

Specifications for Ladle Hooks

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1.0 Scope

1.1 Intended Coverage

This Technical Report covers laminated ladle hooks, which are used primarily for lifting hot metal ladles. Hooks rigidly attached to a spreader beam should be avoided and therefore are not discussed in this Technical Report (see the Commentary).

1.2 General

The primary concern in the design of a ladle hook is that a sudden, complete failure should not occur. The use of laminated construction, where the hook is made up of a number of separate steel plates, is the most important factor in ensuring that such a mode of failure does not occur.

Laminated ladle hooks require periodic visual and non-destructive testing inspection. The ladle hooks should not be coated or painted as the inspection process may be compromised.

2.0 Materials

2.1 Hook Lamination Plates

Various materials have been used for hook lamination plates, ranging from plain carbon steel to high-strength, quenched and tempered steel. Any of these materials may be used successfully, provided that the required design parameters are given proper consideration. Listed below are examples of typical steel grades with their minimum ultimate tensile strengths at room temperature:

- ASTM A516 Grade 55 55,000 psi
- ASTM A516 Grade 60 60,000 psi
- ASTM A516 Grade 65 65,000 psi
- ASTM A516 Grade 70 70,000 psi
- ASTM A514 Grade F 110,000 psi

For hooks that are to be used under very low temperature conditions (below 0°F), avoid using plates such as ASTM A515, which are crack-sensitive at these temperatures.

2.2 Rivets

Typical examples of steel grades for rivets are:

- ASTM A31, Grade A
- ASTM A502

2.3 Eye Bushing

The most common practice is to use steel (either hardened or not hardened) for the eye bushing.

2.4 Trunnion Seat Wear Plate

Material for the trunnion wear plate shall be selected according to the design and the desired life of the trunnion and/or trunnion wear sleeve. Typical examples of wear plate materials are:

- Cast Bronze: 88% Cu, 10% Sn, 2% Pb
- Steel: AISI 1045 — Flame Hardened
ASTM A128 — 11–14% Austenitic Manganese Steel
ASTM A514 — Quenched and Tempered
ASTM A668 K and L — Quenched and Tempered

2.5 Wear Plates (Bumper Plates)

Wear plate material shall be selected on the basis of impact resistance, to withstand service impacts between the hook and the trunnion.

3.0 Fabrication

3.1 Lamination Plates

Hooks conforming to this specification will normally have four or more laminations. The recommended thickness of laminated plates is 3/4 in. to 1 1/4 in. Plates used for making the hook laminations shall be rolled within the thickness, flatness, size and surface finish specified in ASTM A6, “General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.” The plate shall be inspected and certified from the supplier or mill.

If individual plate straightening is necessary, it can be done by mechanical means. The original equipment manufacturer shall provide guidelines for any repairs requiring heating and mechanical reconditioning (see Appendix A).

3.2 Cutting to Size

Within the limitations listed below, lamination plates shall be cut to the design contour using a machine-guided cutting device. Finishing of plates will not be required unless specifically called for on the drawing or included in a stipulated edge preparation for welding.

The underside of the cut plate shall be free of slag and the cut surface shall be smooth, square and free of defects on the plate surface. Corner imperfections can be removed by grinding, provided the ground corners are smooth and free from stress risers and do not create more than a 1/8 in. bevel or corner radius. Burnt surface imperfections, if they occur, shall be immediately corrected. Imperfect cut surfaces shall be conditioned by grinding to render the surface free from injurious gouges or serrations.

3.3 Riveting

The purpose of riveting is to hold the lamination together, to distribute the load to all laminates so that each of the cross-sections of the hook and the shank work as an integral section, and to ensure the resistance to longitudinal shear between the laminates.