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RECORD OF REVISIONS

Rev	Date	Description	POC	RM
0	8/16/04	Initial issue.	Kelly Bingham, <i>FWO-DECS</i>	Gurinder Grewal, <i>FWO-DO</i>
1	5/18/05	Added Para. 4.1.F, added management assessments; modified 5.2.B.	Kelly Bingham, <i>ENG-DECS</i>	Gurinder Grewal, <i>ENG-CE</i>
2	2/1/06	Added weld inspection doc reqt's (5.6, 5.8, Att 3). OST became ISD 342-1.	Kelly Bingham, <i>ENG-DECS</i>	Mitch Harris, <i>ENG-DO</i>
3	5/17/06	Referred to 1-01 for roles & responsibilities (4.1.A). Modified Section 6 to Clarify requirements to procure welded items & services	Kelly Bingham, <i>ENG-DECS</i>	Mitch Harris, <i>ENG-DO</i>
4	10/27/06	Administrative changes only. Organization updates from LANS transition. IMP and ISD number changes based on Conduct of Engineering IMP 341. Other administrative changes.	Kelly Bingham FM&E-DES	Kirk Christensen CENG
5	06/06/08	Corrected audit findings in Para. 5.2.E 5.4.A & 5.12.B. For inspections, added requirements for MT&E and owner's inspector. Other minor clarifications.	Kelly Bingham ES-DE	Kirk Christensen CENG
6	11/3/08	Added stainless & nickel carbon contact requirements at Sect. 5.7	Kelly Bingham ES-DE	Kirk Christensen CENG

Contact the Welding Standards POC for upkeep, interpretation, and variance issues

Section 1-02	<u>Welding POC / Committee</u>
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GWS 1-02 ADMINISTRATIVE CONTROL OF WELDING & BRAZING

1.0 PURPOSE & SCOPE

- A. This procedure defines the administrative controls for the LANL Welding Program for compliance with engineering drawings and specifications, applicable codes and standards, and contract requirements.
- B. This procedure applies to all welding activities performed by LANL, SSS, and subcontractors at LANL as invoked by contract documents, in accordance with Reference 1.

2.0 REFERENCES

1. GWS 1-01, Introduction and Scope
2. GWS 1-03, Welding and Brazing Material Procurement and Control

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3. GWS 1-05, Welder Certification by Performance Qualification Test
4. LANL [P300](#), Integrated Work Management

3.0 ACRONYMS AND DEFINITIONS

Acronym / Term	Description
AWS-CWI	American Welding Society, Certified Welding Inspector
CM-CE	LANL's Construction Engineering Group in Construction Management Division
Codes and Standards	National consensus standards / requirements adopted by LANL for system construction and occupancy, administered for the protection of the public, worker, and environment (e.g., health, safety, and welfare. As used herein, codes include, for example, ASME, AWS, API, and AWWA standards
M&TE	Measuring and test equipment
Non-Code Welding	Welding that does not require compliance to a national consensus code, where based on the service and usage, failure of the weld or joint would not result in serious consequences or result in a safety hazard. The WPA in conjunction with the engineer-of-record for Programs and Projects is responsible for specifying non-code welds and has the option to specify the appropriate level of weld inspection.
Nondestructive Examination (NDE)	An examination process conducted to detect internal or surface defects in materials using techniques that do not damage or destroy the item being tested. The most common types of NDE are radiography (RT), ultrasonic (UT), magnetic particle (MT), and liquid penetrant (PT) methods. Depending on the applicable code, visual examination (VT) may also require control as an NDE process.
Post Weld Heat Treatment (PWHT)	The process of removing or reducing residual stresses in welds using heat applied in accordance with an approved procedure.
Project	Work to be accomplished that includes welding.
QA-IQ	IQ - Institutional Quality Management Group
Subcontractor	A legal entity that assumes by contract, obligations for delivery of a specified scope of work (product or service). As used herein, the term includes vendor, equipment vendor, fabricator, or constructor, and their sub-tier suppliers.
Welder	Within the LANL Welding Program, the term Welder also applies to welding operator, brazer, and brazing operator, as appropriate to the context of use.
WFP	Welding Fabrication Procedure (see Welding Standards, Vol. 2)
WPA	LANL Welding Program Administrator
WTS	Welding Technique Sheet (see Welding Standards, Vol. 4)

4.0 GENERAL**4.1 Roles and Responsibilities**See GWS [1-01](#).

5.0 PROCEDURE

5.1 Program Implementation

- A. Welding, nondestructive examination, and post weld heat treatment activities, including requirements for welding procedures, weld material procurement and control, and welder qualification, shall be in accordance with the LANL Welding Program, applicable codes and standards, engineering specifications, and contract requirements.
- B. ASME “Code-stamped” Vessels and Piping only: Welding activities within the scope of the ASME Boiler and Pressure Vessel Code (Section I; Section III Divisions 1, 2, or 3; Section IV; Section VIII Divisions 1, 2, or 3; or Section X) or National Board Inspection Code (NBIC) shall be accomplished in accordance with the appropriate Subcontractor’s ASME Quality System Manual and corresponding Certificate(s) of Authorization.

5.2 Welding Procedures

- A. All welding performed within the Program scope as identified in GWS 1-01 by or for LANL shall be performed using pre-qualified, qualified, or ANSI/AWS Standard Welding Procedure Specifications. The qualification of LANL welding procedures shall be in accordance with GWS 1-04, *Welding Procedure Qualification Tests and Records*, of this program.
- B. Assignment of Welding Procedure Specifications for Safety Class, Safety Significant, ML-1, and ML-2 work activities shall be approved by an AWS Certified Welding Inspector or SME authorized by the LANL WPA.

Guidance Note: Generally, a test will be administered to determine SME qualification.

- C. For all other project or program applications the responsible Manager or designated Supervisor / Engineer shall review the applicable drawings, specifications, and materials to be welded to ensure appropriate welding procedures specifications are available to cover the work. If necessary, a new welding procedure specification shall be requested in accordance with GWS 1-02, *Preparation and Control of LANL Welding Standards*, and GWS 1-04, *Welding Procedure Qualification Tests and Records*. The WPA shall be contacted to resolve welding procedure questions.
- D. Subcontractor welding procedures shall comply with requirements of GWS 1-09, *Control of Subcontracted Welding*.
- E. Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Welder Qualification/Certification records produced by LANL legacy organizations must be reviewed and approved by the LANL WPA. Once determined acceptable by the WPA, they need not be re-qualified for use within the LANL Welding Program.

5.3 Welder Performance Qualification/Certification (On-Site)

- A. All welding performed, within the scope as identified in GWS 1-01, by or for LANL, shall be performed by welders that are currently certified, having completed testing and qualification in accordance with GWS 1-05, *Welder Performance Qualification /Certification*.

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- B. Welders performing exempted (non-code) work shall pass one or more of the standard tests for the welding process(es) they use as listed in GWS 1-05, *Welder Performance Qualification / Certification* Attachment 2, Index of Qualification Tests, or as determined by the WPA.¹
- C. The responsible Manager / Supervisor / Engineer shall assure that each welder assigned to weld on a facility, project, or program has been certified in accordance with GWS 1-05, *Welder Performance Qualification / Certification*.
- D. The responsible LANL or SSS (facility, project, or program) Manager / Supervisor / Quality Assurance or Quality Control Representative shall periodically review welder certifications to ensure welders maintain their qualifications. Welders shall be re-certified as required by the applicable codes and standards and GWS 1-05, *Welder Performance Qualification / Certification* of this program.

5.4 Welder Performance Qualification/Certification (Off-Site)

- A. Off-Site Welder Performance Qualification / Certification: The subcontractor shall meet the appropriate engineering specifications, applicable codes and standards, and contract requirements. Appropriate welding requirements shall also be flowed down to sub-tier subcontractors. See GWS 1-09.

5.5 Weld Material Procurement, Receipt, Issue, and Control

- A. Procurement, receiving, issue, and control of welding materials shall be in accordance with GWS 1-03, *Welding and Brazing Material Procurement and Control*.

5.6 Field Welding Control

- A. Upon receipt of the engineering drawings and specifications the Project or SSS Manager shall issue the documents to the responsible work Supervisor / Engineer. The Supervisor / Engineer shall coordinate with the assigned project or designated quality assurance or quality control representative for preparation of Attachment 1, *Weld Tracking Chart* for welds requiring NDE or PWHT. The form shall be used for identification of the welding procedure, assignment of required inspection points, and documentation of completed welding control and inspection / NDE activities.
- B. Field drawings, sketches, isometrics, weld maps, etcetera shall be used to identify and document inspection and process control procedures and activities. Code-governed welds shall be identified with the welder's identification symbol in accordance with GWS 1-05. For welds not requiring PWHT or NDE (except VT), required inspections and process control activities shall be identified, controlled, and documented on a field drawing / sketch. Unless otherwise specified, the welder's symbol may be stenciled, stamped, or marked next to the weld or identified on documentation traceable to the weld. Weld maps or sketches, when authorized by engineering, may be used for weld traceability. Subcontractors shall be required to identify their welds in accordance with applicable code requirements and contract documents.
- C. The responsible Supervisor / Engineer shall requisition craft or Laboratory welding personnel, as necessary, and coordinate with the responsible LANL or SSS (facility, project,

¹ Ref. Lab Director desires per 6-10-2003 meeting (EMref-32), DIR-04-227 draft (EMref-35), 7/22/04 All Hands Meeting (EMref-31), and e-mails from Jim Angelo, PS-DO (EMref-34)

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- or program) QA/QC Representative, on the number of welders to be qualified, and the applications / welding processes to which the welders will be assigned.
- D. The responsible and qualified Supervisor / Engineer, AWS CWI, or WPA-qualified equivalent shall monitor weld joint fit-up, production welding activities, and PWHT operations to ensure conformance to applicable specifications and drawings.
 - E. The responsible Project representative or LANL or SSS (facility, project, or program) QA/QC Representative shall conduct inspections and verifications in support of required welding program activities. Note: Additional welding requirements may be included in the project-specific welding procedures or Welding Technique Sheets (WTS).

5.7 Controlling Contact with Stainless & Nickel Alloy Steels² (effective 2/1/09)

- A. These requirements establish a means of controlling metal-removal and handling tools in order to prevent contamination of stainless and nickel based alloy steel with other metals that would result in corrosion or other detrimental conditions.
- B. These requirements are applicable to the following:
 - 1. Files
 - 2. Burrs
 - 3. Wire brushes
 - 4. Grinding wheels (see “G” below)
 - 5. Drums
 - 6. Disks
 - 7. Saw blades
 - 8. Construction aids such as bending, clamping, lifting devices etc.
- C. Tools which have been previously used on carbon steel or aluminum shall not be used on stainless or nickel alloy steel.
- D. Prior to use, tools for stainless and nickel based alloy steel metal removal shall be permanently identified with blue color code in an area of least wear.
- E. Color-coded tools (marked blue) shall be segregated. Intermixing of blue color code tools with other tools is prohibited.
- F. Jaws of bench vises or construction aids shall be covered with suitable material to prevent cross carbon steel contamination of stainless and nickel alloy steels.
- G. Only aluminum oxide abrasive grinding wheels or engineering approved equal (color coded blue) shall be used on stainless or nickel steels.
- H. Do not use soft carbon steel tools (e.g., wire brushes) on stainless steel. Hardened steel (hammers, tool steel for machining, etc.) may be used.

Note: If it is discovered that tools previously used on carbon steel or aluminum have been used on stainless or nickel alloys the contaminated areas shall be cleaned and reworked with tools meeting these requirements.

5.8 Welding Inspection and Surveillance

- A. Visual or NDE inspection of code welds shall be performed by a LANL Approved AWS/CWI, or WPA-qualified equivalent, in accordance with specified code and standards; design documents; and GWS 1-11, *Visual Welding Inspection and NDE Qualification*.
 - a. Welding Inspections required by consensus codes and standards shall be documented.

² Similar to documented practices at other DOE sites and parent company. EMRef-57.

(reference Attachment 3: Welding Inspection Report) Welding Inspection Reports shall identify at least the following:

- i. Acceptance/rejection as based on the criteria specified by the design documents
 - ii. Code or Standard used for acceptance and class, category, or service
 - iii. Record attributes inspected and severity from 0 to 4 (0= none, 1= trace, 2= minor, 3= marginal, 4= rejectable)
 - iv. Identification and location of welds inspected
 - v. MT&E – Identification and date of calibration expiration for measuring and test equipment used
 - vi. Name & Date of person who performed the inspection
 - vii. Inspector's qualification level
- B. Non-Code: Visual examinations of non-code welds may be performed by the welder or responsible supervisor. Verification and close-out of non-code welding packages may be by the welding foreman or responsible supervisor.
- a. Welding Inspections, when required, shall be documented. (reference Attachment 3: Welding Inspection Report) Welding Inspection Reports shall identify at least the following:
 - i. Acceptance/rejection as based on the criteria specified by the design documents
 - ii. Criteria used for acceptance
 - iii. Record attributes inspected and severity from 0 to 4 (0=none, 1= trace, 2= minor, 3= marginal, 4= rejectable)
 - iv. Identification and location of welds inspected
 - v. Name & Date of person who performed the inspection
 - vi. Inspectors qualification level
- C. NDE: Nondestructive examination of welds shall be performed in accordance with Subsection 5.8.

5.9 Owners Inspector

When applicable codes or standards require or allow that work be inspected by an owner's representative:

- A. LANL will act for DOE to authorize/provide Owners inspectors or representatives.
- B. When the applicable code requires owner inspection the required inspections shall be completed and documented
- C. When the applicable code or standard provides an option for owners inspection, the requirement for and the type and extent of owner inspection will be made by the LANL
- D. At LANLs discretion, LANL inspectors may serve as both the manufacturer/fabricator examiner and owners inspector

Guidance Note: Some Codes (example AWS D1.1) require that if Para. 5.8.D is exercised it must be invoked by contract with the manufacture/fabricator

- E. Owner inspectors or representative personnel shall be qualified & approved by CM-CE.

Guidance Note: See GWS [1-11](#) Para 5.3 regarding Inspector Qualifications.

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- F. Inspections shall be performed and documented as required by applicable code or design and CM-CE procedures.

See GWS 1-02 [Attachment 4 - Owners Inspection Requirements by Code and Standard](#) for listing of codes and standards that may require two levels of inspection.

5.10 Welding Documentation

- A. The following documentation, when completed, shall be forwarded to the responsible Facility / Program / Project or SSS, QA/QC Representative for review and acceptance. Records shall be maintained by appropriate and authorized project management.
- Copies of Welding Procedure Specifications or Weld Technique Sheets.
 - Weld Data Records / Field Drawings / Sketches / Weld Maps
 - Welding inspection records
 - NDE records, including radiographs
 - PWHT records
 - Weld Tracking Charts (Attachment 1)
- Guidance Note: Welder Qualification/Certification Records and original WPSs, WFPs, and/or WTSs are maintained by the WPA.*
- B. Upon Facility / Program / Project or SSS, QA/QC acceptance, completed welding documentation shall be forwarded to the responsible Facility, Project, or Program Manager for retention in accordance with LANL or SSS records management requirements.
- C. Subcontractor welding records shall be processed in accordance with contract requirements. As a minimum, the records required by this procedure, or equivalent documentation from the subcontractor's program, shall be required.
- D. Welding documentation may be maintained in hard copy and or electronic format. Records shall include the minimum information required by procedure, and shall be identifiable, legible, and retrievable.

5.11 Nondestructive Examination (NDE)

- A. The responsible and qualified Facility / Program / Project or SSS, QA/QC Representative shall monitor the performance of NDE to ensure compliance with engineering requirements and applicable codes and standards. NDE controls shall include reviews to ensure the following.
1. NDE equipment is correct, functional, appropriately calibrated and NRTL (Nationally Recognized Testing Laboratory) listed or approved by an ESO if not NRTL listed.
 2. Radioactive materials licenses and registrations for proposed radiation producing devices are correct and current.
 3. Performance of NDE at the work site is correct, complete and safe in accordance with applicable codes, standards and engineering specifications.
 4. Correct use of barricades, warning signs and radiation monitoring devices during field radiographic operations.
 5. Records of Welding Inspection are documented and identify the following:

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- i. Acceptance/rejection based on the criteria specified by the design documents
 - ii. Code or Standard used for acceptance and class, category, or service
 - iii. Record attributes inspected and severity from 0 to 4 (0=none, 1= trace, 2= minor, 3= marginal, 4=rejectable)
 - iv. Identification and location of welds inspected
 - v. MT&E – Identification and date of calibration expiration for equipment used
 - vi. Name & Date of person who performed the inspection
 - vii. Inspectors qualification level
- B. Personnel performing and interpreting NDE results shall be qualified and certified as Level II or Level III (SNT-TC-1A or CP-189) in the appropriate NDE method.
- C. NDE subcontractors shall be approved in accordance with LANL procurement procedures prior to the start of NDE activities. As a minimum, NDE subcontractors shall have an approved procedure (written practice) for qualification and certification of NDE personnel in accordance with the American Society for Nondestructive Testing (ASNT) SNT-TC-1A or CP-189 document, as required by the code of construction. Subcontractor NDE procedures and personnel qualification records shall be forwarded to the LANL WPA for retention in LANL files.
- D. The responsible and qualified Facility / Program / Project or SSS, QA/QC Representative shall review NDE reports and radiographic film interpretations for acceptance. Review shall ensure that reports, radiographic film quality, and final weld quality meet the requirements of the specification and the applicable code. Radiographic film should be stored in accordance with Attachment 2 where applicable.
- E. The responsible and qualified Facility / Program/Project or SSS, QA/QC Representative shall track weld reject rates. Weld reject rates shall be calculated based on linear inches of weld radiographed and rejected unless other methods of calculation are required by the specification or contract. Reports shall be distributed to the effected Project/Program or Facility Manager for action as may be appropriate.

5.12 Post Weld Heat Treatment

- A. Post weld heat treatment operations at LANL shall be performed in accordance with engineering specifications; applicable codes and standards; and GWS 1-08, *Post Weld Heat Treatment*.

5.13 Welding/Brazing and Thermal Cutting Safety & Training (On-Site)

- A. All onsite welding, brazing, and thermal cutting is subject to the requirements of Welding, Cutting and other Spark or Flame-Producing Operations as delineated in LIR 402-840-01.
- B. Personnel performing and supporting welding, brazing, or thermal-cutting activities shall have completed the required training plans as listed in GWS 1-03 Para. 5.5.A.1 and 5.6.E; GWS 1-05 Para. 4.1.E; and GWS 1-10, Para. 6.1.E and Attachment 2, Requirements Matrix for Welding Training.

6.0 PROCUREMENT OF WELDED ITEMS

- A. When the safety of LANL personnel, the public, or the environment are potentially at risk from a weld failure, the requester is responsible for ensuring that the procurement specification includes the necessary provisions to ensure welding offsite and onsite welding is performed properly.
- B. Requestor must follow LANL requirements for quality procurement – i.e., fill-out and attach a Procurement Quality Assurance Requirements Form [838c](#) and check the Special Processes box under Certification and Documentation. Depending on the complexity and importance, also check other applicable boxes and specify requirements. These may include requirements stating the applicable design, code, or standard (e.g., AWS, ASME B & PV Code, ASME B31 series, API, AWWA, etc.) and ensuring use of qualified procedures and personnel using controlled filler material, and having necessary inspection by qualified personnel or independent third-party personnel.
- C. Safety Class, Safety Significant, ML-1, and ML-2 items typically require use of suppliers from the IQ-PQ Institutional Evaluated Supplier List ([IESL](#)) and/or use of a commercial grade dedication process (e.g. ISD330-10).
- D. Refer to [P840-1](#), Procurement Quality, for more information on procurement.
- E. See also GWS 1-09 for subcontracted/procured welding.
- F. *Guidance: Assistance with welding and inspection specification is available from ES-DE and the LANL WPA.*

7.0 ATTACHMENTS

Attachment 1: Weld Tracking Chart

Attachment 2: Recommended Practice for Storage of Processed Radiographic Film

Attachment 3: Weld Inspection Record

Attachment 4: Required Owner Inspections by Code and Standard