AWS D8.10M:2021
An American National Standard

Specification for Automotive Weld Quality—Laser Beam Welding of Steel

American Welding Society®

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Approved by the
American National Standards Institute
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Specification for Automotive Weld Quality—Laser Beam Welding of Steel

1st Edition

Prepared by the
American Welding Society (AWS) D8 Committee on Automotive Welding

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This document contains both visual and measurable acceptance criteria for laser beam welds in steels. The information contained herein may be used as an aid by designers, laser beam welding equipment manufacturers, welded product producers, and others involved in the automotive industry and laser beam welding of steels.

American Welding Society®

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

This publication is the first edition of the AWS D8.10M:2021, *Specification for Automotive Weld Quality—Laser Beam Welding of Steel*.

This document has been prepared to establish acceptance criteria for laser beam welds in automotive structures fabricated from steels including the Advanced High Strength Steels (AHSS). As a specification, the criteria and techniques contained are obligatory when cited as a normative reference on a drawing or in a contract.

This specification was prepared by the AWS D8E Subcommittee on Automotive Laser Beam Welding of the AWS D8 Committee on Automotive Welding. This publication is issued under the auspices of the AWS D8 Committee on Automotive Welding.

Table of Contents

Page No.

Personnel v
Foreword vii
List of Tables x
List of Figures x

1. General Requirements 1
1.1 Scope 1
1.2 Units of Measurement 1
1.3 Safety 2

2. Normative References 2

3. Terms and Definitions 2

4. Weld Process Control 3

5. General Provisions 3
5.1 Application 3
5.2 Welding Process 4
5.3 Limitations 4
5.4 Equipment Qualification 4
5.5 Weld Identification and Inspection 4
5.6 Types of Weld Joints and Applicable Welds 4

6. Laser Beam Welding Acceptance Criteria 5
6.1 Visual Requirements 6
6.2 Light Source 6
6.3 Surface Inspection—Manual Visual 7
6.4 Surface Inspection—Automated 7
6.5 Destructive Inspection—Metallographic 7
6.6 Destructive Inspection—Peel and Chisel 7
6.7 Destructive Inspection—Shear and Cross Tension 9

Annex A (Informative)—Informative References 23
Annex B (Informative)—Requesting an Official Interpretation on an AWS Standard 25

List of AWS Documents on Automotive Welding 27

List of Tables

Table		Page No.
1	Classification of Steels for Laser Beam Welding Purposes	6
2	Surface Inspection Acceptability Limits	8
3	Metallographic Inspection Acceptability Limits	9
4	Shear Tension Sample Dimensions	18
5	Cross Tension Sample Dimensions	19

List of Figures

Figure		Page No.
1	Joint Configurations for Laser Beam Welds	5
2	Top Sheet Burn-Through	10
3	Complete Burn-Through	10
4	Skip	11
5	Porosity	11
6	Concavity—Surface and Metallographic Views	11
7	Undercut—Surface and Metallographic Views	12
8	Crack	12
9	Spatter	12
10	Weld Penetration	13
11	S-Value Determination	13
12	Concavity	14
13	Undercut	14
14	Pores, Pits, and Inclusions	15
15	Crack	16
16	Complete Burn-Through	17
17A	Schematic for Lap Joint Shear Tension Samples	17
17B	Schematic for Fillet Joint Shear Tension Samples	18
18	Schematic for Cross Tension Samples	18
19	Metrics Monitored in Shear and Cross Tension Tests	19
20	Interfacial Fracture	20
21	Partial Thickness Fracture (Surface View)	21
22	Full Thickness Fracture (Cross Tension Sample)	22

Specification for Automotive Weld Quality—Laser Beam Welding of Steel

1. General Requirements

1.1 Scope. This specification defines quality characteristics and metrics pertinent to laser beam welding used in automotive body applications, exclusive of butt joint configurations. Laser beam welds may be applied as intermittent (stitch) or continuous and either linear or shaped. The evaluation methods and inspection criteria specified herein can be used to evaluate the effectiveness of particular welding equipment and procedures used to weld a particular base material combination. The criteria and metrics are the same for all welds regardless of the service load. The quality standards established by this specification do not constitute a lower bound of suitability for service; welds that do not meet the weld quality criteria of this specification may be satisfactory for certain applications. The acceptance criteria of this standard are not intended for applications outside this scope (such as post-crash weld quality assessment); attempts to do so may lead to an erroneous result.

1.1.1 Applicability and Limitations. Laser beam welding processes are generally limited to weldable steels. The American Welding Society (AWS) defines weldability as "the relative ease with which a material may be welded to meet an applicable standard." A term known as "Carbon Equivalent" is used to quantify weldability of steels. Several formulas are available to calculate the carbon equivalent for steels. Users should apply the equation that best suits their application. One of the most commonly used is the one developed by the International Institute of Welding (IIW) (Ref. *ASM Handbook,* Volume 6A: *Welding Fundamentals and Processes*, page 133, 2011). The IIW equation is as follows:

$$Ceq_{IIW} = C + \frac{(Mn + Si)}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

It should be noted that the carbon equivalent should be used as a guideline to indicate the weldability of a given grade of steel, but not as an absolute parameter. If the above equation is used to calculate the carbon equivalent, it is recommended that the same equation continues to be used so as to avoid obtaining a different carbon equivalent value for the same or similar materials.

1.1.2 Advanced High Strength Steels Considerations. With the introduction of Advanced High Strength Steels (AHSS) (Reference: WorldAutoSteel Joining Guidelines, WorldAutoSteel.org) in automotive applications, steels with a carbon equivalent greater than 0.3 have been successfully welded using the laser beam welding processes. Generation 3 (GEN3) steels that possess higher elongation and tensile strengths than the generation 1 AHSS (such as dual phase steels) are also being welded using laser beam welding processes. GEN3 steels possess significant amounts of alloying additions and tend to have carbon equivalents greater than 0.3. While these newer steel grades with higher carbon equivalents have been welded successfully, users are advised to assess their weldability using suitable test methods and develop their own welding procedures to verify that acceptable welds are achieved for their intended application.

1.1.3 Additional Considerations. The items listed below are examples of factors that need to be considered when welding steels with high carbon equivalents:

(1) High cooling rates may induce cracking in some steels.

(2) Vaporization of some alloying elements can occur leading to alterations in fusion zone and heat-affected zone (HAZ) properties.

(3) Welding of thin sections requires precision fixturing and close fit-up tolerances to achieve acceptable welds.

(4) Joints which are highly constrained during welding may induce cracking in some steels.

1.2 Units of Measurement. This standard makes sole use of the International System of Units (SI).