# Project Report

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WELD PENETRATION ANALYSIS

Weld penetration analysis is necessary because for joints which are subject to cyclic loads, certain % of weld penetration is necessary. These critical joints are marked as $ and $$ on the drawing.

Applications- For testing MIG welding on all types of joints of the following materials – Low carbon steel, medium carbon steel, Austenitic steel, ferritic steel, Martensitic steel (MS steel), Stainless steel (SS) and various grades of aluminum.

Cut Sections for weld checking-

* For pipe to sheet & sheet to sheet joints

1. If welding length <= 30mm, take the cut section at the centre of the weld run.
2. If welding length >30mm, take the cut section at 10mm from the start & end of the weld run.

* For pipe-to-pipe joints, take the cut section at the centre of the weld run.
* For 360deg round weld take 2 cut sections 10mm away from the overlap area.

Procedure

1. Joints are cut using abrasive cutting machine.
2. Polishing of the surface on belt grinder of sizes 60grit, 120, 200, 400, 800grit emery paper. (Emery paper is made from silicon carbide)
3. Clean the specimen with compressed air.
4. Chemical treatment

* For MS steel, use nital solution (95% methanol + 5% nitric acid).
* For SS, dip in murkanis solution (109ml potassium ferricyanide + 109ml KOH + 100ml water).
* For Aluminum materials, dip in aqua regia solution ( 10ml nitric acid+ 30ml hydrochloric acid + 10ml water).

1. Rinse in water & air dry the specimen.
2. Do micrography and generate a report based on it.

Parameters to be checked –

* Weld leg size
* Weld penetration= Minimum 25% of thinner thickness in both sheet
* Effective throat length = Minimum 0.707 times of minimum leg length.
* Root gap
* Toe angles
* Undercut = A portion where bead is not filled, which forms a groove in base metal along the toe of the weld.
* Internal porosity= Spherical cavity in the bead
* Internal crack= Fracture in the weld bead
* Excess penetration

## Material Analysis for chassis manufacturing

Steel is made up of various elements of which iron is in the maximum proportion. By varying the proportions of various elements, we obtain various steel grades of desired characteristics. Some of the most important elements found in maximum number of steel grades and their uses in steel grades are as follows:

1. Carbon- It determines the hardness and strength of the steel.
2. Manganese- It increases hardenability, tensile strength and wear resistance. It removes O2 & S when iron ore is converted to iron. It is an essential element that helps to convert iron into steel. It decreases brittleness.
3. Sulphur- Sulphur alloyed steel can be machined very well by turning, milling and drilling. It forms MgS in metal structure which increases chip breaking. Therefore, sulphur content must be kept low as it increases brittleness
4. Phosphorus- It can be both a steel pest and an alloying element. Harmful effects dominate & can lead to embrittlement and cold brittleness. As an alloying element it exerts its effect in low-alloy steel with C% of 0.1%. In this case it increases strength and corrosion resistance
5. Silicon- It increases yield strength and scale resistance (Resistance to corrosion by air at elevated temperatures). It also hinders carbide formation (carbide formation leads to reaction between carbon from atoms and elements in steel such as Cr, Al, Si. This promotes local stresses in the structure).
6. Aluminum- It is 50% lighter than iron due to its low density. Aluminum is soft metal, excellent for forming & machining despite softness, Aluminum sheets are stiff & give steel a high degree of stability
7. Nb (niobium) is almost always found together with tantalum. Because of their chemical similarity, it is very hard to separate them. Both form carbides in steel structures which make steel grades chem resistant & heat resistant
8. Even a small amount of Titanium significantly increases the toughness & strength of steel. Titanium alloyed steel is more malleable & exhibit greater resistance to intercrystallite corrosion
9. Vanadium positively influences most of the properties of steel, vanadium forms carbide which increases strength, wear resistance & toughness, Addition of vanadium leads to formation of small grains in steel microstructure, which increases weldability of steel.

Various types and grades of steel are used for chassis manufacturing based on their chemical composition, mechanical properties such as tensile strength, % elongation, yield strength, plastic strain ratio and tensile strain hardening exponent. A detailed report consisting of various grades of steel used in chassis manufacturing is attached below-

"C:\Users\Aditya Mundhada\OneDrive\Documents\material analysis.xlsx"

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