

# Evaluation of Single-Pass Plasma Arc Welding Process in 8 mm Thick 15CrMoV6 Material

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## Abstract

15CrMoV6 is a low carbon steel which combines a high yield strength with good toughness and weldability. This alloy finds many applications in the aerospace, defence, power generation and motorsports industries in such components as roll cages, pressure vessels, suspensions, rocket motor casings, wish bones and subframes. Because of its good strength-ductility combination and ease of fabrication the material has been extensively used in rocket-motor hardware in the Indian Space Programme. The mechanical properties of weldment do not respond to the welding process, they remain same for weld in annealed condition or heat treated condition. Generally, machine GTAW process is widely used for welding of this material. This process is skill dependent which is done in manual or semi-automatic mode and hence production through-put is very limited. Again amount of distortion and no. of repair associated with machine GTAW welding is higher. In order to improve the productivity, quality and to reduce distortion in the weld, single pass Plasma Arc Welding (PAW) is adopted for the welding. Weld process parameters for PAW are established through various welding trials. The weld procedure specification (WPS) for 8 mm thick 15CrMoV6 material is qualified in both annealed and hardened & tempered condition.

The GTAW process and PAW processes have been compared on the basis of mechanical properties, HT condition of the parent metal at the time of joining. Non - destructive testing (NDT) results comparison of both the welding processes show confidence on soundness of weldments without any defects. Also, the macrostructure of the weld has been evaluated for the weldment of conventional GTAW and PAW process.

The weld efficiency obtained through PAW are found to be better than GTAW process along with increased productivity as welding is carried out in single pass. With PAW process, proof stress is improved by 4.5% and UTS is improved by 7%. Approx. 80% reduction in filler wire and welding gas consumption. On welding SPM, productivity is improved by 50% and welding time is reduced by 85%.

**Keywords:** 15CrMoV6, Machine GTAW, Plasma arc welding, Productivity, Weld efficiency

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