

What is Welding Defect?

Welding defects are formed in a welding work due to the weak or poor technique used by the inexperienced or untrained welders or due to structural problems in the welding operation.

Or you can say, in a [welding process](#), the size and shape of the metal structure are varied. It is maybe due to the incorrect welding process or the application of the incorrect welding procedure.

An ideal weld or good weld must be one that exists with good penetration with sufficient fusion between the filler metal and the edge preparation.

Furthermore, we have also written about different welding processes like [plasma arc welding](#), [laser beam welding](#), [resistance welding](#), [gas welding](#), and [arc welding](#) you can check it out by clicking on them.

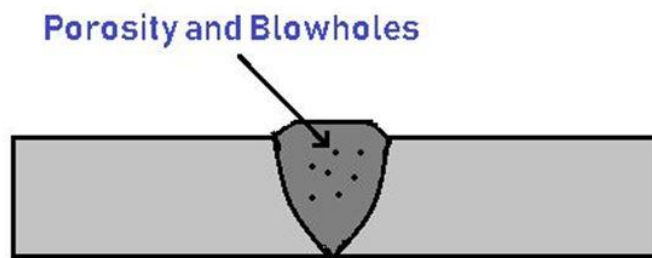
For this article, let's discuss the types of welding defects that appear while welding.

Types of Welding Defects

Following are the **types of welding defects**:

1. Porosity and Blowholes
2. Undercut
3. Weld crack
4. Incomplete fusion
5. Slag inclusion
6. Incomplete penetration
7. Spatter
8. Distortion
9. Hot Tear

#1 Porosity and Blowhole



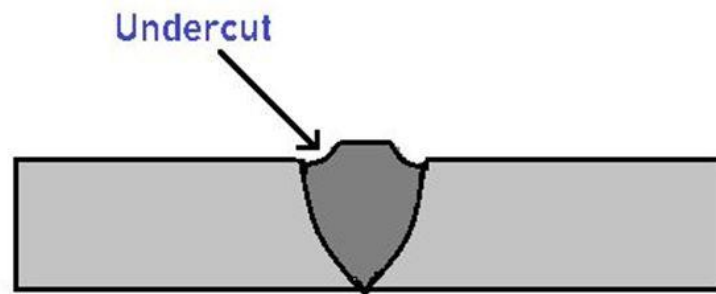
Porosity is a group of small bubbles and blowholes are relatively large hidden holes or pores. They are mainly caused by trapped gases. Porosity is a result of weld metal contamination.

Read Also: [Types of Rivets: Riveted Joints, Methods, Applications \(PDF\)](#)

Causes and Remedies of Porosity

Causes of Porosity	Remedies of Porosity
Using insufficient electrode de oxidant.	Choosing suitable electrode and filler materials.
Applying too large gas flow.	Checking the gas flow meter and ensure that it is adapted as needed with appropriate pressure and flow settings.
Using a larger arc.	Make sure that arc distance is correct.
Existence of moisture in the process.	Cleaning the metal before starting the welding process.
Unsuitable gas shield.	Decreasing welding speed, it will allow the gas to escape.
Dirty job surface i.e. the occupation of scales, rust, oil, and grease, etc. on the surface of the job.	Individual cleaning and prevention of pollution from entering the weld zone.

#2 Undercut



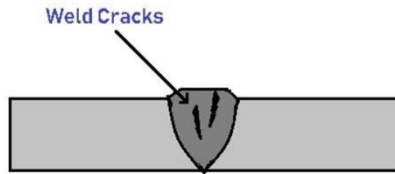
Undercut in welding makes imperfection, it is the formation of grooves in the weld toe, which decreases the cross-sectional thickness of the base metal. As a result of this weld and workpiece get weakened.

Causes and Remedies of Undercut

Causes of Undercut	Remedies of Undercut
Incorrect use of angle, which will deliver more heat to the free edges.	Using of suitable electrode angle, with more heat delivered towards thicker components.
Because of too fast weld speed.	Decreasing the travel speed of the electrode, but it should not be too slow.
Using poor welding methods.	Applying the multipass technique.
Use of incorrect gas shielding and filler metal.	Selecting the shielding gas with the right structure for the material you are welding.
Doing too high weld current.	When approaching thin areas and free edges, use an appropriate stream to reduce them.
Using larger diameter electrodes.	Decreasing the arc length.

Read Also: [What is Coupling? 13 Different Types of Coupling with \[PDF\]](#)

#3 Weld Crack



These are the most dangerous types of welding defects. It is almost not allowed by all standards in the production. It can appear on the surface, in the weld metal, or in an area affected by strong heat.

There are different types of cracks that occur during welding, it depends on the temperature.

1. Hot Cracks

Hot cracks happen while the welding process or during the crystallization process of the weld joint. Temperatures at this point can exceed 10,000C.

2. Cold Cracks

These cracks occur after the weld is created and the metal temperature has passed down. They can also be made hours or days after welding steel. This mostly occurs when the deformation is made in the steel structure.

3. Crater Cracks

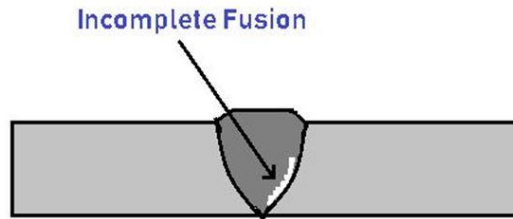
These cracks occur at the end of the welding process before the operator completes the weld joint. They are usually made near the end of the process.

When the weld pool cools and freezes, the weld must be sufficient in volume to overcome the metal shrinkage. Otherwise, it will make a crater crack.

Causes and Remedies of Weld Crack

Causes of Weld Crack	Remedies of Weld Crack
Using hydrogen while welding ferrous metals.	Using suitable metals.
Applying low current with high welding speed.	Utilizing the appropriate welding speed and current.
The design concept is poor.	Using proper design concept.
Not doing preheating before starting welding.	Preheating the metal before starting welding.
Contamination of base metal.	Cleaning the metal surface before welding.
Residual stress solidification due to shrinkage.	Giving decent cooling of the weld area.
The high mixture of sulfur and carbon in the metal.	Using a correct mixture of sulfur and carbon in the metal.
Improper filling of the crater in welding.	Ensure that the crater is properly filled to prevent crater cracks.

#4 Incomplete Fusion

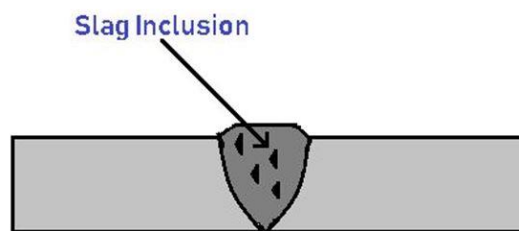


These types of welding defects occur when there is a shortage of suitable fusion between the metal and weld. It may also be visible between adjacent weld beads. This produces a gap inside the joint that is not filled with molten metal.

Causes and Remedies of Incorrect Fusion

Causes of Incorrect Fusion	Remedies of Incorrect Fusion
Contamination of metal surface.	Cleaning the welding area of the metal surface before welding.
Using low heat input.	Utilizing the proper heat input for welding.
The diameter of the electrode is wrong for the thickness of the material you are welding.	Using the correct diameter of the electrode to fit the thickness of the material that you are welding.
Incorrect electrode angle.	Ensure the angle of the electrode is suitable for welding.
Employing too fast travel speed.	Decreasing the speed of arc travel.
The weld pool is very large and it moves ahead of the arc.	Make sure the weld pool that you are using is proper according to the movement of the arc.

#5 Slag Inclusion



Slag inclusion is welding defects that are usually visible in welds. The slag is a dangerous substance that appears as a product of stick welding, flux-core arc welding, and submerged arc welding.

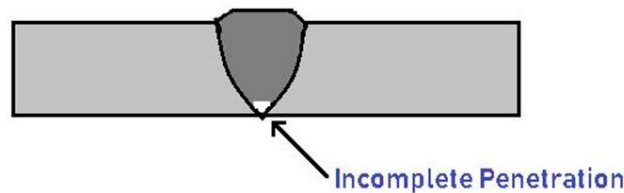
It is can occur when the flux, which is a solid shielding material applied when welding, melts in the weld or on the surface of the weld region. Slag inclusion decreases the strength of the joint and hence makes it weaker.

Read Also: [Forging: Types, Methods, Operations, Advantages & More](#)

Causes and Remedies of Slag Inclusion

Causes of Slag Inclusion	Remedies of Slag Inclusion
Poor chipping and cleaning of previous passes in multipass welding.	Through the wire brush, cleaning the weld bed surface before the next layer is deposited.
Due to the incorrect angle of electrode.	Adjusting the angle of the electrode.
Using too low welding current.	Increasing the current density.
Insufficient space for puddle of molten weld metals.	Redesigning the joint to allow sufficient space for proper use of the puddle of molten weld metals.
May be cooling is very fast.	Decreasing the rapid cooling.
Cleaning of the metal may be improper.	Proper cleaning of the metal before welding.
The speed of welding is fast.	Reducing the speed of the welding.

#6 Incomplete Penetration



In these types of welding defects, penetration is defined as the distance from the uppermost surface of the base plate to the maximum extent of the weld nugget.

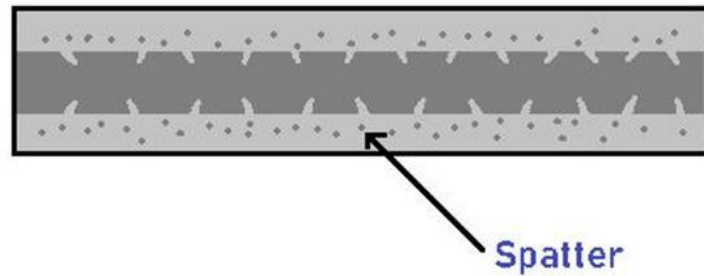
Incomplete penetration happens when the metal groove is not entirely filled, which means that the weld metal does not fully spread through the joint thickness.

Causes and Remedies of Incomplete Penetration

Causes of Incomplete Penetration	Remedies of Incomplete Penetration
There was too much space between the metal that you are welding with.	Assuring that the surface is jointly fine.
You are moving the bead too fast, which does not allow sufficient metal to accumulate in the joint.	Decreasing the arc travel speed.
You are using a very low amper setting, which results in the current not being strong enough to melt the metal properly.	Selecting a decent welding current.
Using improper joints.	Improving the design of the joint.
Wrong position of the electrode.	Make sure the position of electrode is very accurate.
Using of larger diameter electrode.	You must need to use proper of diameter electrode as suitable for your welding.

Read Also: [14 Types of Grinding Machines \[Complete Guide\] with Diagram & PDF](#)

#7 Spatter

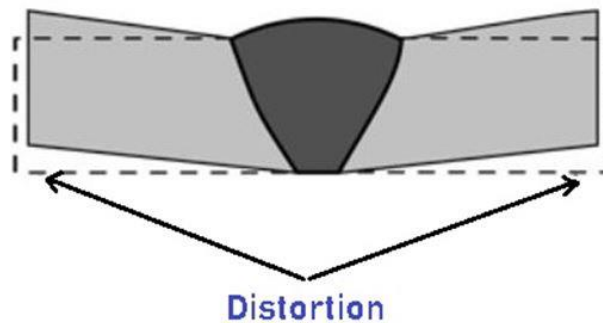


Spatters are tiny metal particles that are ejected from the arc during welding and accumulate on the base metal throughout the weld bead along its length. This is particularly common happens in gas-metal arc welding.

Causes and Remedies of Spatter

Causes of Spatter	Remedies of Spatter
Contamination of metal surface.	Cleaning metal surfaces before welding.
The working angle of the electrode is much more rigid.	Decreasing the arc length and increasing the electrode angle.
Utilizing too high amper current and too low voltage settings.	Using proper polarity with adjusting the weld current.
Using the larger arc and wet electrode.	Make sure to use proper arc and electrode according to the welding.

#8 Distortion



Distortion is the difference in size and location between the positions of the two metal plates before and after welding due to the [temperature grade](#) present at several points along the weld joints.

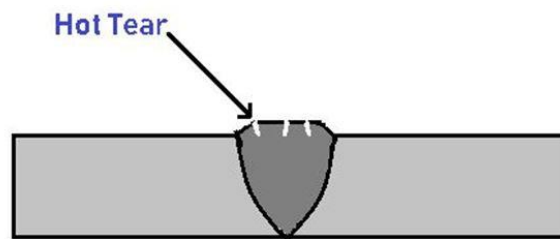
Or in other words, you can say that the distortion is due to uneven extension and reduction of the weld metal and that all kinds of distortion rise with the number of metal deposition.

Read Also: [What is Extrusion Process: Working, Types, Applications, Advantages](#)

Causes and Remedies of Distortion

Causes of Distortion	Remedies of Distortion
Employing incorrect welding orders.	Ensure to use the correct welding order.
Using a large number of passes with small diameter electrodes.	Using the appropriate number of weld passes.
Because of high residual stresses in the plate to be welded.	Make sure you use the appropriate amount of weld metal as required by the joint. This will decrease contraction forces.
Due to the slow speed of arc travel.	Maintaining the speed of arc travel.
Not using any measuring instrument for dimension purpose.	If required you can use a measuring instrument, so that dimensional accuracy is accurate.
Using too much time for welding process.	Decreasing the time of the welding process so that the volume around the metal is not even expanded.

#9 Hot Tear



In these types of welding defects, the deposited metal starts to develop crack from the nearby edge so that it will solidify the crack increase.

Due to the tearing of grain boundaries of the weld metal before it freezes and the metal is still in [plastic condition](#). Therefore, it is also known as solidification cracking.

Causes and Remedies of Hot Tear

Causes of Hot Tear	Remedies of Hot Tear
The thickness of the electrode is may be wrong.	Using the right thickness of the electrode according to the base metal to be welded.
Not using a suitable welding current.	Ensure the use of suitable welding current as needed.
It is due to the incorrect choice of proper materials.	Using a suitable type of material for the electrode.

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