1 Scope

1.1 This specification details the minimum inspection, testing and certification requirements for impeller castings for high energy applications requiring certified material test reports and surface examination using the liquid penetrant method.

Note: Sulzer procedures referred to in this specification can be downloaded from

www.sulzer.com/q-documents

2 Materials

2.1 Material type specification and grade shall be as stated in the Sulzer Purchase Order.

2.2 Impellers with an outside diameter of 500 mm (19.7") and less in duplex or super-duplex stainless steel shall be solution annealed with a maximum of 6 mm (1/4") radial machining allowance in the bore (12 mm / ½" diametrically).

3 Manufacturer's Certification

3.1 The following documentation shall be provided as appropriate:

a) Certified material test report (e.g. EN 10204 type 3.1)

b) Heat treatment details including any post weld heat treatment

c) NDE report on completion of surface examinations

d) Location and size of major repair excavations

e) NDE report of repair excavations

f) NDE report on completion of a weld repair

3.2 All documentation shall be in the English language, legible and suitable for reproduction.

4 Inspection

4.1 Examinations shall be carried out on completion of heat treatments.

4.2 Visual Examination:-

a) Test Procedure – Sulzer TP-0012 Visual examination of castings

b) The surface of the casting shall be examined and shall be free from adhering sand, scale, fins or any other foreign protrusions

c) **Impeller casting Class 'A'** - The surface finish of hydraulic surfaces shall be at least 3.2µm (N8). A surface finish of up to 6.3µm (N9) is acceptable in inaccessible areas

d) **Impeller casting Class 'B'** - The surface finish of hydraulic surfaces shall be at least 6.3µm (N9). A surface finish of up to 12.5µm (N10) is acceptable in inaccessible areas

4.3 Dimensional control (unless otherwise stated):

a) Vane thickness at inlet and outlet: +1.0mm / - 0.0mm (+0.040" / -0.000")

b) Outlet width: Nominal dimension + 0.0 / -1.0mm (+0.000" / -0.040")

c) Vane spacing at inlet and outlet: ± 1°

d) Smallest passage width R1, R2 and R3 measured using cylindrical disc gauges

e) Vane tips shall be ground flush with shroud outside diameter if they protrude.

4.4 Vane inlet and outlet hydraulic geometric profile measurements and/or any other measurements required shall be agreed between Sulzer and supplier on an individual purchase order basis

4.5 Liquid penetrant examination:

a) Test Procedure – Sulzer TP-0001 Liquid penetrant examination

b) Areas to be examined – 100% accessible surfaces

c) Acceptance – No cracks or hot tears, other indications as EN 1371-1 Quality level 2,

4.6 Sulzer and/or their client's representatives shall be afforded access and assistance at all reasonable times to carry out inspections at the manufactures premises.

5 Repairs

5.1 Unacceptable surface imperfections shall be removed and blended into their surrounding surfaces to avoid any sharp contours.

5.2 Whenever an imperfection is to be weld repaired, the excavation shall be examined by the liquid penetrant method (clause 4.5) to verify that the imperfection has been removed or reduced to an acceptable size.

5.3 No repair welding shall be carried out prior to Sulzer's review of the proposed weld repair procedures.

5.4 All weld repairs shall be carried out using welding procedures and operators qualified in accordance with:

a) ASTM A 488, ASME IX;

or

b) ISO EN 15614/EN 287

5.5 Approval by Sulzer shall be obtained before any major weld repair is carried out.

5.6 Definition of a major weld repair:-

a) Removal of more than 40% of the section thickness or 6mm (0.240") whichever is the smaller

b) All through wall excavations

5.7 When impact testing is required by the purchase order or material specification, then the welding procedure qualifications and weld metal shall include impact testing to the same test criteria.

5.8 On completion of welding, repaired areas shall be blended into their surrounding surfaces to avoid sharp contours and be examined by the liquid penetrant method (clause 4.5). When subsequent heat treatment is required, examination shall be conducted after heat treatment.

6 Product Marking

6.1 To provide traceability between the material and the documentation, each piece of material/component shall be individually marked, at a prominent location with the following:

a) Casting melt/heat number

b) Material grade and class

c) Sulzer Purchase Order number, line item number

d) Part article number

7 General Notes

7.1 All certification and delivery advice documentation shall include the Sulzer Purchase Order number, line item number, casting melt/heat number and material number.

7.2 All documentation shall be provided on or prior to delivery of the material.

7.3 Acceptance of the material shall be on satisfactory compliance to the Purchase Order requirements.

7.4 All standards referenced shall be current issues unless stated otherwise.

7.5 Failure to comply with the above requirements could result in rejection or delayed payment of invoices.

7.6 Thorough casting inspection shall be conducted by the foundry prior to shipment to guarantee that all hydraulic passages are free from sand, scale, flashing, fins, core supports, shot, swarf, etc. and that all castings are free from defects that allow a leak path between adjacent passages. Castings inspected at Sulzer not meeting these requirements shall be rejected.