

WELD DEFECTS KIT

RealCareer® Welding Solutions

INSTRUCTOR GUIDE



The RealCareer® Welding Solutions Weld Defects Kit contains 13 models, including the most common defects and discontinuities that can occur when welding. Use this defect kit to help your students understand how weld defects occur and how to address them by correcting both their machine and their technique.

Kit includes:

- 1 quality weld model
- 12 weld defect models
- Online access to Weld Defects curriculum
- 1 weld defect definition insert
- 1 Instructor Guide
- 1 Case

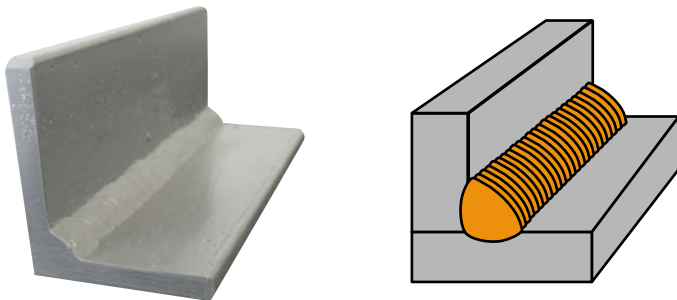


To access your Weld Defects curriculum, visit:

www.realityworks.com/welddefectskit-downloads

#1 Quality Weld

Consistent weld path and quality fusion of metal through proper welding technique and machine settings.



Causes

- A Quality Weld should consist of no visual defects and pass all other testing parameters, usually provided by a Welding Procedure Specification (WPS)

Machine

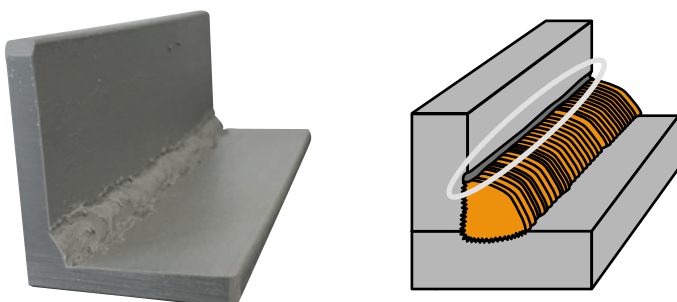
- A Quality Weld can be obtained by following your machine's suggested settings for the particular weld you are working on
- Many welds will have WPS's to help ensure your machine's settings are set correctly for each individual weld

Technique

- A Quality Weld can be obtained by following proper welding technique, which includes proper Work Angle, Travel Angle, Travel Speed, Contact to Work Distance (CTWD) and Straightness.
- Many welds will have WPS's that will help ensure you stay within proper technique parameters for individual welds

#2 Undercut

An indentation or channel melted into the base metal adjacent to the toe or root of a weld and left unfilled by weld metal.



Causes

- Improper machine settings
- Improper Work Angle
- Improper Wire Feed Speed
- Fast Travel Speed
- Arc Length is too long
- High amperage settings
- Rust on metal

Correction of Defect - Check Your Machine

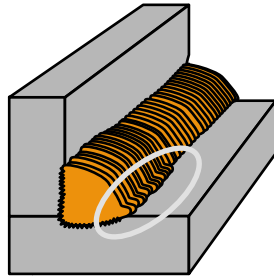
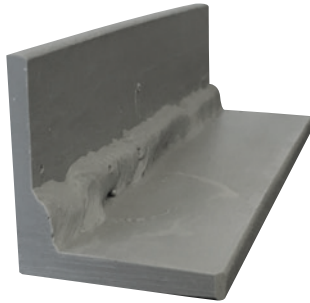
- Decrease voltage or increase Wire Feed Speed (GMAW)
- Decrease amperage (SMAW)

Correction of Defect - Check Your Technique

- Keep Work Angle around 45° for a fillet weld and 90° for a groove weld
- Decrease Travel Speed
- CTWD may be too short; try staying between 1/4 – 1/2 inches from metal (GMAW)
- Arc Length is too long; try staying around 1/8 inches from metal (SMAW)
- Clean base metal before welding

#3 Overlap

The protrusion or overhang of weld metal beyond the bond at the toe or root of a weld without fusing to the base metal.



Causes

- Travel Speed is too slow
- Wire Feed Speed is too high (GMAW)
- Arc Length is too short (SMAW)
- Improper Work Angle and/or Travel Angle
- Improper Work Angle often results in a weld bead with overlap on one toe and undercut on another

Correction of Defect - Check Your Machine

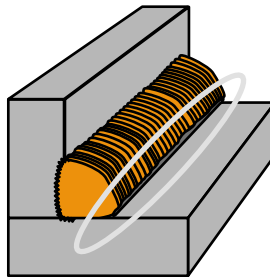
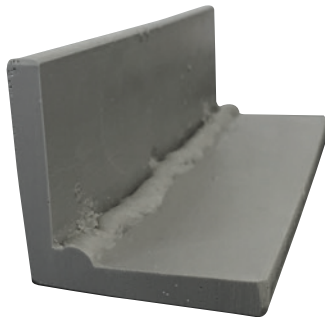
- Decrease voltage or increase Wire Feed Speed (GMAW)
- Check your amperage setting (SMAW)

Correction of Defect - Check Your Technique

- Keep Work Angle around 45° for a fillet weld and 90° for a groove weld
- Travel Angle may be too steep; keep Travel Angle between 0° – 15°
- CTWD may be too long; try staying 1/4 – 1/2 inches away (GMAW)
- Arc Length is too short; try staying around 1/8 inches away (SMAW)
- Increase Travel Speed

#4 Lack of Fusion

The failure of a welding process to fuse or join together layers of weld metal, or weld metal and base metal.



Causes

- Improper machine settings
- Travel Speed is too fast
- Improper Work Angle
- Contamination of base metal
- Improper (too steep) Travel Angle
- Too much wire is sticking out (GMAW)
- Improper Arc Length (SMAW)

Correction of Defect - Check Your Machine

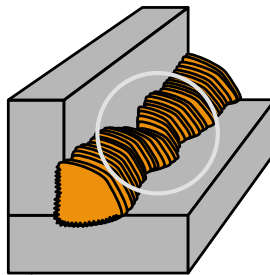
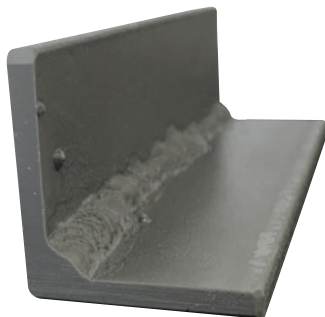
- Adjust setting for the thickness of the base metal
- Increase amps if bead is large and ropery (SMAW)
- Increase Wire Feed Speed if bead is small and use proper Travel Speed (GMAW)

Correction of Defect - Check Your Technique

- Keep Work Angle around 45° for a fillet weld and 90° for a groove weld
- Keep Travel Angle at 0° – 15°
- Keep CTWD between 1/4 – 1/2 inches (GMAW)
- Arc Length close to 1/8 inches (SMAW)
- Decrease Travel Speed
- Clean base metal before welding

#5 Inconsistency

The weld bead is not constant and varies throughout the weld, leading to different filler metal thicknesses, penetration depths and fusion issues.



Causes

- Improper machine settings
- Improper welding technique (Work Angle, Travel Angle, Travel Speed, CTWD and/or Straightness)

Correction of Defect - Check Your Machine

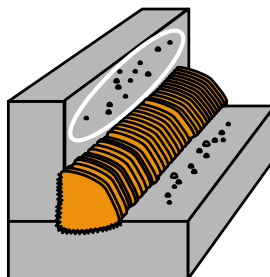
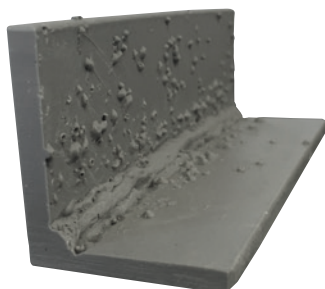
- Proper set-up of your welding machine is important and can be obtained by following your machine's suggested settings for the particular weld you are working on
- Many welds will have WPS's to help ensure your machine's settings are set correctly for each individual weld

Correction of Defect - Check Your Technique

- Keep Work Angle around 45° for a fillet weld and 90° for a groove weld
- Travel Angle should be around 0° – 15° for both fillet and groove welds
- Many welds will have WPS's to help ensure you are within the correct Travel Speed; check prior to welding
- CTWD for most welds should be 1/4 – 1/2 inches from metal (GMAW)
- Arc Length for most welds should be 1/8 inches from metal (SMAW)

#6 Spatter

The metal particles expelled during arc and gas welding that do not form part of the weld.



Causes

- Improper machine settings
- Too much wire is sticking out (GMAW)
- Arc Length is too long (SMAW)
- Improper Work Angle
- Improper Travel Angle
- Contaminated base metal

Correction of Defect - Check Your Machine

- Adjust settings for the thickness of the base metal
- Decrease volts or amps if paired with undercut
- Check Wire Feed Speed

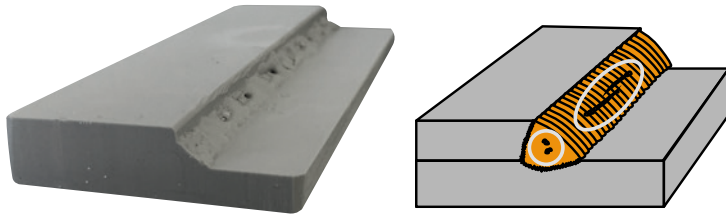
Correction of Defect - Check Your Technique

- Keep Work Angle around 45° for a fillet weld and 90° for a groove weld
- Keep Travel Angle at 0° – 15°
- CTWD for most welds should be between 1/4 – 1/2 inches from metal (GMAW)
- Arc Length for most welds should be 1/8 inches from metal (SMAW)
- Clean base metal

#7 Slag Inclusions

When foreign material is trapped in the weld metal or between the weld and the base metal, the most common is slag, a non-metallic solid material.

NOTE: Slag Inclusion occurs mainly in SMAW and FCAW welding processes.



Causes

- Improper welding technique
- Improper amperage
- Presence of coatings on certain metals
- Type of flux coating
- Not cleaning weld properly between passes in multi-pass welds

Correction of Defect - Check Your Machine

- Increase amperage

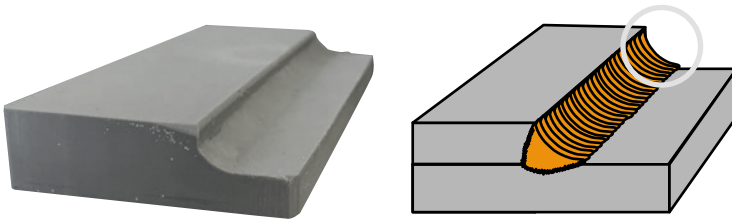
Correction of Defect - Check Your Technique

- Decrease travel speed
- Remove all slag between welding passes (grind, chip or wire brush)

#8 Concavity

When the distance from the weld face perpendicular to a line joining the weld toes curves inward toward the weld joint.

NOTE: Only fillet welds can be concave depending on the function of the welds. Concave welds are measured by the throat and have a "caved in" appearance.



Causes

- Improper machine settings
- Improper Wire Feed Speed (GMAW)
- Improper Amperage (SMAW)
- Improper Travel Speed
- Too few passes in a multi-pass weld

Correction of Defect - Check Your Machine

- Adjust settings for the thickness of the base metal
- Decrease amps (SMAW)
- Increase Wire Feed Speed (GMAW)

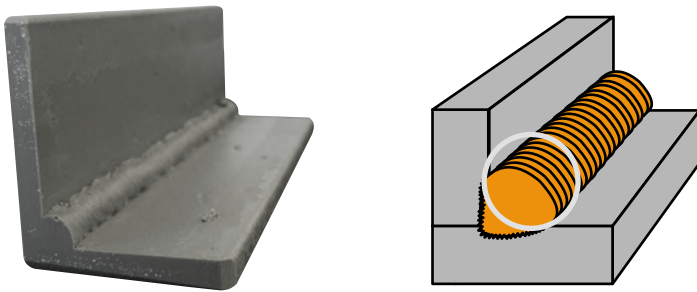
Correction of Defect - Check Your Technique

- Decrease Travel Speed
- Keep Travel Angle 0° – 15°
- Grind to proper size
- Add more passes in a multi-pass weld

#9 Convexity

The maximum distance from the weld face perpendicular to a line joining the weld toes. The weld has a rounded profile.

NOTE: Only fillet welds can be convex depending on the function of the welds. Convex welds are measured by the legs and have a rounded or curved outward appearance.



Causes

- Improper machine settings
- Improper Wire Feed Speed (GMAW)
- Improper Amperage (SMAW)
- Improper Travel Speed
- Too many passes in a multi-pass weld

Correction of Defect - Check Your Machine

- Adjust settings for the thickness of the base metal
- Increase amps (SMAW)
- Decrease Wire Feed Speed (GMAW)

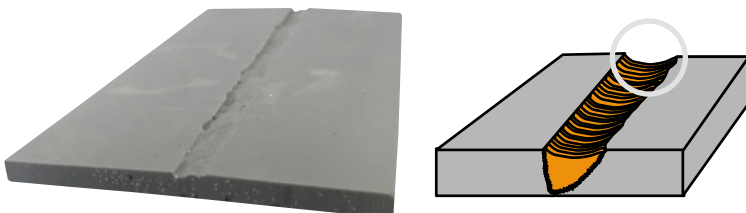
Correction of Defect - Check Your Technique

- Increase Travel Speed
- Keep Travel Angle 0° – 15°
- Grind to proper size
- If multi-pass weld, weld fewer passes

#10 Insufficient Reinforcement

When the weld metal lacks sufficient build-up above the base metal.

NOTE: Only groove welds are measured by amounts of reinforcement. Reinforcement is defined as the amount of weld above the base metal. Groove welds typically require 10-20% reinforcement.



Causes

- Improper machine settings
- Wire Feed Speed is too low (GMAW)
- Improper Travel Speed
- Too few weld passes in a multi-pass weld

Correction of Defect - Check Your Machine

- Increase Wire Feed Speed (GMAW)
- Decrease amperage (SMAW)

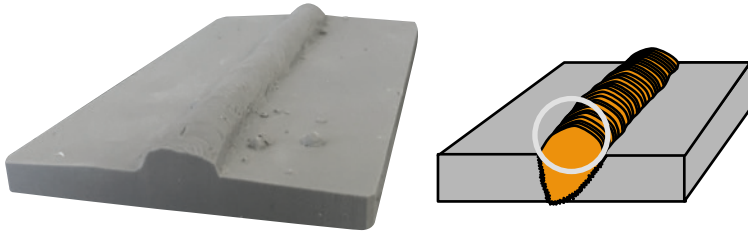
Correction of Defect - Check Your Technique

- Decrease Travel Speed
- Add more weld passes to fill in areas of a multi-pass weld

#11 Excessive Reinforcement

When the weld metal has too much build-up above the base metal.

NOTE: Only groove welds are measured by amounts of reinforcement. Reinforcement is defined as the amount of weld above the base metal. Groove welds typically require 10-20% reinforcement.



Causes

- Wire Feed Speed is too high (GMAW)
- Improper Travel Speed
- Too many passes in a multi-pass weld

Correction of Defect - Check Your Machine

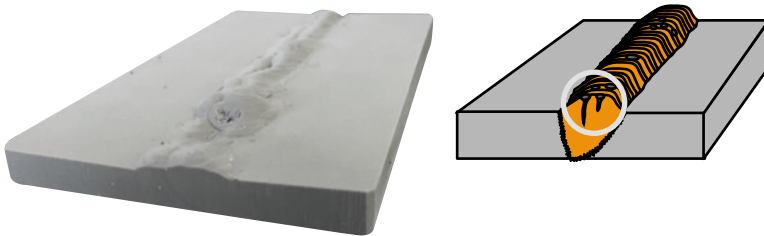
- Decrease Wire Feed Speed (GMAW)
- Increase amps (SMAW)

Correction of Defect - Check Your Technique

- Increase Travel Speed
- Keep Travel Angle 0° – 15°
- If multi-pass weld, weld fewer passes
- Grind to proper size

#12 Porosity

The presence of inclusions or gas pockets in a weld.



Causes

- Improper shielding gas
- Damp electrodes
- Contaminated metal
- Low amperage

Correction of Defect - Check Your Machine

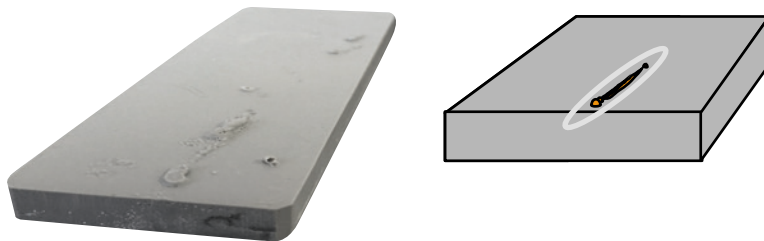
- Adjust shielding gas flow (GMAW)
- Check electrode to make sure shielding flux is not chipped away (SMAW)
- Increase amperage (SMAW)
- Clean nozzle from spatter
- Clean diffuser from spatter

Correction of Defect - Check Your Technique

- CTWD for most welds should be between 1/4 – 1/2 inches from metal (GMAW)
- CTWD for most welds should be 1/8 inches from metal (SMAW)
- Keep nozzle out of the weld puddle (GMAW)
- Keep Arc Length in first third of the welding puddle (SMAW)
- Clean base metal

#13 Arc Strike

Accidental striking of an arc outside the welding area (zone). This can lead to metal cracking and weakness.



Causes

- Improper welding technique
- Striking the arc in the improper location
- Carelessness

Correction of Defect - Check Your Machine

- Make sure you are ready to weld before getting into welding position; have machine set before preparing to weld

Correction of Defect - Check Your Technique

- Make sure you are ready to weld before moving into the welding zone
- Use the proper “striking” or “tapping” method
- Remove arc strikes with sanding or grinding

Notice! The weld defect illustrations are designed to highlight typical weld issues. They are not meant to mirror the RealCareer® Welding Solutions Weld Defects Kit models, which may encompass multiple defects simultaneously and may not look identical to your weld defects.

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