

Importance of Earthing of Completion of Electrical Circuit with Minimum Resistance in Welding

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Welding special electric welding, spot or arc needs a completion of circuit so that we can use electrical energy. Machines built with very high electronics content to give us a very stable current with less than 0.2% ripple factor are sensitive to the grounding and earthing that is return cable. With Holder, torch or gun and feeders being designed by machine manufacturers a very good care is taken to ensure smooth passage of current to end point or last point where welding consumable gets electrically charged. Cross section of the current carrying cable, and its insulation type, rubber, open with gas cooling or water cooling or flux coated decides the capacity. A small multi core flexible copper wire in water cooled TIG torch can take current up to 400 amps as it is in water whereas same in SMAW welding with rubber coating requires diameter which is minimum 10 times bigger.

We don't appreciate it as it comes from manufacturers of the machines or accessories provider. Return cable or earthing cable is in our jurisdiction and that where I am tempted to share my experience as we neglect it in almost every set up.

In a pressure vessel we have multiple types of joints, and we use various aids to get 1G position for ease of welding.

Let us start with long seams manually done with SMAW, TIG, MIG Saw.... processes what is a right location to have an Earthing. When set up is made with or without tacking depending on how rolling is being done, material type, thickness, type of joint.... Best way in my opinion is to connect it as close as starting point. Logic here is that we shall have a good contact for initiation of arc and as welding stabilizes even if we are going away from earthing heat produces better conductivity and ensure smooth passage of current through shell. If we are using HF for start of arc, then it is very important to have a good earthing and no spark shall be generated at the

earthing so tightening of clamp is essential. Most of the time, we have run on and run off coupons attached to long seam so little over tightening on these clamps is advisable. Normal Clamp type of earthing is good, but ensure flat surface is in maximum contact with the shell, and Bolt has no sharp edge, if required put copper or low strength mild steel piece of 1.6/2 mm between shell and bolt. If fixture is used for ovality control of for better set up still use run in coupon for earthing connection.

For circumferential joints rotary earthing clamps are advisable which have a good cross section and copper bush or copper-carbon brush combination. Since these are open and not insulated, we need to take care that no fixture or accessories for rotation touches it. Once again, many manufacturers provide points or provisions for earthing, but I have always used a location on the job unless prohibited by material of construction, sensitive area which may have current concentration or possibility of arcing or if current transfer is not smooth it may have increase in temp in this area. Ensure bushing, bearing is not lubricated, and it shall be dry but smooth in movement. If bearings are used it shall be sealed and periodic cleaning and ensuring smooth rotation is must. For diameter more than 2m it is advisable to have 2/3 earthing at 120/180 deg apart for smooth passage of current.

For welding nozzles, lugs, tray support rings, brackets or Dish ends it is recommended to have earthing on both the parts. Similarly, if we are having dissimilar joint provide earthing on both the parts. Important for earthing is to ensure clamp has sufficient area of contact to take care of planned current and easiest way to calculate is look for diameter of the welding cable and ensure area of this cable is ensured in contact. A practical test is to check and ensure that earthing clamp does not get heated up during complete welding than ambient

temp. This could be pre heat temperature. When we are going to use fixture or accessory for earthing not only earthing clamp to Fixture or accessory connection is important but most important is to have a good contact between fixture or accessory and job to be welded. Specially for thin jobs and materials like Titanium, Aluminum, which are sensitive to heat and oxidation and poor conductors like stainless steel, and precipitation steels it is must to have a proper contact. We can provide copper strips or same material thin sheets for improving contact if shape is irregular. A quick check using multimeter which is very commonly available with maintains team to find resistance between job and earthing cable and ensure it is below 2 Ohms (ideally it shall be zero).

Make use of copper as far as designing your earthing clamp unless copper is prohibited to meet the parent material. Over design so that in practical conditions it will never heat up. I hope you understood the importance of the earthing and once you develop this habit you will find reduction in weld defects both visual and in NDT. For general fabricator making grill and temp structures or gates and sheds it may not be so important but for us in Pressure vessel industry or where we use other than Mild steel, we need to be careful. I suggest we can all share some good design of earthing clamps either used by buying from market of designed and developed in house. Even though it may be a patented item or your original thinking we can help each other and save costly repairs. This is one step towards becoming globally competitive.