Module 7

Welding Defects and testing

Types of defects

- Slag Inclusion
- Undercut
- Porosity
- Incomplete fusion
- Overlap
- Underfill
- Spatter
- Excessive Convexity
- Incomplete Penetration
- Excessive Penetration

Slag Inclusion

Slag is the waste material created and bits of this solid material can become incorporated into weld. Bits of flux and rust can be counted as slag.

Cause:- Low amperage, improper techniques, slow travel rate

Prevention:- Increase amperage, increase travel rate

Repair:- Remove by grinding or other mechanical process

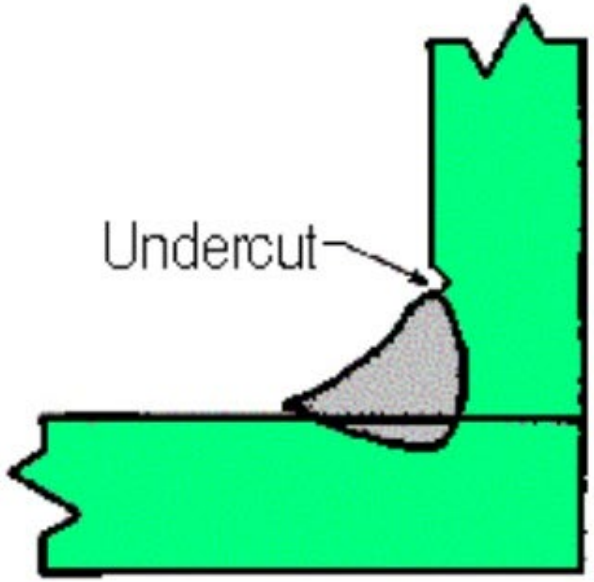
UNDERCUT

Undercutting is an extremely common welding defect. It happens when your base metal is burned away at one of the toes of a weld. portion of base metal melted away

Cause:- High amperage, wrong electrode angle, long arc length, electrode is too large for the base metal

Prevention:- clean metal before welding

Repair:- Weld with smaller electrode, sometimes must be low hydrogen with preheat.

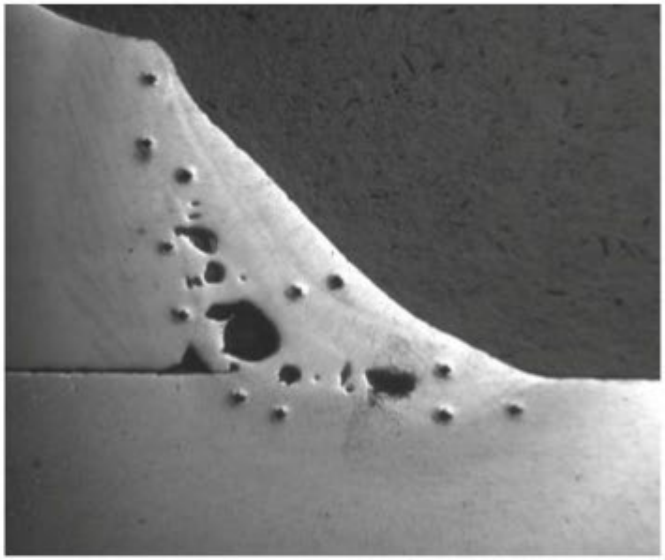


POROSITY

In this defect, air bubbles or gases are present in the weld zone

Cause:- inclusion of atmospheric gases, sulfur in weld metal, or surface contaminants

Prevention:- slower speed to allow gases time to escape



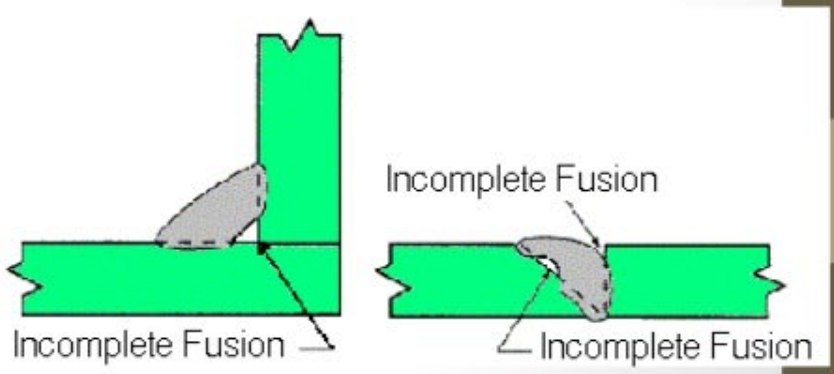
INCOMPLETE FUSION

A weld bead in which fusion has not occurred throughout entire cross section of joint

Cause:- Low amperage, fast travel speed, short arc gap, lack of preheat, electrode too small, unclean base metal

Prevention:- Eliminate the potential causes

Repair:- Remove & reweld, being careful to completely remove the defective area.



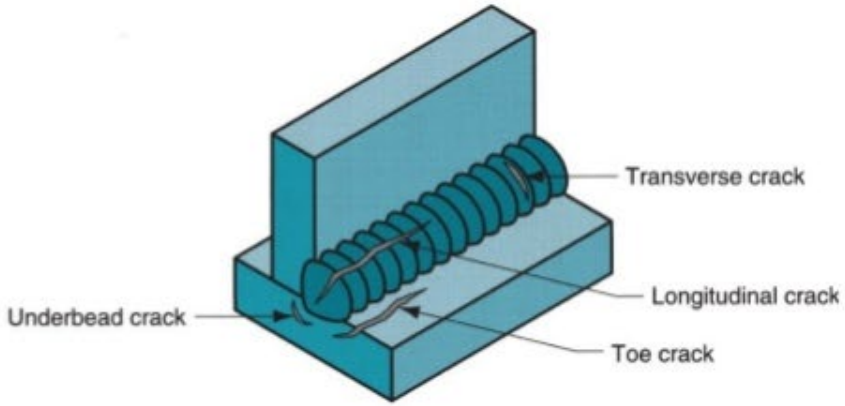
Cracks

It is a discontinuity in the metal that significantly reduces strength

Cause:- low ductility of weld, solidification shrinkage

Prevention:-

When finishing move back the electrode to fill up the crack, Increase crater fill time by power source.

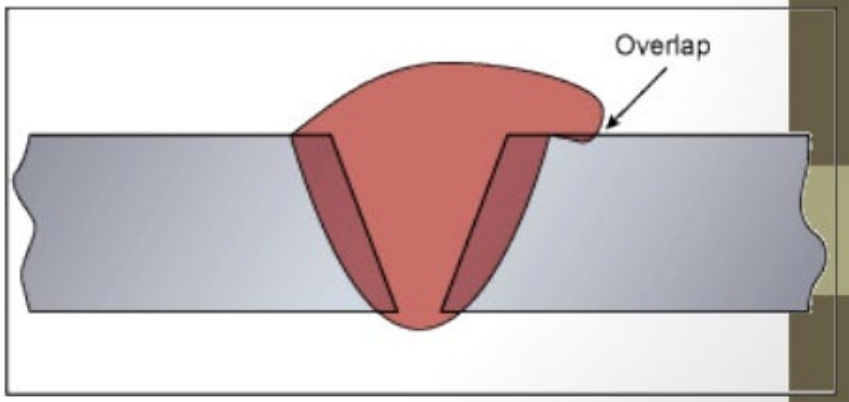


OVERLAP

Weld metal spills beyond joint onto part surface but no fusion occurs

Cause:- Improper welding technique, steep electrode angle, fast travel speed

Prevention:- Overlap is a contour problem. Proper welding technique will prevent this problem



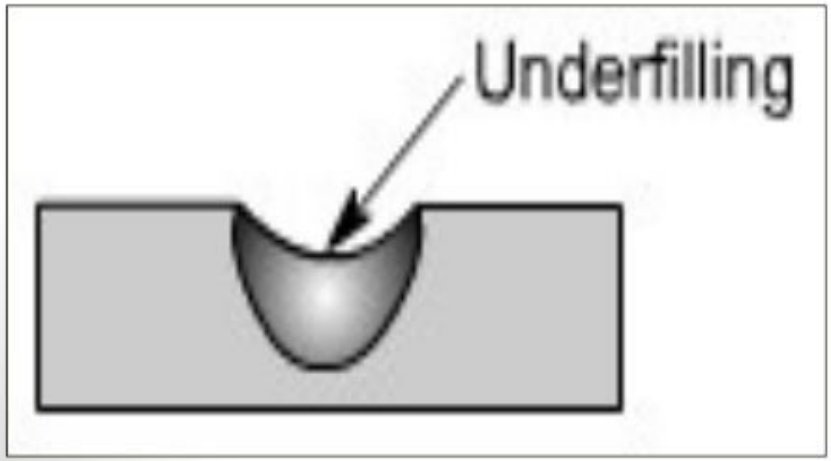
UNDERFILL

Depression in weld below adjacent base metal surface

Cause:- Improper welding techniques

Prevention:- Apply proper welding techniques for the weld type & position. Use stripper beads before the cover pass.

Repair:- Simply weld to fill. May require preparation by grinding.



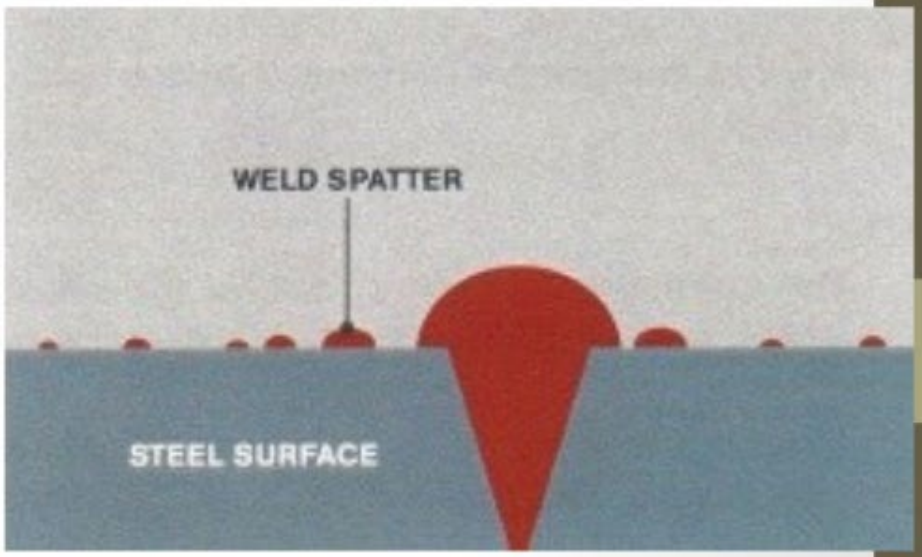
SPATTER

Small particles of metal that attach themselves to the surface of the material

Cause:- High arc power, Damp electrodes

Prevention:- Reduce arc power, reduce arc length, use dry electrodes

Repair:- Remove by mechanical process



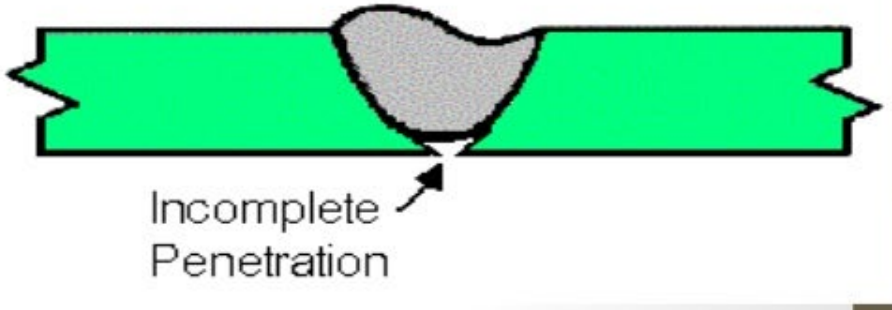
INCOMPLETE PENETRATION

Incomplete penetration happens when your filler metal and base metal aren't joined properly, and the result is a gap or a crack of some sort.

Cause:- Low amperage, low preheat, tight root opening, fast travel speed, short arc length

Prevention:- Correct the contributing factors.

Repair:- Back gauge and back weld

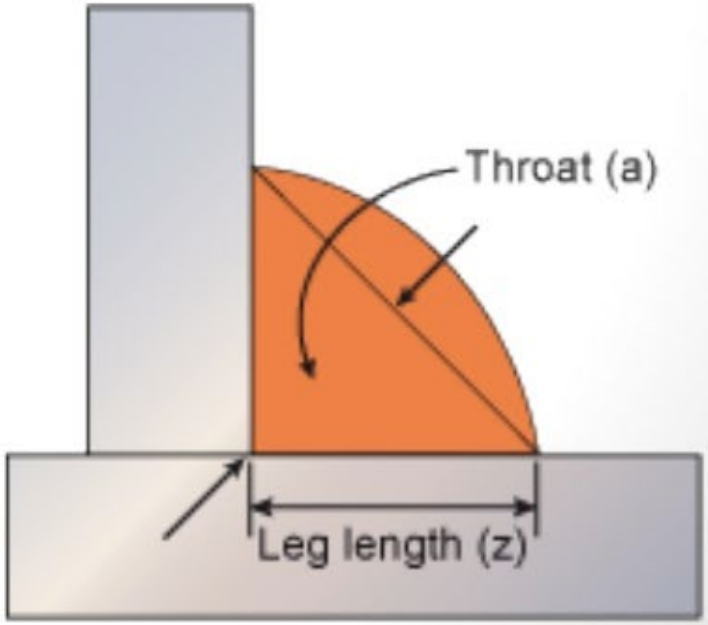


EXCESSIVE CONVEXITY

Cause:- Amperage & travel speed

Prevention:- Observe proper parameters & techniques

Repair:- Must blend smoothly into the base metal



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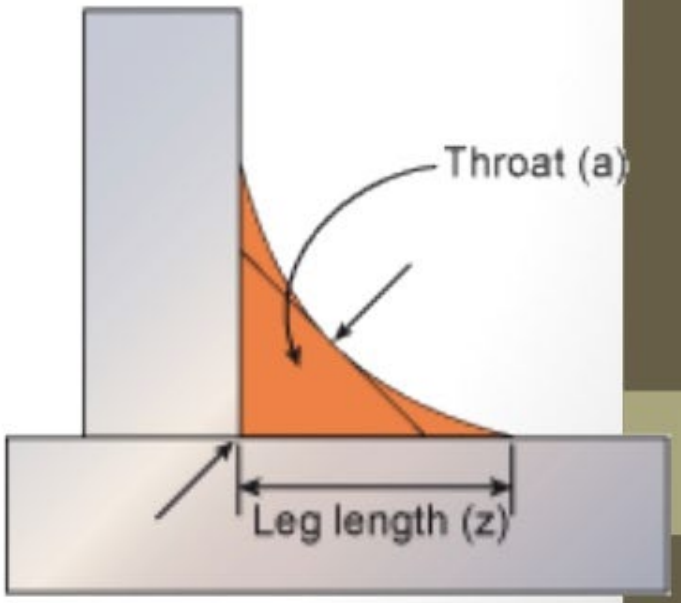


Nondestructive Testing

What is nondestructive testing?

Non**D**estructive **T**esting (NDT) is the process of doing inspections, testing, or evaluating materials, components or assemblies for defects without destroying the material or component.

- **NDT test methods may be used to determine:**
  - the size, shape, or orientation of a flaw (such as a crack or porosity)

The most frequently used test methods are:

Visual Testing (VT)
Liquid Penetrant Testing (PT)
Magnetic Particle Testing (MT)
Ultrasonic Testing (UT)
Radiographic Testing (RT) (X-ray)

Visual Testing (VT)

VT is the visual observation of the surface to evaluate the presence of surface discontinuities. Corrosion, misalignment of parts, physical damage and cracks are some of the discontinuities that may be detected by VT.

VT is the most commonly used test method in industry as most test methods require that the operator look at the surface of the part being inspected. VT inspections may be by direct looking, or may be by use of optical instruments such as magnifying glasses, mirrors, borescopes, and remote Viewing.

Liquid Penetrant Testing (PT)

PT uses a liquid with high surface wetting characteristics is applied to the surface and allowed to seep into defects and then excess liquid is removed.

A developer is applied the trapped penetrant is pulled out of the defect where it can be seen.

Visual inspection is then performed.

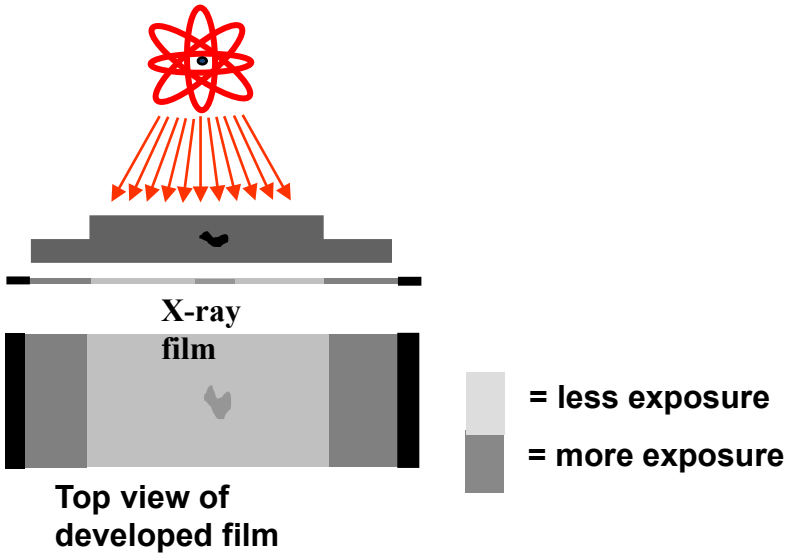
The penetrant used is often loaded with a fluorescent dye and the inspection is done under UV light to increase test sensitivity.

Ultrasonic Testing (UT)

Ultra-high frequency sound is introduced into the part being inspected and if the sound hits a material with a different acoustic impedance (density and acoustic velocity), some of the sound will reflect back to the sending unit and can be presented on a visual display.

Radiographic Testing (RT)

RT involves exposing a test object to radiation so that the radiation passing through the object is recorded on a medium placed against the opposite side. The recording media can be industrial x-ray film or one of several types of digital radiation detectors. If there is a void or defect in the part, more radiation passes through, causing a darker image on the film or detector.



Magnetic Particle Testing (MT)

In MT the part is magnetized. Finely milled iron particles coated with a dye pigment are then applied to the specimen. These particles are attracted to magnetic flux leakage fields and will cluster to form an indication directly over the discontinuity. This indication can be visually detected under proper lighting conditions.