

AMA DataSet Limited



British Standards Institute

Simon Mather
Managing Director
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British Standards Institute – BSI



Overview

Full online editorial system to manage BSI publications with the capability of having multiple users and real-time high-speed typesetting to PDF within out any limitations. The editor has features to manage Tables, Figures and Equations along with the facility to proof these individually whilst editing. Revisions are maintained via track changes control and auditing with options to lock files once signed-off.

The editorial system also has a full document management control with access privileges for articles, images and proofs.

Features

Commissioned 2017

Sector Publishing

Location London

Platform AMA DataSet – Strata CMS

A general overview of the editorial is listed below:

- Multiple users with secure access and IP control
- Editorial user managed by the BSI
- File management of documents
- Object control
- Editing of content, tables, and equations in an easy-to-use editor
- Typeset the publication in real-time within out any limitations
- Track changes and auditing of documents
- Facility to upload image recourses, EPS or JPEG
- Facility to import and export publication as XML
- Create consolidated and loose-leaf publications
- Archiving publications, clean revisions, create new next version

Security

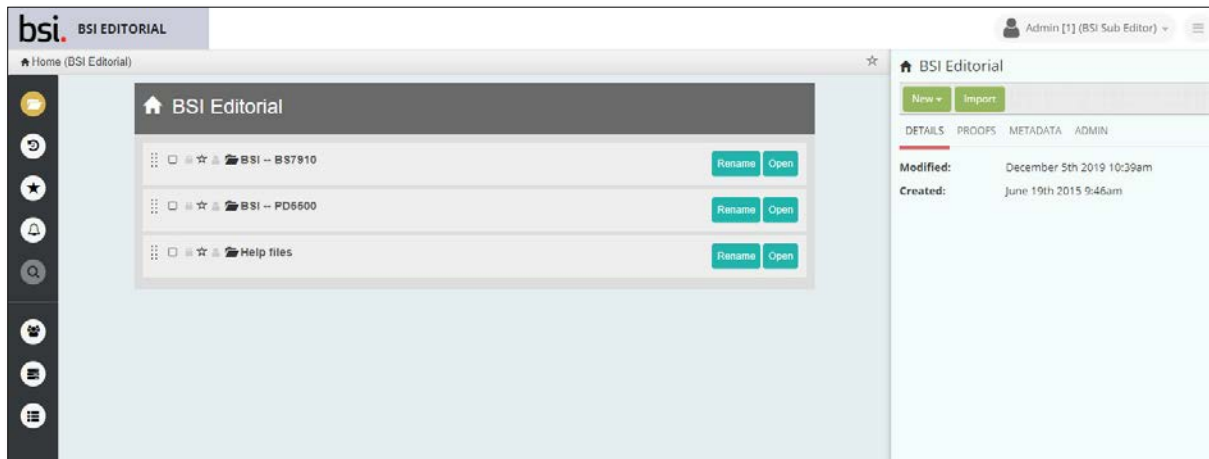
An integral part of AMA's CMS, Strata, is that all actions are audited throughout the editorial process, this can be sign-in, navigation, through to editing. User access is an import part of the CMS and user can be locked down by IP or double authentication.

File management of documents

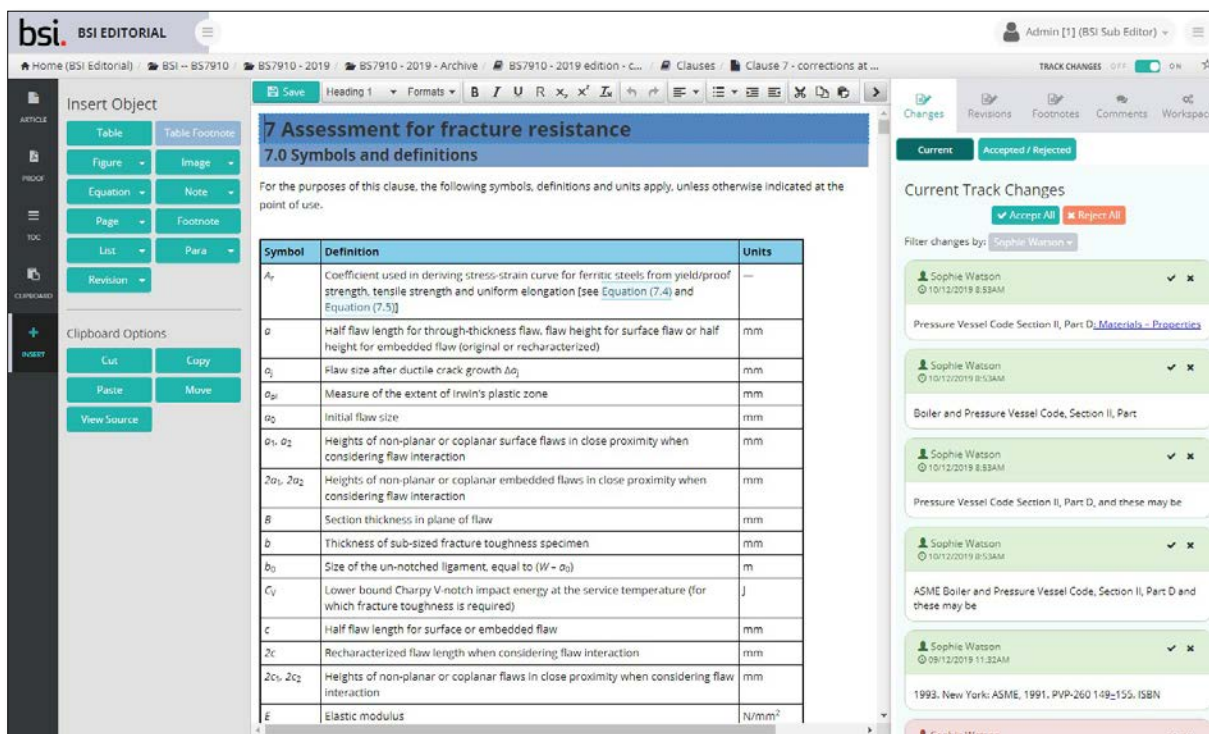
The system has a sophisticated management for asset control from editable documents through to resource files such as images and proofed PDFs. The user has the facility of locking documents, bookmark for quick access and adding metadata. Below is a quick overview of features.

- Share or Lock of resources (files and folders)
- Access level control of resources
- Add resources to favourite list
- Copy, duplicate and rename of resources
- Reorder and move
- Security control

- Metadata
- Import of XHTML, XML, images
- Import documentation
- Proof template control
- Proof script control



Folder view, showing file management of documents



Editing of document, showing panels 'Insert Object' and 'Track Change'

Object control

The document editor uses eXtensible HyperText Markup Language (XHTML) as its core base and it is this provides the user with a graphical view when editing documents to ensure that complex items such as tables or equations are laid out correctly. This provides the user an easy way to manage document coding, be it editing, importing, exporting or direct editing of the XHTML within the editorial system.

The editor uses blocks of XHTML data to control complex items such as a Figure and Tables, these are referred to as 'Objects'. The user has the facility of inserted objects within the editor to build the page. Using this method, complex setting such as figures and equations within a table are simply objects within objects and each individual object is designed to typeset to the assigned template.

The screenshot shows the BSI Editorial interface. On the left is the 'Insert Object' panel with buttons for Table, Figure, Equation, Note, Page, Footnote, List, Para, and Revision. Below this are 'Equation Options' (Delete, Add Eq Text, Update, Regenerate Eqs) and 'Proof Object Options' (PDF Press, PDF Proof). The main editor area shows a document with sections like '7.1.10.2 As-welded structures' and equations such as $Q_m = \sigma'_Y$ and $Q_m = \left(1.4 - \frac{\sigma_{ref}}{\sigma'_Y}\right) \sigma'_Y$. On the right is the 'Source code' panel, which displays the XHTML code for the document, including tags for sections, equations, and footnotes.

Coding of the documents using XHTML

The screenshot shows the BSI Editorial interface. The 'Insert Object' panel is highlighted with a red box, and a red arrow points to the 'Revision' button. The document content shows sections like 'Annex C Assessment of vessels subject to fatigue' and 'C.1 Introduction'. The 'Insert Object' panel includes buttons for Table, Figure, Equation, Note, Page, Footnote, List, Para, and Revision. Below this are 'Clipboard Options' (Cut, Copy, Paste) and 'Proof Object Options' (PDF Press, PDF Proof). The main editor area shows a document with sections like 'Annex C Assessment of vessels subject to fatigue' and 'C.1 Introduction'.

Insert Object panel, showing various predefined control for Tables, Figure and Equations

bsi. BSI EDITORIAL

Home (BSI Editorial) / BSI -- BS7910 / BS7910 - 2019 / BS7910 - 2019 - Archive / BS7910 - 2019 edition - c... / Clauses / Clause 7 - correct

Insert Object

- Table
- Table Footnote
- Figure
- Image
- Equation
- Note
- Page
- Footnote
- List
- Para
- Revision

Note Options

- Delete

Proof Object Options

- PDF Press
- PDF Proof
- PDF +Track
- PDF Tag

Clipboard Options

- Cut
- Copy
- Paste
- Move
- View Source

K_J	Value of fracture toughness derived from J-integral	N/mm ^{3/2}
$K_{Jc(limit)}$	Limiting value of K_{Jc}	N/mm ^{3/2}
K_{Jm}	Fracture toughness derived from J_m	N/mm ^{3/2}
K_m	Fracture toughness at maximum load	N/mm ^{3/2}
K_{mat}	Characteristic material fracture toughness determined in terms of stress intensity factor	N/mm ^{3/2}
K_r	Fracture ratio	—
K_u	Value of K at either: a) unstable fracture; or b) onset of arrested brittle crack or pop-in <i>NOTE This term applies only where $\Delta a > 0.2$ mm.</i>	N/mm ^{3/2}
$K_{0.2mm}$	Initiation of tearing fracture toughness	N/mm ^{3/2}
K_b	Fracture toughness estimated from CTOD	N/mm ^{3/2}
K_{1mm}, K_{2mm}	K_{mat} corresponding to the postulated amount of tearing, typically up to 1 mm or 2 mm	N/mm ^{3/2}
k_{tb}	Bending stress concentration factor	—
$k_{0.90}$	Value of the one-sided tolerance limit for a normal distribution	—
L	Attachment length	mm
L_r	Ratio of reference stress to yield strength (or applied load to limit load)	—
$L_{r,max}$	Maximum permitted limit of L_r	—
M_{kv}, M_{kmv}, M_{kb}	Stress intensity magnification factors for a flaw at the weld toe	—
M_{mv}, M_b	Stress intensity magnification factors for flaw shape	—
m	Parameter as a function of yield strength and tensile strength, used in converting K_{mat} to δ_{mat} and vice versa; see Equation (7.16) and Equation (7.17)	—

Showing side panel with multiple Objects within Objects. In this case there is a Note within a List within a Table

List of objects

- Table: straddle columns and rows; footnote
- Figures: multiple images
- Images
- Equation: inline and numbered
- Notes
- Break: page; section
- Footnotes
- List
- Paragraph
- Revision marks
- Object within Objects

Editing of content via the editor

With any editor it is essential to maintain consistency and ease of use. To achieve this, the editor has two side panels and a top bar to aid the user.

The left panel has article control, listing of typeset proofs, document navigation and object inserts. When a user places their cursor into the edited text, the object panel will change to reflex the nested position and any available options for that object, such as insert row when in a Table object.

bsi. BSI EDITORIAL

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Insert Object

ARTICLE: Table, Table Footnote

PROOF: Figure, Image

TOC: Equation, Note

CLIPBOARD: Page, Footnote

List, Para

Revision

Row Options

Insert before, Insert after

Delete row, Cut row

Copy row, Paste row

Cell Options

Merge cells, Split cell

Equal Cols (%), Widths (%)

Row Type: Body

Vertical Align: Top

Rules

7 Assessment for fracture resistance

7.0 Symbols and definitions

For the purposes of this clause, the following symbols, definitions and units apply, unless otherwise indicated at the point of use.

Symbol	Definition	Units
A_r	Coefficient used in deriving stress-strain curve for ferritic steels from yield/proof strength, tensile strength and uniform elongation [see Equation (7.4) and Equation (7.5)]	—
a	Half flaw length for through-thickness flaw, flaw height for surface flaw or half height for embedded flaw (original or recharacterized)	mm
a_j	Flaw size after ductile crack growth Δa_j	mm
a_{pl}	Measure of the extent of Irwin's plastic zone	mm
a_0	Initial flaw size	mm
a_1, a_2	Heights of non-planar or coplanar surface flaws in close proximity when considering flaw interaction	mm
$2a_1, 2a_2$	Heights of non-planar or coplanar embedded flaws in close proximity when considering flaw interaction	mm
B	Section thickness in plane of flaw	mm
b	Thickness of sub-sized fracture toughness specimen	mm
b_0	Size of the un-notched ligament, equal to $(W - a_0)$	m
C_V	Lower bound Charpy V-notch impact energy at the service temperature (for which fracture toughness is required)	J
c	Half flaw length for surface or embedded flaw	mm
$2c$	Recharacterized flaw length when considering flaw interaction	mm
$2c_1, 2c_2$	Heights of non-planar or coplanar flaws in close proximity when considering flaw interaction	mm
E	Elastic modulus	N/mm ²

Left panel showing the options of Table Object

bsi. BSI EDITORIAL

Home (BSI Editorial) / BSI -- BS7910 / BS7910 - 2019 / BS7910 - 2019 - Archive / BS7910 - 2019 edition - C... / Clauses / Clause 7 - correctio

Insert Object

ARTICLE: Table, Table Footnote

PROOF: Figure, Image

TOC: Equation, Note

CLIPBOARD: Page, Footnote

List, Para

Revision

Equation Options

Delete, Add Eq Text

Update, Regenerate Eqs

Width %

Proof Object Options

PDF Press, PDF Proof

PDF +Track, PDF Tag

Clipboard Options

7.1.5.3

Equation (7.18) is used if both of the following conditions are met:

a) there is limited ductile crack extension prior to fracture

b) fracture takes place under small scale yielding

$K_{Jc} < K_{Jc(11111)}$

$K_{Jc(11111)} = \frac{Eb_0\sigma_Y}{(1 - \nu^2) 30}$

NOTE 1 In this equation, units for $K_{Jc(11111)}$ are

NOTE 2 Note 2 of 7.1.4.6 is applicable here.

7.1.5.4

If condition 7.1.5.3a) is not met, K_{Jc} is replaced by $K_{Jc(11111)}$ and condition 7.1.5.3b) is not used.

NOTE As an alternative, the Master Curve approach may be used.

Equation Editor - Google Chrome

bsi.lama.uk.com/equationEditor/equationEditor.html?runLocal=true&codeType=Latex&encloseAl

Formula

Operator ($\pm \times \div$)

Relation ($= < > \leq \geq$)

Group logical ($\infty \subseteq \in$)

Logical ($< > \leq \geq$)

Arrow ($\Rightarrow \Leftarrow \Leftrightarrow$)

Relation ($A = B$)

Math & Physics ($h \sigma \mu$)

Greek ($\alpha \pi \Psi$)

Fraktur ($\mathfrak{A} \mathfrak{B} \mathfrak{C} \mathfrak{D}$)

Double Struck ($\mathbb{A} \mathbb{B} \mathbb{C} \mathbb{D}$)

Fonts

Edit in LaTeX

```

1 \displaystyle {
2 \quad \left( K_{Jc(11111)} \right) = \frac{
3 E b_0 \sigma_Y}{
4 (1 - \nu^2) 30}
5 }
6
7 \left( K_{Jc(11111)} \right) = \frac{
8 E b_0 \sigma_Y}{
9 (1 - \nu^2) 30}
10
11 \left( K_{Jc(11111)} \right) = \frac{
12 E b_0 \sigma_Y}{
13 (1 - \nu^2) 30}

```

Equation Preview

$$K_{Jc(11111)} = \left[\frac{Eb_0\sigma_Y}{(1 - \nu^2) 30} \right]^{0.5}$$

Equation editor using LaTeX

The right panel has additional options for the user:

- Track changes
- Revisions
- Footnotes
- Comments
- Workspace
 - Inline characters
 - Metadata
 - Functions: renumbering
 - Gallery
 - Search and Replace

as flaws under this heading.

TABLE: 8.9
CAPTION: Limits for non-planar flaws in steel weldments stress-relieved by PWHT

Quality category	Maximum length of slag inclusion, mm	Limits for porosity expressed as % percentage of area on radiograph, %
Q1	19	3
Q2	58	3
Q3 and lower	No maximum	5

8.8 Assessment of shape imperfections using quality categories
8.8.1 Assessment of misalignment

The presence of misalignment in a welded joint can reduce the fatigue life because it leads to an increase in stress at the joint when it is loaded, due to the introduction of local bending stresses. Assessment of the effect of misalignment on fatigue life involves calculation of the bending stress (see Annex D). Secondary bending stresses are not induced as a result of misalignment in continuous welds loaded longitudinally or in joints subjected only to applied external bending. Thus, there is no limit to the allowable extent of misalignment in such cases, from a fitness-for-service viewpoint.

In the assessment of weldments in which the only imperfection is misalignment, the quality category required should be determined in accordance with 8.5.3, or, if Equation (8.11) is used, 8.7.2. The misalignment is acceptable if the total

Current Track Changes

Filter changes by: Sophie Watson

- Sophie Watson (28/10/2019 1:12PM)
 - for porosity expressed as 5 of area on
- Sophie Watson (28/10/2019 1:12PM)
 - for porosity expressed as a percentage of area on
- Sophie Watson (28/10/2019 1:10PM)
 - shown to be embedded and non-planar as defined in Clause 4b) should be analysed for

Right-hand panel showing track changes

Q7	1.00×10^{11}	—	37	12
Q8	6.14×10^{10}	—	32	10
Q9	3.89×10^{10}	—	27	9
Q10	2.38×10^{10}	—	23	8

To facilitate comparisons of the fatigue lives of flaws with those of weld design details in steels (see 8.5.3.2), quality category $S-N$ curves Q1 to Q6 are identical to the design $S-N$ curves Footnote 2 corresponding to 97.7% survival limits, for classes D to G2 in the fatigue design guidance document BS 7608 (see Table 8.6). Furthermore they are directly comparable with some of the design $S-N$ curves in BS EN 1993-1-2 for welded steels. The flaw acceptance levels given also ensure 97.7% probability of survival when related to the quality category $S-N$ curves. However, in the assessment of planar flaws, they may be adapted to consider other probabilities of survival (see 8.6.4), for example if a higher probability of survival is required for flaws than for design details.

FOOTNOTE 2 The equivalent curves BS 7608 use the notation $S_r - N$.

8.5.2.2 Effect of material type

The majority of the data on which the procedures of 8.6 and 8.7 are based are from fatigue tests on welds containing flaws and from fatigue crack propagation studies on ferritic steels (some data for aluminium alloys were also analysed). It is, however, generally observed that, in dry air environments, fatigue cracks grow at closely similar rates in a wide range of steels, including austenitic stainless steels.

The curves in Figure 8.3 and the corresponding values of S in Table 8.6 for quality categories in aluminium alloy welds

Footnotes

- Admin [1] (03/01/2020 10:01 am)
 - The units and value of A depend on those used to measure da/dN and ΔK , and on the value of the exponent, m . If A is known in one set of units, A_b , the corresponding value for another set of units, A_b , is given by:
$$A_b = A_a \frac{f_a}{f_b^m}$$
 - where:
 - f_a is the conversion factor for da/dN from the first to the second unit system; and
 - f_b is the conversion factor for ΔK from the first to the second unit system.
- Admin [1] (03/01/2020 10:01 am)
 - The equivalent curves BS 7608 use the notation $S_r - N$.

Right-hand panel showing footnotes

Archive / BS7910 - 2019 edition - c... / Clauses / Clause 7 - corrections at ...

non-uniform distributions are described in Annex Q.

S

condition, with a flaw lying in a plane parallel to the welding direction (i.e. the stresses σ to the weld), the tensile residual stress (Q_m) should initially be assumed to be equal to the yield strengths of the weld or parent metal. This is termed the “appropriate” case of a flaw parallel to the weld.

condition, with a flaw lying in a plane transverse to the welding direction (i.e. the stresses σ parallel to the weld), the tensile residual stress should initially be assumed to be equal to the yield strength of the material in which the flaw is located. This is termed the “appropriate” case of a flaw perpendicular to the weld. If the flaw lies partly in weld metal and partly in parent metal, the residual stress should be assumed to be equal to the greater of the room temperature yield strengths of the weld metal and parent metal.

residual stress may be assumed as a result of the primary loading applied to the as-welded joint. The residual stress may then be assumed as the lower of Equation (7.24a) and Equation (7.24b):

(7.24a)

(7.24b)

TRACK CHANGES OFF ON

Changes Revisions Footnotes Comments Workspace

Inline Metadata Functions Gallery

Find/Replace

Inline HTML

General Punctuation

Math Symbols

Greek

Fractions

Letter with Accents

Special Characters

Right-hand panel showing inline characters within workspace tab

2019 - Archive / BS7910 - 2019 edition - c... / Clauses / Clause 7 - corrections at ...

Failure Assessment Diagram

Fracture-dominated failure region

Unacceptable region

Acceptable region

Collapse-dominated failure region

Assessment point

FAL (continuous yielding)

FAL (discontinuous yielding)

L_r

es an argument based on initiation of crack growth and the case of stable tearing under material and temperature are such that a ductile tearing mechanism might occur. A single value of toughness. This can be a value associated with limited ductile tearing. For the value of toughness used as a measure of initiation typically corresponds to 0.2 mm of crack growth, in accordance with the fracture toughness testing standard used (see 7.1.4 to 7.1.7) so should not be performed for crack growth below that figure.

re included. Sensitivity studies taking account of realistic variations in input parameters should be the effect on margins.

of L_r

TRACK CHANGES OFF ON

Changes Revisions Footnotes Comments Workspace

Inline Metadata Functions Gallery

Find/Replace

Proof in Folder Yes

Proof Run On No

Proof DPC No

Proof Slug No

Proof for All

Publication Year

Section Type

Section Number

Running Head

Running Footer

Page Folio Start

Page Folio Type number

Footnote Start 1

import_file_type xml

Right-hand panel showing metadata of the document within workspace tab

The screenshot shows a document editor interface. The main document area displays a flowchart titled "Flowchart for fracture assessment". The flowchart starts with "Selection of option (7.1.1, 7.3, 7.4.3)" and branches into three options. Each option leads to a decision point: "Would an Option 2 assessment be appropriate?", "Would an Option 3 assessment be appropriate?", and "Would an Option 4 assessment be appropriate?". Depending on the answers (Yes/No), the flowchart leads to various outcomes, including "Structure has been demonstrated satisfactory in this procedure", "Report Annex H", and "Structure must be demonstrated satisfactory in this procedure".

On the right-hand panel, there is an "Image gallery" tab. It shows two image thumbnails labeled "2015-0025..." and "2015-0025...". The gallery includes a search bar and a "Find/Replace" button.

Right-hand panel showing image gallery within workspace tab

Proofing

The user can typeset either a single object such as an equation, typeset a whole document or typeset a folder many documents. The template is designed for a given publication with the XHML compiling to XML and set with the assigned template set in the metadata. This process is extremely quick and can set up to 500 pages per minute. All proofing is performed in the background allowing the user to continue with editing.

Landscape and continuation of objects such as Tables and Figures are automatically set without the need of user intervention. Each proof is saved and can be retrieved at any time. Previous typeset documents can be compared with newer version to create loose-leaf documents.

Pagination is controlled automatically and set via the metadata of the document or folder.

The user can proof for press PDF, colour coded for ease of checking, proof with track changes.

The screenshot shows a page from the British Standard BS 7910:2019. The page includes a table of recommended fatigue crack growth threshold, ΔK_{th} values for assessing welded joints. The table is divided into two main sections: "Table 8.5 Recommended fatigue crack growth threshold, ΔK_{th} values for assessing welded joints" and "Table 8.6 Recommended fatigue crack growth threshold, ΔK_{th} values for assessing non-welded joints".

Table 8.5 includes columns for Material, Environment, and ΔK_{th} (N/mm^{3/2} (MPa^{1/2}, m)). The table lists values for various materials and environments, including steels, aluminium alloys, and non-ferrous metals.

Table 8.6 includes columns for Material, Environment, and ΔK_{th} (N/mm^{3/2} (MPa^{1/2}, m)). The table lists values for various materials and environments, including steels, aluminium alloys, and non-ferrous metals.

Proofing with colour-coded objects to ensure mark-up is valid

Sample PDF pages from BSI editorial system

BRITISH STANDARD

BS 7910:2019

Table 7.4 Guidance for determining whether yielding is continuous or discontinuous (continued)

Yield strength range, MPa	Process route	Composition aspects	Heat treatment aspects	Assume yield plateau (discontinuous yielding) ^{A)}
$R_{eH} > 350$	Controlled rolled	BS EN 10025-3 and BS EN 10025-4 compositions	Light TMCR schedules ($R_{eH} < 400$)	Yes
			Heavy TMCR schedules ($R_{eH} > 400$)	(Yes)
$R_{eH} \leq 500$	Quenched and tempered	Mo or B present with microalloy additions Cr, V, Nb or Ti	Heavy tempering favours plateau	Yes
			Light tempering favours no plateau	(Yes)
		Mo or B not present but microalloy additions Cr, V, Nb or Ti are (V has a particularly strong effect)	Heavy tempering	(Yes)
			Light tempering	(No)
$R_{p0.2}$ or $R_{eH} > 500$	Quenched and tempered	Mo or B present with microalloy additions Cr, V, Nb or Ti	Tempering to $R_{p0.2} < -690$	(No)
			Tempering to $R_{p0.2} > -690$	No
		Mo or B not present but microalloy additions Cr, V, Nb or Ti are	Tempering to $R_{p0.2} < -690$	Yes
			Tempering to $R_{p0.2} \geq -690$	(No)
$R_{p0.2} \leq 1\ 000$	As-quenched	All compositions	NA	No

^{A)} Text in brackets indicates that there is uncertainty and a sensitivity analysis should be conducted to establish the effect the presence or absence of a yield plateau has on the assessment.

^{B)} Yield strength in Table 7.4 is defined as the upper yield, R_{eH} , to harmonize with the relevant standards.

The extent of the Lüders strain, $\Delta\varepsilon$, is estimated from:

$$\Delta\varepsilon = 0.037\ 5(1 - 0.001\sigma_Y) \text{ for } \sigma_Y \leq 1\ 000 \text{ MPa} \quad (7.8)$$

where:

σ_Y is the yield strength.

Equation (7.8) may be used in conjunction with Equation (7.4) to estimate the stress-strain curve for material which Table 7.4 indicates has a Lüders plateau. This is achieved by employing Equation (7.4) to obtain strain up to the yield strength and then adding the $\Delta\varepsilon$ increment from Equation (7.8) to the calculated strains; then Equation (7.4) is re-applied for stress equal to and exceeding the yield strength up to the tensile strength.

7.1.3.7 Tensile properties from hardness

When tensile data are not available from C-Mn steels, yield/proof strength and tensile strengths (in MPa) at room temperature can be estimated from measured Vickers hardness (HV_{10}) as follows (see BS EN ISO 15653):

Parent metal:

BS 7910:2019

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Where any uncertainty exists concerning the relevance of available data for the particular assessment being performed, specific data should be obtained using the methods given in BS ISO 12108 (see also 10.3.3.3).

8.2.3.3 Recommended fatigue crack growth laws for steels in air

Values of the constants A and m in Equation (8.1), given in Table 8.3, should be used for:

- steels (ferritic, austenitic or duplex ferritic-austenitic) with yield or 0.2% proof strengths $\leq 700 \text{ N/mm}^2$;
- operation in air or other non-aggressive environments at temperatures up to 100°C .

Unless justification for using different values is provided, the upper bound (mean + 2SD) values for $R \geq 0.5$ should be used for all assessments of flaws in welded joints. These laws are shown in Figure 8.2 a).

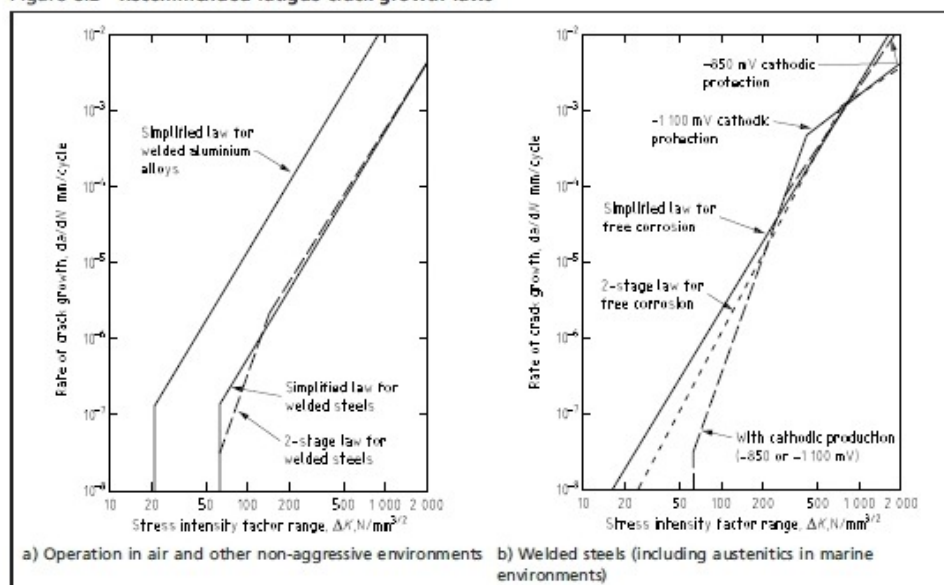
Table 8.3 Recommended fatigue crack growth laws for steels in air ^{A)}

R	Stage A				Stage B				Stage A/ Stage B transition point ΔK , N/mm ^{3/2}	
	Mean curve		Mean + 2SD		Mean curve		Mean + 2SD			
	A ^{B)}	m	A ^{B)}	m	A ^{B)}	m	A ^{B)}	m	Mean curve	Mean + 2SD
<0.5	1.21 × 10 ⁻²⁶	8.16	4.37 × 10 ⁻²⁶	8.16	3.98 × 10 ⁻¹³	2.88	6.77 × 10 ⁻¹³	2.88	363	315
≥0.5	4.80 × 10 ⁻¹⁸	5.10	2.10 × 10 ⁻¹⁷	5.10	5.86 × 10 ⁻¹³	2.88	1.29 × 10 ⁻¹²	2.88	196	144

^{A)} Mean + 2SD for $R \geq 0.5$ values recommended for assessing welded joints.

^{B)} For da/dN in mm/cycle and ΔK in $\text{N/mm}^{3/2}$.

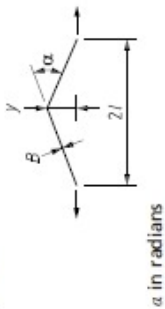
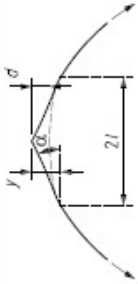
Figure 8.2 Recommended fatigue crack growth laws



BRITISH STANDARD

BS 7910:2019

Table D.1 Formulae for calculating the bending stress due to misalignment in butt joints (continued)

Type	Detail	Bending stress σ_s	Remarks
e) Angular misalignment between flat plates	 α in radians	Assuming boundary conditions equivalent to fixed ends: $\frac{\sigma_s}{P_m} = \frac{3y}{B} \left[\frac{\tanh(\beta/2)}{\beta/2} \right]$ $= \frac{3a/2l}{4B} \left[\frac{\tanh(\beta/2)}{\beta/2} \right]$ pinned ends: $\frac{\sigma_s}{P_m} = \frac{6y}{B} \left[\frac{\tanh(\beta)}{\beta} \right]$ $= \frac{3a/2l}{2B} \left[\frac{\tanh(\beta)}{\beta} \right]$ where, in each case: $\beta = \frac{2l}{B} \left(\frac{3\sigma_{max,m}}{E} \right)^{0.5}$	The tanh correction (in square brackets) allows for reduction in angular misalignment due to straightening of joint under tensile loading. It is always ≤ 1 and therefore it is usually conservative to ignore it. The exception is if, when combined with axial misalignment, the angular component has the effect of reducing the overall stress. Its effect is negligible for $2l/B < 10$ and it is independent of the assumed end fixing condition for $2l/B > 100$. Note, for compressive loading, without any lateral restraint, the "tanh" term becomes a "tan" term and it is no longer conservative to ignore it. Assuming an idealized geometry: $d = \frac{y}{2} \text{ or } \frac{al}{2}$
f) Angular misalignment at longitudinal or circumferential seams in tubes or vessels		Assuming boundary conditions equivalent to fixed ends: $\frac{\sigma_s}{P_m} = \frac{3d}{B(1-\nu^2)} \left[\frac{\tanh(\beta/2)}{\beta/2} \right]$ pinned ends: $\frac{\sigma_s}{P_m} = \frac{6d}{B(1-\nu^2)} \left[\frac{\tanh(\beta)}{\beta} \right]$ where, in each case: $\beta = \frac{2l}{B} \left[\frac{3(1-\nu^2)\sigma_{max,m}}{E} \right]^{0.5}$	

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BRITISH STANDARD**BS 7910:2019**

where:

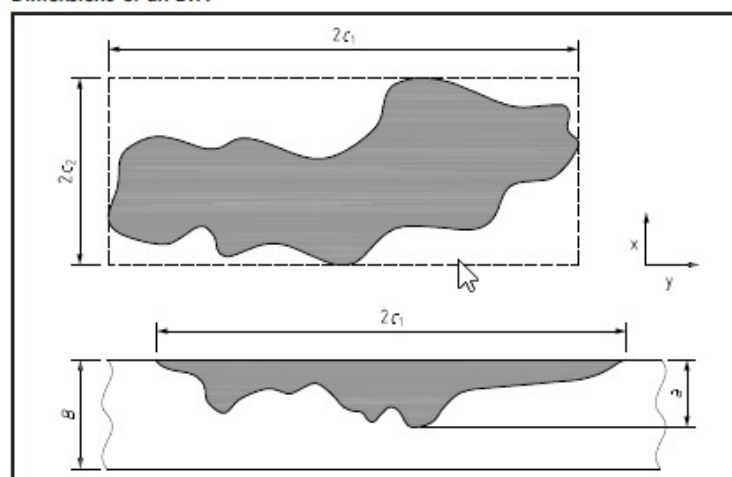
σ_{ref} is obtained from an appropriate reference stress solution (G.4 to G.6);

f_c is a factor of safety (see G.2.5).

The reference stress solutions given in G.4 to G.6 are applicable only to the assessment of LTAs.

The methods for assessing LTAs are based on the assumption of a rectangular profile, i.e. the dimensions of the LTA are defined by its maximum depth and maximum lengths in the axial and circumferential directions (see Figure G.2). Methods based on a river-bottom profile of an LTA are given in ASME B31G and DNVGL-RP-F101 [G.2].

Figure G.2 Dimensions of an LTA



G.4 LTAs in a cylinder

G.4.1 Hoop stress

The reference stress is calculated from the following equation:

$$\sigma_{ref2} = \left[\frac{1 - \left(\frac{a}{B} \right) \frac{1}{Q}}{1 - \left(\frac{a}{B} \right)} \right] \sigma_2 \quad (G.3)$$

where:

$$Q = \sqrt{1 + 0.62 \left(\frac{c_1^2}{r_o B} \right)} \quad (G.4)$$

G.4.2 Axial stress

The reference stress is calculated from the following equation:

$$\sigma_{ref1} = \left[\frac{\pi \left(1 - \frac{a}{B} \right) + 2 \frac{a}{B} \sin \left(\frac{c_1}{r_o} \right)}{\left(1 - \frac{a}{B} \right) \left[\pi - \left(\frac{c_1}{r_o} \right) \left(\frac{a}{B} \right) \right]} \right] \sigma_1 \quad (G.5)$$

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