June 1967 Brief 67-10163

NASA TECH BRIEF

Effects of Heat Input Rates on T-1 and T-1A Steel Welds

Widespread weld-fabrication of T-1 and T-1A steels by a comparably wide variation in technical competence of fabricators has produced apparent contradictions and confusion regarding their use. Much of the information reported in the literature has been pertinent, but some has been challenged by practical fabricators. The unusual requirements for reliable, quenched and tempered structural steel weldments present problems which warrant recognition and cautious handling. The potential advantages of these steels relative to meeting aerospace objectives have emphasized the need for dependable, working knowledge of them, especially with regard to the reliability of weldments. The primary purposes of this investigation were to resolve some of these questions by emphasizing and correlating the technology of these steels pertinent to practical production weld-fabrication.

The program was designed to investigate 16 combinations comprised of two variations in each of four significant criteria as follows:

1. Grades of steel: T-1 and T-1A
2. Plate thickness: ½ inch and 1 inch
3. Weld groove design: U and V
4. Welding heat intensity: *Low and high

*(Related to manufacturer's recommendations)

All weldments were designed to represent the following:

1. Plane butt-joints: flat position
2. Maximum possible restraint
3. Manual arc welding with coated electrodes
4. Malpractices in welding these steels with both insufficient and excessive heat.

This investigation was approached from the following viewpoints:

First, the main interest in these steels is based on their impressive potential for efficient engineering design in welded structures. Enthusiasm for them has suffered substantial restraint due to fears of failure based largely upon unfamiliarity and suspicion inherent to using such a relatively new type of structural steel. The frequency and substance of reports indicating disappointment with the weldability of these steels have probably distorted the truth. However, this indicates that minimum standards of welding control and discipline are more critical in this class of steel than in conventional structural steels.

Second, conditions corresponding to production weldment circumstances were considered. The program was based on the use of good commercial welding practices which allowed a certain amount of latitude to welders fabricating the test weldments, although sound welding techniques were always used.

Third, welding heat input rate was considered the primary control parameter in the program. Under predetermined conditions of interpass temperature, arc energy and welding speed, the significant problem to resolve was that of maintaining uniformity quite comparable to machine welding. With this problem resolved, necessary control could be exercised concurrently with reasonably close simulation of production conditions.

Complete details of this investigation are contained in: "A Study on the Effects of Various Heat Input Rates on T-1 and T-1A Steel Welds," by M. G. Olsen, R. A. Davis, and S. W. Worden, NASA TM

(continued overleaf)

X-53537, November 14, 1966, Marshall Space Flight Center.

Note:

Copies of this technical memorandum are available from:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B67-10163

Patent status:

No patent action is contemplated by NASA.

Source: M. G. Olsen, R. A. Davis and S. W. Worden (M-FS-2475)