

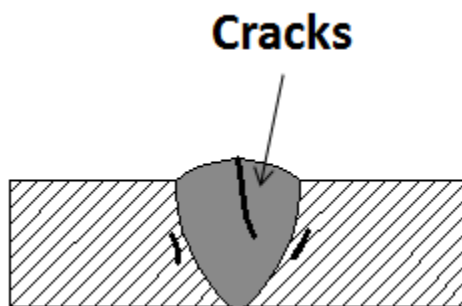
Welding Defects

Welding Defects can be defined as the irregularities formed in the given weld metal due to wrong welding process or incorrect welding patterns, etc. The defect may differ from the desired weld bead shape, size, and intended quality. Welding defects may occur either outside or inside the weld metal. Some of the defects may be allowed if the defects are under permissible limits but other defects such as cracks are never accepted.

The various types of welding defects with their causes and remedies are listed below:

1. Weld Crack

The most serious type of welding defect is a weld crack and it's not accepted almost by all standards in the industry. It can appear on the surface, in the weld metal or the area affected by the intense heat.



Causes of cracks:

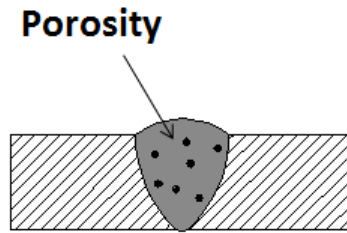
- Use of hydrogen when welding ferrous metals.
- Residual stress caused by the solidification shrinkage.
- Base metal contamination.
- High welding speed but low current.
- No preheat before starting welding.
- A high content of sulphur and carbon in the metal.

Remedies:

- Preheat the metal as required.
- Provide proper cooling of the weld area.
- Use proper joint design.
- Remove impurities.
- Use appropriate metal.
- Use proper welding speed and amperage current.

2. Porosity

Porosity occurs as a result of weld metal contamination. The trapped gases create a bubble-filled weld that becomes weak and can with time collapse.



Causes of porosity:

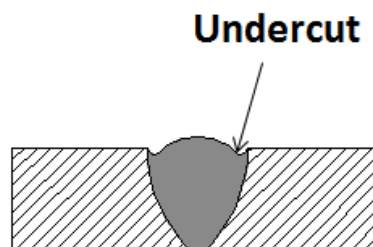
- Using a longer arc.
- The presence of moisture.
- Improper gas shield.
- Use of too high gas flow.
- Contaminated surface.

Remedies:

- Clean the materials before you begin welding.
- Use dry electrodes and materials.
- Use correct arc distance.
- Check the gas flow meter and make sure that it's optimized as required with proper with pressure and flow settings.
- Reduce arc travel speed, which will allow the gases to escape.

3. Undercut

This welding imperfection is the groove formation at the weld toe, reducing the cross-sectional thickness of the base metal. The result is the weakened weld and work piece.



Causes:

- Too high weld current.
- Too fast weld speed.

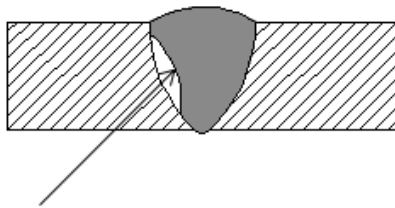
- The use of an incorrect angle, which will direct more heat to free edges.
- Incorrect usage of gas shielding.
- Incorrect filler metal.

Remedies:

- Use proper electrode angle.
- Reduce the arc length.
- Reduce the electrode's travel speed, but it also shouldn't be too slow.
- Choose shielding gas with the correct composition for the material type you'll be welding.
- Use of proper current, reducing it when approaching thinner areas and free edges.

4. Incomplete Fusion

This type of welding defect occurs when there's a lack of proper fusion between the base metal and the weld metal. It can also appear between adjoining weld beads. This creates a gap in the joint that is not filled with molten metal.



Incomplete Fusion

Causes:

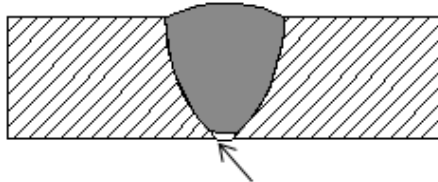
- Low heat input.
- Surface contamination.
- Electrode angle is incorrect.
- Travel speed is too fast.
- The weld pool is too large and it runs ahead of the arc.

Remedies:

- Use a sufficiently high welding current with the appropriate arc voltage.
- Before you begin welding, clean the metal.
- Avoid molten pool from flooding the arc.
- Use correct electrode diameter and angle.
- Reduce deposition rate.

5. Incomplete Penetration

Incomplete penetration occurs when the groove of the metal is not filled completely, meaning the weld metal doesn't fully extend through the joint thickness.



Incomplete Penetration

Causes:

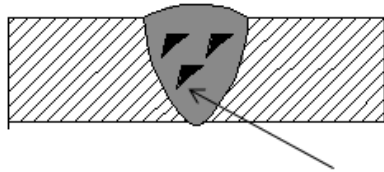
- There was too much space between the metal you're welding together.
- You're moving the bead too quickly, which doesn't allow enough metal to be deposited in the joint.
- You're using a too low amperage setting, which results in the current not being strong enough to properly melt the metal.
- Large electrode diameter.
- Improper joint.

Remedies:

- Use proper joint geometry.
- Reduce arc travel speed.
- Choose proper welding current.
- Check for proper alignment.

6. Slag Inclusion

Slag inclusion is one of the welding defects that are usually easily visible in the weld. Slag is a vitreous material that occurs as a by-product of stick welding, flux-cored arc welding and submerged arc welding. It can occur when the flux, which is the solid shielding material used when welding, melts in the weld or on the surface of the weld zone.



Slag inclusion

Causes:

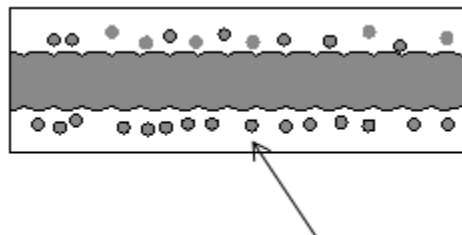
- Improper cleaning.
- The weld speed is too fast.
- Incorrect welding angle.
- The weld pool cools down too fast.
- Welding current is too low.

Remedies:

- Increase current density.
- Reduce rapid cooling.
- Adjust the electrode angle.
- Remove any slag from the previous bead.
- Adjust the welding speed.

7. Spatter

Spatter occurs when small particles from the weld attach themselves to the surrounding surface. It's an especially common occurrence in gas metal arc welding. No matter how hard you try, it can't be completely eliminated. However, there are a few ways you can keep it to a minimum.



Spatter

Causes:

- The running amperage is too high.
- Voltage setting is too low.
- The work angle of the electrode is too steep.

- The surface is contaminated.
- The arc is too long.
- Incorrect polarity.
- Erratic wire feeding.

Remedies:

- Clean surfaces prior to welding.
- Reduce the arc length.
- Adjust the weld current.
- Increase the electrode angle.
- Use proper polarity.