
W10 Spheroidal or nodular graphite iron castings

(1978)
(Rev. 1
1995)
(Rev. 2
May 2004)

W10.1 Scope (1978)

W10.1.1 All important spheroidal or nodular graphite iron castings, as defined in the relevant construction Rules, are to be manufactured and tested in accordance with the requirements of the following paragraphs.

W10.1.2 These requirements are applicable only to castings where the design and acceptance tests are related to mechanical properties at ambient temperature. For other applications additional requirements may be necessary, especially when the castings are intended for service at low or elevated temperatures.

W10.1.3 Alternatively, castings which comply with national or proprietary specifications may be accepted provided such specifications give reasonable equivalence to these requirements or otherwise are specially approved or required by the Classification Society.

W10.1.4 Where small castings are produced in large quantities the manufacturer may adopt alternative procedures for testing and inspection subject to the approval of the Classification Society.

W10.2 Manufacture (1978)

W10.2.1 All important castings are to be made at foundries where the manufacturer has demonstrated to the satisfaction of the Classification Society that the necessary manufacturing and testing facilities are available and are supervised by qualified personnel. A programme of approval tests may be required in accordance with the procedures of individual Classification Societies.

W10.2.2 Suitable mechanical methods are to be employed for the removal of surplus material from castings. Thermal cutting processes are not acceptable, except as a preliminary operation to mechanical methods.

W10.2.3 Where castings of the same type are regularly produced in quantity, the manufacturer is to make any tests necessary to prove the quality of the prototype castings and is also to make periodical examinations to verify the continued efficiency of the manufacturing technique. The Surveyor is to be given the opportunity to witness these tests.



W10
cont'd**W10.3 Quality of castings
(1978)**

W10.3.1 Castings are to be free from surface or internal defects which would be prejudicial to their proper application in service. The surface finish is to be in accordance with good practice and any specific requirements of the approved plan.

**W10.4 Chemical composition
(1978)**

W10.4.1 Unless otherwise specially required, the chemical composition of the iron used is left to the discretion of the manufacturer, who is to ensure that it is suitable to obtain the mechanical properties specified for the castings. When required by individual Classification Societies the chemical composition of ladle samples is to be reported.

**W10.5 Heat treatment
(Rev. 1995)**

W10.5.1 Except as required by W10.5.2 castings may be supplied in either the as cast or heat treated condition.

W10.5.2 For some applications, such as high temperature service or where dimensional stability is important, it may be required that castings be given a suitable tempering or stress relieving heat treatment. This is to be carried out after any refining heat treatment and before machining. The special qualities with 350 N/mm² and 400 N/mm² nominal tensile strength and impact test shall undergo a ferritizing heat treatment.

W10.5.3 Where it is proposed to locally harden the surfaces of a casting full details of the proposed procedure and specification are to be submitted for approval by the Classification Society.

**W10.6 Mechanical tests
(Rev.2 May 2004)**

W10.6.1 Test material, sufficient for the required tests and for possible re-test purposes, is to be provided for each casting or batch of castings.

W10.6.2 The test samples are generally to be one of the standard types detailed in Figs. 1, 2 and 3 with a thickness of 25 mm. Test samples of other dimensions, as detailed in Figs. 1, 2 and 3 may, however, be specially required for some components.

W10.6.3 At least one test sample is to be provided for each casting and unless otherwise required may be either gated to the casting or separately cast. Alternatively test material of other suitable dimensions may be provided integral with the casting.

W10.6.4 For large castings where more than one ladle of treated metal is used, additional test samples are to be provided so as to be representative of each ladle used.

W10.6.5 As an alternative to W10.6.3, a batch testing procedure may be adopted for castings with a fettled mass of 1 tonne or less. All castings in a batch are to be of similar type and dimensions, cast from the same ladle of treated metal. One separately cast test sample is to be provided for each multiple of 2,0 tonnes of fettled castings in the batch.



W10

cont'd

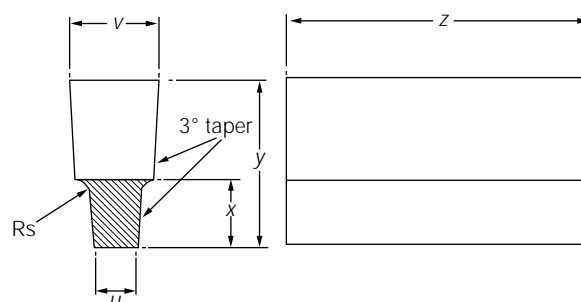


Fig. 1 Type A test samples (U-type)

| Dimensions | Standard sample | Alternative samples when specially required | | |
|------------|-------------------------|---|-----|-----|
| u (mm) | 25 | 12 | 50 | 75 |
| v (mm) | 55 | 40 | 90 | 125 |
| x (mm) | 40 | 30 | 60 | 65 |
| y (mm) | 100 | 80 | 150 | 165 |
| z | To suit testing machine | | | |
| R_s | Approximately 5mm | | | |

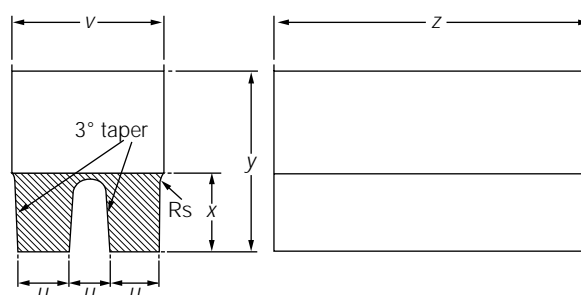


Fig. 2 Type B test samples (double U-type)

| Dimensions | Standard sample |
|------------|-------------------------|
| u (mm) | 25 |
| v (mm) | 90 |
| x (mm) | 40 |
| y (mm) | 100 |
| z | To suit testing machine |
| R_s | Approximately 5mm |



W10

cont'd

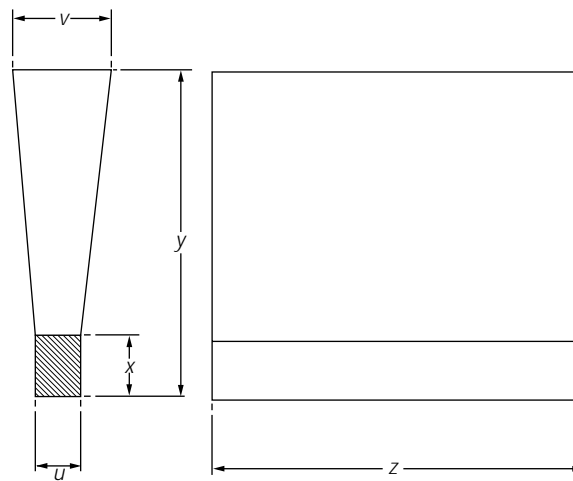


Fig. 3 Type C test samples (Y-type)

| Dimensions | Standard | Alternative samples | | |
|---|-------------------------|-------------------------|--------------|--------------|
| | sample | when specially required | | |
| u (mm) | 25 | 12 | 50 | 75 |
| v (mm) | 55 | 40 | 100 | 125 |
| x (mm) | 40 | 25 | 50 | 65 |
| y (mm) | 140 | 135 | 150 | 175 |
| z | To suit testing machine | | | |
| Thickness of mould surrounding test sample | 40mm min. | 40mm min. | 80mm min. | 80mm min. |

W10.6.6 Where separately cast test samples are used, they are to be cast in moulds made from the same type of material as used for the castings and are to be taken towards the end of pouring of the castings. The samples are not to be stripped from the moulds until the temperature is below 500°C.

W10.6.7 All test samples are to be suitably marked to identify them with the castings which they represent.

W10.6.8 Where castings are supplied in the heat treated condition, the test samples are to be heat treated together with the castings which they represent.

W10.6.9 One tensile test specimen is to be prepared from each test sample and is to be machined to the dimensions given in W2.

W10.6.10 All tensile tests are to be carried out using test procedures in accordance with W2. Unless otherwise agreed all tests are to be carried out in the presence of the Surveyors.

W10.6.11 Impact tests may additionally be required and in such cases a set of three test specimens of agreed type is to be prepared from each sample. Where Charpy V-notch test specimens are used, the dimensions and testing procedures are to be in accordance with W2.



W10

cont'd

W10.7 Mechanical properties

(Rev.2 May 2004)

W10.7.1 Table 1 gives the minimum requirements for 0,2% proof stress and elongation corresponding to different strength levels. Typical Brinell hardness values are also given in Table 1 and are intended for information purposes only.

W10.7.2 Castings may be supplied to any specified minimum tensile strength selected within the general limits detailed in Table 1 but subject to any additional requirements of the relevant construction Rules

Table 1 Mechanical properties

| Specified minimum tensile strength (N/mm ²) | 0,2% proof stress (N/mm ²) min. | Elongation on $5,65 \sqrt{S_0}$ (%) min. | Typical hardness values (Brinell) (see W10.7.1) | Impact energy | | Typical structure of matrix (see W10.9.3) | |
|--|---|--|---|---------------|-------------------------|---|-------------------------------|
| | | | | Test temp °C | KV ⁽²⁾ J min | | |
| Ordinary qualities | 370 | 230 | 17 | 120-180 | - | - | Ferrite |
| | 400 | 250 | 12 | 140-200 | - | - | Ferrite |
| | 500 | 320 | 7 | 170-240 | - | - | Ferrite/Perlite |
| | 600 | 370 | 3 | 190-270 | - | - | Ferrite/Perlite |
| | 700 | 420 | 2 | 230-300 | - | - | Perlite |
| | 800 | 480 | 2 | 250-350 | - | - | Perlite or Tempered structure |
| Special qualities | 350 | 220 | 22 ⁽³⁾ | 110-170 | +20 | 17(14) | Ferrite |
| | 400 | 250 | 18 ⁽³⁾ | 140-200 | +20 | 14(11) | Ferrite |
| <p>NOTE</p> <ol style="list-style-type: none"> For intermediate values of specified minimum tensile strength, the minimum values for 0,2% proof and elongation may be obtained by interpolation. The average value measured on 3 Charpy V-notch specimens. One result may be below the average value but not less than the minimum shown in brackets. In the case of integrally cast samples, the elongation may be 2 percentage points less. | | | | | | | |

W10.7.3 Unless otherwise agreed only the tensile strength and elongation need be determined. The results of all tensile tests are to comply with the appropriate requirements of Table 1.

W10.7.4 Re-test requirements for tensile tests are to be in accordance with UR W2.



W10
cont'd**10.8 Inspection**
(Rev. 1995)

W10.8.1 All castings are to be cleaned and adequately prepared for examination. The surfaces are not to be hammered, peened or treated in any way which may obscure defects.

W10.8.2 Before acceptance, all castings are to be visually examined including, where applicable, the examination of internal surfaces. Unless otherwise agreed the verification of dimensions is the responsibility of the manufacturer.

W10.8.3 Supplementary examination of castings by suitable nondestructive testing procedures is generally not required except in circumstances where there is reason to suspect the soundness of the casting.

W10.8.4 When required by the relevant construction Rules, castings are to be pressure tested before final acceptance.

W10.8.5 In the event of any casting proving defective during subsequent machining or testing is to be rejected notwithstanding any previous certification.

W10.8.6 Cast crankshaft are to be subjected to a magnetic particle inspection. Crack like indications are not allowed.

W10.9 Metallographic examination
(Rev. 1995)

W10.9.1 For crankshafts the metallographic examination will be mandatory.

W10.9.2 When required, a representative sample from each ladle of treated metal is to be prepared for metallographic examination. These samples may conveniently be taken from the tensile test specimens but alternative arrangements for the provision of the samples may be adopted provided that they are taken from the ladle towards the end of the casting period.

W10.9.3 Examination of the samples is to show that at least 90% of the graphite is in a dispersed spheroidal or nodular form. Details of typical matrix structures are given in Table 1 and are intended for information purposes only.

10.10 Rectification of defective castings
(1978)

W10.10.1 At the discretion of the Surveyor, small surface blemishes may be removed by local grinding.

W10.10.2 Subject to the prior approval of the Surveyor, castings containing local porosity may be rectified by impregnation with a suitable plastic filler, provided that the extent of the porosity is such that it does not adversely affect the strength of the casting.

W10.10.3 Repairs by welding are generally not permitted.

W10.11 Identification of castings
(Rev. 1995)

W10.11.1 The manufacturer is to adopt a system of identification which will enable all finished castings to be traced to the original ladle of treated metal and the Surveyor is to be given full facilities for so tracing the castings when required.

W10.11.2 Before acceptance, all castings which have been tested and inspected with satisfactory results are to be clearly marked by the manufacturer. At the discretion of individual Classification Societies any of the following particulars may be required.



W10
cont'd

- (i) Quality of cast iron.
- (ii) Identification number or other marking which will enable the full history of the casting to be traced.
- (iii) Manufacturer's name or trade mark.
- (iv) The Classification Society's name, initials or symbol.
- (v) Abbreviated name of the Classification Society's local office.
- (vi) Personal stamp of Surveyor responsible for inspection.
- (vii) Where applicable, test pressure.
- (viii) Date of final inspection.

W10.11.3 Where small castings are manufactured in large numbers, modified arrangements for identification may be specially agreed with the Classification Society.

**W10.12 Certification
(1978)**

W10.12.1 The manufacturer is to provide the Surveyor with a test certificate or shipping statement giving the following particulars for each casting or batch of castings which has been accepted:

- (i) Purchaser's name and order number.
- (ii) Description of castings and quality of cast iron.
- (iii) Identification number.
- (iv) Results of mechanical tests.
- (v) Where applicable, general details of heat treatment.
- (vi) Where specifically required, the chemical analysis of ladle samples.
- (vii) Where applicable, test pressure.

