Australian Standard™

Non-destructive testing—Eddy current testing for the detection of surface flaws

Part 1: In non-ferromagnetic metallic products

This Australian Standard was prepared by Committee MT/7, Non-destructive Testing of Metals and Materials. It was approved on behalf of the Council of Standards Australia on 12 February 1999 and published on 5 May 1999.

The following interests are represented on Committee MT/7:

Australasian Railway Association

Australian Aerospace Non-destructive Testing Committee

Australian Industry Group

Australian Institute for Non-destructive Testing

Australian Nuclear Science and Technology Organisation

Australian Pipeline Industry Association

Bureau of Steel Manufacturers of Australia

Electricity Supply Association of Australia

Industrial Research, New Zealand

Institution of Engineers Australia

National Association of Testing Authorities, Australia

New Zealand Non-destructive Testing Association

Public Transport Corporation

Society of Automotive Engineers, Australasia

Victorian WorkCover Authority

WorkCover New South Wales

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which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.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 97506.

Australian Standard™

Non-destructive testing—Eddy current testing for the detection of surface flaws

Part 1: In non-ferromagnetic metallic products

First published as AS 4544.1—1999.

Published by Standards Australia
(Standards Association of Australia)
1 The Crescent, Homebush, NSW 2140

ISBN 0 7337 2570 8

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee MT/7, Non-destructive Testing of Metals and Materials, and is based on a document submitted by the Australian Aerospace Non-destructive Testing Committee (AANDTC).

The aim of the Standard is to specify general requirements for the detection of surface flaws present in components manufactured from non-ferrous metals and alloys. It is applicable to the aerospace industry and other industries where this test method is employed.

This Standard is the first of a series of Standards to be produced on the eddy current testing of metallic products.

A related Australian Standard is AS 2084—1987, *Non-destructive testing—Eddy current testing of metal tubes*.

Currently no international or national Standards have been produced on the subject of eddy current testing for the detection of surface flaws in general components.

This Standard is the result of a consensus among Australian and New Zealand representatives on the Joint Committee to produce it as an Australian Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

CONTENTS

Page

FOREWORD

Eddy current inspection is based on the principles of electromagnetic induction and is used to identify or differentiate between a wide variety of physical, structural and metallurgical conditions in electrically conductive ferromagnetic and non-ferromagnetic metals and metal parts. Eddy current inspection can be used for the following purposes:

(a) To measure or identify such conditions and properties as electrical conductivity, magnetic permeability, heat treatment condition, hardness and physical dimensions.

(b) To detect seams, laps, cracks, voids and inclusions.

(c) To sort dissimilar metals and detect differences in their composition, microstructure and other properties.

(d) To measure the thickness of a non-conductive coating on a conductive metal or the thickness of a non-magnetic metal coating on a magnetic metal.

Because eddy current inspection employs electromagnetic induction, it does not require direct electrical contact with the part being inspected. The method is based on indirect measurement; thus, it is necessary to establish a correlation between the instrument readings and the structural characteristics and serviceability of the parts being inspected.

The inspection coil is an essential part of every eddy current inspection system. Its shape depends to a considerable extent on the purpose of the inspection and on the shape of the part being inspected.

This Standard gives requirements for the inspection of non-ferromagnetic materials for surface defects. The eddy current inspection method is most suitable for inspections where the nature of the defect is known so that the inspection system can be optimized for the detection of this defect. The limitation of the eddy current method is that it is not well suited to broad area scanning where various types of defects are sought.

STANDARDS AUSTRALIA

Australian Standard

Non-destructive testing—Eddy current testing for the detection of surface flaws

Part 1: In non-ferromagnetic metallic products

1 SCOPE This Standard specifies requirements for eddy current flaw detection of non-ferromagnetic metals and alloys and includes requirements for the preparation of test procedures, calibration standards and calibration procedures. It covers the inspection of flat and curved surfaces, and bolt holes. This Standard does not include criteria for acceptance or rejection.

NOTE: Advice and recommendations on information to be supplied by the purchaser at the time of enquiry or order are contained in the purchasing guidelines set out in Appendix A.

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

AS

1470 Health and safety at work—Principles and practices

1929 Non-destructive testing—Glossary of terms

2062 Non-destructive testing—Penetrant testing of products and components

3669 Non-destructive testing—Qualification and registration of personnel—Aerospace

3998 Non-destructive testing—Qualification and certification of personnel—General engineering

3 DEFINITIONS For the purposes of this Standard, the definitions given in AS 1929 and those below apply.

3.1 Absolute probe—a probe containing a coil that responds to all electromagnetic properties of the test part.

3.2 Coil—one or more turns of a conductor wound to produce a magnetic field when current passes through the conductor.

3.3 Coil impedance—the total opposition to current flow through a coil and which is represented by the ratio of the coil voltage to the coil current. This impedance is affected by the material within the magnetic field generated by the coil and is sometimes used to measure eddy current response.

3.4 Differential probe—an eddy current probe of two or more coils in which an output is generated by the difference in the individual responses of each coil to the test material.

3.5 Eddy currents—currents caused to flow in an electrical conductor by the time or space variation, or both, of an applied magnetic field.

3.6 Edge effect—the effect on the magnetic field caused by the geometric boundaries of the test specimen. The effect is large in magnitude and similar in phase to a large crack. Also called ‘end effect’.