

Radiographic examination of fusion welded butt joints in steel —

**Part 2: Methods for steel over 50 mm up
to and including 200 mm thick**

UDC 669.146.621.791.053.6:620.179.15

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

Co-operating organizations

The Welding Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- Aluminium Federation
- Associated Offices Technical Committee*
- Association of Consulting Engineers
- British Constructional Steelwork Association
- British Electrical and Allied Manufacturers' Association*
- British Railways Board
- British Steel Industry*
- Crown Agents for Oversea Governments and Administrations
- Department of Employment
- Department of Trade and Industry
- Department of Trade and Industry, National Engineering Laboratory
- Institution of Civil Engineers
- Institution of Electrical Engineers
- Institution of Mechanical Engineers
- Institution of Production Engineers
- Institution of Structural Engineers
- Lloyd's Register of Shipping*
- London Transport Executive
- Ministry of Defence
- Ministry of Defence, Navy Department*
- Shipbuilders' and Repairers' National Association*
- Society of British Aerospace Companies Limited*
- Welding Institute*

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- British National Committee for Non-destructive Testing
- Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales
- Engineering Equipment Users' Association
- Institute of Physics and the Physical Society
- Ministry of Defence, Army Department
- National Coal Board
- Non-destructive Testing Society of Great Britain
- Process Plant Association
- Society of Motor Manufacturers and Traders
- Society of Non-destructive Examination
- United Kingdom Atomic Energy Authority
- Water-tube Boilermakers Association
- Individual firm

This British Standard, having been approved by the Welding Industry Standards Committee, was published under the authority of the Executive Board on 22 October, 1973

© BSI 01-1999

First published, March 1955
First revision, December 1962
Second revision, October 1973

The following BSI references relate to the work on this standard:
Committee reference WEE/34
Draft for comment 71/40749

ISBN 0 580 07601 6

Amendments issued since publication

Amd. No.	Date of issue	Comments
2285	June 1977	Incorporated in this reprint
4388	October 1983	Indicated by a sideline in the margin

Contents

	Page
Co-operating organizations	Inside front cover
Foreword	ii
1 Scope	1
2 Equipment and range of application	1
3 Type of film	1
4 Protection	1
5 Surface condition	1
6 Weld image location	1
7 Identification of radiographs	2
8 Marking	2
9 Density of radiograph	2
10 Image quality indicators	2
11 Intensifying screens	2
12 Cassettes	2
13 Focus-to-film distance	3
14 Object-film distance	3
15 Alignment of X-ray or gamma-ray beam	3
16 Overlap of film	3
17 Interception of unwanted and scattered radiation	4
18 Processing	4
19 Viewing	4
Appendix A Explanatory information on the techniques	5
Figure 1 — I.Q.I. sensitivity values for different types of equipment	7
Table 1 — Types of equipment	1
Table 2 — Intensifying screens	2
Table 3 — Minimum focus-to-film distances	3
Publications referred to	Inside back cover

Foreword

Both the 1955 and 1962 editions of this standard were published in the form of “General recommendations”, but now that radiographic practice has become so established this revised version is written in the mandatory form.

The revision was undertaken for several reasons: to introduce metric units, to implement relevant ISO Recommendations and to take account of technical developments that have occurred since the previous edition. Consequently, the standard has been divided into two parts, not only to align with the thickness division adopted in the ISO Recommendations, but also to allow more definitive requirements to be given in Part 2 for the greater thicknesses.

There is only a limited number of types of equipment suitable for this work (e.g. there are no commercial X-ray sets operating between 400 kV and 1 000 kV). Therefore the available equipment has been arranged into a number of groups, and techniques are detailed which are suitable for the production of satisfactory radiographs from the equipment in each group, but no indication is given of when a particular technique should be used. The extent of radiographic examination that should be applied and standards of acceptance are not specified as both of these aspects should be covered in the appropriate application standard or be agreed between the contracting parties.

The explanatory information in Appendix A amplifies and, in some instances, gives the reasons underlying what is stated in this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard deals with methods for the radiographic examination of fusion welded butt joints in steel over 50 mm up to and including 200 mm thick.

The techniques have many features in common and the major differences lie in

- 1) the type of equipment used,
- 2) the type of film used.

No attempt is made to define which equipment shall be used for any particular application because this is a matter for agreement between the contracting parties.

NOTE The titles of the British Standards referred to in this standard are listed on the inside back cover.

2 Equipment and range of application

Table 1 shows the types of equipment which are known to be commercially available and indicates the steel thicknesses (within the range covered by this standard) for which the equipment is considered to be suitable for the inspection of butt joints.

Table 1 — Types of equipment

Group	Description of equipment	Useful thickness
		mm
A	X-rays: up to 400 kV	50 – 85
B	X-rays: 1 and 3 MV, focus size 4 mm	50 – 150 ^a
C	X-rays: linear accelerator, 3–8 MV	70 ^b – 200
D	X-rays: betatrons and linear accelerators, 8–35 MV	70 ^b – 200
E	Gamma rays, Cobalt 60	50 – 150 ^c
F	Gamma rays, Iridium 192	50 – 110 ^c
^a For the 3 MV equipments, the maximum thickness can be extended to 200 mm. ^b These thicknesses may be reduced to 60 mm if ultra-fine-grain films are used and a density of 3.0 is reached. ^c The upper end of the thickness range can only be achieved with either very high strength sources or very long exposure times.		

3 Type of film

The film used shall be one of the types known as ultra-fine-grain or fine-grain direct-type film.

NOTE 1 The type of film used with metal intensifying screens is known both as “non-screen” and as “direct-type” film.

NOTE 2 BS 5230 explains how industrial film speed and contrast are measured. Until measurements based on that standard are available the type of film should be agreed between the contracting parties.

	Kodak	Gevaert	Dupont
ultra-fine-grain high-contrast	Industrex M	D2	45
	Industrex T	D4	55
fine-grain high-contrast	Industrex A	—	65
	Industrex C	D7	75
medium-speed	Industrex D	—	—

This grouping of films under the various types does not mean that they are identical; it merely indicates which films come within the groupings. For a film not listed above, the appropriate grouping should be agreed between the contracting parties.

4 Protection

Exposure of any part of the human body to X-rays or gamma rays can be injurious. It is essential that whenever X-ray equipment or radioactive sources are in use, adequate precautions shall be taken to protect the radiographer and others in the vicinity.

NOTE It should be noted that the use of X-ray equipment and gamma radiography in factories, on sites and in certain other premises and works coming within the scope of the Factories Act 1961 is currently controlled by the Ionising Radiations (Sealed Sources) Regulations 1969 and Radioactive Substances Act 1960.

In the near future, the 1969 Regulations will be replaced by Ionising Radiations Regulations which will control all uses of X-rays and gamma rays for radiographic purposes. In addition there may be local regulations and requirements which need to be taken into consideration.

Some radiographic equipment recommendations are specified in BS 5650.

Advice on radiation safety may be obtained from the National Radiological Protection Board, Harwell, Didcot, Oxon OX11 0RQ.

5 Surface condition

In order to obtain maximum flaw sensitivity, the part of the work to be examined shall be smooth and free from irregularities such as weld ripples and grinding or chipping marks. The contour of the weld surface shall be smooth and any change in section shall be gradual. By agreement between the contracting parties, the weld may be examined in the as-welded condition.

Temporary backing should be removed prior to radiography.

If the above conditions cannot be met the expedients described in A.2 may be used by agreement between the contracting parties.

6 Weld image location

Markers, usually in the form of lead arrows or other symbols, shall be placed alongside, but clear of, the outer edges of the weld to identify its position.