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Australian Standard 2452.2—1981

NON-DESTRUCTIVE TESTING—DETERMINATION OF THICKNESS

Part 2—DETERMINATION OF THE REMAINING WALL THICKNESS OF CORRODED PIPE BY THE USE OF RADIOGRAPHY

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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL ORGANIZATIONS and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Atomic Energy Commission

Australian Gas Association

Australian Institute for Non-destructive Testing

Australian Welding Institute

Bureau of Steel Manufacturers of Australia

Confederation of Australian Industry

Department of Defence

Departments of Industrial Relations, N.S.W.

Departments of Labour and Industry, Victoria

Department of Productivity

Electricity Supply Association of Australia

Institute of Australian Foundrymen (N.S.W. Division)

Metal Trades Industry Association of Australia

National Association of Testing Authorities

Railways of Australia Committee

Society of Automotive Engineers—Australasia

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PREFACE

This standard was prepared by the Association's Committee on Non-destructive Testing of Metals and Materials at the request of the Metals Standards Board and Committee ME/2, Gas Cylinders. It provides a basis for determining the remaining wall thickness, after assessment of the depth of pitting or corrosion, of an empty corroded pipe or vessel.

This standard is the second part of a three-part standard on thickness measurements: Part 1* covers the measurement of wall thickness using radiographic methods; Part 3* covers the measurement of thickness by acoustic methods.

The method specified in this standard relies on the use of a source of radiation (X-rays or gamma rays) and on testing personnel being experienced in the handling and use of radiation equipment and materials.

An order of accuracy of ± 10 percent has been attained using the method specified. However, as a result of further refinement of the method, it is expected that this figure will be lowered in the next edition.

NOTE: The effectiveness of non-destructive testing is dependent upon the technical competence of the personnel performing the tests and on their ability to interpret indications given by the test.

The Australian Institute of Non-destructive Testing (AINDT) operates a qualification scheme with respect to a person's general knowledge of a non-destructive testing method. These AINDT qualifications are recognized by the National Association of Testing Authorities, Australia (NATA) which operates an accreditation scheme for non-destructive testing authorities.

This standard may require reference to the following Australian standards:

AS 1929	Glossary of Terms Used in Non-destructive Testing
AS 2177	Radiography of Welded Butt Joints in Metal Part 1—Methods of Test.

*In course of preparation.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
NON-DESTRUCTIVE TESTING—DETERMINATION OF THICKNESS

PART 2—DETERMINATION OF THE REMAINING WALL THICKNESS OF CORRODED PIPE BY THE USE OF RADIOGRAPHY

1 SCOPE. This standard sets out a method for the determination of the remaining wall thickness of empty corroded pipe and pressure vessels by the use of X-ray or gamma-ray radiation testing, after assessment of depth of pitting or corrosion.

NOTES:

1. For the purpose of this standard, pipe is synonymous with tube.
2. The accuracy of the method described decreases when the pipe or vessel contains liquid, solids or products of corrosion.
3. The application of the method is limited by the size of the densitometer aperture which should be less than the diameter of the pit. A further limitation is that a densitometer averages the density over the aperture area with the result that the remaining wall thickness may be over estimated.
4. Bearing in mind the comments made in Notes 2 and 3 above, the order of accuracy of the method specified in this standard is considered to be within ± 10 percent.

2 SAFETY PRECAUTIONS. Exposure of any part of the human body to ionizing radiation can be injurious. It is therefore essential that when X-ray equipment or other radioactive sources are being used, adequate precautions shall be taken to protect testing personnel and any other persons in the vicinity.

NOTE: The use of radioactive substances and irradiating apparatus is controlled by various Statutory Regulations. Reference should also be made to the 'Code of Practice for the Control and Safe Handling of Sealed Radioactive Sources Used in Industrial Radiography' issued by the National Health and Medical Research Council.

3 DEFINITIONS. For the purpose of this standard, the terms and definitions given in AS 1929 and the following apply:

Existing wall—the original internal wall of a pipe minus wastage of metal by corrosion and/or abrasion and which is essentially free of corrosion pits.

Pit depth—the depth, in millimetres, of a corrosion pit taken from the existing wall surface to the bottom of the pit.

Remaining wall thickness—the thickness of uncorroded metal taken from the bottom of a pit to the external wall.

4 PRINCIPLE. The intensity of radiation passing through a pipe varies with the wall thickness. Restrictions in wall thickness caused by corrosion or erosion are recorded on radiographic film as differences in radiographic film density. These differences are measured with a densitometer and the results obtained are compared against radiographic density/metal thickness curves of known characteristics.

5 EQUIPMENT AND ACCESSORIES.

5.1 Radiation Facilities. The choice of radiation facility (X-ray or gamma ray) depends upon the intensity of radiation required to penetrate the pipe wall and produce a radiographic image having adequate film contrast.

NOTE: Adequate contrast for steel is achieved when the film density difference between the uppermost step of the step wedge (see Appendix A) and a step of not less than 80 percent the thickness of the upper step, is at least 0.1 for every film density/steel thickness curve.

5.2 Intensifying Screens. Intensifying screens shall be used to reduce exposure time, or the effects of scattered radiation, when using X-ray tube voltages greater than 120 kV or when using gamma rays.

5.3 Markers for Identification of Radiographs. Markers in the form of lead arrows, lead shot or other symbols shall be used to identify radiographs with the section under test.

5.4 Film Type. The choice of film will depend upon the intensity of radiation used, the pipe metal and upon the time available for exposure of the film to radiation. A list of films is given in Appendix C of Part 1 of this standard.

5.5 Densitometer. A densitometer shall be used and be capable of measuring radiographic film densities to within 0.05 of a unit over the range of 1 to 4. The diameter of the aperture on the densitometer shall be 1 mm.

Suitable viewing facilities, as described in AS 2177, Part 1 should be used.

6 PROCESSING OF RADIOGRAPHS. The film shall be processed in accordance with recognized good practice. The developer should be maintained in good condition and protected from oxidation when not in use by means of a suitable cover. The strength and temperature of the developer should be checked at regular intervals by processing a strip of film on which has been exposed a step wedge which will give known density values under standard processing conditions. Reduced density values will indicate the need for replenishing or changing the solution.

Processing conditions in the preparation of step-wedge curves shall be identical to those which apply to the test area.

Under-developing or over-developing of film to compensate for errors in exposure is not permitted. The use of chemical or other means to reduce or increase the density of fully processed emulsions is not permitted.