

SECTION 05 05 23

WELDING-QUALITY ASSURANCE

PART 1 GENERAL

1.1 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
1. Canadian Standard Association CSA:
 - a. G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - b. W59, Welded Steel Construction (Metal Arc Welding).
 - c. W59.2, Welded Aluminum Construction.
 - d. W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - e. W47.1, Certification of Companies for Fusion Welding of Steel.
 - f. W47.2, Certification of Companies for Fusion Welding of Aluminum.
 - g. W117.2, Safety in Welding, Cutting and Allied Processes.
 - h. W178.1 Certification of Welding Inspection Organizations.
 - i. W178.2, Certification of Welding Inspector.
 - j. W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum
 2. ASTM International (ASTM):
 - a. A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
 - b. E10, Standard Test Method for Brinell Hardness of Metallic Materials.
 - c. E23, Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
 3. American Welding Society (AWS):
 - a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - b. A3.0, Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermal Spraying.
 - c. D1.1, Structural Welding Code – Steel.
 - d. D1.3, Structural Welding Code - Sheet Steel.
 - e. D1.6, Structural Welding Code – Stainless Steel.
 - f. QC1, Standard for AWS Certification of Welding Inspectors.
 4. Canadian General Standards Board (CGSB):
 - a. 48.9712 Non-Destructive Testing – Qualification and Certification of NDT Personnel.
 5. American Society of Mechanical Engineers (ASME):
 - a. BPVC SECTION V, Nondestructive Examination.
 - b. BPVC SECTION IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators Welding and Brazing Qualifications.

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1.2 DEFINITIONS

- A. Class W47.1 welding positions flat (F) horizontal (H); vertical (V) overhead (O).
- B. CJP: Complete Joint Penetration.
- C. CWB: Canadian Welding Bureau.
- D. CWI: Certified Welding Inspector.
- E. GTSM: Gauge to Sound Metal.
- F. MT: Magnetic Particle Testing.
- G. NDE: Nondestructive Examination.
- H. NDT: Nondestructive Testing.
- I. PJP: Partial Joint Penetration.
- J. PQR: Procedure Qualification Record.
- K. PT: Liquid Penetrant Testing.
- L. RT: Radiographic Testing.
- M. UT: Ultrasonic Testing.
- N. VT: Visual Testing.
- O. WPQ: Welding Personnel Performance Qualification.
- P. WPS: Welding Procedure Specification.
- Q. WPDS: Welding Procedure Data Sheets.
- R. WQR: Welder Qualification Record.
- S. Contractor's inspection:
- T. Verification Inspection:

1.3 SUBMITTALS

- A. Shop and Field Drawings:
 - 1. Welding Data (Shop and Field):
 - a. Show on a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with

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reference called out for WPS and NDE numbers in tail of welding symbol.

- b. Distinguish between shop and field welds.
 - c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
 - d. Fillet weld symbols shall show fillet size and length.
 - e. Groove weld symbols shall indicate CJP or PJP or GTSM in the tail of the symbol, as applicable.
 - f. For pipe fittings, provide a joint weld beveling diagram.
 - g. Welding and NDE symbols shall be in accordance with AWS A2.4.
 - h. Welding terms and definitions shall be in accordance with AWS A3.0.
 - i. Submit welding data together with shop drawings as a complete package.
- B. Informational Submittals:
1. When CAN/CSA applies, WPS's and related WPDS's shall be submitted for all joints prequalified in accordance with W59. Similar documentation is required for non prequalified joints accompanied by PQR's for the non-prequalified joints. All such documentation shall be affixed with the CWB acceptance stamp.
 2. When AWS applies, WPS's standard formats shall be submitted for all prequalified and non prequalified joints. In addition, PQR's shall be submitted for non-prequalified joints.
 3. When the BPVC applies, WPS's and PQR's shall be submitted in accordance with ASME SECT. IX approved by the authority having jurisdiction.
 4. When CAN/CSA W55.3 applies, documentation of resistance welded joint qualification accepted by the CWB shall be submitted.

1.4 QUALIFICATIONS

- A. Structural fabricators and erectors shall be certified in accordance with CAN/CSA W47.1-03 and/or W47.2.
- B. BPVC fabricators shall be qualified in accordance with ASME Section IX.
- C. Welding personnel shall be qualified in accordance with the appropriate codes – CAN/CSA W47.1 or W47.2; AWS D1.1; D1.2; D1.6; ASME Section IX.
- D. CWI shall be qualified in accordance with CAN/CSA W178.2 or AWS QC1 and shall have prior experience with the welding codes specified.
- E. Non-destructive inspection personnel shall be qualified in accordance with the appropriate CAN/CGSB requirements or NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.5 SEQUENCING AND SCHEDULING

- A. Unless otherwise specified, all Submittals required in this Section shall be submitted and approved prior to commencement of welding operations.

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PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 GENERAL

- A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

3.2 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

- A. Contractor's Inspection Criteria:
1. Selection of Welds to be Tested: Unless 100 percent NDT is specified herein, as agreed upon between Engineer and Contractor.
 2. Unless otherwise specified, perform NDT of welds at a frequency as shown in the attached NDT table in accordance with the referenced welding codes. Perform UT on CJP groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply.
- B. Weld Acceptance criteria for Contractor's inspection shall be based on the acceptance criteria as per the governing welding codes listed in the NDT table.

3.3 SOURCE AND FIELD QUALITY CONTROL

- A. Contractor Inspection:
1. The W178.2 (or QC1-96) CWI, employed by the Contractor, shall be present whenever shop or field welding is to be performed. The CWI shall perform inspection prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in referenced welding codes and as follows:
 - a. Verifying conformance of specified job material and proper storage.
 - b. Monitoring conformance with approved WPS.
 - c. Monitoring conformance of WPQ.
 - d. Inspecting weld joint fit-up and in-process inspection.
 - e. Providing 100 percent visual inspection of all welds.
 - f. Supervising nondestructive testing personnel and evaluating test results.
 - g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.
- B. Verification Inspection:
1. An independent testing agency will be retained by The City to perform verification inspection and testing of welds.

3.4 WELD DEFECT REPAIR

- A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

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- B. Repair and retest rejected weld defects to meet the design, plans and specifications.
- C. Retesting shall be performed with the same NDT method used for initial tests and to the same frequency of testing.

3.5 SUPPLEMENTS

- A. The supplements listed below, following “End of Section,” are a part of this Specification.
 - 1. Welding and Nondestructive Testing Table.

END OF SECTION

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WELDING AND NONDESTRUCTIVE TESTING						
Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
05 12 00 Structural Steel Framing	CAN/CSA W59, Welded Steel Construction (Metal Arc Welding)	Yes	Yes	Yes	Yes	10% UT or RT of all groove-and-butt joint welds; 10% MT of all fillet welds; see Section 05 12 00

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 REFERENCES

- A. Comply with the latest edition of the following statutes codes and standards and all amendments thereto.
1. Canadian Standard Association (CSA):
 - a. CAN/CSA-G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - b. CAN/CSA-S16 Design of Steel Structures.
 - c. CISC, Canadian Institute of Steel Construction "Code of Standard Practices".
 2. ASTM International (ASTM):
 - a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Steel Piling.
 - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - c. A123/A, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - d. A143, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - e. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - f. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - g. A384, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
 - h. A385, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
 - i. A563, Standard Specification for Carbon and Alloy Steel Nuts.
 - j. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - k. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - l. A992, Standard Specification for Structural Steel Shapes.
 - m. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - n. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - o. F436, Standard Specification for Hardened Steel Washers.

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- p. F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
- 3. American Welding Society (AWS):
 - a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.

1.2 DESIGN REQUIREMENTS

- A. Framing Design:
 - 1. Structural Steel Framing System has been designed on the basis of steel sections shown. It is the intent of Contract that indicated steel sizes, shapes, thicknesses, arrangements and grades of material be used.
 - 2. If for any reasons sections shown are not available, substitute sections may be proposed for use and must be accepted in writing by the Contract Administrator prior to use. Contract Administrator may consider such substitutions only if proposed members provide equal or greater strength with deflection compatible with adjacent construction, and do not interfere in any way with the architectural construction or the installation of mechanical and electrical utilities. No increase in payment will be made because of substitutions.
- B. Connections – General:
 - 1. Design in accordance with CAN/CSA-S16, Clause 21 - Connections.
 - 2. Connections may be bolted or welded.
 - 3. Design connections for end reactions from torsion, bending moment, shear, and axial load where indicated.
 - 4. Where no end reaction is indicated, design connection on the basis of simple construction for the end reaction of a laterally supported beam of a given span under a uniformly distributed factored load that has attained its maximum moment capacity in accordance with Standardized Shear Connections published by Canadian Institute of Steel Construction (CISC).
 - 5. For beams with intersecting bracing members, design connections for beam reaction plus reaction from the bracing members.
- C. Bolted Connections:
 - 1. Unless noted otherwise, use bearing-type connections with snug-tightened bolts.
 - 2. Use high-strength bolts in accordance with CAN/CSA-S16, Clause 22 – Design and Detailing of Bolted Connection.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Provide Shop Drawing details showing:
 - a. Submit fabrication and erection documents. Include connection design details, shop details, erection diagrams and erection procedures.
 - b. Submit connection design details and calculations bearing seal and signature of a professional engineer registered in the Province of Manitoba for review and approval prior to submitting shop details.

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- c. Indicate fabrication details including cuts, copes, connections, bolt tension, holes, bearing plates, threaded fasteners, shop coatings, galvanizing, or other surface treatments, and welds on shop details. Indicate welds using American Welding Society (AWS) welding symbols in accordance with AWS A2.4.
 - d. On erection diagrams, mark each member with a number corresponding to the drawing containing the shop details of the member.
 - e. Submit shop details and erection diagrams together for each structure or part of structure.
 - f. Shop drawings will be reviewed for general arrangement and material specifications.
 - g. Shop drawings bearing seal and signature of a professional engineer will not be reviewed for structural adequacy.
 - h. Dimension shop drawings in units same as Contract Drawings.
- B. Informational Submittals:
- 1. Mill Certificates of tests made in accordance with ASTM A6.
 - 2. High-Strength Bolts (Plain Non-coated and Hot-Dip Galvanized):
 - a. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
 - b. Manufacturer's inspection test report results for production lot(s) furnished, to include:
 - 1) Tensile strength.
 - 2) Yield strength.
 - 3) Reduction of area.
 - 4) Elongation and hardness.
 - c. Certified Mill Test Reports for Bolts and Nuts:
 - 1) Name and address of manufacturer.
 - 2) Bolts correctly marked.
 - 3) Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.
 - 3. Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.
 - 4. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding-Quality Assurance.
 - 5. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer with description of material processed and ASTM standard used for coating.
 - 6. Diagrams/Templates: Anchor bolt diagrams and/or templates for anchor bolt locations, in accordance with installing trade's schedule requirements.

1.4 QUALITY ASSURANCE

- A. Identification:
- 1. Marking:
 - a. Heat number, producer's name or brand mark materials to comply with CAN/CSA-G40.20-M.
 - b. For member identification do not use die stamping.
 - c. Shop mark all members for fit and match.

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- d. Mark galvanized materials with a stamp or wire-on tag indicating the name of the galvanizer, the applicable code, and the weight of zinc coating.

B. Welding Qualifications: As specified in Section 05 05 23, Welding-Quality Assurance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

- 1. Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.
- 2. Deliver structural members to project Site in protective manner that snow, road salt, dirt, etc. will not cause discoloring or damage to steel protective coating.

B. Storage:

- 1. Protect structural steel members and packed materials from corrosion and deterioration.
- 2. Store in dry area and not in direct contact with ground.
- 3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.

C. Handle materials to avoid distortion or damage to members or supporting structures.

D. Use nylon or padded cables for handling galvanized steel.

PART 2 PRODUCTS

2.1 MATERIALS

A. All material shall be new and shall conform to the following:

- 1. W and H-Shapes:
 - a. ASTM A992, Grade 50 ksi, or
 - b. CAN/CSA-G40.20/G40.21 Grade 350W.
- 2. Shapes Except W and H-Shapes, Rolled plates and Bars:
 - a. CAN/CSA-G40.20/G40.21 Grade 300W.
- 3. Hollow Structural Sections (HSS): CAN/CSA-G40.20/G40.21 Grade 350W Class C.

2.2 FASTENERS

A. Adhesive Anchors:

- 1. Stainless steel, internally threaded insert.
- 2. Manufacturer and Product: Hilti HIS-R Insert with HIT HY 200 adhesive.

B. High-Strength Bolts: ASTM A325, bolt type 1, galvanized.

C. Nuts: ASTM A563, type to match bolt type and finish.

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- D. Hardened Steel Flat and Beveled Washers: ASTM F436, type to match bolt finish.
- E. Welding Electrodes: See Section 05 05 23, Welding-Quality Assurance.

2.3 FABRICATION

- A. General:
 - 1. Fabricate as shown and in accordance with CAN/CSA-S16 and CISC Code of Standard Practice for Structural Steel Buildings and Bridges.
 - 2. Columns shall be full length members without splices, unless shown otherwise.
 - 3. Mark and match mark materials for field assembly.
 - 4. Complete assembly, including bolting and welding of units, before start of finishing operations.
 - 5. Field measure before fabrication.
 - 6. Provide camber as indicated on Drawings. Shop camber to produce parabolic profile. Field camber is not allowed.
- B. Connections:
 - 1. Shop Connections: Weld or bolt.
 - 2. Meet requirements of CAN/CSA-S16.
 - 3. Meet OSHA requirements for one independent bolt at beams framing in to column web connections.
- C. Welded Construction:
 - 1. As specified in Section 05 05 23, Welding-Quality Assurance.
 - 2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.
- D. Interface With Other Work:
 - 1. Holes:
 - a. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.
 - b. Cut holes and reinforce openings only where shown.
 - c. No flame-cut holes will be permitted without prior approval of Contract Administrator. Cutting of holes in structural members in the field will not be permitted except with written approval of Contract Administrator.
 - d. Prevent accumulation of water in tubular members or enclosed sections by providing drainage holes.
- E. Galvanizing:
 - 1. Fabricate steel to be galvanized in accordance with ASTM A143, A384, and A385. Avoid fabrication techniques that could cause distortion or embrittlement of steel.
 - 2. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
 - 3. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
 - 4. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123.

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5. Hot-dip galvanize A325 bolts, nuts, washers, and hardware components in accordance with ASTM A153. Oversize holes to allow for zinc alloy growth. Shop assemble bolts, nuts, and washers with special lubricant and test in accordance with ASTM A325 and A563.
 6. Galvanize components of bolted assemblies separately before assembly.
- F. Beams:
1. Rolled sections and/or welded wide flange sections to be straight without camber, except where beams exceed 12 m in length, in which case, camber beams 3 mm per 3 m of length, unless noted on drawings.

2.4 SOURCE QUALITY CONTROL

- A. Welding:
1. Visually inspect fabrication welds as specified in Section 05 05 23, Welding-Quality Assurance.
 2. An independent testing agency will be retained by The City to perform inspection and testing of fabrication welds as specified in Section 05 05 23, Welding-Quality Assurance.
 3. Repair and retest defective welds as specified in Section 05 05 23, Welding-Quality Assurance.

PART 3 EXECUTION

3.1 ERECTION

- A. Meet requirements of CAN/CSA S16 and CISC Code of Standard Practice for Structural Steel.
- B. Install Contractor-designed temporary construction bracing to provide necessary support until components are in place and construction is complete.
- C. High-Strength Bolted Connections:
1. Tighten in accordance with CAN/CSA S16 Clause 23 Installation and Inspection of Bolted Joints.
 2. Hardened Washers:
 - a. Use beveled style and extra thickness where required by CISC Specification.
 - b. Use square or rectangular beveled washers at inner flange surfaces of Canadian Standard beams and channels.
 3. For bearing-type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.
- D. Welded Connections:
1. As specified in Section 05 05 23, Welding-Quality Assurance.
 2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

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3.2 ANCHOR BOLTS

- A. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in-place work.
- B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.
- C. Projection of anchor bolts beyond face of concrete and threaded length shall be adequate to allow for full engagement of all threads of hold-down nuts, adjustment of leveling nuts, grouts blow base plate, washer thicknesses, and construction tolerances, unless indicated otherwise.
- D. Placement Tolerances:
 - 1. As required by CAN/CSA S16, unless indicated otherwise.
 - 2. Embedded anchor bolts shall not vary from the dimensions as shown on Drawings by more than the following:
 - a. Center to center of any two bolts within an anchor group: 3 mm.
 - b. Center to center of adjacent anchor bolt groups: 6 mm.
 - c. Variation from perpendicular to theoretical bearing surface: 1:50.

3.3 FIELD ASSEMBLY

- A. Set structural frames accurately to lines and elevations shown.
- B. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.
- C. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.
- D. Level and plumb individual members of structure within tolerances shown in CAN/CSA S16 Clause 29.7 Erection Tolerances.
- E. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.
- F. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.

3.4 MISFITS AT BOLTED CONNECTIONS

- A. Where misfits in erection bolting are encountered, immediately notify Contract Administrator for approval of one of the following methods of correction:
 - 1. Ream holes that must be enlarged to admit bolts and use oversized bolts.
 - 2. Plug weld misaligned holes and redrill holes to admit standard size bolts.
 - 3. Drill additional holes in connection, conforming with CSA Standards for bolt spacing and end and edge distances, and add additional bolts.

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4. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.
5. Field weld connections to provide equivalent strength of bolts with the approval of Contract Administrator.

- B. Do not enlarge incorrectly sized or misaligned holes in members by burning or by use of drift pins.

3.5 MISFITS AT ANCHOR BOLTS

- A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.
- B. Do not flame cut to enlarge holes without prior approval of Contract Administrator.

3.6 GAS CUTTING

- A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.
- B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by Contract Administrator.
- C. Finish flame-cut sections equivalent to sheared and punched appearance.

3.7 REPAIR AND CLEANING

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.
- B. Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.
- C. Remove weld back-up bars and grind smooth.

3.8 REPAIR OF DAMAGED HOT-DIP GALVANIZED COATING

- A. Conform to ASTM A780.
- B. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
- C. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
- D. Use magnetic gauge to determine that thickness is equal to or greater than base galvanized coating.

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3.9 FIELD QUALITY CONTROL

- A. High-Strength Bolted Connections:
1. An independent testing agency will be retained by The City to perform the following inspection and testing in accordance with CAN/CSA S16:
 - a. Marking identification and conformance to ASTM standards.
 - b. Alignment of bolt holes.
 - c. Placement, type, and thickness of hardened washers.
 - d. Tightening of bolts.
 2. Bearing-Type Connections Not Fully Tensioned (N, X): Snug tight condition with plies of joint in firm contact.
 3. Fully Tensioned (FT) Bearing and Slip Critical (SC) Connections:
 - a. Conduct preinstallation test.
 - b. Monitor installation and tightening of DTIs or TC bolts.
 - c. Monitor condition of faying surfaces for slip critical connections.
 4. Preinstallation Test:
 - a. Conduct jobsite test prior to start of work using a bolt tension measuring device.
 - b. Select representative sample of not less than three bolts of each diameter, length, and grade.
 - c. Conduct test in accordance with Specification for Structural Joints Using ASTM A325 Bolts.
 5. Nondestructive Testing (NDT) Report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.
 6. Defective Connections: Correct and reinspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.
- B. Welded Connections:
1. Visually inspect field welds in accordance with Section 05 05 23, Welding-Quality Assurance.
 2. An independent testing agency will be retained by The City to perform inspection and testing of field welds as specified in Section 05 05 23, Welding-Quality Assurance.
 3. Repair and retest defective welds as specified in Section 05 05 23, Welding-Quality Assurance.

END OF SECTION