

Explanatory Notes for BC 1: 2008

1.0 Overview

These explanatory notes explain in details the various design procedures which can be adopted during the design stage and their design implications based on the recommendations given in BC 1: 2008.

2.0 Design procedure

The design procedure is essentially based on the classification approach which consists of both adequacy assessment and reliability assessment of the steel materials to be used in design to BS 5950. The design implication of each class is summarised in Figure I. The differences between adequacy assessment and reliability assessment are given in Table I.

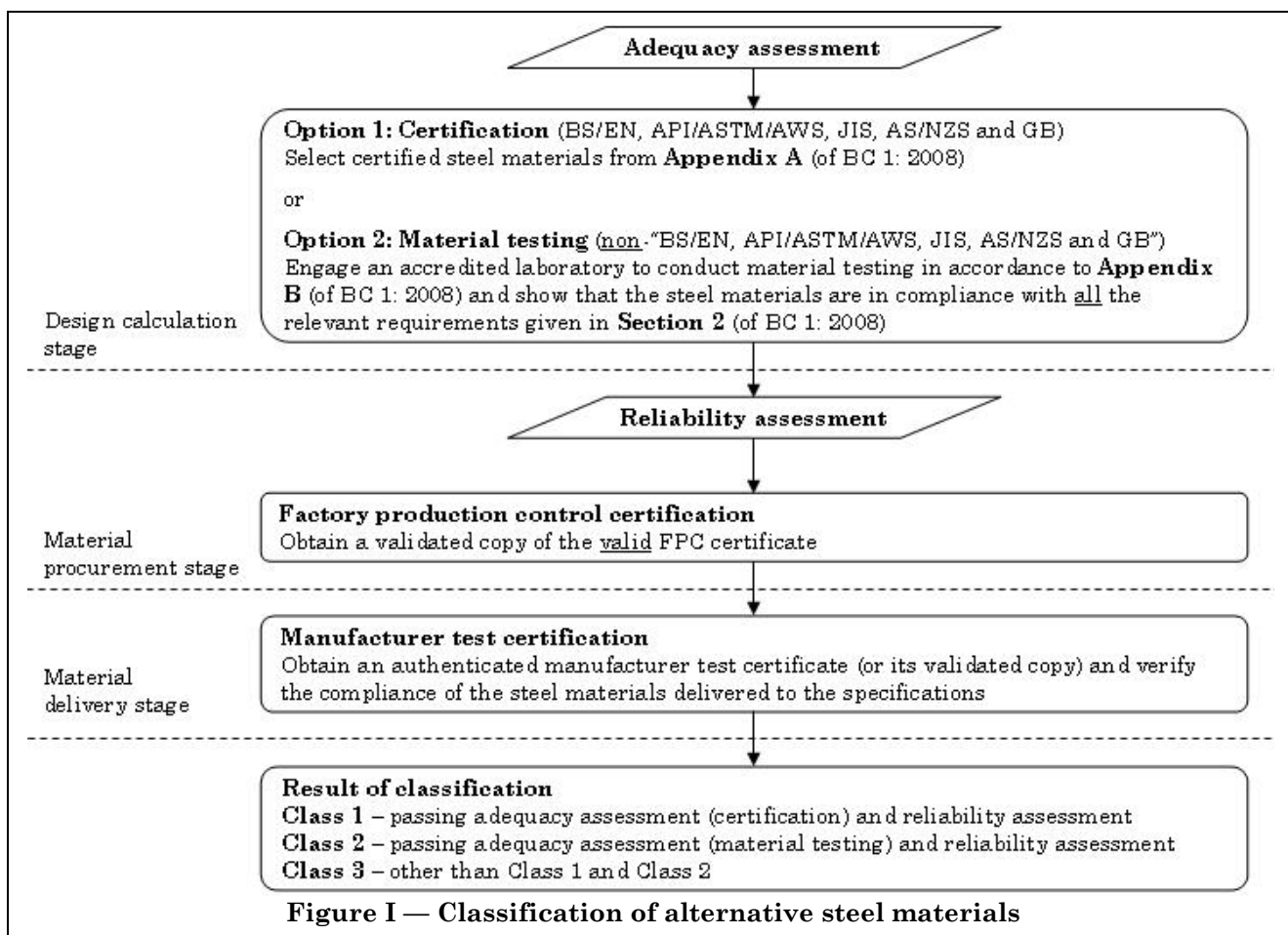


Table I — Comparison of adequacy assessment and reliability assessment

	Adequacy assessment	Reliability assessment
1. Requirements to meet	Material performance requirements, as given in Section 2 (of BC 1: 2008)	Quality assurance requirements, as given in Section 3 (of BC 1: 2008)
2. Object of assessment	Steel materials to be used in design to BS 5950 in Singapore	Both the steel materials and their manufacturers
3. Mode of assessment	Certification <u>or</u> material testing	Factory production control certification <u>and</u> material test certification

2.1 Adequacy assessment

The first step in the classification approach involves the adequacy assessment, i.e. verification of material adequacy against the material performance requirements given in **Section 2** (of BC 1: 2008). Two modes of adequacy assessment are possible, namely certification and material testing, as further explained in **2.1.1** and **2.1.2**, respectively.

The differences in implementing these two modes of assessment are given in Table II.

2.1.1 Certification

Certification is the process of rigorous evaluation of the material specifications given in the British/European, American, Japanese, Australian/New Zealand and Chinese material standards, against the essential material performance requirements in **Section 2** (of BC 1: 2008).

A list of certified steel materials, which contains those materials with their specifications complying with the relevant material performance requirements, is derived for the convenience of the users of BC 1: 2008.

The use of any steel material from this list of certified steel materials shall be considered as meeting the relevant material performance requirements given in **Section 2** (of BC 1: 2008) and passing the adequacy assessment.

Action to be taken by QPs or his representatives:

During the design stage, QPs shall select the steel material from the list of certified steel materials given in **Appendix A** of BC 1: 2008.

QPs shall carry out the design and calculation using the design parameters recommended in **4.1** of BC 1: 2008, assuming the materials will be sourced from manufacturers who can meet the quality assurance requirements as well.

2.1.2 Material testing

Material testing is the process of demonstrating the adequacy of non-certified steel materials outside those considered in 2.1.1 during the design stage, through appropriate sample testing and test method as given in **Appendix B** of BC 1: 2008.

Such testing for the purpose of adequacy assessment during the design stage shall not exempt the purchasers from performing the obligatory inspection and testing in accordance with appropriate regulations during contract execution stage.

Test reports from accredited laboratory under the Singapore Laboratory Accreditation Scheme (SINGLAS) or other laboratory accredited under a mutual recognition agreement with SINGLAS are required to prove that such materials are able to comply with all the relevant material performance requirements given in **Section 2** (of BC 1: 2008).

When the limiting values are not given in **Section 2** (of BC 1: 2008), linear interpolation shall be allowed to determine the limiting value for the test parameters of interest.

Action to be taken by QPs or his representatives:

During the design stage, QPs shall engage an accredited laboratory to conduct material sample testing in accordance to **Appendix B** of BC 1: 2008 and submit a test report containing necessary information (see Table III) to show that the materials are in compliance with all the relevant material performance requirements given in **Section 2** of BC 1: 2008.

QPs shall carry out the design and calculation using the design parameters recommended in **4.2** of BC 1: 2008, again assuming the materials will be able to meet the quality assurance requirements as well.

Table II — Comparison of certification and material testing as mode of adequacy assessment

	Certification	Material testing
1. Party to take action	BCA (action already taken)	QPs (action to be taken)
2. Steel materials covered	Certified steel materials, as given in Appendix A (of BC 1: 2008)	Any steel materials not listed in Appendix A (of BC 1: 2008) manufactured to material standards which are current and confirmed, regardless of the country or region of origin
3. Condition to pass the assessment	QPs are to select steel materials from the list of certified steel materials given in Appendix A (of BC 1: 2008)	QPs are to engage an accredited laboratory to conduct material testing in accordance to Appendix B (of BC 1: 2008) and show that the steel materials are in compliance with <u>all</u> the relevant requirements given in Section 2 (of BC 1: 2008)
4. Class of material, if pass the assessment	Class 1, if also pass the reliability assessment	Class 2, if also pass the reliability assessment
5. Class of material, if fail the assessment	Class 3, and review design	Class 3, and review design

2.2 Reliability assessment

The second step in the classification approach involves the reliability assessment, i.e. verification of material reliability against the quality assurance requirements given in **Section 3** (of BC 1: 2008). Reliability assessment to ensure the steel materials are manufactured under stringent quality assurance system shall meet the quality assurance requirements given in **Section 3** (of BC 1: 2008). It shall be noted that failure in the reliability assessment shall result in the downgrading of material class to Class 3.

Notes on the implementation of reliability assessment, namely factory production control certification and manufacturer test certification are given in 2.2.1 and 2.2.2. Implementation of reliability assessment are summarised in Table IV.

2.2.1 Factory production control certification

The manufacturers shall have a factory production control (FPC) system attested by an independent third-party certification agency acceptable to or recognised by BCA (see **Annex B** for the list of certification agencies acceptable to BCA and a sample of FPC certificate).

Valid FPC certificates issued by the certification agency upon successful first and annual inspections shall be produced by the manufacturers as an indicator of a FPC system acceptable to BCA.

General requirements on FPC are given in **3.1** (of BC 1: 2008). It shall also be noted that:-

- ISO 9001 certificate for quality management system is complimentary, however, it is regarded as insufficient to demonstrate reliability of the FPC system for manufacturers in a production environment;
- FPC certificates shall form the acceptable indicator for an attested production control system in manufacturing a particular type of steel materials (see **Section 2** of BC 1: 2008 for the nine types of steel materials and a sample FPC certificate in **Annex B** of these notes);
- FPC certificates to manufacture BS EN steel materials under the European Union Construction Directives or API Monograms, both which are already widely recognised in the European market and the oil and gas industry respectively, shall be considered 'acceptable in lieu'. The FPC system of such manufacturers in manufacturing the particular type of steel materials shall be considered already attested.

Action to be taken by QPs or his representatives:

Upon confirmation of the source of the steel materials, QPs shall evaluate the validated copy of the valid FPC certificate, obtained either directly from the manufacturer or through the stockist or trader. The document mentioned shall also be made available for subsequent inspection by BCA, if required.

2.2.2 Manufacturer test certification

The manufacturers shall issue an authenticated test certificate for every batch of steel materials delivered as a form of quality assurance on the steel materials.

Mandatory information on test results (as per 3.2.5 of BC 1: 2008) corresponding to different type of steel materials is summarised in Table III.

It shall also be noted that:-

- use of the test results of feedstock materials, if any, shall be clearly indicated;
- actual quantity of steel materials purchased from the stockist or trader shall be clearly indicated and the validated copy of the authenticated test certificate corresponding to the steel materials delivered shall be given to the purchaser.

Table III — Mandatory test results to be indicated on manufacturer test certificate

Type of steel materials	Mandatory test results
<ul style="list-style-type: none"> ▪ Steel plates ▪ Hot rolled sections ▪ Hollow sections ▪ Steel for cold forming¹ 	<ul style="list-style-type: none"> ▪ Yield strength¹ ▪ Tensile strength¹ ▪ Elongation after fracture¹ ▪ Impact energy ▪ Chemical content¹, based on ladle or product analysis, of carbon, sulphur, phosphorous, silicon, manganese, copper, chromium, molybdenum, nickel, aluminium, niobium, titanium, vanadium, nitrogen and any other element intentionally added ▪ Carbon equivalent value computed based on equation¹: $CEV (\%) = \% C + \frac{\% Mn}{6} + \frac{\% Cr + \% Mo + \% V}{5} + \frac{\% Cu + \% Ni}{15}$
<ul style="list-style-type: none"> ▪ Non-preloaded bolting assemblies ▪ Preloaded bolting assemblies 	<ul style="list-style-type: none"> ▪ Yield strength (bolts) ▪ Tensile strength (bolts) ▪ Elongation after fracture (bolts) ▪ Hardness (bolts, nuts and washers) ▪ Proof load stress (nuts) ▪ Chemical content, based on product analysis, of carbon, sulphur and phosphorous (bolts and nuts)
<ul style="list-style-type: none"> ▪ Welding consumables 	<ul style="list-style-type: none"> ▪ Yield strength ▪ Tensile strength ▪ Elongation after fracture ▪ Impact energy

Type of steel materials	Mandatory test results
<ul style="list-style-type: none"> ▪ Profiled steel sheets 	<ul style="list-style-type: none"> ▪ Yield strength ▪ Tensile strength ▪ Chemical content, based on ladle or product analysis, of carbon, sulphur, phosphorous, silicon, manganese, copper, chromium, molybdenum, nickel, aluminium, niobium, titanium, vanadium, nitrogen and any other element intentionally added
<ul style="list-style-type: none"> ▪ Stud shear connectors 	<ul style="list-style-type: none"> ▪ Yield strength ▪ Tensile strength ▪ Elongation after fracture

Action to be taken by QPs or his representatives:

Upon confirmation of the source of steel materials, QPs shall evaluate sample copy of manufacturer test certificate, obtained directly from the manufacturer or through the stockist or trader.

Upon delivery of the steel materials to the site, QPs to inspect and confirm that all the mandatory information are indicated on the actual certificate. The document shall also be made available for inspection by BCA, if required.

Table IV — Comparison of implementation of factory production control certification and manufacturer test certification in reliability assessment

	Factory production control (FPC) certification	Manufacturer test certification (MTC)
1. Requirements to meet	Factory production control, as given in 3.1 (of BC 1: 2008) and attestation checklist	Manufacturer test certificates, as given in 3.2 (of BC 1: 2008)
2. Object of assessment	The manufacturers of steel materials	The steel materials
3. Certificate to be produced by the manufacturers	A valid factory production control (FPC) certificate issued by certification agency acceptable to or recognised by BCA	<ul style="list-style-type: none"> ▪ A sample test certificate ▪ An authenticated test certificate containing complete information for every batch of steel materials delivered
4. Valid coverage of the certificate	The production control and quality assurance provided by the manufacturer in producing the particular type of steel materials	Quality assurance on the particular batch of steel materials delivered
5. Condition to pass the assessment	QPs are to evaluate the certificate*, upon confirmation of source of materials	<ul style="list-style-type: none"> ▪ QPs are to evaluate the sample certificate*, upon confirmation of source of materials ▪ QPs are to evaluate the actual certificate*, which shall also specify the actual quantity of steel materials delivered
*Validated copy of certificates shall be available for inspection		

	Factory production control (FPC) certification	Manufacturer test certification (MTC)
6. Class of material, if pass both assessments	<ul style="list-style-type: none"> ▪ Class 1, if pass the adequacy assessment through certification; ▪ Class 2, if pass the adequacy assessment through material testing 	
7. Class of material, if fail at least one of the two assessments	Class 3	

2.3 Summary of design procedure

Necessary actions to be taken by QPs and BCA during the various stages in the overall design procedure are summarised in Table V and Table VI.

Table V — Actions to be taken by QPs and BCA for Class 1 steel materials

Stage	QPs	BCA
1. Design calculation	<ul style="list-style-type: none"> ▪ Select only certified steel materials from Appendix A of BC 1: 2008 ▪ <u>Assume</u>* materials to be Class 1 and adopt design parameters from 5.1 of BC 1: 2008 ▪ Submit the necessary design calculation as per normal 	<ul style="list-style-type: none"> ▪ Evaluate and approve the submission
2. Material procurement	<ul style="list-style-type: none"> ▪ Confirm the source of steel materials ▪ Obtain a validated copy of the <u>valid</u> FPC certificate ▪ Obtain a sample of manufacturer test certificate to ensure all mandatory information can be provided ▪ Keep copy of above document for inspection 	<ul style="list-style-type: none"> ▪ Check the certificate, if necessary ▪ Appoint a certification agency to inspect the manufacturer (optional)
3. Material delivery	<ul style="list-style-type: none"> ▪ Obtain an authenticated manufacturer test certificate (or its validated copy) and verify the compliance of the steel materials delivered to the specifications ▪ Keep copy of above document for inspection 	<ul style="list-style-type: none"> ▪ Check the certificate, if necessary
<p>* It shall be noted that QPs can only <u>assume</u> that the materials will be Class 1 during the design calculation stage; it is therefore extremely important that QPs perform the necessary follow-up actions during the material procurement and delivery stages to <u>confirm</u> the materials to be Class 1</p>		

Table VI — Actions to be taken by QPs and BCA for Class 2 steel materials

Stage	QPs	BCA
1. Design calculation	<ul style="list-style-type: none"> ▪ Engage an accredited laboratory to conduct sample material testing in accordance to Appendix B and show that the steel materials are in compliance with <u>all</u> the relevant requirements given in Section 2 ▪ <u>Assume</u>* materials to be Class 2 and adopt design parameters from 5.2 of BC 1: 2008 ▪ Submit a copy of the test report and the necessary design calculation as per normal 	<ul style="list-style-type: none"> ▪ Evaluate and approve the submission ▪ Request for test report from an independent inspection agency (optional)
2. Material procurement	<ul style="list-style-type: none"> ▪ Confirm the source of steel materials ▪ Obtain a validated copy of the <u>valid</u> FPC certificate ▪ Obtain a sample of manufacturer test certificate to ensure all mandatory information can be provided ▪ Keep copy of above document for inspection 	<ul style="list-style-type: none"> ▪ Check the certificate, if necessary ▪ Appoint a certification agency to inspect the manufacturer (optional)
3. Material delivery	<ul style="list-style-type: none"> ▪ Obtain an authenticated manufacturer test certificate (or its validated copy) and verify the compliance of the steel materials delivered to the specifications ▪ Keep copy of above document for inspection 	<ul style="list-style-type: none"> ▪ Check the certificate, if necessary
* It shall be noted that QPs can only <u>assume</u> that the materials to be Class 2 during the design calculation stage; it is therefore extremely important that QPs perform the necessary follow-up actions during the material procurement and delivery stages to <u>confirm</u> the materials to be Class 2		

3.0 Alternative procedure

In lieu of the adequacy and reliability assessments recommended in 4.1 and 4.2 (of BC 1: 2008), a material performance-based assessment based on rigorous material testing and control might be appropriate, subject to case-by-case approval from BCA (under clause 4.4 special case of BC 1: 2008).

If approved, the steel materials concerned may be treated as Class 2 materials if their adequacy and reliability can be guaranteed through rigorous control and testing plans of the materials delivery to site.

As a minimum, such assessment shall include:-

- 100% material visual inspection and non-destructive testing to verify manufacturing tolerances;
- 100% destructive testing for all batches and heat numbers (see Table III for tests required);
- test reports from accredited laboratory; and
- a material assessment report from an independent expert consultant.

Annex A List of non-certified steel materials

This list only covers non-certified steel materials manufactured to standards given in **Appendix A** of BC 1: 2008. Each material in this list is non-certified because of at least one or more of the following reasons: -

- A. Strength: Out-of-range
- B. Ductility: Inadequate/Unspecified
- C. Toughness: Inadequate/Unspecified
- D. Hardness: Inadequate/Unspecified
- E. Chemical composition: Non-permitted/Unspecified
- F. Manufacturing tolerance: Non-permitted/Unspecified
- G. Manufacturing process: Rimmed steel
- H. Manufacturing process: Quenched & tempered steel
- I. Not applicable to structural use

A.1 Non-certified British/European steel materials

Material standard	Specification
1. Steel plates	
BS EN 10025-2:2004	▪ E295
	▪ E335
	▪ E360
	▪ S185
	▪ S450J0
BS EN 10025-6:2004	▪ S890Q
	▪ S890QL
	▪ S890QL1
	▪ S960Q
	▪ S960QL
2. Hot rolled sections	
BS EN 10025-2:2004	▪ E295
	▪ E335
	▪ E360
	▪ S185
	▪ S450J0
BS EN 10025-6:2004	▪ S500Q
	▪ S500QL
	▪ S500QL1
	▪ S550Q
	▪ S550QL
	▪ S550QL1

Material standard	Specification
	▪ S620Q
	▪ S620QL
	▪ S620QL1
	▪ S690Q
	▪ S690QL
	▪ S690QL1
	▪ S890Q
	▪ S890QL
	▪ S890QL1
	▪ S960Q
	▪ S960QL
3. Steel for cold forming	
BS EN 10025-2:2004	▪ E295
	▪ E335
	▪ E360
	▪ S185
	▪ S450J0
BS EN 10149-2:1996	▪ S600MC
	▪ S650MC
	▪ S700MC
BS EN 10326:2004	▪ S550GD

A.2 Non-certified American steel materials

Material standard	Specification
1. Steel plates	
ASTM A 283-2003(07)	▪ A
	▪ B
	▪ C
	▪ D
ASTM A 514-2005	▪
ASTM A 529-2005	▪ 50
	▪ 55
ASTM A 573-2005	▪ 440
	▪ 480
ASTM A 871-2001	▪ 60
	▪ 65
2. Hot rolled sections	
ASTM A 529-2005	▪ 50
	▪ 55
3. Hollow sections	
API 5L-2004	▪ PSL1
ASTM A 53-2007	▪ A
	▪ B
ASTM A 268-2005a	▪
ASTM A 333-2005	▪
ASTM A 423-1995(04)	▪
ASTM A 500-2007	▪ A
	▪ B
	▪ C
	▪ D
ASTM A 501-2007	▪ A
ASTM A 595-2006	▪
ASTM A 618-2004	▪ Ia
	▪ Ib
	▪ II
	▪ III
ASTM A 847-2005	▪
4. Steel for cold forming	
ASTM A 109-2003	▪
ASTM A 308-2006	▪ SS 30
	▪ SS 33
	▪ SS 40
ASTM A 653-2007	▪

Material standard	Specification
ASTM A 606-2001	▪
ASTM A 792-2006a	▪ SS 255
	▪ SS 275
	▪ SS 340
ASTM A 875-2006	▪ SS 330
ASTM A 1003-2005	▪ ST 230H
	▪ ST 230L
	▪ ST 255H
	▪ ST 255L
	▪ ST 275H
	▪ ST 275L
	▪ ST 340H
▪ ST 340L	
ASTM A 1011-2007	▪ HSLA 480
	▪ HSLA-F 480
	▪ HSLA-F 550
	▪ HSLAS 310
	▪ HSLAS 340
	▪ HSLAS 380
	▪ HSLAS 410
	▪ HSLAS 450
	▪ HSLAS-F 410
	▪ SS 275
	▪ SS 310
	▪ SS 340
	▪ SS 380
	▪ SS 410
▪ SS 480	
▪ SS 550	
5. Non-preloaded bolting assemblies	
ASTM A 193-2007	▪
ASTM A 194-2007b	▪ 1
	▪ 2
	▪ 3
	▪ 6
	▪ 8
ASTM A 307-2007b	▪ A
ASTM A 563-2007a	▪ 8S3-B
6. Preloaded bolting assemblies	
ASTM A 193-2007	▪
ASTM A 194-2007b	▪ 2H

A.3 Non-certified Japanese steel materials

Material standard	Specification
1. Steel plates	
JIS G 3101: 2004	▪ SS330
	▪ SS400
	▪ SS490
	▪ SS540
JIS G 3106: 2004	▪ SM400A
	▪ SM400B
	▪ SM400C
JIS G 3114: 2004	▪ SMA400AW
	▪ SMA400AP
	▪ SMA400BW
	▪ SMA400BP
	▪ SMA400CW
	▪ SMA400CP
	▪ SMA490AW
	▪ SMA490AP
JIS G 3128: 1999	▪ SHY 685
	▪ SHY 685N
	▪ SHY 685NS
JIS G 3131: 2005	▪ SPHC
	▪ SPHD
	▪ SPHE
JIS G 3132: 2005	▪ SPHT 1
	▪ SPHT 2
	▪ SPHT 3
	▪ SPHT 4
JIS G 3136: 2005	▪ SN400A
2. Hot rolled sections	
JIS G 3101: 2004	▪ SS330
	▪ SS400
	▪ SS490
	▪ SS540
JIS G 3106: 2004	▪ SM400A
	▪ SM400B
	▪ SM400C
JIS G 3114: 2004	▪ SMA400AW
	▪ SMA400AP
	▪ SMA400BW
	▪ SMA400BP
	▪ SMA400CW
	▪ SMA400CP
	▪ SMA490AW
	▪ SMA490AP
▪ SMA570P	
JIS G 3136: 2005	▪ SN400A
3. Hollow sections	
JIS G 3444: 2006	▪ STK290
	▪ STK400

Material standard	Specification
	▪ STK500
	▪ STK490
	▪ STK540
JIS G 3466: 2006	▪ STKR400
	▪ STKR490
JIS G 3475: 1996	▪ STKN400W
	▪ STKN400B
4. Steel for cold forming	
JIS G 3101: 2004	▪ SS330
	▪ SS400
	▪ SS490
	▪ SS540
JIS G 3106: 2004	▪ SM400A
	▪ SM400B
	▪ SM400C
JIS G 3114: 2004	▪ SMA400AW
	▪ SMA400AP
	▪ SMA400BW
	▪ SMA400BP
	▪ SMA400CW
	▪ SMA400CP
	▪ SMA490AW
	▪ SMA490AP
▪ SMA570P	
JIS G 3136: 2005	▪ SN400A
JIS G 3302: 2005	▪ SGHC
	▪ SGH340
	▪ SGH400
	▪ SGH440
	▪ SGH490
	▪ SGH540
	▪ SGCC
	▪ SGCH
	▪ SGCD1
	▪ SGCD2
	▪ SGCD3
	▪ SGC340
	▪ SGC400
	▪ SGC440
▪ SGC490	
▪ SGC570	
JIS G 3312: 2005	▪ CGCC
	▪ CGCH
	▪ CGCD1
	▪ CGC340
	▪ CGC400
	▪ CGC440
	▪ CGC490
▪ CGC570	
JIS G 3321: 2005	▪ SGLHC

Material standard	Specification
	<ul style="list-style-type: none"> ▪ SGLH400 ▪ SGLH440 ▪ SGLH490 ▪ SGLH540 ▪ SGLCC ▪ SGLCD ▪ SGLC400 ▪ SGLC440 ▪ SGLC490 ▪ SGLC570
JIS G 3322: 2005	<ul style="list-style-type: none"> ▪ CGLCC ▪ CGLCD ▪ CGLC400 ▪ CGLC440 ▪ CGLC490 ▪ CGLC570
JIS G 3352: 1979	<ul style="list-style-type: none"> ▪ SDP 1 ▪ SDP 2 ▪ SDP 3

Material standard	Specification
8. Profiled steel sheets	
JIS G 3302: 2005	<ul style="list-style-type: none"> ▪ SGHC ▪ SGCC ▪ SGCH ▪ SGCD1 ▪ SGCD2 ▪ SGCD3 ▪ SGC570
JIS G 3321: 2005	<ul style="list-style-type: none"> ▪ SGLHC ▪ SGLH400 ▪ SGLH440 ▪ SGLH490 ▪ SGLH540 ▪ SGLCC ▪ SGLCD ▪ SGLC400 ▪ SGLC440 ▪ SGLC490 ▪ SGLC570

A.4 Non-certified Australian/New Zealand steel materials

Material standard	Specification
1. Steel plates	
AS/NZS 1594-2002	<ul style="list-style-type: none"> ▪
2. Hot rolled sections	
AS/NZS 1679.1-1996	<ul style="list-style-type: none"> ▪ 250 ▪ 300 ▪ 350 ▪ 400
4. Steel for cold forming	
AS 1397-2001	<ul style="list-style-type: none"> ▪ G 500 ▪ G 550
AS 1548-1995	<ul style="list-style-type: none"> ▪ 5-490N or A ▪ 7-430 N, R, T or A

Material standard	Specification
	<ul style="list-style-type: none"> ▪ 7-460 N, R, T or A ▪ 7-490 N, R, T or A
AS/NZS 1594-2002	<ul style="list-style-type: none"> ▪
AS/NZS 1595-1998	<ul style="list-style-type: none"> ▪ CA 220 ▪ CA 260 ▪ CA 350 ▪ CW 300
AS/NZS 3678-1996	<ul style="list-style-type: none"> ▪ 250 ▪ 300 ▪ 350 ▪ 400 ▪ 450

A.5 Non-certified Chinese steel materials

Material standard	Specification
1. Steel plates	
GB/T 700-2006	▪ Q195F
	▪ Q195Z
	▪ Q215AF
	▪ Q215AZ
	▪ Q215BF
	▪ Q215BZ
	▪ Q235AF
	▪ Q235AZ
	▪ Q235BF
	▪ Q275AF
	▪ Q275AZ
GB/T 1591-1994	▪ Q295A
	▪ Q345A
	▪ Q390A
	▪ Q420A
2. Hot rolled sections	
GB/T 700-2006	▪ Q195F
	▪ Q195Z
	▪ Q215AF
	▪ Q215AZ
	▪ Q215BF
	▪ Q215BZ
	▪ Q235AF
	▪ Q235AZ
	▪ Q235BF
	▪ Q275AF
	▪ Q275AZ
GB/T 1591-1994	▪ Q295A
	▪ Q345A
	▪ Q390A
	▪ Q420A
3. Hollow sections	
GB/T 700-2006	▪ Q195F
	▪ Q195Z
	▪ Q215AF
	▪ Q215AZ
	▪ Q215BF
	▪ Q215BZ
	▪ Q235AF
	▪ Q235AZ
	▪ Q235BF
	▪ Q235BZ
	▪ Q275AF
	▪ Q275AZ
	▪ Q275BZ
	GB/T 1591-1994
▪ Q295B	
▪ Q345A	
▪ Q345B	

Material standard	Specification
	▪ Q390A
	▪ Q390B
	▪ Q420A
	▪ Q420B
	▪ 10
	▪ 20
GB/T 8162-1999	▪ 35
	▪ 45
	▪ 40Mn2
	▪ 45Mn2
	▪ 27SiMn
	▪ 40MnB
	▪ 45MnB
	▪ 20Mn2B
	▪ 20Cr
	▪ 30Cr
	▪ 35Cr
	▪ 40Cr
	▪ 45Cr
	▪ 50Cr
	▪ 38CrSi
	▪ 12CrMo
	▪ 15CrMo
	▪ 20CrMo
	▪ 35CrMo
	▪ 42CrMo
	▪ 12CrMoV
	▪ 12Cr1MoV
	▪ 38CrMoAl
	▪ 50CrVA
	▪ 20CrMn
	▪ 20CrMnSi
	▪ 30CrMnSi
	▪ 35CrMnSiA
	▪ 20CrMnTi
	▪ 30CrMnTi
	▪ 12CrNi2
	▪ 12CrNi3
	▪ 12CrNi4
▪ 40CrNiMoA	
▪ 45CrNiMoVA	
4. Steel for cold forming	
GB/T 700-2006	▪ Q195F
	▪ Q195Z
	▪ Q215AF
	▪ Q215BF
	▪ Q235AF
	▪ Q235BF
▪ Q275AF	

Annex B List of certification agencies acceptable to BCA

Certification agencies in this list are considered acceptable to BCA. FPC certificate issued by any agency in this list is an attestation of a reliable FPC system adopted by the manufacturer in manufacturing a particular type of steel material.

- American Bureau of Shipping (ABS)
- American Petroleum Institute (API)
- Bureau Veritas (BV)
- Det Norske Veritas (DnV)
- Germanischer Lloyd
- Lloyd's Register
- Moody International
- Nippon Kaiji Kyokai (ClassNK)
- TÜV Rheinland

See Figure II for a sample of FPC certificate required and the mandatory information to be indicated.

❶ **Factory Production Control Certificate to BC 1:2008**

In compliance with the Factory Production Control requirements of
the Building and Construction Authority, Singapore.

This is to certify that the Factory Production Control system of:

❷ ***Name of the manufacturer***

in the factory located at:

❸ ***Address of factory***

has been assessed under the Factory Production Control requirements of
BC 1:2008 and conforms to its requirements for the production of

List of product standards and, if appropriate:-

- ❹ {
- *standard for manufacturing tolerances (see Appendix A of BC 1:2008)*
 - *additional provisions to which the product conforms*
 - *particular conditions applicable to the use of the product (addendum sheet if necessary)*

❺ ***Conditions and period of validity, where applicable***

This certificate is only valid when:

- ❻ {
- | | |
|---------------------|-------------------------|
| Certificate no.: | <i>BC1-1234-56789</i> |
| First issue date: | <i>21 February 2008</i> |
| Current issue date: | <i>21 February 2008</i> |
| Expiry date: | <i>20 February 2011</i> |

❼ {



***Name and address
of the certification
agency***

❼ {

*Authorised
signatory*

.....

***Name and position
on behalf of
name of the certification agency***

Figure II — Mandatory information, as numbered, for BC 1: 2008 FPC certificate (sample)