## Welding problems and defects – causes and remedies

### Spatter

**Causes**
- Welding current too high.
- Arc too long.
- Incorrect polarity – arc blow.
- Insufficient gas shielding.

**Remedies**
- Reduce welding current.
- Adjust arc length.
- Use the correct polarity for the consumable.
- Check shielding gas type and flow rate. Clean gas nozzle. Ensure torch to plate angle.

### Deformation

**Causes**
- Unfavourable bead positioning.
- Incorrect use of electrode.
- Root gap too small.
- Electrode size too big.
- Travel speed too high.

**Remedies**
- Increase joint included angle.
- Clamp.
- Select cleaner parent material or buffer plate edges.
- Reduce travel speed.

### Arc blow

**Causes**
- Arc striking difficulties.
- Lack of fusion defects.
- Solidification cracks.
- Undercut.
- Lack of root penetration.

**Remedies**
- Use a smaller diameter electrode.
- Use arc welding.
- Apply strongly tack and bottom passes.
- Use smaller electrode, use lower welding current. Apply stringer bead technique.
- Lower the travel speed until weld solidifies in an elliptical form.

### Longitudinal cracks in the heat affected zone

**Causes**
- The base material is prone to hardening (because of high C content or other alloying elements).
- Weld costs down too rapidly.
- Hydrogen in the weld (e.g. because of wet weld edges, wrong or damp electrodes or shielding gases.

**Remedies**
- If possible, choose a material with a lower weldability. If not, apply and maintain preheat and interpass temperature and delayed cooling.
- Apply a higher preheat temperature.
- Remove moisture from welding zone. Use low-hydrogen weld consumables from moisture protective packagings or rebake welding consumables.

### Lack of fusion defects

**Causes**
- Weld pool too large.
- Arc voltage too low.
- Earth lead is not connected properly.
- Welding current too low.
- Joint included angle is incorrect.
- Unweldable bead positioning.

**Remedies**
- Increase welding current and lower travel speed.
- Reduce deposition rate and/or increase travel speed.
- Increase joint included angle.
- Position electrode or torch in such a way that the plate edges are melted.
- Position beads in such a way that sharp angles with other beads or plate edges are avoided.

### Crater cracks

**Causes**
- The welding ended too abruptly. The crack begins at a void in the welding crater, caused by the solidification shrinkage.

**Remedies**
- When finishing, move back the electrode to fill-up the crater.
- With root pass welding, quickly move the arc from the weld pool to the plate edge.
- Increase crater fill-time on power source.

### Undercut

**Causes**
- Insufficient de-slagging between passes.
- Convex passages which produce slag pockets.
- Unweldable bead sequence.

**Remedies**
- Select cleaner parent material or buffer plate edges.
- Increase joint angle, use lower welding current.
- Use smaller electrode, use lower welding current. Apply stringer bead technique.
- Lower the travel speed until weld solidifies in an elliptical form.
- Apply strongly tack and bottom passes.

### Solidification cracks

**Causes**
- Formation of phases with a low melting point in the weld, due to P, S, Cu – mostly from the parent metal.
- Unweldable joint geometry – width/depth ratio < 1.
- Weld pool too large.
- Travel speed too high (weld solidifies in an arrow shaped). When finishing, travel back.
- Tack welds or root passes not sufficiently strong for shrinkage forces, in case of restrained joints.

**Remedies**
- Use an AC electrode where possible.
- Try welding away from the earth clamp connection. Try splitting the earth clamp and connect to both sides of the joint.
- Use an AC electrode where possible. Position earth lead clamp such that it counteracts the influence of heavy work piece parts. Keep arc as short as possible.

### Welding problems – causes

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| Porosity | Moisture, for example from incorrectly stored electrodes or fluxes. | Use arc welding.
- Use arc welding.
- Apply strongly tack and bottom passes. |
| Slag inclusions | Insufficient de-slagging between passes. | Use arc welding.
- Use arc welding.
- Apply strongly tack and bottom passes. |
| Lack of root penetration | Insufficient de-slagging between passes. | Use arc welding. |

**See www.esab.com for more information.**