
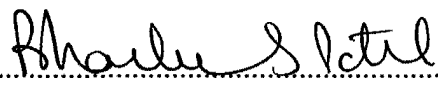




| SUPPLY SPECIFICATION<br>WELDING FOR TRANSPORT CONTAINERS |  |
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| <b>Design Approval</b>                                   | D W Rogers<br><br>.....<br>(signature)<br>date: 12/02/04          |
| <b>Quality System Approval</b>                           | B S Patel<br><br>.....<br>(signature)<br>date: 26 February 2004 |
| <b>Date Implemented</b>                                  | 25 MAR 2004  |
| <b>Controlled file number</b>                            |  |



## 1.0 PURPOSE AND SCOPE

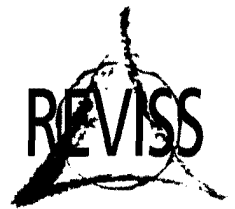
This document specifies the requirements for arc welding, resistance spot welding, brazing and soldering and the associated inspection processes used in the fabrication of transport containers for radioactive materials. It is not necessarily restricted to this application. It applies to both stainless and carbon steels. It does not cover the welding or joining of non-ferrous materials.

## 2.0 REFERENCES

- SS 028: current issue: Quality assurance requirements for controlled purchases.
- BS 499: Part 2C: 1980: Welding symbols.
- BS 1140: 1993: Specification for resistance spot welding of uncoated and coated low carbon steel.
- BS 1723: Part 1: 1986: Specification for brazing.
- BS 1723: Part 2: 1986: Guide to Brazing.
- BS 5500: 2000: Specification for unfired fusion welded pressure vessels.
- BS EN 287-1: 1992: Approval testing of welders for fusion welding. Steels.
- BS EN 288-2: 1992: Welding procedure specification for arc welding.
- BS EN 288-3: 1992: Welding procedure tests for the arc welding of steels.
- BS EN 571-1: 1997: Non-destructive testing. Penetrant testing. General principles.
- BS EN 875: 1995: Destructive tests on welds. Impact testing.
- BS EN 876: 1996: Destructive tests on welds. Longitudinal tensile test.
- BS EN 895: 1995: Destructive tests on welds. Transverse tensile test.
- BS EN 910: 1996: Destructive tests on welds. Bend testing.
- BS EN 1043-1: 1996: Destructive tests on welds. Hardness testing.
- BS EN 1043-2: 1997: Destructive tests on welds. Micro-hardness testing.
- BS EN 1320: 1997: Destructive tests on welds. Fracture testing.
- BS EN 1321: 1997: Destructive tests on welds. Macro- and microscopic examination
- BS EN 1435: 1997: Non-destructive examination of welds. Radiographic examination.
- BS EN 1712: 1997: Non-destructive examination of welds. Ultrasonic examination. Acceptance levels.
- BS EN 1714: 1998: Non-destructive examination of welds. Ultrasonic examination.
- BS EN 12517: 1998: Non-destructive examination of welds. Radiographic examination. Acceptance levels.
- BS EN 24063: 1992: Welding, brazing, soldering and braze welding of metals. Nomenclature of processes and reference numbers for symbolic representation on drawings.
- BS EN 25817: 1992: Arc-welded joints in steel. Quality levels for imperfections.
- ASME V: Boiler and pressure vessel code. Non-destructive examination.
- ASME IX: Boiler and pressure vessel code. Welding and brazing qualifications.

## 3.0 DEFINITIONS

- Purchaser : REVISS Services (UK) Ltd.
- Supplier : Organisation named in the purchase order
- Welder : Person performing a manual welding operation
- Operator : Person controlling a welding machine.



## 4.0 QUALITY ASSURANCE

- See SS 028 for general quality assurance and documentation requirements.
- See purchase order and any specifications referenced therein for any supplementary requirements.

## 5.0 GENERAL

- The purchase order takes precedence over the manufacturing drawing.
- The manufacturing drawing takes precedence over this specification.
- The manufacturing drawing specifies the weld form, size and, if necessary, the process, the inspection technique and any pre- or post-heat treatment.
- Welding, brazing and soldering terms and symbols comply with BS 499 and BS EN 24063. Any drawing using the current, 1999, issue of BS 499 will carry a note to that effect.
- Brazing and soldering procedures do not require procedure approval by the Purchaser.
- The Supplier is responsible for planning the order of operations to minimise distortion.

## 6.0 ARC WELDING

### 6.1 STANDARDS AND ALTERNATIVES

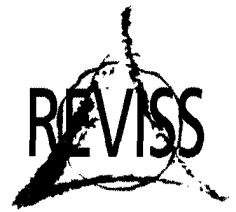
This specification follows the general principles and appropriate requirements of BS5500. Other national or international pressure vessel standards may be considered technically equivalent, subject to approval by the Purchaser. As an example ASME IX (weld and welder approval) and ASME V (inspection) are acceptable. In any event the Supplier must be able to demonstrate a basic similarity in procedure and welder tests, methods of inspection and acceptance criteria. Weld procedure and welder qualification tests that may be required are BS EN 875 (impact), BS EN 876 (longitudinal tensile), BS EN 895 (transverse tensile), BS EN 910 (bend), BS EN 1043-1 & 2, (hardness), BS EN 1320 (fracture) and BS EN 1321 (macroscopic examination).

### 6.2 GENERAL

- All welding shall be performed in accordance with a welding procedure specification or other work instruction that conforms to BS EN 288-2. The only exception to this being for the welding of non-structural items such as source holders, mesh panels, labels etc.
- The Supplier may deviate from the drawing specification for weld preparation in order to comply with established welding procedures subject to Purchaser approval.
- All weld spatter shall be removed.
- Discolouration shall be removed from stainless steel fabrications. If discolouration is removed by chemical etching the surface must be cleaned of all residue following the manufacturer's instructions.

### 6.3 WELDING PROCEDURE APPROVAL

- Approval testing of welding procedures shall be conducted and recorded in accordance with BS EN 288-3 except for non-structural items.
- In addition, for butt welds in plate over 10 mm thick, a longitudinal tensile test should be conducted.
- Weld yield strength shall not be less than the specified minimum value for the parent metal. Elongation shall not be less than 80% of the specified minimum value for the parent metal.



- Impact tests in ferritic steels with specified low temperature properties shall be conducted at a temperature not exceeding that recommended by BS5500, Appendix D, or equivalent national standard. Unless otherwise specified the minimum design temperature shall be taken to be  $-40^{\circ}\text{C}$ .

#### **6.4 WELDER APPROVAL**

- Approval testing of welders shall be conducted and recorded in accordance with BS EN 287-1, except for non-structural items, where the supplier shall certify that the welder is competent and adequately trained.
- A welder who successfully welds all the test pieces for a weld procedure test need not be required to undertake the welder prolongation test for a subsequent period of six months.

#### **6.5 CONSUMABLES**

- Welding consumables shall be the same as those used in the weld qualification procedure except when alternative consumables are permitted within the grouping schemes specified in BS EN 288-3.
- The storing and handling of welding consumables shall be controlled in accordance with procedures written on the basis of the maker's information.
- Welding consumables and their packaging shall be marked in accordance with the welding standard.

#### **6.6 ALIGNMENT**

Joint, i.e. parent metal, alignment must comply with the welding procedure.

#### **6.7 TACK WELDS**

Tack welds may be incorporated into the weld only if permitted by the weld procedure.

#### **6.8 TEMPORARY ATTACHMENTS**

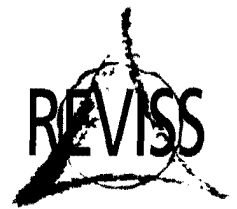
- Any temporary attachments or supports welded to the structure shall be of the same nominal chemical composition as the structure in that area.
- The location of such attachment welds shall be chosen, as far as is practicable, to avoid existing welds and areas to be subsequently welded.
- The welding process shall follow a welding procedure or be approved by the Purchaser.
- The weld area shall be dressed smooth after removal of the attachment.

#### **6.9 HEAT TREATMENT**

- Any pre-or post-weld heat treatment requirements will be specified on the manufacturing drawing.
- No welding is to take place if parent metal temperature is less than  $0^{\circ}\text{C}$ .

#### **6.10 WELD PROFILE**

- The weld profile will be specified on the manufacturing drawing.
- Any dressing or machining requirements will be specified on the manufacturing drawing.



## 6.11 INSPECTION

### 6.11.1 General

- Non-destructive testing of the parent materials or fusion faces prepared for welding is not required.
- The manufacturing drawing will specify the final inspection technique. Intermediate inspection such as for the root run shall be in accordance with the welding procedure.
- Inspection personnel for visual and dye penetrant inspection shall be certified by the Supplier to be trained to the required standard.
- Inspection personnel for ultrasound and radiography shall hold an appropriate certificate of competence from an independent inspection authority.
- Batch inspection:
  - 1) A batch shall be considered to be two or more identical components welded by the same welder following the same procedure using the same equipment with the same settings without significant delay between consecutive welding operations.
  - 2) Visual and dye penetrant inspection requirements may not be modified.
  - 3) Radiographic and ultrasound inspection requirements may be modified to take account of the additional control afforded by the continuity of the production process. This is considered on a case by case basis and is subject to written agreement from the Purchaser.

### 6.11.2 Visual Inspection

- All welds, with the exception of any surfaces that are subsequently machined, shall be visually inspected. Machined surfaces need only meet the dimensional and surface finish requirements specified on the manufacturing drawing.
- Acceptance criteria: Table 5.7 (3), BS 5500 or BS EN 25817 (quality level B, stringent) to the extent permitted by access.
- Excess reinforcement is acceptable provided overall dimensions are within tolerance.

### 6.11.3 Dye/liquid Penetrant Inspection

- To be carried out on the weld surface in its final condition, i.e. after any subsequent machining operation, in accordance with BS EN 571-1.
- Acceptance criteria: No indications permitted.

### 6.11.4 Radiographic Inspection

- To be carried out in accordance with BS EN 1435, Class B technique.
- Surfaces may be dressed only where weld surface ripples or irregularities will interfere with interpretation of the radiograph.
- Acceptance criteria: Table 5.7 (1), BS 5500 or BS EN 12517, Level 1.
- Where geometry or design make radiography impractical or unreliable the Supplier has several options:
  - 1) Prepare a coupon of the same geometry and materials and not less than the greater of 10% of the length of the production weld or 200 mm. The welder, or operator, shall weld the coupon at the same time as the production weld, run for run, without changing any machine settings. The coupon shall then be machined as necessary to allow a satisfactorily clear radiograph. The production weld may then be sentenced on the coupon results.
  - 2) Use ultrasound inspection in accordance with 6.11.5 below.
  - 3) Use dye penetrant inspection on each weld run in accordance with 6.11.3 above.



### 6.11.5 Ultrasound Inspection

- To be carried out in accordance with BS EN 1714, Level B.
- The condition of surfaces in contact with the probe must comply with the requirements of BS EN 1714.
- Acceptance criteria: Table 5.7 (2) BS 5500 or BS EN 1712, Level 2.
- Where geometry or design make ultrasound impractical or unreliable the Supplier has several options:
  - 1) Prepare a coupon of the same geometry and materials and not less than the greater of 10% of the length of the production weld or 200 mm. The welder, or operator, shall weld the coupon at the same time as the production weld, run for run, without changing any machine settings. The coupon shall then be machined as necessary to allow a satisfactorily ultrasound scan. The production weld may then be sentenced on the coupon results.
  - 2) Use radiographic inspection in accordance with 6.11.4 above.
  - 3) Use dye penetrant inspection on each weld run in accordance with 6.11.3 above.

### 6.12 REPAIRS

- Repair welds shall be carried out to an approved procedure and are subject to the same acceptance criteria as the original work.

### 6.13 TRACEABILITY MARKINGS

- All materials, other than those less than 6 mm thick or those used in non-structural fabrications, shall be permanently marked on an external surface, for instance by stamping, vibro-engraving or equivalent process, with the cast or heat number for that material.
- Welds in materials so marked shall be permanently marked in their vicinity with the welder's identity mark.
- Where possible a marking shall be sited on an unmachined external surface. If all external surfaces are machined the marking shall avoid areas of 0.8  $\mu\text{m}$  surface finish and shall be only be deep enough to be legible. If there is no accessible external surface the marking may be omitted.
- Temporary markings shall be removed after manufacture but before any acceptance testing.

## 7.0 RESISTANCE SPOT WELDING

- Spot welding shall comply with the general principles of BS 1140.
- Welder/operator and inspector shall be certified by the Supplier to be trained to the required standard.
- The procedure shall be established using identical samples (materials, thicknesses, surface condition or coatings and number and size of welds).
- Weld samples shall be clearly identified with the procedure, issue status and date.
- Samples shall be tested destructively by splitting apart the joint with a hammer and chisel.
- A plug of metal from one side shall be retained on the other side of the joint.
- Prior to any production spot welding the welder shall check the machine settings by destructively testing a sample as above. No production spot welding may take place until the settings have been satisfactorily rechecked.
- After continuous production welding for a period of two hours, and subsequently every two hours, the welder shall check the machine settings by retesting a sample as above.



## 8.0 BRAZING AND SOLDERING

- Brazing shall comply with the general principles of BS 1723, Parts 1 & 2.
- The welder/operator and inspector shall be certified by the Supplier to be trained to the required standard.
- The Supplier shall be able to show that the consumables are suitable for the process and materials being joined.
- The storing and handling of welding consumables shall be controlled in accordance with procedures written on the basis of the maker's information.
- The brazing/soldering procedure shall be established using identical samples (materials, thicknesses and surface condition).
- The procedure shall include the removal of corrosive fluxes and cleaning agents.
- Samples shall be examined visually with a 2-4 times magnifying lens. The joint shall show no evidence of lack of flow or cracks in or around the joint.