

Engineering Division Welding Procedure

1.0 Purpose

To ensure appropriate controls are identified and maintained such that the Engineering Division's mission to produce welded fabrications that meet or exceed project specifications as well as applicable codes and standards is fulfilled.

This is accomplished through proper engineering of fabrications including materials, design and weld joint risk assessment, the employment of qualified welding procedures, qualified and authorized welding operators, appropriate weld inspection activities and the production and maintenance of records establishing that applicable codes and standards have been met.

2.0 Revision History

Revision Number	Date	Description

3.0 Persons Affected

Applies to all Engineering Division personnel involved in the engineering, design, specification and/or fabrication of welded components and assemblies.

4.0 Policy

Assures compliance with LBNL Publication 3000 – Chapter 33, Welding, Joining and Thermal Cutting Policy

5.0 Definitions

- ANSI – American National Standards Institute
- API – American Petroleum Institute
- ASME – American Society of Mechanical Engineers
- Authorized Welding Operator – A “Qualified” Welding Operator whom is specifically authorized by the Engineering Division to perform specific types of welding operations
- AWS – American Welding Society
- Designated Weld Joint Risk Assessor – Person authorized by the Engineering Division Deputy Director for Mechanical Engineering to assess weld joints and assign risk categories to them based on engineering, design, service environment and applicable codes and standards.

- LBNL Qualified Welding Operator – One qualified to perform Negligible and/or Low Risk weld joints through a combination of one or more of the following:
 - Education
 - Work experience
 - On the job training
 - Successful completion of mock-up weld joints
- National Consensus Code Qualified Welding Operator - One holding current AWS, API and/or ASME welding qualification documents in specific welding operations
- Qualified Welding Procedure – A written procedure that describes the various elements of specific National Consensus Code-bound welding procedures
- Standard Welding Procedure – A written procedure that describes the various elements of welding procedures not governed by National Consensus Codes
- Welding Operator – “Qualified” and “Authorized” Welders by craft as well as those performing welding work incidental to their craft

6.0 Responsibilities

- 6.1 It is the responsibility of the Engineering Division Deputy Director for Mechanical Engineering to assure compliance with this procedure.
- 6.2 It is the responsibility of the Designated Weld Joint Risk Assessors to assure each weld joint is assessed and assigned a risk category.
- 6.3 Engineering Division Technical Managers are responsible for ensuring weld joints are produced to specifications provided.
- 6.4 Engineering Division Welding Operators are expected only to weld joints for which they are qualified and authorized as well as to produce fabrications that meet or exceed the specifications of the requestor.

7.0 Procedures

7.1 Weld Joint Risk Assessor Qualification

- 7.1.1** Weld Joint Risk Assessors are qualified to assess weld joints and assign weld joint risk categories based on weld joint service environment and applicable codes and standards, using a tiered system that includes one or more of the following criterion:
- Education and formal training
 - Work experience
 - On the job training
 - Holding current Professional Engineer’s License

7.2 Weld Joint Risk Assessor Authorization

- 7.2.1** Authorized Weld Joint Risk Assessors are designated by the Engineering Division Deputy Director for Mechanical Engineering based on qualifications (above 7.1.1),

7.3 Weld-Joint Risk Assessment

- 7.3.1** All Engineering Division generated weld joints shall be assessed by a Designated Weld Joint Risk Assessor with consideration given for the type of weld joint, it's service environment, the risk of failure and adherence to applicable codes and standards.
- 7.3.2** For non-Engineering Division generated welding work, the division making the request is responsible for providing weld joint risk category assessments for each joint requested.
- 7.3.2.1** Engineering Division Designated Weld Joint Risk Assessors may be available to assist those requestors lacking Authorized Weld Joint Risk Assessors

7.4 Welding Operator Qualification

- 7.4.1** Welding Operators are qualified to perform specific weld joint types of specific weld joint risk categories using a tiered system that includes one or more of the following criterion:
- Completion of all required safety training
 - Education and formal training
 - Work experience
 - On the job training
 - Successful completion of mock-ups or actual work projects that are subsequently inspected for weld-joint quality as appropriate for the service environment and risk category of a given joint or joints
 - Holding current National Consensus Code welder qualification documentation

7.5 Welding Operations

- 7.5.1** All Engineering Division welding operations shall be Authorized by a competent Authority and performed by "Qualified" Welding Operators.
- 7.5.2** Upon determination of either negligible or low weld-joint risk assessment, that work may be performed by any Engineering Division Authorized Welding Operator working under Standard Welding Procedures for which they are Qualified.
- 7.5.3** Upon identification of medium and/or high weld-joint risk assessment, that work will be performed only by National Consensus Code Qualified Welding Operators working under qualified welding procedures.
- 7.5.3.1** National Consensus Code-bound welding work will be performed only by Welding Operators holding current National Consensus Code Qualification documentation

7.5.3.2 Welding work governed National Consensus Codes and performed by LBNL personnel is restricted to the type of welding specified in the National Consensus Code Qualification documents held by the Welding Operator. No other code-bound work will be performed.

7.6 Materials

7.6.1 Where required by code or by weld-joint risk category assignment, certified parent materials will be used.

7.6.1.1 Maintenance of parent materials certification records will be the responsibility of the requestor.

7.6.2 Where required by code or by weld-joint risk category assignment, certified weld filler materials will be used.

7.6.2.1 Maintenance of weld filler certification records will be the responsibility of the requestor.

7.6.3 Where required by code or by weld-joint risk category assignment, certified weld shielding gases will be used.

7.6.3.1 Maintenance of weld shielding gases records will be the responsibility of the requestor.

7.6.4 Purchased weld filler material is inspected to verify type, size and quantity match the requisition prior to storage or usage.

7.6.5 Engineering Division stores weld filler rods for welding areas in a manner designed to maintain the integrity of the material. Typical weld filler materials stored and used are: 7018, and 6010 and 308 electrodes as well as standard weld filler rod for GTAW welding of aluminum, stainless steel, titanium, tantalum, molybdenum and copper.

7.7 Quality Control

7.7.1 Welded joints and assemblies shall undergo quality control measures using a tiered system based on weld joint service environment, weld joint risk category and applicable codes and standards. Inspection activities shall comprise one or more of the following criterion:

- Visual inspection
- Vacuum leak rate testing
- Non-destructive testing (X-ray, ultrasound, etc.)
- Destructive testing of sample joints (controlled bending and breaking of joints)
- Employment of certified welding inspectors
- Employment of certified weld inspection laboratories

7.8 Prohibited Welding Operations

7.8.1 The LBNL Engineering Division does not perform welding on Safety Class (SC), Safety Significant (SS) or Vital Safety Systems (VSS), Structures, Systems and Components (SSC) as identified by

current Quality Assurance Programs (ref. 10 CFR 830 Subpart A and DOE Orders 414.1B, Quality Assurance).

7.9 Document Control

- 7.9.1** A record of currently LBNL and National Consensus Code Qualified Welding Operators and the procedures and weld joint risk categories for which they are qualified to perform will be maintained by the Engineering Division
- 7.9.2** A record of all Standard and Qualified welding procedures will be maintained by the Engineering Division
- 7.9.3** A record of current National Consensus Code Welder Qualification documents will be maintained by the Engineering Division
- 7.9.4** A record of current Designated Weld Joint Risk Assessors and the weld risk categories they are authorized to assess will be maintained by the Engineering Division

7.10 Procured Welding

- 7.10.1** In the event that National Consensus Code-bound welding is requested and the Engineering Division accepts to subcontract the work, the vendor shall be required to provide all applicable certification, inspection and testing documentation.
- 7.10.2** All such documentation will be delivered to and become the responsibility of the requestor.

7.11 Safety Requirements

- 7.11.1** Safety permitting protocol, training, procedures and documents for welding activities include:
 - Hot Work Permits
 - Confined Space Entry Permits
 - Radiological Work Permits
- 7.11.2** Additional safety and PPE requirements for eye protection, head protection, protective clothing, respiratory protection, and hearing protection are addressed separately in specific EHS programs: PPE, Respiratory Protection, and Hearing Conservation. Typical controls and personal protective equipment used are appropriate open ventilation, HEPA filtered and non-filtered local exhaust, weld rated lenses for eye protection, safety glasses, leather gloves, leathers, ear protection, respiratory protection, weld hoods/face shield and weld blind screens as necessary.
- 7.11.3** Records of assessments for special safety requirements and their monitoring data are tracked in an electronic EH&S database. For each monitored project, a full description of the hazard, controls, employee name, similar exposure group (SEG), PPE, and results of monitoring is recorded in this database. The applicable exposure

limit, regulatory source of that limit, measured result, and notation of any exceedance is included.

7.11.4 All LBNL Engineering Division qualified and authorized welding operators complete appropriate EH&S training courses. Required training classes specific to the most common hazards encountered in welding activities include:

- Compressed Gas and Cryogen Safety (EHS0231)
- Confined Space Hazards (EHS0275)
- Hot Work Permit Training (EHS0535)
- Fire Extinguisher Safety (EHS0530)
- Fire Extinguisher Safety Retraining (EHS0531)
- Lead Hazard Awareness Training (EHS0330)
- Respirator Training (EHS0310)

7.11.5 Required EHS training for all employees is specified by completion of and minimum annual review/update of a Job Hazard Analysis. Training documentation is maintained in a database, with electronic re-training reminders sent to employees and supervisors.

Rev No.	Approver Title	Approver Signature	Date
V1.0	Mech. Engn. Department Head	_____	_____

References

- 1) PUB 3000 – Chapter 33 Welding Joining and Thermal Cutting
- 2) PUB 3000 – Chapter 12 Fire Prevention and Protection
- 3) EHS0535 – Hot Work Permits
- 4) PUB 3000– Chapter 4 Industrial Hygiene
- 5) PUB 3000– Chapter 21 Radiation Safety
- 6) PUB 3000– Chapter 19 Personnel Protective Equipment
- 7) 29 CFR 1910.252, Welding, Cutting, and Brazing
- 8) 8 California Code of Regulations (CCR) Article 90, Electrical Welding, Cutting and Heating
- 9) DOE Order 420.1, Facility Safety
- 10) DOE Order 440.1, Worker Protection Management for DOE Federal and Contractor Employees
- 11) NFPA Standard 51B, Fire Prevention in Use of Cutting and Welding Processes
- 12) American National Standards Institute (ANSI) Standards Z49.1, Safety in Welding, Cutting and Allied Processes
- 13) Implementation Guide to DOE Orders 420.1 and 440.1, Fire Safety Program
- 14) Energy Facility Contractors Group Contactor Alert on Potential Welding Program Issues
- 15) American Society of Mechanical Engineers (ASME)
- 16) American Welding Society (AWS)