AWS D14.8M:2009
(ISO/TR 17844:2004 IDT)
An American National Standard

Standard Methods for the Avoidance of Cold Cracks

American Welding Society

Approved American National Standard
ANSI

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Standard Methods for the Avoidance of Cold Cracks

1st Edition

Prepared by the
American Welding Society (AWS) D14 Committee on Machinery and Equipment

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This is the U.S. national adoption of ISO 17844:2004, *Welding — Comparison of standardized methods for the avoidance of cold cracks*.

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Foreword

This foreword is not part of AWS D14.8M:2009 (ISO/TR 17844:2004 IDT), *Standard Methods for the Avoidance of Cold Cracks*, but is included for informational purposes only.

This standard is the U.S. national adoption of ISO 17844:2004, *Welding — Comparison of standardized methods for the avoidance of cold cracks*. This identical adoption (IDT) retains the technical content, structure, and wording of the ISO document, although it contains the following editorial changes:

(1) the decimal comma has been replaced by the decimal point, and

(2) the words "this International Standard" have been replaced by "this standard."

This standard makes sole use of the International System of Units (SI). Safety and health issues and concerns are beyond the scope of this standard, and therefore are not fully addressed herein. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, and applicable federal and state regulations.

The purpose of this document is to compare currently available methods for determining welding procedures for avoiding hydrogen induced cold cracking during fabrication.

This subject has been extensively studied in recent years and many methods of providing guidance on avoidance of cold cracking have been published. These methods vary considerably in how comprehensively the subject has to be treated. It was considered appropriate to set certain important working criteria for selecting the published methods to be included in this document. In deciding which criteria would be adopted it was agreed that these should include the capabilities for effective use by industry, the end user. Thus the methods should be able to be used on the basis of traditionally available information and relevant factors. The agreed list of criteria was set to include the following main input parameters:

(1) steel composition,
(2) welding heat input,
(3) joint geometry and material thickness,
(4) weld hydrogen level, and
(5) preheat

and in addition:

(6) graphical/computer format of data.

Using the above criteria, the following methods were selected:

(1) *CE* (EN 1011-2/ISO/TR 17671-2, C.2-Method A);
(2) *CET* (EN 1011-2/ISO/TR 17671-2, C.3-Method B);
(3) CE_N (JIS B 8285); and
(4) P_{cm} (AWS D1.1).

Each method is considered in a separate clause, under the following headings:

(1) Description of type of test data used to devise the guidelines, e.g., CTS, y-groove, etc.;
(2) Parent metal composition and range of applicability;
(3) Material thickness and range of applicability;
(4) Hydrogen level and welding processes;
(5) Heat input;
(6) Other factors/special considerations; and
(7) Determination of preheat (step-by-step example description).

An informative annex compares and contrasts the predictions of the methods in respect of ten different steels and a range of material thickness, joint geometries, heat inputs, and hydrogen levels.

It is important that any calculations using a given method are undertaken using the current edition of the appropriate standard.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D14 Committee on Machinery and Equipment, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Welding — Comparison of standardized methods for the avoidance of cold cracks

1 Scope

In addition to EN 1011-2/ISO/TR 17671-2, this document contains further methods for avoidance of cold cracking used by other members of ISO. This document gives guidance for manual, semi-mechanized, mechanized and automatic arc welding of ferritic steels, excluding ferritic stainless steels, in all product forms.

Further information about the materials and process parameters is given in Clauses 2 to 5.

NOTE 1 All references are listed in the annex “Bibliography.”

NOTE 2 All used abbreviations in this document are explained in EN 1011-2/ISO/TR 17671-2, and Annex B.

2 *CE*-method

2.1 Cracking test method

This method is based on an original concept of critical hardness to avoid HAZ (heat-affected zone) hydrogen cracking. It has been empirically developed incorporating the extensive results of HAZ hardenability studies and cracking tests, the latter mainly but not exclusively being the CTS test type. In its present general format the scheme was originally published in 1973 and, with modifications and updates, has been continuously incorporated in British Standards for nearly 25 years. The experience of its use, both in the UK and elsewhere, has been extremely satisfactory.

2.2 Parent metal composition range

The parent metals covered are carbon, carbon manganese, fine grained and low alloyed steels (groups 1 to 3 of CR ISO 15608:2000).

The steels that were used over many years to develop the method have covered a wide range of compositions and it is believed that they are adequately represented by Table 1.

Table 1 — Range of chemical composition of the main constituents for parent metal for *CE*-method

Element	Percentage by weight
Carbon	≥ 0.05, ≤ 0.25
Silicon	≤ 0.8
Manganese	≤ 1.7
Chromium	≤ 0.9
Copper	≤ 1.0
Nickel	≤ 2.5
Molybdenum	≤ 0.75
Vanadium	≤ 0.20