



## Model specification for the purchase of reclaimed steel sections

### 1 Introduction

This model specification is for the purchase of reclaimed steel sections and should be used in conjunction with Annex J – Sustainability Specification of the National Structural Steelwork Specification for Buildings (NSSS), BCSA Pub. No. 65/22.

This model specification applies to suppliers of steel products placed on the market as reclaimed structural steel sections for the fabrication of structural steelwork.

Business models for the reclamation and reuse of structural steelwork are still evolving. The likely model anticipated within this specification is as follows:

- The demolition contractor reclaims the steelwork from an existing building,
- The demolition contractor sells the reclaimed steelwork to a stockholder,
- The stockholder tests and certifies the reclaimed steelwork,
- The stockholder sells the certified, reclaimed steelwork to the steelwork contractor,
- The steelwork contractor fabricates the reclaimed steelwork in accordance with the NSSS or BS EN 1090-2.

This model specification applies to the contract between the stockholder (the supplier) and the steelwork contractor (the purchaser).

The supplier should comply with the full requirements of this specification, unless otherwise agreed with the purchaser of steel products.

### 2 Definitions

|                      |   |
|----------------------|---|
| Constituent products | Materials or products used in manufacturing with properties which enter into structural calculations or otherwise relate to the mechanical resistance and stability of works and parts thereof, and/or their fire resistance, including aspects of durability and serviceability.<br>[BS EN 1090-1] |
| Purchaser            | The company purchasing the reclaimed steel products. Generally, this is a steelwork contractor that fabricates and executes the   |

structural steelwork, undertaking the role of constructor defined in BS EN 1090-2.

Supplier The company supplying the reclaimed steel products. The supplier is generally a steel stockholder.

*Note: The terms “agent” and “trader” are also common usage in the steel supply chain, but these terms are not formally recognised under this specification.*

Inspection document Document issued by the manufacturer in which the manufacturer declares the products supplied are in compliance with the requirements of the order and/or relevant standard, and in which the manufacturer supplies supporting test results.

Reclaimed steel products Individual elements extracted from an existing structure selected for disassembly, and then reused as a *new* product for erection and fabrication of another structure, e.g. hot-rolled and cold-formed steel profiles.

### 3 Referenced documents

The following documents and standards are referred to in this model specification.

- Brown DG, Pimentel RJ, Sansom MR (2019). Structural steel reuse — assessment, testing and design principles (SCI-P427). The Steel Construction Institute, Ascot. *(available for free download from <https://portal.steel-sci.com/shop.html>)*
- BS EN 1090-1:2009+A1:2011, *Execution of steel structures and aluminium structures — Part 1: Requirements for conformity assessment of structural components*, which specifies requirements for conformity assessment of performance characteristics for structural steel components and kits placed on the market as construction products.
- BS EN 1090-2:2018, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*, which sets all the technical requirements that should be taken into account for the execution of structural steelwork.
- BS EN 1993-1-1:2005+A1:2014 (and its UK National Annex), *Eurocode 3 — Design of steel structures — Part 1-1: General rules and rules for buildings*, which gives general rules for the design of steel structures.
- BS EN 1993-1-8:2005 (and its UK National Annex), *Eurocode 3 — Design of steel structures — Part 1-8: Design of joints*, which specialises in the design of steel joints.
- BS EN 1993-1-10:2005 (and its UK National Annex), *Eurocode 3 — Design of steel structures — Part 1-10: Material toughness and through-thickness properties*, which contains design guidance for the selection of steel for fracture toughness and for through thickness properties of welded elements where there is a significant risk of lamellar tearing during fabrication.
- BS EN 10029:2010, *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*, which specifies requirements for tolerances for hot-rolled non-alloy and alloy steel plates.

- BS EN 10034:1993, *Structural steel I and H sections — Tolerances on shape and dimensions*, which specifies tolerances on shape dimensions and mass of structural steel I and H sections. The requirements do not apply to I and H sections rolled from stainless steel or to taper flange sections.
- BS EN 10051:2010, *Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels — Tolerances on dimensions and shape*, which applies to (i) continuously hot-rolled uncoated flat products with a maximum width of 2200 mm of non-alloy and alloy steels including stainless steels, and (ii) hot-rolled strip for cold rolling.
- BS EN 10055:1996, *Hot rolled steel equal flange tees with radiused root and toes — Dimensions and tolerances on shape and dimensions*, which sets out requirements for the nominal dimensions and the tolerances on dimensions, shape and mass of hot-rolled steel equal flange tees with radiused root and toes. The standard is not applicable to equal flange tees produced from stainless steel.
- BS EN 10056-1:2017, *Hot rolled steel equal flange tees with radiused root and toes — Part 1: Dimensions and tolerances on shape and dimensions*, which details dimensions of hot-rolled equal and unequal leg angles.
- BS EN 10056-2:1993, *Specification for structural steel equal and unequal leg angles — Part 2: Tolerances on shape and dimensions*, which specifies tolerances on the shape dimensions and mass of hot-rolled structural steel with equal and unequal leg angles.
- BS EN 10204:2017, *Metallic products — Types of inspection documents*, in which details are given for the different types of inspection documents supplied to the purchaser, in accordance with the requirements of the order, for the delivery of all metallic products e.g. plates, sheets, bars, forgings, castings, whatever their method of production.
- BS EN 10210-1:2006, *Hot finished structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*, which specifies technical delivery conditions for hot finished hollow sections of circular, square, rectangular or elliptical forms. It applies to hollow sections formed hot, with or without subsequent heat treatment, or formed cold with subsequent heat treatment to obtain equivalent metallurgical conditions to those obtained in the hot formed product.
- BS EN 10210-2:2019, *Hot finished structural hollow sections — Part 2: Tolerances, dimensions and sectional properties*, which provides tolerances, dimensions and sectional properties for hot finished circular, square, rectangular and elliptical structural hollow sections, manufactured in wall thicknesses up to 120 mm.
- BS EN 10219-1:2006, *Cold formed welded structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*, which specifies the technical delivery conditions for cold formed welded structural hollow sections of circular, square or rectangular forms. The standard applies to structural hollow sections formed cold without subsequent heat treatment.
- BS EN 10219-2:2019, *Cold formed welded steel structural hollow sections — Part 2: Tolerances, dimensions and sectional properties*, which details tolerances, dimensions and sectional properties for cold formed welded circular, square, rectangular, and elliptical structural hollow sections, manufactured in wall thicknesses up to 40 mm. It also provides information to be obtained by the manufacturer.
- BS EN 10279:2000, *Hot rolled steel channels — Tolerances on shape, dimension and mass*, which specifies requirements for the tolerances on dimensions, shape and mass of hot-rolled steel channels with tapered flanges, or parallel flanges.

- BS EN 10365:2017, *Hot rolled steel channels, I and H sections — Dimensions and masses*, which provides the nominal dimensions and masses of the hot rolled steel channels, I and H sections, covering a range of shapes.
- BS EN ISO 377:2017, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*, which specifies requirements for the identification, location and preparation of samples and test pieces intended for mechanical tests on steel sections, bars, rods, flat products, and tubular products.
- BS EN ISO 8501-1:2007, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*, which specifies a series of rust grades and preparation grades of steel surfaces.
- BS EN ISO 9001:2015, *Quality management systems — Requirements*, which specifies requirements for a quality management system when an organisation (i) needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and (ii) aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.
- BS EN ISO/IEC 17025:2017, *General requirements for the competence of testing and calibration laboratories*, which specifies the general requirements for the competence, impartiality, and consistent operation of laboratories.

For dated references of Standards, only the edition cited applies, e.g. Clause x of BS EN 1090-2:2018. For undated references, the latest edition of the referred standard, including any amendments, applies, e.g. BS EN 1090-2.

## 4 Selection and acceptance criteria

The following procedure should be adopted for verification of the structural reusability of steel members as constituent products:

1. A pre-deconstruction audit should be carried out, and documentation showing the location and describing the building structure from where the members were recovered should be provided, including the date of construction, for all members.
2. The demolition contractor should salvage steel products for reuse from building structures first erected after 1970, and that were not exposed to extensive dynamic loading, e.g. fatigue-dominated structures, and other severe conditions, e.g. fire.  
*Note: It is assumed that the date of construction is the same as the date of manufacture of the steel members.*
3. The supplier should visually inspect all surfaces, to ensure that there is no significant loss of section due to corrosion (loss exceeding 5% of the element thickness is considered significant). In the case of structural hollow sections, the external surface of the weld seam should be inspected by Magnetic Particle Inspection to confirm there are no surface breaking defects.

*Note 1: Elements need to be visually exposed, therefore fire protection, if present, needs to be removed.*

*Note 2: If the loss of section thickness from corrosion exceeds 5% and if agreed by all parties, reduced section properties can be calculated and used in the design process.*

4. The supplier should remove all coatings containing toxic substances, e.g. lead, cadmium, asbestos, and surface scaling, by preparing the surfaces to Sa2½ in accordance with BS EN ISO 8501-1.
5. The condition of any welds should be carefully assessed, see also Section 8.4 of SCI-P427.
6. Members fabricated from reclaimed steel should not have holes in the vicinity — see requirements for minimum spacing given in BS EN 1993-1-8 — of locations where new holes are to be drilled in the member.
7. The supplier should measure the sectional dimensions, if not known. Three locations along the members for comparison against nominal values should be selected, see also items 8 and 9 below.
8. For open cross-sections — wide flange H and universal I beams —, BS EN 10034 specifies tolerances on shape dimensions of structural steel beams and columns. At the level of cross-section for universal beams and columns, the following tolerances should be observed: height of cross-section, flange width, web thickness, flange thickness, out-of-squareness, and web off-centre. Flange thickness should be measured at quarter points along the member, each at top left half-flange and bottom right half-flange, and web thickness should be measured at quarter points along beam central axis.
9. For closed cross-sections, e.g. Circular Hollow Sections (CHS), Square Hollow Sections (SHS), and Rectangular Hollow Sections (RHS), BS EN 10219-2 specifies tolerances on shape dimensions of cold-formed structural hollow sections. At the level of cross-section, the following tolerances should be observed: outside dimensions (CHS, SHS, and RHS), thickness (CHS, SHS, and RHS), out-of-roundness (for CHS), concavity/convexity (for SHS, and RHS), and squareness of sides (for SHS, and RHS).
10. Tolerances on the member straightness should comply with the National Structural Steelwork Specification for Building Construction (NSSS).  
*Note: Tolerances on older, reclaimed sections may be different to current requirements and therefore straightening may be required to comply with the NSSS.*
11. All members should be free from discontinuities (imperfections and defects) caused during the reclamation process. Discontinuities may be rectified by the supplier. Any discontinuities not rectified, shall be assessed by the purchaser before purchase.
12. Diffuse necking is not permitted in any cross-section, e.g. connection areas and elements in tension.
13. Reclaimed sections which are beyond economic repair/reconditioning should be recycled.

## 5 Technical specification

### 5.1 Steel products

At the time of order, the purchaser shall require the relevant properties to be specified for reclaimed steel products by the supplier, see Section 5.3.

At the time of order, the purchaser shall specify any other special requirements, e.g. a particular steel chemistry, or a particular limit on the carbon equivalent value.

### 5.2 Tolerances on dimensions and shape

Constituent products shall conform with the appropriate product standards. Rolled steel sections, and hollow sections used as members shall be supplied with dimensions and tolerances that comply with the standards from Table 1.

**Table 1** Rolled steel sections, plates and hollow sections: dimension standards

| Form                           | Dimensions                 | Tolerances                 |
|--------------------------------|----------------------------|----------------------------|
| I and H sections               | BS EN 10365<br>(or BS 4-1) | BS EN 10034<br>(or BS 4-1) |
| Hollow sections (hot finished) | BS EN 10210-2              | BS EN 10210-2              |
| Hollow sections (cold formed)  | BS EN 10219-2              | BS EN 10219-2              |

### 5.3 Material performance requirements

#### 5.3.1 Mandatory requirements

BS EN 1090-2 allows constituent products that are not covered by the standards listed in BS EN 1090-2 to be specified. The following mechanical properties shall be determined:

- Strength, i.e. yield strength,  $f_y$ , and tensile strength,  $f_u$ ,
- Elongation after fracture,  $\epsilon_t$ ,
- Heat treatment delivery condition.

The nominal yield strength shall be in the range of 235 N/mm<sup>2</sup> and 460 N/mm<sup>2</sup>. The minimum nominal tensile strength shall be in the range of 360 N/mm<sup>2</sup> to 550 N/mm<sup>2</sup>.

*Note 1: The ductility requirements for design to BS EN 1993-1-1 and its UK National Annex (NA) are set out in Table 2.*

*Note 2: The specification of the heat treatment delivery condition is relevant for hollow sections. Conservatively, it is recommended that all reclaimed hollow sections are assumed to be cold formed according to BS EN 10219, see also SCI-P427.*

**Table 2** Ductility requirements (UK NA to BS EN 1993-1-1)

| Global analysis | Yield ratio $f_u/f_y$ | Elongation at failure | Ultimate strain $\epsilon_u$ |
|-----------------|-----------------------|-----------------------|------------------------------|
| Elastic         | $\geq 1.10$           | $\geq 15\%$           | $\geq 15 \frac{f_y}{E}$      |
| Plastic         | $\geq 1.15$           | $\geq 15\%$           | $\geq 20 \frac{f_y}{E}$      |

### 5.3.2 Other relevant properties

BS EN 1090-2 also states that the following properties may be required, although not mandatory:

- Stress reduction of area,
- Impact strength or toughness,
- Through-thickness requirements (Z-quality),
- Limits on internal discontinuities or cracks in zones to be welded.

Unless otherwise specified in the purchaser's order, the through-thickness requirements — steel qualities or sub-grade — shall be in accordance with the requirements as given in Table 3.

*Note: The values in Table 3 are based on Table 2.2 of the NSSS assuming steelwork to be welded generally with detail being "moderate" and the presence of tensile stress.*

*Alternatively, a fracture mechanics approach that conforms to the recommendations given in BS EN 1993-1-10 may be used to determine the toughness requirements.*

**Table 3** Maximum thickness, in [mm]

| Steelwork | S235 |     |     | S275 |     |     | S355 |    |     |
|-----------|------|-----|-----|------|-----|-----|------|----|-----|
|           | JR   | J0  | J2  | JR   | J0  | J2  | JR   | J0 | J2  |
| Internal  | 106  | 200 | 200 | 77   | 200 | 200 | 35   | 95 | 188 |
| External  | 42   | 197 | 200 | 32   | 166 | 200 | 16   | 65 | 145 |

### 5.3.3 Weldability

The steel weldability shall be declared as follows, see BS EN 1090-2:

- A maximum limit for the carbon equivalent, or,
- A declaration of its chemical composition in sufficient detail for its carbon equivalent to be calculated.

## 6 Product testing

The supplier shall specifically test reclaimed steel products following the guidance given in The Steel Construction Institute (SCI) protocol, see SCI-P427. All tests carried out by the supplier shall be undertaken by a laboratory certified as competent to BS EN ISO/IEC 17025 by a UKAS — or equivalent — accredited testing laboratory.

Non-destructive hardness testing shall be carried out for batching steel products (to identify test units) and not to determine the yield strength of the material.

Test units should be established in accordance with the sampling strategies proposed in Section 6.1 of SCI-P427.

The testing programme should comply with the requirements from Section 7 of SCI-P427.

For tensile testing, the coupons should be extracted from the web and flange, unless otherwise specified, usually at the end of the member.

The supplier shall declare the results in accordance with the recommendations in Appendix B of SCI-P427.

The supplier shall provide to the purchaser, a copy of all test reports from the certified laboratory showing the test data.

## 7 Quality management

The supplier shall have a quality management system with a scope that complies with the requirements of BS EN ISO 9001 and is certified by a certification body accredited by UKAS or an equivalent approved body. Prior to order, the supplier shall provide verification of BS EN ISO 9001 compliance to the purchaser.

The supplier shall have a system of receipt, dispatch and delivery that ensures traceability from the demolition contractor to point of delivery of the steel products to the purchaser. The supplier shall have in place an identifier — marking — that ensures traceability of individual members back to the pre-deconstruction audit information and all inspection documents and test reports.

Marking may be achieved using durable and distinguishing marks applied in a way that will not damage the section/s (e.g. stencils, machine markings, scribing, colour codes etc.). Chiselled notches are not permitted. Hard stamped, punched and drilled marks may be used if specified. Alternatively, soft or low stress stamps may be used.

If the supplier fabricates the steel products in accordance with BS EN 1090-2, then the supplier shall have in place a certified factory production control system issued by an Approved (Notified) Body in accordance with BS EN 1090-1.



## 8 Documentation requirements

The following data records shall be provided to or collected by the supplier:

**Table 5** Documentation required by the supplier

| Item                 | Documentation type   | Additional description   |
|----------------------|--|--|
| Building information | Documentation prepared for the specific reclaimed steel products | Including pre-deconstruction audit, age, location, form of construction, e.g. braced or continuous, drawings, if available, etc.<br><i>Note: See item Nos. 1 and 2 in Section 4.</i> |

The supplier shall provide the following data records to the purchaser:

**Table 6** Documentation provided by the supplier

| Item   | Documentation type                                    | Additional description  |
|--|---|---|
| Survey of individual members: dimensions and visual inspection | Quality record  | <ul style="list-style-type: none"> <li>— Surface condition, including corrosion.<br/><i>Note: See item No. 3, 11 and 12 in Section 4.</i></li> <li>— Type and condition of the coating and any surface preparation.<br/><i>Note: See item No. 4 in Section 4.</i></li> <li>— Member individual identification.</li> </ul> |
|  | Geometry record                                       | <ul style="list-style-type: none"> <li>— Section dimensions and nominal section designation.<br/><i>Note: See items No. 7, 8 and 9 in Section 4. See also Section 5.2.</i></li> <li>— Length and straightness, and any straightness operations.<br/><i>Note: See item No. 10 in Section 4.</i></li> </ul>                 |
| Inspection   | Test units records                                    | <ul style="list-style-type: none"> <li>— Follow requirements given in Section 6.1 of SCI-P427.</li> <li>— Assign a unique identifier to each member in each test unit, e.g. using consecutive integer identifiers.</li> </ul>   |
|  | Sampling  | <ul style="list-style-type: none"> <li>— Including sampling strategies for members, and the location of drilling or cutting of samples.<br/><i>Note: Samples are usually selected randomly: each member of the test unit has the same probability of being sampled.</i></li> </ul>  |
| Testing of materials   | Laboratory test reports and any supplementary test(s) | <ul style="list-style-type: none"> <li>— See Sections 5.3 and 6.</li> <li>— Nominal steel grade, see Section C.1 of SCI-P427.</li> </ul>  |

The supplier shall retain copies of all documents, including the laboratory test reports and other quality records, and keep records of checks carried out on these documents and any non-conformance reports for a period of 10 years.

## 9 References

The supplier and the purchaser shall have access to up-to-date copies of all the relevant standards referred to in this specification.

## 10 Undertaking

I/we the undersigned agree to supply steel products in accordance with this specification and any variation from this agreement will be agreed in writing.

**On behalf of supplier:**

**On behalf of purchaser:**

Company: \_\_\_\_\_

Company: \_\_\_\_\_

Signed: \_\_\_\_\_

Signed: \_\_\_\_\_

Print: \_\_\_\_\_

Print: \_\_\_\_\_

Date:

Date: