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RECORD OF REVISIONS

Rev	Date	Description	POC	OIC
0	8/16/04	Initial issue.	Kelly Bingham, <i>FWO-DECS</i>	Gurinder Grewal, <i>FWO-DO</i>
1	5/18/05	Modified 1.0.B & 5.2.1.e; added bullet 6 under Para. 1.0.E.2, clarified 5.2.A and 5.2.1.e, added 5.2.1 f & g, other minor editorial changes.	Kelly Bingham, <i>ENG-DECS</i>	Gurinder Grewal, <i>ENG-CE</i>
2	5/17/06	Modified purpose & scope to clarify application to subcontracted welding; modified exclusions listing.	Kelly Bingham, <i>ENG-DECS</i>	Mitch Harris, <i>ENG-DO</i>
3	10/27/06	Administrative changes only. Organization updates from LANS transition. IMP and ISD number changes based on new Conduct of Engineering IMP 341. Other administrative changes.	Kelly Bingham, <i>FM&E-DES</i>	Kirk Christensen, <i>CENG</i>

**CONTACT THE WELDING STANDARDS POC
for upkeep, interpretation, and variance issues**

GWS 1-01	<u>Welding POC / Committee</u>
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GWS 1-01 INTRODUCTION AND SCOPE

1.0 PURPOSE AND SCOPE

- A. The purpose of the LANL Welding Program (Chapter 13) as described herein is to establish and identify welding and joining requirements and criterion for welding and joining activities (programmatic and facility) performed by or for the Laboratory on site, including those activities performed by subcontractors, including but not limited to SSS, facility, project, program, and other sub-contracted welding operations. Requirements for purchase of offsite welded items or services are also addressed in GWS 1-02 (*Para. 6.0.B*) & GWS 1-09 (*Para. 4.1.C*).
- B. The LANL Welding Program addresses the following criteria¹:
1. Appropriate design of welded structures, systems, and components (SSC). This is accomplished by application of other appropriate Chapters of the LANL Engineering Standards Manual.
 2. Welding and brazing performed by or for LANL, SSS, and subcontractors shall be performed to properly qualified and approved procedures.
 3. Joining (solvent bonding, adhesive, and electro-fusion joints): When required by consensus codes and standards (e.g., ASME B31.3 & 49 CFR Part 192), joining shall be done by qualified personnel following approved procedures.²
 4. Welding and brazing performed by or for LANL, SSS, and subcontractors shall be performed by certified welders who have demonstrated their welding qualifications by test.
 5. Consumable welding materials shall be properly procured, received, stored, controlled, and issued to ensure weld quality and prevent use by unqualified personnel.
 6. Welding inspection shall be done in accordance with applicable national consensus codes and standards as identified in the Welding Program and project design documents, or as otherwise specified in the absence of applicable codes and standards.
- C. The Scope of LANL's Welding Program provides administrative, engineering, technical, and process controls for welding and brazing activities performed by or for LANL, except as noted in Section 5.2, Exclusions and 5.3 Exemptions.
- D. Subcontractor Welding
1. Onsite: Subcontractors employed by or for LANL shall be required in contract documents to comply with the applicable requirements of this program. This is intended to include full participation in the LANL Welding Program.³
 2. Off-Site: Requirements for Subcontracted Welding shall be identified in contract documents as outlined in GWS 1-09, *Control of Subcontracted Welding*.

¹ Criteria from 10 CFR 830.122, DOE Order 414.1C, ASME B&PVC, AWS Structural Welding Codes and API - 1104

² Ref ASME/ANSI B31.3, Ch 7, Para. 328 and its sub-paragraphs and 49 CFR Part 192 - 273, 281, 283, 285, 287 re Transportation of Natural and other Gas by Pipeline

³ In 2004/2005 this Program superseded the corresponding LANL KSL Support Services Subcontractor Welding Program elements as of the effective date of each original (Rev 0) LANL GWS section.

- As a minimum, contract documents shall identify applicable consensus codes and standards when they apply.
3. Only subcontractors with the applicable ASME or National Board Certificate(s) of Authorization⁴ shall perform welding on pressure-retaining code-stamped items after their welding program has been reviewed and accepted by the LANL WPA.
- E. For welding activities that would normally fall outside the defined scope of specified national consensus codes and standards for fabrication and welding, such codes and standards shall be adopted and used to the extent possible.⁵ The WPA shall have the authority to determine applicability of codes in these cases.
1. Applications that are similar to those included in specified national codes and standards shall utilize such codes and standards (and corresponding LANL welding standards) as if they applied.
 2. Applications that are not similar in materials or processes to a specified Code or Standard shall define and produce the following:
 - Design basis; i.e., mechanical properties, part geometry, acceptance criteria.
 - A method to verify that the welding procedure can produce acceptable welds
 - A method to demonstrate that the welder has the skill to produce sound welds in accordance with the specified welding procedure (reference GWS 1-02, *Administrative Control of Welding and Brazing, para 5.3.B*)
 - If filler material is used, procure and control filler materials per GWS 1-03
 - Identify methods and perform inspections, required to judge welds against predetermined acceptance criteria.
 - Provide documentation that these objectives have been defined and identified.
 3. *Guidance: National codes and standards controlling welding were available from the LANL intranet (inside firewall) from the Research Library's Information Handling Services subscription at time of writing at <http://lib-www.lanl.gov/infores/stand/ihs/index.htm> . This included AWS and ASME B31 series piping codes and ASME B&PV Code. It did not include all the API and AWWA standards at writing; contact WPA.*

2.0 REFERENCES

None

⁴ Certificate holders are organizations that have been authorized by the ASME to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code.

⁵ LANL Director expectations stated in 6-10-2003 Meeting (EMRef-32); 10CFR851 Worker Safety and Health App A Sect. 4; and DOE Order 440.1A, Worker Protection Management for DOE Federal and Contractor Employees, Attachment 2 Paragraph 20.c. Also, adaptation of existing standards is usually more cost effective than development of new procedures, specs, and inspection criteria. NOTE: EMRef is a Standards Program cataloging system for hard-to-find references.

3.0 ACRONYMS AND DEFINITIONS

Acronym/Term	Description
AHJ	Authority having jurisdiction
AWS CWI	American Welding Society, Certified Welding Inspector
C of C	Certificate of Compliance
CMTR	Certified Material Test Report
ESM	LANL Engineering Standards Manual
Facility	<p>Normally at LANL, facility is a synonym for Real Property and Installed Equipment. RP&IE is the land, improvements on the land such as buildings, roads, fences, bridges, and utility systems and the equipment installed as part of the basic building construction that is essential to normal functioning of a building space, such as plumbing, electrical and mechanical systems. This property/equipment is also referred to as institutional or plant and was formerly known as Class A. [from DOE Order 4330.4B]</p> <p>In the context of this chapter's nuclear-applicable sections, facility refers to the definition of nuclear facility in 10 CFR 830 and includes process (programmatic) systems and activities.</p>
GWS	General Welding Standards
hazard category	The DOE-STD-1027 category as defined by LIR 300-00-05, <i>Facility Hazard Classification</i> . http://labreq.lanl.gov/pdfs/ops/01_operations/lir3000005.pdf <i>Guidance: Nuclear facilities will be Cat 1, 2, 3, or Radiological; non-nuclear facilities are Category A, B, or C (becoming High, Medium, and Low).</i>
IWD	Integrated Work Document, a work management tool per IMP 300.2
LIR	Laboratory implementation requirements.
ML	Management level, defined in LIR 230-01-02, Graded Approach for Facility Work (or Programmatic equivalent). http://labreq.lanl.gov/pdfs/ops/01_operations/lir2300102.pdf . <i>Guidance: Related LIG: http://labreq.lanl.gov/pdfs/ops/01_operations/lig2300102.pdf</i>
POC	Point of contact. For the ESM discipline POCs see http://engstandards.lanl.gov/engrman/HTML/poc_techcom1.htm
PQR	Procedure Qualification Records
Program/ Programmatic/ PP&PE	A synonym for Personal Property and Programmatic Equipment. PP&PE is equipment used purely for programmatic purposes, such as reactors, accelerator machinery, chemical processing lines, lasers, computers, machine tools, etc., and the support equipment dedicated to the programmatic purpose. This property/equipment is also referred to as organizational, research, production, operating or process and was formerly known as Class B. [DOE Order 4330.4B]
QA-IQ	LANL Quality Assurance – Institutional Quality Group (QA-IQ); became a group in the Quality Assurance Division June 1, 2006.

Acronym/Term	Description
Safety Class (SC) SSC	<i>Safety class structures, systems, and components</i> means the structures, systems, or components, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses. [10 CFR 830: § 830.3 Definitions.]
SSC	Structures, systems, and components.
SSS	Support Services Subcontractor
WFP	Welding Fabrication Procedure
WMR	Weld Material Requisition
WPA	[LANL] Welding Program Administrator
WPS	Welding Procedure Specification
WTS	Welding Technique Sheet

NOTE: The terms WPS, welding, WTS, and WFP as used throughout the LANL Welding Program also apply to brazing, bonding, and related procedures unless noted otherwise. In addition, use of the terms “Welder” and “Welding Operator” also apply to “Brazer,” “Bonder,” and “Brazing Operator” where applicable.

4.0 GENERAL

4.1 Roles and Responsibilities

- A. The **LANL Engineering Standards Manager** is responsible for development of the engineering, technical administration and distribution of the LANL Welding Standards in accordance with engineering specifications, national codes and standards, state or local regulatory standards as deemed pertinent, and this program manual.
- B. The **LANL Welding Program Administrator (WPA)** is responsible for assisting the engineer-of-record in establishing welding and inspection requirements in engineering drawings and specifications, consistent with systems safety criteria, applicable codes and standards, and requirements of the LANL Welding Program and to provide technical assistance to departments in procurement, storage, issue and control of consumable welding materials filler materials..
- C. **Institutional Quality Management** is responsible for auditing activities performed in accordance with the LANL Welding Program for compliance with applicable requirements.
- D. **SSS** is responsible for providing resources, facilities, and support activities for implementation of the LANL Welding Program, as directed by the LANL WPA. The **SSS, or subcontractor** assigned supervisor is responsible for implementation of welding activities, including identification of required WPS, WFP, and WTS for performance of the work.
- E. **Facility, project, program, and SSS management and supervision** have overall responsibility to implement and enforce the requirements of this program within their respective areas of responsibility. They shall have the responsibility, authority, and organizational freedom to identify welding-related problems and to initiate and verify corrective action. Welding problems that cannot be resolved by the affected parties and/or LANL

- Welding Program Administrator shall be brought to the attention of the Division Leader for resolution. Control welding by using the IWD⁶ process for all onsite welding activities. Additional details are outlined in GWS 1-03 (*Section 5.5*).
- F. The LANL WPA's Division (Facility Management and Engineering and successors) is responsible for management self-assessments of the LANL Welding Program; these will be conducted biennially following the Division Quality Assurance Plan, e.g., [PLAN-ENG-101](#).

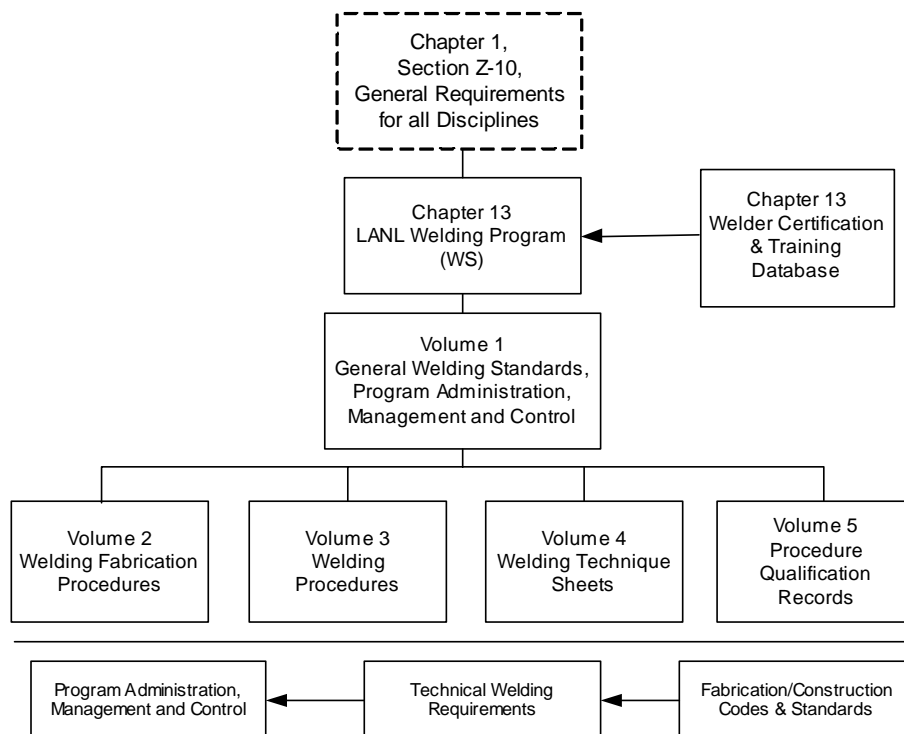
5.0 PROCEDURE

5.1 General

- A. The LANL Welding Standards are comprised of Volumes 1 through 5, as follows:
- **Volume 1 - General Welding Standards (GWS):** provide the administrative controls for development and implementation of the LANL Welding Program. GWSs describe the overall administrative requirements to evaluate, formulate, implement, develop, test, and maintain written procedures and provide technical assistance for all welding and brazing activities performed by or for LANL.
 - **Volume 2 - Welding Fabrication Procedures (WFP):** prepared to provide guidance for the welder and acceptance criteria for production welds to specific code requirements.
 - **Volume 3 - Welding Procedure Specifications (WPS):** contain engineering and technical welding requirements written to specific fabrication and construction standards -- e.g., ASME, AWS, and API.
 - **Volume 4 - Welding Technique Sheets (WTS):** contain job-specific controls for welding applications that are SC, SS, ML-1, or ML-2; or to limit procedure variables based on desired characteristics such as weld sequencing, profiles, finishes, etc.
 - **Volume 5 - Procedure Qualification Records (PQR):** records of welding data used when welding a test coupon and which identify the essential, supplementary essential, and non-essential variables recorded during the welding of the test coupon and the destructive or nondestructive test results of tested specimens.

⁶ This approach was directed by the LANL Director June 10, 2004 in a meeting at the Welding School (EMref-32), and reiterated in his 7/22/04 All Hands Meeting (EMref-31). EMRef is a Standards Program cataloging system for hard-to-find references.

B. The hierarchy and the organization of the ESM for this chapter is depicted below:



5.2 Exclusions

A. The Welding Program excluded activities do not require a Welding Procedure Specification or WFP-driven inspections, but do require an IWD, basic welder qualifications, and control of filler material to meet the intent of the requirements in GWS 1-03 to prevent uncontrolled access to and cross-contamination of material. Neither the Welding Checklist nor the CWI signature is required, though use of the checklist is recommended.⁷

1. Exclusions include:

- a. Weapons components (diamond-stamped/War Reserve parts or prototypes of such parts that fall within the scope of QC-1).
- b. Training and qualification coupons; coupons shall be controlled and disposed of after training is complete; they shall not be used for any useful function other than training.
- c. Process development coupons/parts; coupons/parts shall be controlled and shall not be used for any useful function other than process development.
- d. Other items, fabrications, or components not covered by the LANL Engineering Standards, other LANL mandates, or DOE Orders and whose failure would not cause personnel injury or major expense. This includes the following items:
 - Electrical motor repair - brazing or welding

⁷ Reference desires of LANL Director: 6-10-2004 meeting (EMref-32), DIR-04-227 draft (EMref-35); All Hands Meeting 7/22/04 (EMRef-31), and e-mails from Jim Angelo, PS DL (EMref-34)

- Fence posts, gates or utility access covers - Unless required by security
 - Guardrails and handrails protecting stumbles, plus falls less than 30 inches⁸
 - Gutters and down spouts
 - Machine shop temporary hold-down welds
 - Mobile earthmoving equipment hard surfacing or buildup (e.g., buckets and blades)
 - Soft soldering (under 840 degrees F)
 - Target repair at shooting range (PTLA)
 - Temporary welds/installations - Concrete forms or tie-rods only
 - Thermocouple wire connections
 - Tool repair - brazing or welding
 - Vehicle body work and exhaust systems
- e. Welders shall have requisite skill and use appropriate filler materials and processes when welding excluded activities. The Welder's supervisor shall determine if the welder has requisite skill.

NOTE:

Filler material used for Excluded and Exempted activities must be physically secured and controlled to prevent cross-contamination with other welding tasks.

Filler material must only be issued to personnel authorized by their supervisor.

It is recommended that filler materials used for Excluded and Exempted activities be procured, controlled and issued using the process outlined in GWS 1-03 (*Para. 5.5*).

5.3 Exemptions

- A. In addition to the exclusions above, exemptions may be granted by the WPA as determined by documenting and completion of the Partial Exemption Process using the procedure, flow chart, and form in Attachment 1.
- B. Attachment 1 may be modified or withdrawn at the discretion of the WPA and Standards Manager (does not require Standards Board approval).

5.4 Welding Program Elements

- A. The LANL Welding Program defined herein incorporates the following:
 - 1. Development and processing of Welding and Brazing Procedure Specifications (WPS/BPS).
 - 2. Development and processing of Welding Procedure Qualification Tests and Record (WPQT and PQR).
- B. Development and processing of code-specific Welding Fabrication Procedures (WFP).
- C. Development and processing of Welding Technique Sheets (WTS) for specific welding techniques and process control.

⁸ IBC-2003 requires guards for heights above 30"; presumably, falls of less distance would likely not cause severe injury, and failure is also unlikely.

- D. Welder Certification by Performance Qualification Testing (WPQT), and maintenance of qualification records.
- E. Personnel training including skills and upgrading.
- F. Weld material procurement and control.
- G. Material specifications.
- H. Weld joint design.
- I. Administrative control of welding, including control of subcontractor welding activities.
- J. Visual weld inspection criteria and acceptance standards.
- K. Nondestructive examination requirements and applications.
- L. Each section of the Program is designed to be used in support of, or in conjunction with, the applicable Welding Fabrication Procedures (WFP), Welding Technique Sheets (WTS), or Welder Performance Qualification Test (WPQT).
- M. Each section of the General Welding Standards (GWS) is provided with a statement of purpose, scope, and responsibilities.
- N. These Standards contain general welding and fabrication references and guides as well as specific engineering and technical information regarding Welding Procedure Specifications (WPS), Welding Fabrication Procedures (WFP), Welding Technique Sheets (WQT), Welder Certification by Performance Qualification Tests (WPQT), Weld and Brazing Material Procurement and Control, Weld Joint Design, Post Weld Heat Treatment (PWHT), Welder Training and Testing, weld acceptance criteria, and applicability of codes and standards.
- O. Should there appear to be a conflict between any section of the Standards and other governing criteria regarding specific technical or engineering requirements, the most stringent shall apply, unless specifically clarified by the WPA. All such conflicts shall be brought to the attention of the WPA for resolution. See also ESM Chapter 1 Section Z10 on conflicts.

6.0 ATTACHMENTS

ATTACHMENT 1: PARTIAL EXEMPTION PROCESS

Exhibit A: Welding Program Exemption Process Flow Guide

Exhibit B: Request for Partial Exemption