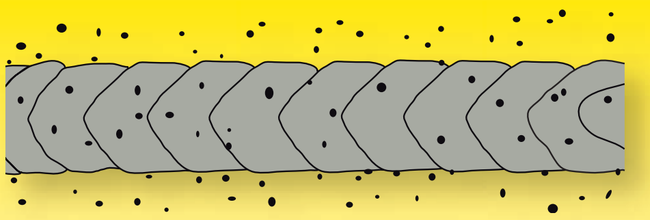


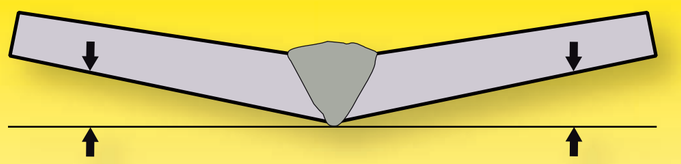
Welding problems and defects – causes and remedies



Spatter

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

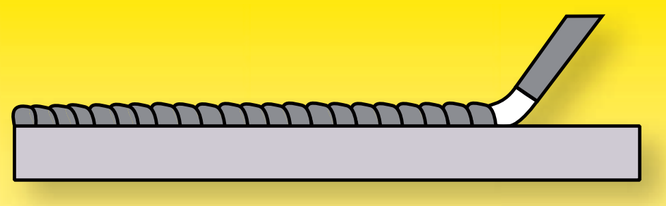
Remedies
- Reduce welding current.
- Reduce arc length.
- Check use of correct polarity for the consumable in question.
- Check shielding gas type and flow rate. Clean gas nozzle. Increase torch to plate angle.



Deformation

Causes
- Unsuitable welding sequence.
- Too many and too thin beads, usually because the electrode is too small.
- Poor plate fit-up before welding.
- Plates clamped insufficiently.

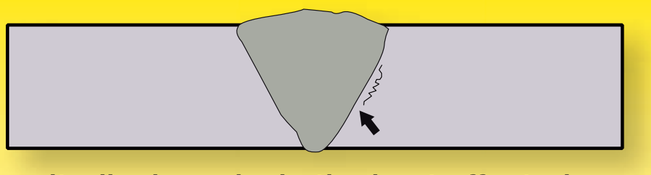
Remedies
- Weld from both sides of the joint. Weld from the centre out, in opposite directions.
- Use a larger electrode. If possible, a high recovery type.
- Compensate for shrinkage by fixing the work pieces with a counter-angle.
- Clamp.



Arc blow

Causes
- Arc deflection as a result of magnetic effects into the opposite direction of the earth lead clamp.
- Arc deflection as a result of magnetic effects in the direction of heavy parts of the work piece (with magnetic materials) – especially at corners and edges.

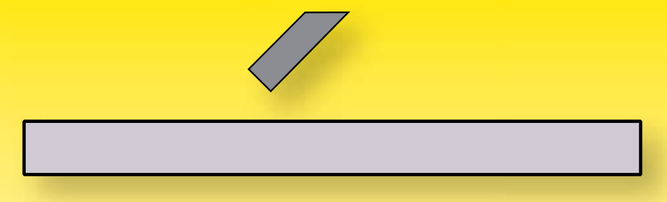
Remedies
- Use an AC electrode where possible.
- Try welding away from the earth clamp connection. Try splitting the earth clamp and connect to both sides of the joint.
- Use an AC electrode where possible. Position earth lead clamp such that it counteracts the influence of heavy work piece parts. Keep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



Longitudinal cracks in the heat affected zone

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

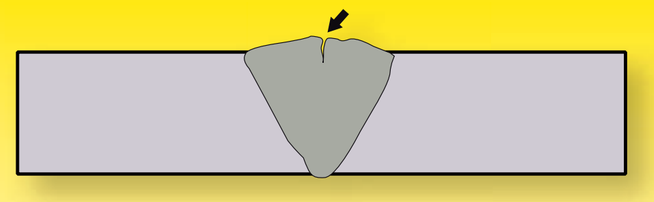
Remedies
- If possible, choose a material with a better weldability. If not, apply and maintain preheat and interpass temperature and delayed cooling.
- Apply a higher preheat temperature.
- Remove moisture from welding zone. Use low-hydrogen welding consumables from moisture protective packagings or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



Arc striking difficulties

Causes
- Welding current too low.
- Arc voltage too low.
- Earth lead is not connected properly.
- Striking end of electrode covered by coating.

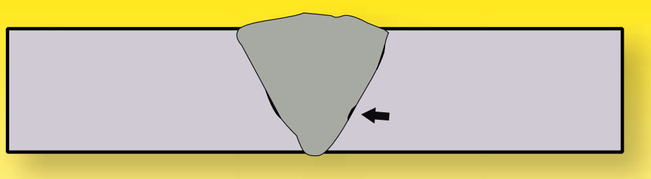
Remedies
- Increase welding current.
- Use power source with a higher open circuit voltage.
- Ensure proper earth lead connection.
- Uncover striking end and touch-strike.



Solidification cracks

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

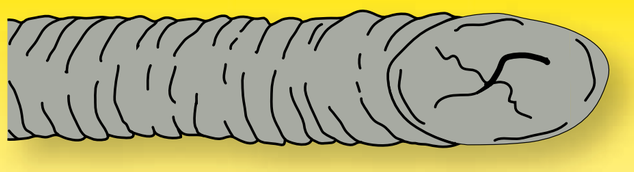
Remedies
- Select cleaner parent material or buffer plate edges.
- Increase joint angle, use lower welding current.
- Use smaller electrode, use lower welding current. Apply stringer bead technique.
- Lower the travel speed until weld solidifies in an elliptical form.
- Apply stronger tacks and bottom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



Lack of fusion defects

Causes
- Heat input too low.
- Weld pool too large and running ahead of the arc.
- Joint included angle too small
- Electrode or torch angle is incorrect.
- Unfavourable bead positioning

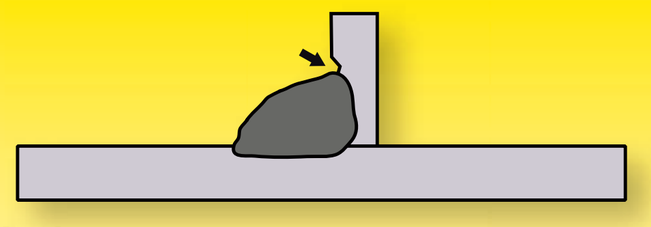
Remedies
- Increase welding current and lower travel speed.
- Reduce deposition rate and/or increase travel speed.
- Increase joint included angle.
- Position electrode or torch in such a way that the plate edges are melted.
- Position beads in such a way that sharp angles with other beads or plate edges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



Crater cracks

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

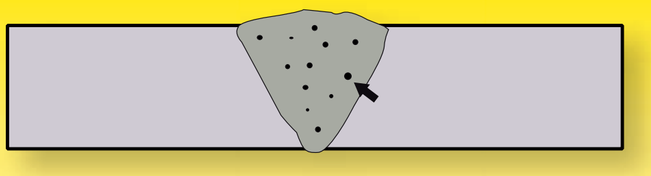
Remedies
- When finishing, move back the electrode to fill-up the crater.
- With root pass welding, quickly move the arc from the weld pool to the plate edge.
- Increase crater fill time on power source.



Undercut

Causes
- Arc voltage too high.
- Arc too long.
- Incorrect electrode use or electrode angle.
- The electrode is too large for the plate thickness in question.
- Travel speed too high

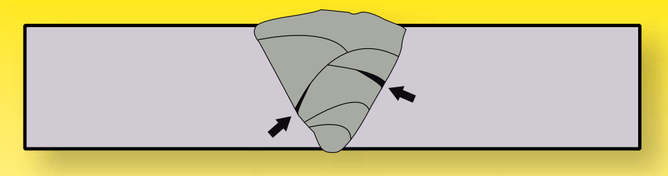
Remedies
- Lower arc voltage.
- Reduce arc length.
- Apply electrode angle of 30° to 45° with the standing leg. Weld lightly trailing.
- Use a smaller diameter electrode.
- Reduce travel speed.



Porosity

Causes
- Moisture, for example from incorrectly stored electrodes or fluxes, humid shielding gas or leaks in water-cooled welding torches.
- Moisture, rust, grease or paint on the plate edges.
- Insufficient gas shielding.
- Welding onto small gaps filled with air.

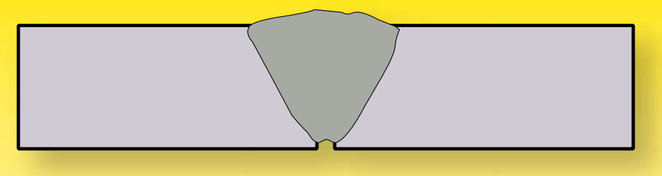
Remedies
- Rebake or use fresh welding consumables, connect new gas bottle, check welding torch for leaks.
- Dry or clean plate edges.
- Check shielding gas type and flow-rate. Clean gas nozzle. Ensure torch to plate angle is not too small.
- Increase welding gap. When possible, apply butt joints instead of fillet or overlap welds.



Slag inclusions

Causes
- Slag runs ahead of the weld
- Insufficient de-slagging between passes
- Convex passes which produce slag pockets.
- Unfavourable bead sequence.

Remedies
- Increase the travel speed or electrode angle.
- Remove slag carefully, grind if necessary.
- Avoid sharp angles or grooves between beads and layers. Increase arc voltage.
- Plan bead sequence such that sharp corners are avoided. Apply stringer bead technique.



Lack of root penetration

Causes
- Root gap too small.
- Electrode size to big.
- Travel speed too high.
- Incorrect use of electrode.

Remedies
- User wider root gap.
- Use electrodes with a diameter of approximately the gap width.
- Apply lower travel speed.
- Weave between plate edges. Weld on ceramic weld metal support at high currents.

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