

# Non-destructive testing — Image quality of radiographs

## Part 3. Image quality classes for ferrous metals

The European Standard EN 462-3 : 1996 has the status of a  
British Standard

ICS 19.100

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee WEE/46, upon which the following bodies were represented:

Association of Consulting Engineers  
 BNF (Fulmer Materials Centre)  
 British Chemical Engineering Contractors' Association  
 British Coal Corporation  
 British Gas plc  
 British Institute of Non-destructive Testing  
 British Iron and Steel Producers' Association  
 British Nuclear Fuels plc  
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 Castings Technology International  
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 Royal Society of Chemistry  
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 Society of British Aerospace Companies Limited  
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 United Kingdom Accreditation Service  
 Welding Institute

The following bodies were also represented in the drafting of the standard, through sub-committees and panels:

British Photographic Association  
 National Nuclear Corporation Ltd.  
 West Bromwich College of Commerce and Technology

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The following BSI references relate to the work on this standard:  
 Committee reference WEE/46  
 Draft for comment 92/85815 DC

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## National foreword

This British Standard has been prepared by Technical committee WEE/46 and is the English language version of EN 462-3 : 1996 *Non-destructive testing — Image quality of radiographs — Part 3: Image quality classes for ferrous metals*, published by the European Committee for Standardization (CEN).

EN 462-3 : 1996 was produced as a result of international discussions in which the United Kingdom took an active part.

BS EN 462-3 : 1996, together with BS EN 462-1 : 1994, BS EN 462-2 : 1994 and BS EN 462-5 : 1996, supersedes BS 3971 : 1980, which is withdrawn.

### Cross-references

| Publication referred to | Corresponding British Standard   |
|-------------------------|--|
|                         | BS EN 462 <i>Non-destructive testing — Image quality of radiographs</i>  |
| EN 462-1                | Part 1 : 1994 <i>Image quality indicators (wire-type) — Determination of image quality value</i>                 |
| EN 462-2                | Part 2 : 1994 <i>Image quality indicators (step/hole type) — Determination of image quality value</i>            |
| EN 462-4                | Part 4 : 1995 <i>Experimental evaluation of image quality values and image quality tables</i>                    |
| EN 462-5                | Part 5 : 1996 <i>Image quality indicators (Duplex wire type), determination of total image unsharpness value</i> |

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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ICS 19.100

Descriptors: Non-destructive tests, industrial radiography, photographic images, image quality indicators, quality classes, iron alloys

English version

## Non-destructive testing — Image quality of radiographs — Part 3: Image quality classes for ferrous metals

Essais non destructifs — Qualité d'image des  
radiogrammes —  
Partie 3: Classes de qualité d'image pour des  
métaux ferreux

Zerstörungsfreie Prüfung — Bildgüte von  
Durchstrahlungsaufnahmen —  
Teil 3: Bildgüteklassen für Eisenwerkstoffe

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Comité Européen de Normalisation  
Europäisches Komitee für Normung

**Central Secretariat: rue de Stassart 36, B-1050 Brussels**

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 138, Non-destructive testing, of which the secretariat is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 1997, and conflicting national standards shall be withdrawn at the latest by April 1997.

EN 462-3 is a Part of a series of European Standards. The other Parts are the following:

- EN 462-1 *Non-destructive testing — Image quality of radiographs*  
*Part 1: Image quality indicators (wire type), determination of image quality value*
- EN 462-2 *Non-destructive testing — Image quality of radiographs*  
*Part 2: Image quality indicators (step/hole type), determination of image quality value*
- EN 462-4 *Non-destructive testing — Image quality of radiographs*  
*Part 4: Experimental evaluation of image quality values and image quality tables*
- EN 462-5 *Non-destructive testing — Image quality of radiographs*  
*Part 5: Image quality indicators (Duplex wire type), determination of total image unsharpness values*

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## 1 Scope

This standard specifies the minimum image quality values to ensure a uniform radiographic quality. It applies to the two types of image quality indicator as detailed in EN 462-1 for wire type IQI and EN 462-2 for step/hole type IQI and for the two techniques described in EN 444. Values are specified for the two classes of radiographic technique specified in EN 444 and for ferrous metals.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

|           |   |
|-----------|---|
| EN 444    | <i>Non-destructive testing — General principles for radiographic examination of metallic materials by x and Gamma rays</i>                                |
| EN 462-1  | <i>Non-destructive testing — Image quality of radiographs<br/>Part 1: Image quality indicators (wire type), determination of image quality value</i>      |
| EN 462-2  | <i>Non-destructive testing — Image quality of radiographs<br/>Part 2: Image quality indicators (step/hole type), determination of image quality value</i> |
| EN 462-4  | <i>Non-destructive testing — Image quality of radiographs<br/>Part 4: Experimental evaluation of image quality values and image quality tables</i>        |
| EN 584-1  | <i>Non-destructive testing — Industrial radiographic film<br/>Part 1: Classification of film systems for industrial radiography</i>                       |
| prEN 1435 | <i>Non-destructive examination of welds — Radiographic examination of welded joints</i>   |
| EN 25 580 | <i>Non-destructive testing — Industrial radiographic illuminators — Minimum requirements (ISO 5580 : 1995)</i>  |

## 3 Definitions

For the purposes of this standard, the following definitions apply:

### 3.1 classification of radiographic techniques

See EN 444.

### 3.2 image quality indicator (IQI)

See EN 462-1 and EN 462-2.

### 3.3 image quality value

See EN 462-1 and EN 462-2.

### 3.4 image quality table

See EN 462-4.

Additional definitions are given in EN 444.

## 4 Image quality classes

### 4.1 Single-wall radiography

The image quality classes given in tables 1 to 4 can be obtained if the requirements of EN 444 are met:

- Image quality class A for the class A radiographic technique (see EN 444).
- Image quality class B for the class B radiographic technique (see EN 444).
- Image quality values given in tables 1 to 4 apply in cases where the IQI is placed on the source side. If it is not possible to place the IQI on the source side it may be placed on the film side. Tables 1 to 4 cannot be applied in this case.

NOTE. The use of exceptional arrangements (for example: use of an iridium 192 source for thin plate sections) can result in obtaining different image quality values from those specified (see footnotes of tables 1 to 4).

### 4.2 Double-wall radiography

The image quality classes given in tables 5 to 12 can be obtained if the requirements of EN 444 are met:

- Image quality class A for the class A radiographic technique (see EN 444).
- Image quality class B for the class B radiographic technique (see EN 444).

NOTE. The use of exceptional arrangements can result in obtaining different image quality values from those specified (see footnotes of tables 6, 8, 10 and 12).

When using double wall radiographic technique, the penetrated thickness  $w$  can be the sum of both wall thicknesses  $t$ .

Tables 5 to 8 indicate the image quality values corresponding to the image quality classes A and B for a double-wall test with interpretation of the two walls, the IQI being placed on the source side of the object (IQI on the source side).

Tables 9 to 12 indicate the image quality values corresponding to the image quality classes A and B for a double-wall test with interpretation of the single image, the IQI being placed on the film side of the object (IQI on the film side).

Tables 9 to 12 may also be used to indicate the image quality corresponding to the double-wall/double image technique when the IQI is placed on the film side. This may be the case of elliptical radiographs according to prEN 1435.

## 5 Arrangement

To determine the image quality, when the radiograph is being taken, the IQI shall be placed on the source side of the section under test. If this is not possible, the IQI may be placed adjacent to the side of the section under test nearest the film. To indicate that this latter arrangement has been used, the image of the letter F shall be visible immediately next to the IQI marking on the radiograph.

The IQI shall always be placed on the object under test in an area where the thickness is as uniform as possible.

Special arrangements are determined by application standards.

## 6 Determination of image quality value

In determining the image quality value, the conditions for viewing radiographs specified in EN 25 580 shall be observed.

For wire type IQIs the number of the thinnest wire which is still visible on the radiograph shall be taken as the image quality value achieved. The image of a wire is accepted to be visible if a continuous length of at least 10 mm is clearly visible in a region of uniform optical density.

For step/hole type IQIs the number of the smallest hole which is visible on the radiograph shall be taken as the image quality value. When the step contains two holes, both shall be visible.

In general, the image quality value shall be determined for every radiograph. If steps have been taken to guarantee that radiographs of similar test objects and regions are produced with identical exposure and processing techniques and no differences in the image quality value are likely, the image quality need not be verified for every radiograph, the extent of image quality verification being subject to agreement between the contracting parties.

## Single-wall technique; IQI on source side

| <b>Table 1. Wire IQI</b>                |                               |
|---|-------------------------------|
| <b>Image quality class A</b>            |                               |
| <b>Nominal thickness <i>t</i></b><br>mm | <b>IQI value<sup>1)</sup></b> |
| up to 1,2                               | W 18                          |
| above 1,2 to 2                          | W 17                          |
| above 2 to 3,5                          | W 16                          |
| above 3,5 to 5                          | W 15                          |
| above 5 to 7                            | W 14                          |
| above 7 to 10                           | W 13                          |
| above 10 to 15                          | W 12                          |
| above 15 to 25                          | W 11                          |
| above 25 to 32                          | W 10                          |
| above 32 to 40                          | W 9                           |
| above 40 to 55                          | W 8                           |
| above 55 to 85                          | W 7                           |
| above 85 to 150                         | W 6                           |
| above 150 to 250                        | W 5                           |
| above 250                               | W 4                           |

<sup>1)</sup> When using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
10 mm to 24 mm: up to 2 values above 24 mm to 30 mm: up to 1 value.

| <b>Table 2. Step and hole IQI</b>       |                               |
|---|-------------------------------|
| <b>Image quality class A</b>            |                               |
| <b>Nominal thickness <i>t</i></b><br>mm | <b>IQI value<sup>1)</sup></b> |
| up to 2                                 | H 3                           |
| above 2 to 3,5                          | H 4                           |
| above 3,5 to 6                          | H 5                           |
| above 6 to 10                           | H 6                           |
| above 10 to 15                          | H 7                           |
| above 15 to 24                          | H 8                           |
| above 24 to 30                          | H 9                           |
| above 30 to 40                          | H 10                          |
| above 40 to 60                          | H 11                          |
| above 60 to 100                         | H 12                          |
| above 100 to 150                        | H 13                          |
| above 150 to 200                        | H 14                          |
| above 200 to 250                        | H 15                          |
| above 250 to 320                        | H 16                          |
| above 320 to 400                        | H 17                          |
| above 400                               | H 18                          |

<sup>1)</sup> When using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
10 mm to 24 mm: up to 2 values: above 24 mm to 30 mm: up to 1 value.



**Single-wall technique; IQI on source side**

| <b>Table 3. Wire IQI</b>                       |                               |
|--|-------------------------------|
| <b>Image quality class B</b>                   |                               |
| <b>Nominal thickness <math>t</math><br/>mm</b> | <b>IQI value<sup>1)</sup></b> |
| up to 1,5                                      | W 19                          |
| above 1,5 to 2,5                               | W 18                          |
| above 2,5 to 4                                 | W 17                          |
| above 4 to 6                                   | W 16                          |
| above 6 to 8                                   | W 15                          |
| above 8 to 12                                  | W 14                          |
| above 12 to 20                                 | W 13                          |
| above 20 to 30                                 | W 12                          |
| above 30 to 35                                 | W 11                          |
| above 35 to 45                                 | W 10                          |
| above 45 to 65                                 | W 9                           |
| above 65 to 120                                | W 8                           |
| above 120 to 200                               | W 7                           |
| above 200 to 350                               | W 6                           |
| above 350                                      | W 5                           |

<sup>1)</sup> When using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
12 mm to 40 mm: up to 1 value.

| <b>Table 4. Step/hole IQI</b>                  |                               |
|--|-------------------------------|
| <b>Image quality class B</b>                   |                               |
| <b>Nominal thickness <math>t</math><br/>mm</b> | <b>IQI value<sup>1)</sup></b> |
| up to 2,5                                      | H 2                           |
| above 2,5 to 4                                 | H 3                           |
| above 4 to 8                                   | H 4                           |
| above 8 to 12                                  | H 5                           |
| above 12 to 20                                 | H 6                           |
| above 20 to 30                                 | H 7                           |
| above 30 to 40                                 | H 8                           |
| above 40 to 60                                 | H 9                           |
| above 60 to 80                                 | H 10                          |
| above 80 to 100                                | H 11                          |
| above 100 to 150                               | H 12                          |
| above 150 to 200                               | H 13                          |
| above 200 to 250                               | H 14                          |

<sup>1)</sup> When using IR 192 sources, IQI values worse than listed values may be accepted as follows:  
12 mm to 40 mm: up to 1 value.

**Double-wall technique; Double image; IQI on source side**

| <b>Table 5. Wire IQI</b>                          |                  |
|---|------------------|
| <b>Image quality class A</b>                      |                  |
| <b>Penetrated thickness <math>w</math><br/>mm</b> | <b>IQI value</b> |
| up to 1,2   | W 18             |
| above 1,2 to 2                                    | W 17             |
| above 2 to 3,5                                    | W 16             |
| above 3,5 to 5                                    | W 15             |
| above 5 to 7                                      | W 14             |
| above 7 to 12                                     | W 13             |
| above 12 to 18                                    | W 12             |
| above 18 to 30                                    | W 11             |
| above 30 to 40                                    | W 10             |
| above 40 to 50                                    | W 9              |
| above 50 to 60                                    | W 8              |
| above 60 to 85                                    | W 7              |
| above 85 to 120                                   | W 6              |
| above 120 to 220                                  | W 5              |
| above 220 to 380                                  | W 4              |
| above 380   | W 3              |

| <b>Table 6. Step/hole IQI</b>                     |                               |
|---|-------------------------------|
| <b>Image quality class A</b>                      |                               |
| <b>Penetrated thickness <math>w</math><br/>mm</b> | <b>IQI value<sup>1)</sup></b> |
| up to 1   | H 3                           |
| above 1 to 2                                      | H 4                           |
| above 2 to 3,5                                    | H 5                           |
| above 3,5 to 5,5                                  | H 6                           |
| above 5,5 to 10                                   | H 7                           |
| above 10 to 19                                    | H 8                           |
| above 19 to 35                                    | H 9                           |

<sup>1)</sup> when using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
up to 3,5 mm: up to 2 values; above 3,5 mm to 10 mm: up to 1 value.

**Double-wall technique; Double image; IQI on source side**

| <b>Table 7 Wire IQI</b>                    |                  |
|--|------------------|
| <b>Image quality class B</b>               |                  |
| <b>Penetrated thickness <i>w</i></b><br>mm | <b>IQI value</b> |
| up to 1,5                                  | W 19             |
| above 1,5 to 2,5                           | W 18             |
| above 2,5 to 4                             | W 17             |
| above 4 to 6                               | W 16             |
| above 6 to 8                               | W 15             |
| above 8 to 15                              | W 14             |
| above 15 to 25                             | W 13             |
| above 25 to 38                             | W 12             |
| above 38 to 45                             | W 11             |
| above 45 to 55                             | W 10             |
| above 55 to 70                             | W 9              |
| above 70 to 100                            | W 8              |
| above 100 to 170                           | W 7              |
| above 170 to 250                           | W 6              |
| above 250                                  | W 5              |

| <b>Table 8. Step/hole IQI</b>              |                               |
|--|-------------------------------|
| <b>Image quality class B</b>               |                               |
| <b>Penetrated thickness <i>w</i></b><br>mm | <b>IQI value<sup>1)</sup></b> |
| up to 1                                    | H 2                           |
| above 1 to 2,5                             | H 3                           |
| above 2,5 to 4                             | H 4                           |
| above 4 to 6                               | H 5                           |
| above 6 to 11                              | H 6                           |
| above 11 to 20                             | H 7                           |
| above 20 to 35                             | H 8                           |

<sup>1)</sup> When using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
4 mm to 11 mm: up to 1 value.

**Double-wall technique; Single or double image; IQI on film side**

| <b>Table 9. Wire IQI</b>                   |                  |
|--|------------------|
| <b>Image quality class A</b>               |                  |
| <b>Penetrated thickness <i>w</i></b><br>mm | <b>IQI value</b> |
| up to 1,2                                  | W 18             |
| above 1,2 to 2                             | W 17             |
| above 2 to 3,5                             | W 16             |
| above 3,5 to 5                             | W 15             |
| above 5 to 10                              | W 14             |
| above 10 to 15                             | W 13             |
| above 15 to 22                             | W 12             |
| above 22 to 38                             | W 11             |
| above 38 to 48                             | W 10             |
| above 48 to 60                             | W 9              |
| above 60 to 85                             | W 8              |
| above 85 to 125                            | W 7              |
| above 125 to 225                           | W 6              |
| above 225 to 375                           | W 5              |
| above 375                                  | W 4              |

| <b>Table 10. Step/hole IQI</b>             |                               |
|--|-------------------------------|
| <b>Image quality class A</b>               |                               |
| <b>Penetrated thickness <i>w</i></b><br>mm | <b>IQI value<sup>1)</sup></b> |
| up to 2                                    | H 3                           |
| above 2 to 5                               | H 4                           |
| above 5 to 9                               | H 5                           |
| above 9 to 14                              | H 6                           |
| above 14 to 22                             | H 7                           |
| above 22 to 36                             | H 8                           |
| above 36 to 50                             | H 9                           |
| above 50 to 80                             | H 10                          |

<sup>1)</sup> When using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
5 mm to 9 mm: up to 2 values; above 9 mm to 22 mm: up to 1 value.

**Double-wall technique, Single or double image;  
IQI on film side**

| <b>Table 11. Wire IQI</b>                   |                  |
|---|------------------|
| <b>Image quality class B</b>                |                  |
| <b>Penetrated thickness <i>w</i><br/>mm</b> | <b>IQI value</b> |
| up to 1,5                                   | W 19             |
| above 1,5 to 2,5                            | W 18             |
| above 2,5 to 4                              | W 17             |
| above 4 to 6                                | W 16             |
| above 6 to 12                               | W 15             |
| above 12 to 18                              | W 14             |
| above 18 to 30                              | W 13             |
| above 30 to 45                              | W 12             |
| above 45 to 55                              | W 11             |
| above 55 to 70                              | W 10             |
| above 70 to 100                             | W 9              |
| above 100 to 180                            | W 8              |
| above 180 to 300                            | W 7              |
| above 300                                   | W 6              |

| <b>Table 12. Step/hole IQI</b>              |                               |
|---|-------------------------------|
| <b>Image quality class B</b>                |                               |
| <b>Penetrated thickness <i>w</i><br/>mm</b> | <b>IQI value<sup>1)</sup></b> |
| up to 2,5                                   | H 2                           |
| above 2,5 to 5,5                            | H 3                           |
| above 5,5 to 9,5                            | H 4                           |
| above 9,5 to 15                             | H 5                           |
| above 15 to 24                              | H 6                           |
| above 24 to 40                              | H 7                           |
| above 40 to 60                              | H 8                           |
| above 60 to 80                              | H 9                           |

<sup>1)</sup> When using Ir 192 sources, IQI values worse than listed values may be accepted as follows:  
5,5 mm to 9,5 mm: up to 2 values; above 9,5 mm to 24 mm: up to 1 value.

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