

SPB-6. Acceptable Upper Oxygen Limit For GTA Full Penetration Welds

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This project is based on the routine deposit GTA full penetration welds onto ASTM A508, Grade 4N, and Class1 steel (a high strength low alloy steel). During welding, an argon backing gas is used to inhibit the formation of oxides on the root layer. The sponsor of this project are currently using oxygen concentrations that vary from 100ppm to 1000ppm in the argon gas back purge, depending on user preference. The purpose of this project is to establish a permissible oxygen upper limit in argon back purge gas, for a GTAW full penetration welding.

The study consisted of producing welds within a backing gas oxygen concentration ranging from 200ppm to 1000ppm in argon, and then visually inspecting each weld. The visual inspection is based on the sponsors color specifications. The color(s) of the oxides on the root weld layer that are acceptable by the sponsor's standards are; uncolored, and gold, while the unacceptable colors are blue, gray and black. Finally, each weld was subjected to a hardness test. A relationship between the hardness and the amount of oxides on the root weld was then established. With the results from the visual and hardness testing the group determined an acceptable gas composition in the back purge.

The group discovered that the higher the oxygen concentration in the backing gas there is a considerable change in color. Furthermore, that the highest oxygen concentration without blue oxides on the root face is at 400ppm.

From the visual, hardness, and the investigation of the data collected, the group was able to establish significant conclusions to the sponsor. The group recommends that welds be performed in backing gas at oxygen concentrations equal to or less than 400 ppm. This conclusion is strictly based on the results of visual testing, since the oxygen used in the back purge has no effect on hardness. 400ppm was the highest amount of oxygen used in the back purge that yielded no blue oxides after visual testing.