

AWS C7.4/C7.4M:2008
An American National Standard

Process Specification and Operator Qualification for Laser Beam Welding



American Welding Society



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Process Specification and Operator Qualification for Laser Beam Welding

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Prepared by the
American Welding Society (AWS) C7 Committee on High Energy Beam Welding and Cutting

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification on laser beam welding discusses applicable specifications, safety, requirements, fabrication, quality examination, equipment calibration and maintenance, approval of work, and delivery of work.



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Foreword

This foreword is not part of AWS C7.4/C7.4M:2008, *Process Specification and Operator Qualification for Laser Beam Welding*, but is included for informational purposes only.

The first practical demonstration of a laser occurred in 1960. As laser output power increased through maturing technology, the use of lasers for material processing became widespread by the early 1970s. Currently, lasers are an accepted industrial tool for traditional and nontraditional materials processing operations that benefit from the laser's unique characteristics. While the materials processing applications of lasers in industry are diverse, this document focuses on the process specification and operator qualification.

The data contained in this *Process Specification and Operator Qualification for Laser Beam Welding* has been compiled and reviewed by the C7C Laser Beam Welding and Cutting Subcommittee of the American Welding Society, which includes representatives from manufacturers and users of laser beam welding, cutting, and drilling equipment.

Table of Contents

	Page No.
<i>Personnel</i>	v
<i>Foreword</i>	vii
<i>List of Tables</i>	x
1. Scope	1
1.1 Materials	1
1.2 Qualification Categories	1
2. Normative References	1
3. Terms and Definitions	2
4. Safety	3
4.1 Electric Shock	3
4.2 Fumes and Gases	4
4.3 Laser Radiation Hazards	4
4.4 Radiation Hazards	4
4.5 Mechanical Systems	4
5. Requirements	4
5.1 Equipment Categories	4
5.2 Materials	5
5.3 Joint Design	5
5.4 Documentation and Records	5
5.5 Procedures	5
5.6 Essential Variables and Limits	6
5.7 Welding Procedure Specifications (WPS)	7
5.8 Testing	7
5.9 Levels of Requalification	7
5.10 System Verification Test (SVT)	7
5.11 Operator Process Qualification Test Record (OPQTR)	8
5.12 Production Welding Record	8
5.13 Inspection Procedures	8
6. Fabrication	8
7. Quality Examination	8
7.1 Nondestructive Examination (NDE)	9
7.2 Discontinuity Limits	9
7.3 Destructive Evaluation	9
8. System Calibration	9
9. Quality Assurance	9
9.1 Sampling Plans	9
9.2 Lot Definition	9
9.3 Preproduction Sampling	9
9.4 Part Acceptance	9
9.5 Periodic Destructive Evaluation	9

10. Approval of Work	9
10.1 Preproduction Development Approval	9
10.2 Deviation to WPS	9
10.3 Reports	9
Annex A (Informative)—Sample Welding Procedure Specification (WPS)	11
Annex B (Informative)—Sample Procedure Qualification Record (PQR)	13
Annex C (Informative)—Sample Operator Process Qualification Test Record (OPQTR)	15
Annex D (Informative)—Nondestructive Evaluation Discontinuity Limits	17
Annex E (Informative)—Guidelines for the Preparation of Technical Inquires	19
List of AWS Documents on High Energy Beam Welding and Cutting	21

List of Tables

Table		Page No.
1	Nondestructive Examination.....	9

Process Specification and Operator Qualification for Laser Beam Welding

1. Scope

This specification covers processing and quality control requirements for laser beam welding. Welding equipment includes both Gas Laser (CO₂) and Solid-State Laser (Nd:YAG, Diode, Ruby, Fiber, Nd:Glass) beam generators in both pulsed and continuous wave as defined in AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*. Tutorial information regarding techniques of welding or details of machine setup or operation is beyond the scope of this specification. For more information on this subject, refer to AWS C7.2, *Recommended Practices for Laser Welding, Cutting, and Related Processes*.

This standard makes use of both U.S. Customary Units and the International System of Units (SI). The latter are shown within brackets [] or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system must be used independently.

Safety and health issues may not be fully addressed by this standard. Users of this standard should consult ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, applicable federal, state, and local regulations, and other relevant documents concerning safety and health issues not addressed herein. Please consult Clause 4 for more information.

1.1 Materials. This specification covers all major engineering alloys including:

1.1.1 Ferrous Alloys (e.g., steels and stainless steels)

1.1.2 Nonferrous Alloys (e.g., Al alloys, Ni alloys, Superalloys)

1.1.3 Heat-Resisting Alloys (e.g., Mo alloys, Ta alloys, W alloys)

1.1.4 Other Metals (e.g., Be and Cu alloys, precious metals)

1.1.5 Nonmetals (e.g., plastics, ceramics, silicon)

1.2 Qualification Categories. There are three categories to which welds may be qualified to: Class A, B, or C. Classification levels are intended to delineate inspection level and process control.

1.2.1 Class A—Critical Applications. Critical weldments include those where a failure of any portion would cause loss of system, loss of major component, loss of control, unintentional release of critical stores, such as fuel or cargo, or endangerment of personnel.

1.2.2 Class B—Semicritical Applications. Semicritical weldments include those where a failure would reduce the overall efficiency of the system, but loss of the system or endangerment of personnel would not be experienced.

1.2.3 Class C—Noncritical Applications. Noncritical weldments include those where a failure would not affect the efficiency of the system or endanger personnel.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

American National Standards Institute (ANSI) standards:

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*;¹ and

ANSI Z87.1, *Practices for Occupational and Educational Eye and Face Protection*;² and

¹ ANSI Z49.1 is published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

² ANSI Z87.1 is published by the International Safety Equipment Association, 1901 North Moore Street, Arlington, VA 22209-1762.