**WELDING PROBLEMS AND DEFECTS – CAUSES AND REMEDIES**

### Spatter

**Causes**
- Welding current too high.
- Weld pool too large and running ahead of the arc.
- Poor or incorrect bead position.
- Unfavourable joint geometry – arc blow.

**Remedies**
- Reduce arc length.
- Ensure bead on arc is not too small.
- Reduce welding current.
- Weld with smaller diameter electrode.
- Increase arc voltage.
- Apply stringer bead technique.

### Deformation

**Causes**
- Unfavourable welding sequence.
- Too many and too thin beads, usually because the electrode is too small.
- Earth lead is not connected properly.
- Low mains voltage.

**Remedies**
- Increase welding current and lower travel speed.
- Use wider root gap.
- Use a smaller diameter electrode.
- Apply electrode angle of 30° to 45° with the standing leg. Weld lightly trailing.
- Reduce arc length.
- Apply electrode angle of 30° to 45° with the standing leg. Weld lightly trailing.
- Reduce travel speed.

### Arc blow

**Causes**
- 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.
- Earth lead is not connected properly.
- Low mains voltage.

**Remedies**
- Select straighter parent material or buffer plate edges.
- Increase joint angle, 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.

### 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 cools down too rapidly.
- Insufficient gas shielding.

**Remedies**
- Insufficient de-slagging.
- Electrode or torch angle is incorrect.
- Unfavourable bead position.

### Lack of fusion defects

**Causes**
- Heat input too low.
- Weld pool too large and running ahead of the arc.
- Insufficinet gas shielding.
- Weld on base metal.

**Remedies**
- Increase welding current and lower travel speed.
- Reduce heat input.
- Apply electrode angle of 30° to 45° with the standing leg. Weld lightly trailing.
- Weld with smaller diameter electrode.
- Apply stringer bead technique.

### 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.
- Run out of rod.

### 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**
- Reduce arc voltage.
- Use a smaller diameter electrode.
- Increase joint angle, use lower welding current.
- Apply stringer bead technique.
- Use a smaller diameter electrode.
- Reduce travel speed.

### 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 too big.
- Travel speed too high.
- Incorrect use of electrode.
- Poor set up.

**Remedies**
- Use wider root gap.
- Use electrodes with a diameter of approximately the gap width.
- Apply lower travel speed.
- Use bead on ceramic backing at high currents.
EN AND ASME WELDING POSITIONS

Butt welds in plate

- Downhand: PA/1G
- Horizontal-vertical: PC/2G
- Overhead: PE/4G
- Vertical-up: PF/3G
- Vertical-down: PG/3G

Fillet welds in plate

- Downhand: PA/1F
- Horizontal: PB/2F
- Overhead: PD/4F
- Vertical-up: PF/3F
- Vertical-down: PG/3F

Butt welds in pipe

- Pipe rotates with axis horizontal, welding downhand: PA/1G
- Pipe fixed with axis vertical, welding horizontal-vertical: PC/2G
- Pipe fixed with axis horizontal, welding upwards: PH/5G
- Pipe fixed with axis horizontal, welding downwards: PD/5G
- Pipe fixed with axis under 45º angle, welding upwards: H-LO45/6G

Fillet welds pipe to plate.

- Pipe rotates with axis horizontal, welding downhand: PB/2FR
- Pipe fixed with axis vertical: PB/2F
- Pipe fixed with axis vertical, welding overhead: PD/4F
- Pipe fixed with axis horizontal, welding upwards: PH/5F
- Pipe fixed with axis horizontal, welding downwards: PJ/5F
## RECOMMENDED WELDING CONSUMABLES

### Base material

<table>
<thead>
<tr>
<th>Material Type</th>
<th>UN Labeled</th>
<th>OK</th>
<th>OK AristoRod, OK Autrod</th>
<th>OK Tubrod (metal-cored)</th>
<th>OK Tubrod (ruttle)</th>
<th>OK Tigrod</th>
<th>OK Autrod + OK Flux</th>
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</thead>
<tbody>
<tr>
<td>Unalloyed steel (EN 10025-2)</td>
<td></td>
<td>48.00</td>
<td>12.50, 12.51</td>
<td>14.11, 14.13</td>
<td>15.14</td>
<td>12.64</td>
<td>12.10 or 12.20+10.71</td>
</tr>
<tr>
<td>Normalised fine grain steel (EN 10025-3)</td>
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<td>48.00</td>
<td>12.50, 12.51</td>
<td>14.11, 14.13</td>
<td>15.14</td>
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<td>Thermo-mechanically treated fine grain steel (EN 10025-4)</td>
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<td>48.00</td>
<td>12.63, 12.64</td>
<td>14.02</td>
<td>15.14</td>
<td>12.64</td>
<td>12.22+10.71</td>
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<tr>
<td>Weather resistant steel (EN 10025-5)</td>
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<td>12.63, 12.64</td>
<td>14.02</td>
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<td>High strength steel (EN 10025-6)</td>
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<td>12.22+10.71</td>
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<tr>
<td>Wear resistant steel</td>
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<td>14.11, 14.13</td>
<td>15.14</td>
<td>12.64</td>
<td>12.22+10.71</td>
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<td>Creep resistant plate (EN 10028-2) or pipe (EN 10216-2)</td>
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<td>12.22+10.71</td>
</tr>
<tr>
<td>Wear resistant steel</td>
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<td>48.00</td>
<td>12.63, 12.64</td>
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<td>15.14</td>
<td>12.64</td>
<td>12.22+10.71</td>
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<tr>
<td>Cast iron</td>
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<td>48.00</td>
<td>12.63, 12.64</td>
<td>14.02</td>
<td>15.14</td>
<td>12.64</td>
<td>12.22+10.71</td>
</tr>
</tbody>
</table>

### Dissimilar steels (black and white)

For service temperature above 300°C with or without stress relieve treatment.

### Repair welding

For repair welding.

### Aluminium and aluminium alloys

<table>
<thead>
<tr>
<th>Material Type</th>
<th>UN Labeled</th>
<th>OK</th>
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<th>OK Tubrod (metal-cored)</th>
<th>OK Tubrod (ruttle)</th>
<th>OK Tigrod</th>
<th>OK Autrod + OK Flux</th>
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</thead>
<tbody>
<tr>
<td>Cast iron</td>
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<td>92.18, 92.58</td>
<td>Nicore 55</td>
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### Repair welding

- Difficult to weld steels, steels with unknown composition and steels prone to hardening.