

Dup

Under Revision see DR 5265

SUPERSEDED BY

AS/NZS 3752: 1996

AS 3752—1990

Australian Standard®

**Welding—Methods for
determination of the diffusible
hydrogen content of ferritic weld
metal produced by arc welding**

F



This Australian Standard was prepared by Committee WD/2, Welding Consumables. It was approved on behalf of the Council of Standards Australia on 10 November 1989 and published on 7 May 1990.

The following interests are represented on Committee WD/2:

Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
Department of Defence
Lloyd's Register of Shipping
Metal Trades Industry Association of Australia
Railways of Australia Committee
Welding Technology Institute of Australia

Review of Australian Standards. *To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up-to-date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.*

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

This Standard was issued in draft form for comment as DR 89017.

AS 3752—1990

Australian Standard®

**Welding—Methods for
determination of the diffusible
hydrogen content of ferritic weld
metal produced by arc welding**

First published as AS 3752—1990.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
STANDARDS HOUSE, 80 ARTHUR ST, NORTH SYDNEY NSW
ISBN 0 7262 6041 X

PREFACE

This Standard was prepared by the Standards Australia Committee on Welding Consumables. It specifies the sampling and analytical procedures for the determination of diffusible hydrogen in weld metal produced by different arc welding processes.

The Standard describes two alternative methods for the measurement of diffusible hydrogen, viz the collection-over-mercury procedure which is basically in line with IIS/IIW Doc. 805-85, *Measurement of hydrogen in ferritic arc weld metal*, and a gas chromatography procedure.

© Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the Head Office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	4
1.2 APPLICATION	4
1.3 REFERENCED DOCUMENTS	4
1.4 DEFINITIONS	4
1.5 PRINCIPLE	4
SECTION 2 APPARATUS	
2.1 GENERAL	6
2.2 WELDING JIG	6
2.3 EUDIOMETER	6
2.4 GAS CHROMATOGRAPH HYDROGEN ANALYSER	6
SECTION 3 PRODUCTION OF WELD SPECIMENS	
3.1 PREPARATION OF TEST PIECE ASSEMBLIES	10
3.2 WELDING	10
3.3 RECORDING OF WELDING DATA	11
3.4 STORAGE AND SAMPLE PREPARATION	11
SECTION 4 WELDING PARAMETERS	
4.1 GENERAL	12
4.2 MANUAL METAL ARC WELDING	12
4.3 SUBMERGED ARC WELDING	12
4.4 GAS METAL ARC WELDING	13
4.5 FLUX CORED ARC WELDING	13
SECTION 5 MEASUREMENT OF DIFFUSIBLE HYDROGEN USING MERCURY DISPLACEMENT PROCEDURE	
5.1 PROCEDURE	14
5.2 REPORTING OF ANALYSIS DATA	15
SECTION 6 MEASUREMENT OF DIFFUSIBLE HYDROGEN USING GAS CHROMATOGRAPHY PROCEDURE	
6.1 PROCEDURE	16
6.2 REPORTING OF ANALYSIS DATA	16
APPENDICES	
A SAFETY PRECAUTIONS IN HANDLING MERCURY	17
B A SUITABLE FORM OF WELDING DATA RECORD SHEET	18
C A SUITABLE FORM OF HYDROGEN ANALYSIS DATA SHEET	19

STANDARDS AUSTRALIA

Australian Standard

Welding—Methods for determination of the diffusible hydrogen content of ferritic weld metal produced by arc welding

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE. This Standard sets out the sampling and analytical procedures for the determination of diffusible hydrogen in weld metal arising from the welding of ferritic steel using arc welding processes with consumable electrodes.

This Standard describes the primary method of hydrogen determination using the method of collection over mercury. An alternative method of determination using gas chromatography is also given.

NOTE: The Standard specifically covers manual metal arc, gas metal arc, flux cored arc and submerged arc welding processes. Extension of the methods to other arc welding processes such as gas tungsten arc or plasma arc welding is possible; however, details should be agreed between the parties concerned.

1.2 APPLICATION. The two principal ways in which this Standard is intended to be used are as follows:

- (a) To enable consumables to be qualified or conformance tested to relevant Australian Standard. In such cases, each consumable must be treated as specified in the relevant Section of this Standard.
- (b) To provide information on the levels of weld hydrogen arising from the use of consumables in specific states (e.g. with varying moisture levels), or as a result of the use of specific welding parameters (e.g. different current levels). For such purposes, the methods can be applied with a variety of welding parameters and states of consumable, and these will be chosen on each occasion in order to provide the specific information sought. It is important, however, that such conditions are stated when results are reported so that misunderstandings between these hydrogen levels and qualification levels are prevented.

1.3 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS

- 1204 Structural steels—Ordinary weldable grades
- 1858 Electrodes and fluxes for submerged-arc welding
 - 1858.1 Part 1: Carbon steels and carbon-manganese steels
 - 1858.2 Part 2: Low and intermediate alloy steels
- 2203 Carbon steel electrodes, cored (for arc welding)
- 2409 Interchangeable conical ground glass joints
- 2717 Welding—Electrodes—Gas metal arc
 - 2717.1 Part 1: Ferritic steel electrodes
- 2812 Welding, brazing and cutting of metals—Glossary of terms
- 2900 Quantities, units and symbols
 - 2900.0 Part 0: General principles concerning quantities, units and symbols

1.4 DEFINITIONS. For the purpose of this Standard, the definitions given in AS 2812 apply.

1.5 PRINCIPLE. The welding consumable or consumables combination to be tested is used to deposit a single weld bead which is rapidly quenched and subsequently stored at -78°C or lower, until required for preparation and analysis.

The specimen obtained in this way is then analysed to determine the diffusible hydrogen in weld metal using one of the following analytical techniques:

(a) *Mercury displacement procedure.* The test specimen is placed under clean mercury in the collecting limb of a eudiometer. As the diffusible hydrogen is released from the sample it collects above the mercury. When the evolution of hydrogen is complete, the length of the gas column is measured and the volume of hydrogen calculated. Evolution is judged complete when consecutive measurements of the collected volume, one day apart and corrected to STP, fail to show any increase greater than 3 percent. The time required for complete evolution depends on both the size of the sample and the temperature of collection, but complete evolution may require up to 14 days. The mass of weld metal is subsequently determined, and the concentration of hydrogen in the fused or deposited metal is calculated.

NOTE: For some purposes the time taken for complete evolution may be unacceptably long. To cater for such cases provision is also made for a 72 h determination (of reduced accuracy) by agreement between the parties concerned.