

WELDING THE HY STEELS

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This report is the third cooperative publication of ASTM and DMIC. The first was the ASTM Data Series Publication, "The Elevated-Temperature Properties of Selected Superalloys", DS 7-S1, issued in July, 1968. The Second, "Compilation of Chemical Compositions and Rupture Strengths of Superalloys", DS 9E, was issued in October, 1970.

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SUMMARY

The principal advantages of the HY-steels are their good combination of strength and toughness over a wide temperature range and their good weldability in heavy sections with little preheat and no postweld heat treatment. This class of steels includes Ni-Cr-Mo steels designated HY-80 and HY-100 and a Ni-Cr-Mo-V steel tentatively designated HY-130. They are low-carbon steels that achieve their strength and toughness through a quenching and tempering heat treatment.

The following welding processes and their proper application to the Hy-steels are discussed: (1) shielded metal-arc welding, (2) submerged-arc welding, (3) gas metal-arc welding, (4) Narrow-Gap welding, (5) gas tungsten-arc welding, (6) plasma arc welding, and (7) electron beam welding.

HY-80 and HY-100 have 80,000 psi and 100,000 psi minimum yield strengths respectively, and very similar chemical compositions. In general, these alloys are considered highly weldable, and their as-welded properties are very good when proper welding procedures are used. HY-130 is a higher alloy quenched-and-tempered steel having a minimum yield strength of 130,000 psi. Development of filler materials for joining HY-130 has been hampered by the difficulty of obtaining the combination of high toughness and high strength required in the as-welded condition.

Heat-affected-zone microcracking and weld- and base-metal delayed cracking have been problems in welding HY-80 and HY-100. These can, however, be controlled by proper melting and processing of the base materials during production and by exercising proper precautions during welding. HY-130 has shown sensitivity to weld-metal contamination by carbon, sulfur, phosphorus, hydrogen, oxygen, and nitrogen.

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