Field, and Maintenance Painting of Steel" (latest edition).
- 10.2. Coatings shall be uniformly applied; each application shall overlap by 50%.
- 10.3. It is recommended, but not required that all personnel performing abrasive blasting and painting/coating application, be trained, and qualified per SSPC PA-1.
- 10.4. All coating application shall be performed according to coating manufacturer's recommendations and following criteria, except where noted otherwise.
- 10.5. It is recommended, but not required that all personnel performing painting/coating inspection be trained to a minimal of NACE Certified Coatings Inspector (CCI) Level 1.
- 10.6. The surface to be coated must be clean, free of dust, and dry before priming or any application of coating.
- 10.7. It is recommended, but not required that coating application be performed in an environmentally controlled coating booth or room.
- 10.8. Coating application shall be performed in a well-lit environment.
- 10.9. No coatings shall be applied when relative humidity is greater than 85%.
- 10.10. No coatings shall be applied on wet surfaces.
- 10.11. Surface temperature shall be maintained at a minimum of 5 degrees F above dew point and rising, to prevent oxidation of blast clean surface.
- 10.12. Environmental Conditions to Monitor/Track
 - 10.12.1. Environmental conditions shall be monitored and tracked using an inspection report. Conditions that need to be monitored are:
 - 10.12.2. Time of Surface Preparation or Coating Application
 - 10.12.3. Ambient Temperature
 - 10.12.4. Surface Temperature
 - 10.12.5. Relative Humidity and Dew Point
- 10.13. Inspection
 - 10.13.1. 100% visual inspection is required and shall not exhibit any of the following discontinuities: runs, sags, holidays, overspray, or visible pinholes.
 - 10.13.2. Dry Film Thickness (DFT) shall be performed in accordance with SSPC PA-2.
 - 10.13.3. Record all info requested on a coatings inspection report that is delivered with each part/shipment.

10.14. Repair of Damaged Coatings

- 10.14.1. Coatings that are damaged shall be cleaned and repaired in accordance with NACE/SSPC standards and coating manufactures instructions.
- 10.14.2. To prepare damaged area follow SSPC-SP 2 “Hand Tool Cleaning” or SSPC-SP 3 “Power Tool Cleaning”, as needed. Feather edges back a minimum of two inches from damaged area, remove sanding dust and solvent wipe with clean rag.
- 10.14.3. Re-coat area using same system that was originally applied, allowing for manufacturers curing and recoat schedules and Dry Film Thickness DFT as specified.

10.15. Other Coatings

- 10.15.1. All other coatings will follow current industry standards, unless specified otherwise.

11. Pressure Vessel and Pipe Fabrication

11.1. Follow current version of industry standard.

- 11.1.1. Power Boilers in accordance with Section I of ASME Boiler and Pressure Vessel Code (ASME “S” Certificate)
- 11.1.2. ASME B31.1 Power Piping under administrative control of Section I of ASME Boiler and Pressure Vessel Code (Boiler External Piping – ASME “PP” or “S” Certificate)
- 11.1.3. Pressure Vessels in accordance with Section VIII, Division 1 of ASME Boiler and Pressure Vessel Code (ASME “U” Certificate)
- 11.1.4. Repair and alteration of Power Boilers, Boiler External Piping and Division I Pressure Vessels in accordance with National Board Inspection Code and rules of governing legal Jurisdiction (National Board “R” Certificate). Work not requiring accreditation.
- 11.1.5. Power Piping (non-boiler external) in accordance with ASME B31.1
- 11.1.6. Process Piping in accordance with ASME B31.3

11.2. Pipe Threading Process

- 11.2.1. Ream pipe before threading.
- 11.2.2. Check for burrs or damaged pipe ends (dents, nicks, etc.) Burrs or nicks are not allowed.
- 11.2.3. After threading, clean threads with wire brush to remove debris. Threads must be clean.
- 11.2.4. Inspect threads for proper depth.
- 11.2.5. Oil and check threads/test fit with new fitting or no/go gage.
 - 11.2.5.1. Do not use worn or old fittings to test threads.
- 11.2.6. Assemble using high quality pipe sealant.
- 11.2.7. Do not over tighten since threads will deform and leak.
 - 11.2.7.1. Rule of thumb is three turns by hand and three turns with a wrench.
- 11.2.8. If assembling and disassembling multiple times threads become compromised.

11.3. Internal and External Misalignment at Circumferential Welds

- 11.3.1. Ends of pipe-to-pipe or pipe-to-flange or fitting joints shall be aligned accurately. Internal misalignment criteria shall be governed by para. 328.4.3 of ASME B31.3 and the following:
 - 11.3.1.1. 24” NPS and smaller pipe-to-pipe or pipe-to-fitting: 0.06” maximum deviation.
 - 11.3.1.2. 26” NPS and larger pipe-to-pipe or pipe-to-fitting: 0.09” maximum deviation when permitted by relevant WPS.
- 11.3.2. If internal misalignment exceeds above stated values, use one of the following:
 - 11.3.2.1. First, rotate pipe or fittings to reduce misalignment to acceptable tolerances.
 - 11.3.2.2. Second, use spreaders, or internal or external lineup clamps to correct moderate issues.

- 11.3.3. If external surfaces of components are not aligned, it is permissible to taper welds between them as per ASME Code Rules.
- 11.4. Tolerances on Linear Dimensions
 - 11.4.1. The tolerance on center-to-center dimension, face-to-face dimension, center-to-face dimension and location of attachments shall be maintained within $\pm 1/8$ ".
 - 11.4.2. PFI Standard ES-24 provides guidelines on ovality if not defined in governing code. Removal of metal shall not be used to achieve these requirements.
- 11.5. Tolerances on mitered Joints
 - 11.5.1. A mitered joint is formed by two or more straight sections of pipe matched and joined in a plane bisecting the angle of junction to produce a change in direction.
 - 11.5.2. An angular offset of 3 deg or less does not require design consideration as a miter bend.
- 11.6. Tolerance on Flanges
 - 11.6.1. Pipe flanges are oriented such that the bolt holes straddle the horizontal (plant north/south) when flange face is horizontal and vertical centerlines when flange face is vertical.
 - 11.6.2. Rotation of flanges, measured as offset between elevation of bolt holes on opposite sides of a flange centerline, shall not exceed $\pm 1/16$ ".
 - 11.6.3. Tilt of flange measured at periphery across any diameter shall not exceed $\pm 1/32$ " from square position.
- 11.7. Tolerances on pipe spools for field adjustment
 - 11.7.1. Where a field fit-up is required, it is recommended that one spool piece shall have a plain end 4-6 inches longer than the dimension indicated on piping drawing for adjustment at site.
 - 11.7.2. The installation contractor is required to verify the dimensions in the field before trimming and beveling spool provided with cutting allowance.
 - 11.7.3. Fabrication contractor makes a provision in material take off for cutting allowance.
 - 11.7.4. Adjacent spool piece is prepared, beveled end in the shop, with no need for any cutting allowance.

12. Stainless Steel

- 12.1. General Fabrication requirements as called out in Section 7 General Fabrication of this standard shall also apply to fabrication of Stainless-Steel components.
- 12.2. All welding shall be performed in accordance with latest edition of ASME Section IX / AWS D1.6 Structural Welding Code – Stainless Steel or AWS D1.3 Sheet Steel.
- 12.3. Protecting Austenitic Stainless Steel from Contamination
 - 12.3.1. The transfer of carbon onto Stainless Steel (SS) surfaces shall be avoided; handling, storage, fabrication processes and shipping are to be controlled.
 - 12.3.1.1. Mechanical damage (e.g., scratches, gouges, and indentations) from chains, clamps, forklift forks, bending and shearing, contaminated grinding discs, carbon steel tables and jigs can embed iron into S.S. surfaces.
 - 12.3.1.2. Welding and grinding of carbon steel near S.S. can transfer iron onto S.S. surfaces and shall be avoided.
- 12.4. Protecting Mill Finished Surfaces
 - 12.4.1. Avoid hammering, grinding, tack welding temporary bracing or scratching stainless steel surfaces.
 - 12.4.2. When using power tools to de-burr sharp or thermally cut edges, grind only the edge, leaving no grinding marks on adjacent areas. Do not mar surrounding surfaces.
- 12.5. Cleaning of Stainless Steel

- 12.5.1. All heat tint, welding flux, slag and rust staining introduced by way of welding, heating, cutting, grinding, or handling shall be removed.
- 12.5.2. All grease, oil, dirt, markers, paint and similar contaminates shall be removed.
- 12.5.3. Abrasive Blast Cleaning shall be limited to Glass Bead; other blast media may be used if deviation/waiver is approved.
- 12.6. Passivation
 - 12.6.1. When required shall meet ASTM A380.

13. Surface Finish

- 13.1. Pre-cleaning Procedures
 - 13.1.1. Personnel who perform surface preparation or coating application shall be familiar with Society of Protective Coatings, SSPC-PA-1 "Shop, Field, and Maintenance Painting of Steel" (latest edition).
 - 13.1.2. Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP1 "Solvent Cleaning" (latest edition) or other agreed-upon methods.
 - 13.1.3. All welds shall be free of flux, weld spatter and slag.
 - 13.1.4. Remove all sharp edges, burrs, and unsightly marks.
- 13.2. Abrasive Blasting
 - 13.2.1. Abrasive blasting shall meet NACE/SSPC Standards and follow abrasive blasting cleaning standards noted in Robinson Inc. drawings, Coating Specification drawings, or PO.
- 13.3. White Metal Blast Cleaning (NACE 1/SSPC-SP5)
- 13.4. Near-White Metal Blast Cleaning (NACE 2/SSPC-SP10)
- 13.5. Commercial Blast Cleaning (NACE 3/SSPC-SP6)
- 13.6. Brush-Off Blast Cleaning (NACE 4/SSPC-SP7)
- 13.7. Surface or Anchor Profile
 - 13.7.1. Surface profile of all blasted surfaces shall be measured using Replica Tape per NACE Standard RP0287 "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape" (latest edition).
 - 13.7.2. Surface profile shall be recorded on all projects, using an inspection report for each project. Replica tape used shall be retained for record.
 - 13.7.3. The number of Surface/Anchor Profile tests to be taken shall assure a consistent profile is obtained across entire surface.
- 13.8. Post Blasting
 - 13.8.1. Remove all foreign matter in and on material prior to shipment, like blasting media.

14. Torquing

- 14.1. Torqued fasteners are at least one of the following: specify a load rating, called out on an assembly drawing, work instruction or customer specification, deemed critical to assembly, or follow equipment manufactures required torquing.
- 14.2. If a torque value is not specified, use provided Torque Tables in Robinson Torque Standards.
- 14.3. Follow proper torque pattern for installation.
- 14.4. Torque Procedure
 - 14.4.1. Apply lubricant, if applicable, and then hand tighten fastener, ensuring it goes in smoothly.
 - 14.4.2. Select proper tool for fastener.
 - 14.4.3. Check that tool is calibrated and in good working condition before using.

- 14.4.4. Tighten all fasteners in 4 rounds –30% of final torque, 60% of final torque, 100% of final torque, then in clockwise rotation starting at first fastener till no more rotations occur at 100% of torque.
- 14.4.5. After torquing, apply with a black paint marker (unless specified differently) a torque stripe from bolt, down nut, washer and onto surface of material.
- 14.5. Torque Inspection
 - 14.5.1. Inspectors will check all torqued fasteners for torque markings.
 - 14.5.2. Inspectors will randomly check torque value at 2% less than required.
 - 14.5.3. They will check specified quantities of fasteners as stated in measurement table below.
 - 14.5.3.1. Fastener will be verified with calibrated tool to same setting as stated for fastener.
 - 14.5.4. Inspectors will then apply a paint dot of a different color to center of bolt head to indicate they were verified.
 - 14.5.4.1. The inspector will verify up to 20 fasteners, randomly selecting different types of fasteners from assembly.
 - 14.5.4.2. Measurement table for quantity of fasteners to verify. (Provided by ISO 2859, ANSI/ASQC Z1.4)

Table 4: Inspection Quantities

# FASTENERS	# TO VERIFY
2-8	2
9-15	3
16-25	5
26-50	8
51-90	13
91+	20

15. Welding

- 15.1. All welding shall be performed in accordance with latest edition of American Welding Society (AWS) and American Society of Mechanical Engineers (ASME) standards:
 - 15.1.1. AWS D1.1 Structural Welding Code – Steel
 - 15.1.2. AWS D1.2 Structural Welding Code – Aluminum
 - 15.1.3. AWS D1.3 Structural Welding Code – Sheet Steel
 - 15.1.4. AWS D1.6 Structural Welding Code – Stainless Steel
 - 15.1.5. ASME Boiler and Pressure Vessel Code - Section VIII & IX.
- 15.2. Welders shall be qualified per requirements of these Codes.
- 15.3. “Welding Procedure Specification’s” (WPS) and supporting “Procedure Qualification Records” (PQR) are required for all welding.
- 15.4. Weldment dimensions are finished dimensions. Allowance for shrinkage or other fabrication techniques are responsibility of fabricator.
- 15.5. Weld Procedure and Acceptance Criteria
 - 15.5.1. All welds shall be visually inspected per Visual Weld Inspection Criteria (Section 15.6). Welds shall be inspected by welder before final inspection.
 - 15.5.2. Any other inspections or criteria required shall be discussed at start of project before any work is started.
 - 15.5.3. All welds shall follow weld symbols on print unless a deviation is cleared by Customer with documentation, Project Manager and Weld Quality Coordinator.

- 15.5.4. Welds without symbols on print shall be discussed prior to welding for type, size, progression, process, and filler.
- 15.5.5. Weld process shall be determined before any work or fit up is started. GMAW short circuit transfer shall not be used on material over .375" thick unless approved by Weld Quality Coordinator.
- 15.5.6. Vertical weld progression shall be discussed on material over .25".
- 15.5.7. Material clean-up shall be discussed prior to welding. (Blasting, grinding, etc.)

15.6. Visual Weld Inspection Criteria

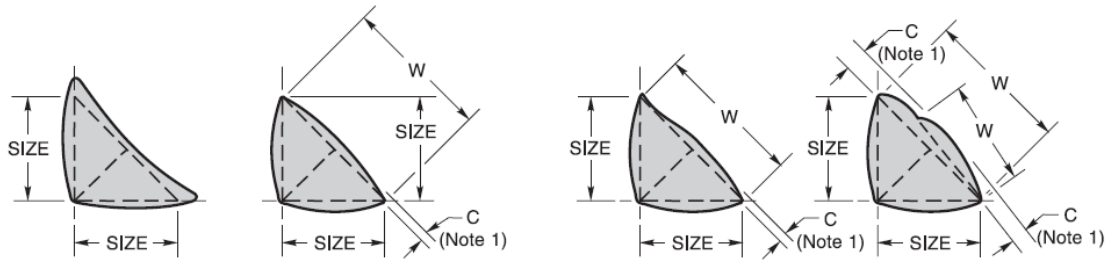
- 15.6.1. No crack will be acceptable.
- 15.6.2. Through fusion shall exist between adjacent layers of weld metal and base metal.
- 15.6.3. All craters shall be filled to provide specified weld size, except for ends of intermittent fillet welds outside of their effective length.
- 15.6.4. All weld profiles shall be in conformance with AWS D1.1 requirements.
- 15.6.5. Visual inspection of welds may begin immediately after completed welds have cooled to ambient temperature. Welder shall inspect all welds before sending parts to final inspection.
- 15.6.6. Size of a fillet weld in any continuous weld may be less than specified nominal size without correction by the following:

Table 5: Weld Size Allowable Decreases

Specified Weld Size	Allowable Decrease
< 3/16	< 1/16
1/4	< 3/32
> 5/16	< 1/8

- 15.6.7. In all cases, undersized portion of weld shall not exceed 10% of weld length.
 - 15.6.8. Undercut shall not exceed 1/32". In primary members, undercut shall be no more than .010" deep when weld is transverse to tensile stress.
 - 15.6.9. Complete joint penetration groove welds in butt joints shall have no visible piping porosity. For all other groove and fillet welds, porosity shall not exceed 0.032" in diameter. The sum of porosity shall not exceed 1/8" in any 12" of weld.
 - 15.6.10. Slag shall be removed from all completed welds and adjacent base metal.
 - 15.6.11. Weld spatter shall be removed.
 - 15.6.12. All welds shall be wrapped around the corner and have through fusion. All start/stops to be same size as weld specified and have through fusion.
- 15.7. Weld Repair
- 15.7.1. If workmanship does not meet minimum requirements outlined above, repairs shall be performed as described below:
 - 15.7.1.1. Overlap, Excessive Convexity or Excessive Reinforcement: excessive weld metal removed by grinding.
 - 15.7.1.2. Excessive concavity of weld or crater, undersize welds, undercutting: surfaces prepared, and additional weld metal deposited to produce acceptable weld size and profile.
 - 15.7.1.3. Incomplete fusion, weld porosity, or slag inclusions: removed and re-welded.
 - 15.7.1.4. Cracks in weld or base metal: extent of crack shall be ascertained by use of magnetic particle inspection, liquid penetrate inspection, or other equally positive means. The crack and sound metal 2 in beyond each end of crack shall be removed, and re-welded. Any base metal repair shall be reviewed and approved by Robinson Inc.
 - 15.7.1.5. Pin holes (piping porosity) in weld: removed to their full depth and re-welded.

15.7.1.6. The removal of weld metal may be done by machining, grinding, or gouging. It shall be done in a manner that adjacent weld or base metal is not nicked or gouged.

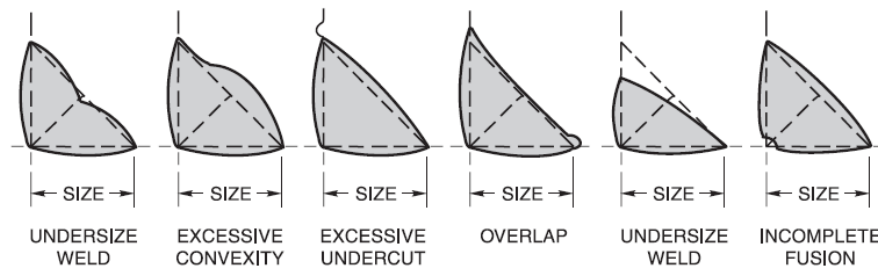


(A) DESIRABLE FILLET WELD PROFILES

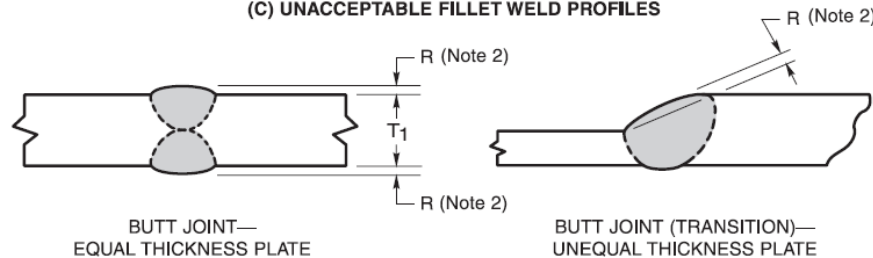
(B) ACCEPTABLE FILLET WELD PROFILES

Note 1. Convexity, C, of a weld or individual surface bead with dimension W shall not exceed the value of the following table:

WIDTH OF WELD FACE OR INDIVIDUAL SURFACE BEAD, W	MAX CONVEXITY, C
$W \leq 5/16$ in. [8 mm]	1/16 in. [2 mm]
$W > 5/16$ in. [8 mm] TO $W < 1$ in. [25 mm]	1/8 in. [3 mm]
$W \geq 1$ in. [25 mm]	3/16 in. [5 mm]

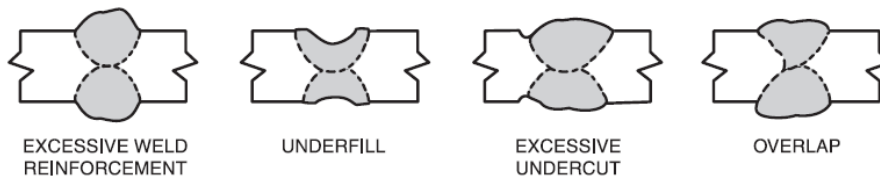


(C) UNACCEPTABLE FILLET WELD PROFILES



Note 2. Reinforcement R shall not exceed 1/8 in. [3 mm] (see 5.24.4).

(D) ACCEPTABLE GROOVE WELD PROFILE IN BUTT JOINT



(E) UNACCEPTABLE GROOVE WELD PROFILES IN BUTT JOINTS

Figure 2

16. Inspection

16.1. Manufacturing operations, including required inspections, examinations, and tests, (including additional material testing after receipt inspection) shall be sufficiently planned and documented to enable Company's

quality representatives to determine at what stages specific inspections and verification activities are to be performed.

- 16.2. The Traveler system shall prescribe or provide reference to materials to be processed along with manufacturing, inspection, examination, and test operations involved.
- 16.3. All incoming materials, products and parts shall be visually inspected to evaluate quality conformance in accordance with PO requirements.
 - 16.3.1. Any nonconformities shall be documented, and relevant parties notified.

17. Rework of Nonconformances

- 17.1. A nonconformity is any condition that does not comply with the rules of the Code, applicable Jurisdiction, specification requirements or this Standard.
- 17.2. Nonconformities shall be promptly identified and communicated to all affected parties.
- 17.3. Rework that results in product conformity is permissible and is reviewed to ensure it meets requirements.
- 17.4. Each occurrence of rework and the nonconformance it corrects shall be recorded.

18. Material Handling and Packaging

- 18.1. Care shall be taken when handling any materials, products, or parts to ensure no damage is done to them.
- 18.2. Product must be securely strapped on pallets, using corner protectors when needed.
- 18.3. Cardboard should be placed between material/product and pallet to prevent damage.
- 18.4. All parts shall be packaged in a way to protect parts through final delivery.
- 18.5. Parts must arrive at destination in the same condition as they left.
- 18.6. The correct packing method must be used based on part material, size, and weight, such that parts are well protected from outside environment and or any damage which may occur during transport.
- 18.7. Packages must be clearly marked and verified that the PO, line item, quantity, part number/description are correct.
- 18.8. Remove all foreign matter in and on material prior to shipment, like machining coolant, blasting media, grinding dust, chemicals, cleaners, slugs, plugs, etc.
- 18.9. Design of Packaging Systems:
 - 18.9.1. Shipping banding or plastic wrap to be used to secure product to skid, inside of crate, etc.
 - 18.9.2. Product must not overhang pallet in any direction
 - 18.9.3. Product must not protrude from crate or package
 - 18.9.4. Product should be packed with packaging supplies (wax paper, foam, bubble wrap, etc.) so the part cannot move inside of box, causing holes.
 - 18.9.5. Product's weight not to exceed box's capabilities to hold through shipment
 - 18.9.6. All skids to be clearly labeled with "do not stack" cones, "fragile" labels, etc. accordingly.
 - 18.9.7. Maximum height of skids to be 90", including standard 6" height skid.
 - 18.9.8. Maximum weight of skid to be 2500lbs.
 - 18.9.9. Standard 48"x40" skid will be charged one "spot" on LTL shipments.
 - 18.9.10. Standard 48"x120" skid will be charged three "spots" on LTL shipments.
 - 18.9.11. Crates with 30" or more overall height should have one side removable from vendor.
 - 18.9.12. Crates should allow 1" of space on all sides, including top, around finished product.
- 18.10. Small Parcel:
 - 18.10.1. All small parcel items to be inside a double wall box, tube, envelope, on a skid, or in a crate.
- 18.11. Coated Parts:



- 18.11.1. Coated parts will be wrapped (plastic, foam, etc.) so as not to be touching other product or external packaging system.
- 18.11.2. Crated is preferred for painted/powder coated parts.