

**LESSON PLAN**

Date \_\_\_\_\_

Trade: - Welder

Name \_\_\_\_\_

Unit/Lesson:-Twenty Seven

**Subject:-** Types of inspections methods. Classification of destructive and non destructive methods. welding economics and cost estimation.

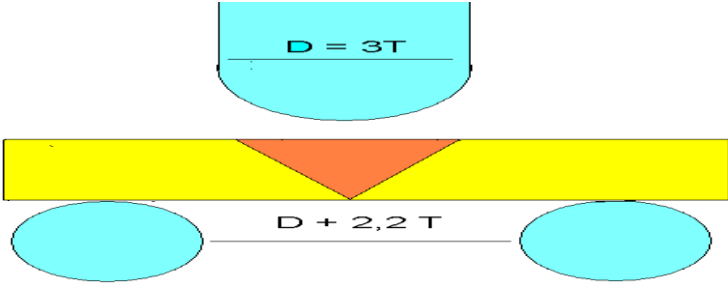
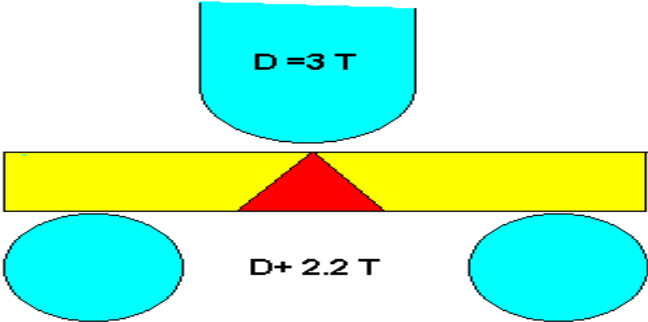
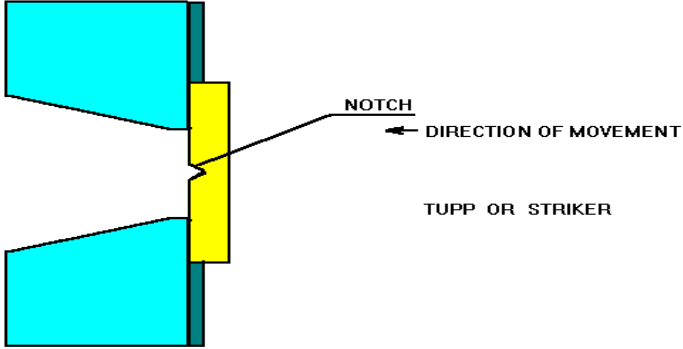
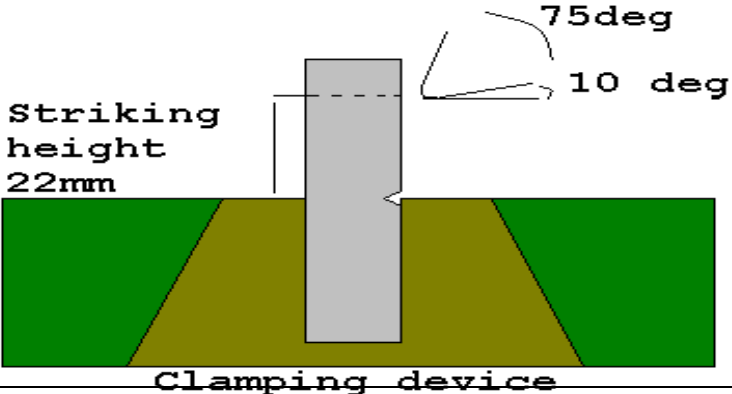
**Motivation: - We learn about** Cast iron –its properties and types.welding methods of cast iron in previous week.

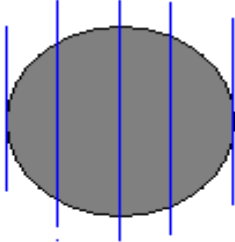
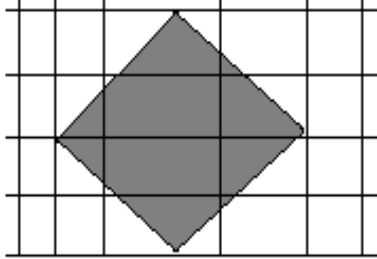
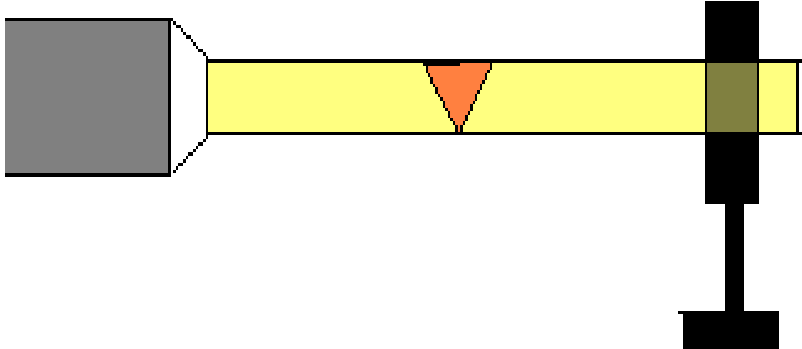
**PREPARATION**

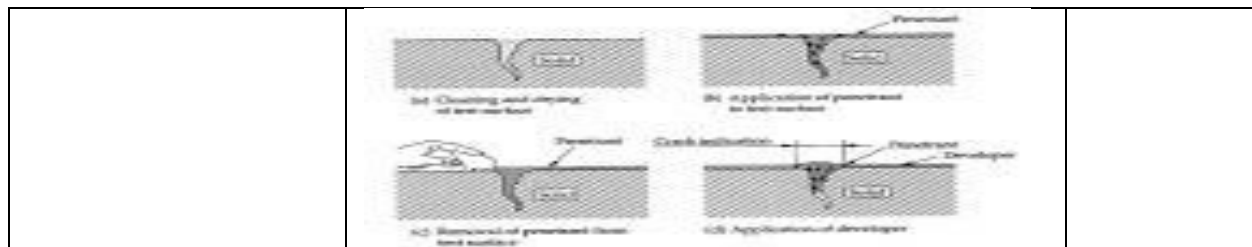
- 1) (Materials, Tools, Models, Charts and other aids)

**INTRODUCTION: weld quality is main in a welding joint. Its depend on some facts as like edge preparation, raw materials, equipments, process and mainly welder.**

Topic	Information Point	Spot Hint
Weld quality inspections	It is very important process to check weld quality. Weld inspection is final step to use weld joint.	
Types of Test	Destructive test Non-destructive test	
Destructive test	In this test joint damaged and not reuse.	
	<ul style="list-style-type: none"> <li>➤ These can be divided into two parts,</li> <li>➤ Tests capable of being performed in the workshop.</li> <li>➤ Laboratory tests.</li> <li>➤ microscopic-macroscopic ,</li> <li>➤ chemical and corrosive</li> </ul>	
Reasons	<ul style="list-style-type: none"> <li>➤ Defects occur during welding which affect the quality and hardness of the plate</li> <li>➤ Other defects occur through lack of knowledge of and skill of the welder</li> <li>➤ For the training of welders</li> </ul>	
WORKSHOP TESTS	TENSILE IMPACT FATIGUE	BENDING HARDNES CRACKING
TENSILE	Material is sectioned and edges rounded of to prevent cracking. Punch marks are made to see elongation.	
BEND TEST	<ul style="list-style-type: none"> <li>➤ Bend through 180<sup>0</sup></li> <li>➤ the specimen should be a minimum of 30mm wide</li> <li>➤ The fulcrums diameter is 3x thickness of the plate</li> <li>➤ The bottom rollers have a distance of the diameter of the former + 2.2 times the thickness of the plate</li> </ul>	

	<ul style="list-style-type: none"> <li>➤ Upper and lower surfaces ground or filed flat and edges rounded off.</li> </ul> <p>the tests should be one against the root -another against the face ,and in some cases a side bend</p>
<p>Root bend</p>	
<p>FACE BEND</p>	
<p>IMPACT</p>	<ul style="list-style-type: none"> <li>➤ CHARPY AND IZOD</li> <li>➤ Gives the toughness and shock loading of the material and weld at varying temperatures with a notch such as under cut</li> <li>➤ The measurement is the energy required to to break a specimen with a given notch</li> <li>➤ 2mm depth at a 45°bevel or a “U” notch.</li> </ul>
<p>CHARPY</p>	
<p>IZOD</p>	

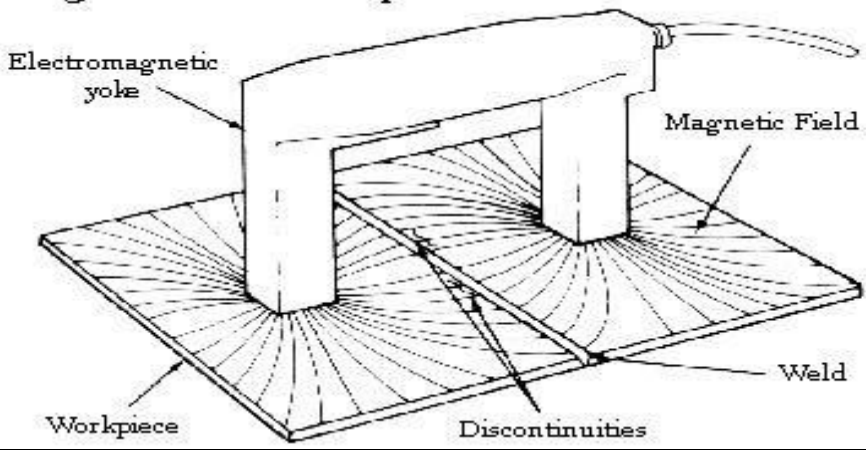
<p><b>HARDNESS TESTS.</b></p> <ul style="list-style-type: none"> <li>➤ This gives the metals ability to show resistance to indentation which show it's resistance to wear and abrasion. <ul style="list-style-type: none"> <li>Brinell</li> <li>Rockwell</li> <li>Vickers diamond pyramid</li> <li>Scleroscope</li> </ul> </li> </ul>		
		
<p><b>FATIGUE</b></p> <ul style="list-style-type: none"> <li>➤ the testing of Material that is subject to fluctuating loads</li> <li>➤ HAIGH Electro magnetic tester.</li> <li>➤ W'O'HLER Uses rotating chuck with weight</li> </ul>		
<p><b>MICROSCOPIC:-</b> Used to determine the actual structure of the weld and parent metal</p> <ul style="list-style-type: none"> <li>➤ Up to 50,000 times magnification with an electron beam microscope</li> <li>➤ Polishing must be of a very high standard</li> </ul>		
<p><b>NON-DESTRUCTIVE TESTING</b></p>		
<p><b>VISUAL</b> While welding</p> <ul style="list-style-type: none"> <li>● The rate the electrode melts</li> <li>● The way the weld metal flows</li> <li>● Sound of the arc</li> <li>● The light given of</li> </ul>	<p>After welding</p> <ul style="list-style-type: none"> <li>● Under cut</li> <li>● Lack of root fusion</li> <li>● Any pin holes from gas or slag</li> <li>● Amount of spatter</li> <li>● Dimensions of weld</li> </ul>	
<p><b>DYE PENETRANTS</b></p>	<p>These are an aid to visual inspection Will only find surface defects Use correct type</p>	
<p>Types</p>	<p>Red Florissant</p>	<p><b>CAUTION</b> Oil based Water washable</p>



**MAGNETIC PARTICLE**

- Mainly for surface defects
- Some sub surface defects can be found
- Only ferrous metal

**Magnetic Particle Inspection**



**Hydraulic Test**

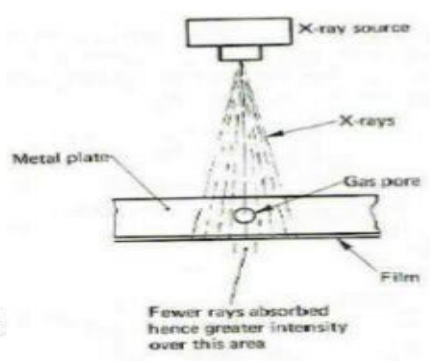
- Used to test pressure vessels
- Pipe lines
- The item for testing is filled with water or oil it is then pressurised using a pump
- A safety valve is set 1.5 to 2 times below the working pressure.

**RADIOGRAPHIC**

X-RAY  
 GAMMA RAY  
 Notes:- Electromagnetic radiation of short duration  
 Both of these methods are a danger to health.

## Radiographic inspection (RT)

- Interior defects (porosity, cracks, voids) can be examined by using X-ray or gamma ray, which can penetrate through materials and its intensity depends on materials thickness and density.
- Provide a permanent film record which is easy to interpret.
- Slow and expensive, however this method is positive to determine defect size.
- RT inspections can reveal flaws deep within a component



**Stethoscope test**

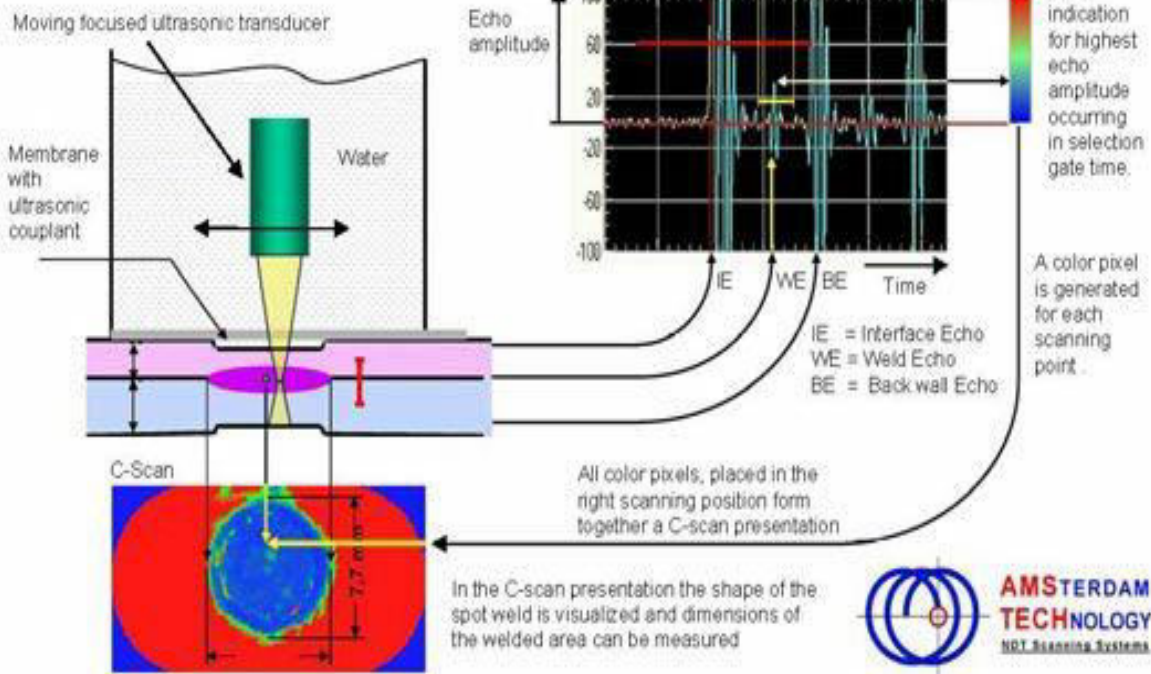
Use stethoscope for listening sound . this test need a experienced welder. The success ratio is almost 60% and no recorded data .

**Visual inspection**

This test is very common test. Every welder check

	joint after welding and almost get ideas for next steps. A skill welder guess 80% for job quality after visual test.	
Magnifying glass	A magnifying glass check 10x image of weld and mostly cracks are detective from this test.	
ULTRASONIC TESTING	This uses high pitched sound The sound will not pass through an air gap so bounces back and is picked up on a receiver The reader is a oscilloscope	

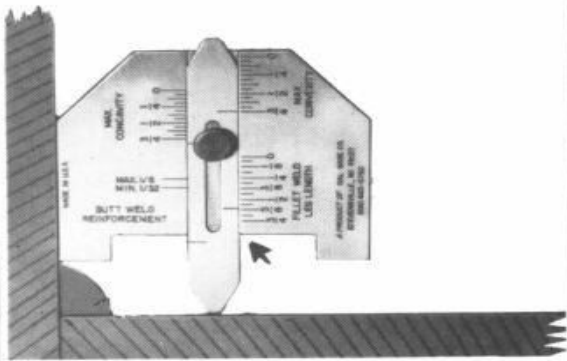
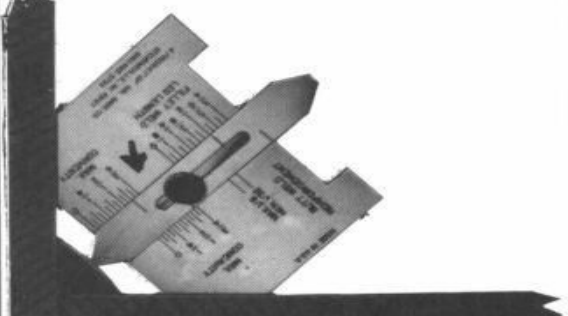
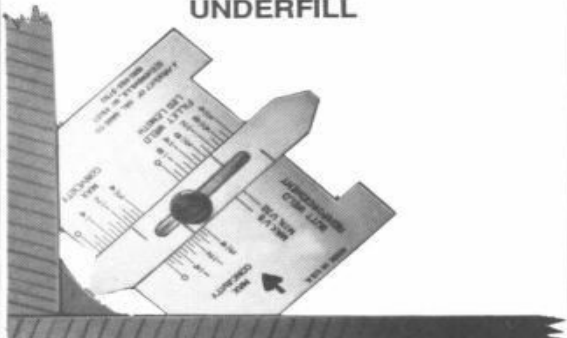
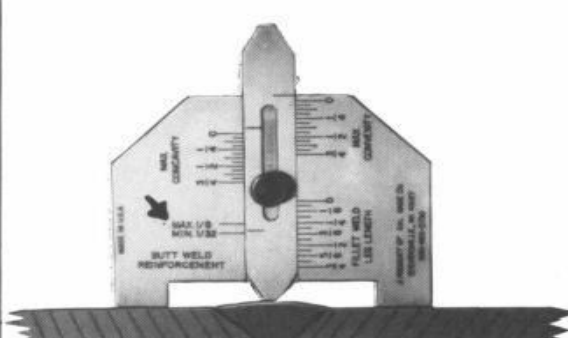
**Mini Scanner  
Ultrasonic Spot Weld Inspection**



Semi-destructive test	<ol style="list-style-type: none"> <li>1. Cutting test</li> <li>2. Acid aching test</li> <li>3. Drilling test</li> </ol>
Cutting test	Cut the weld joint from specific point and check the iron powder from cut.
Acid aching test	Use different type of acid and check cracks.
Drilling test	Drill on joint and collect iron powder and check.
<b>Weld cost and estimation</b>	
Fixed Cost	<b>Those where amounts can not be changed in the short run (e.g. building mortgage, building heat, equipment, insurance costs, bond interest)...</b>
Variable cost	<b>Costs whose total amount goes up or down when volume goes up or down (also called - direct costs, incremental costs, or marginal costs), (e.g. raw materials, shielding gas, electrodes,</b>

	<b>some energy costs, labor)</b>
Opportunity Cost	<p><b>Profits which a foregone choice of action would have earned but which are lost because another choice is made.</b></p> <ul style="list-style-type: none"> <li>• A person who keeps money in a mattress incurs opportunity costs - loss of interest - because of the decision</li> <li>• VW introduced rabbit - sold out immediately - loss opportunity cost of several million dollars because not enough supply</li> <li>• Cabbage Patch Kids</li> <li>• Tickle-me Elmo</li> <li>• Time value of money</li> </ul>
$P \times Q = F + (V \times Q) \quad \rightarrow \quad Q = F/(P-V)$ <p><i>P = price per unit</i>  <i>Q = quantity</i>  <i>F = fixed costs</i>  <i>V = variable costs per unit</i></p>	
<p><b>(\$/ft) Cost incurred to make <u>a</u> weld (includes joint prep, consumables, labor, overhead, pre- &amp; post-weld treatment, etc.)</b></p> <ul style="list-style-type: none"> <li>• Used to compare cost advantages of weld vs. Other manufacturing processes</li> <li>• Used to decide on the most cost effective joint design or most cost effective welding process to use</li> <li>• Used as a basis for investment in new automated equipment</li> </ul>	
<p><b>(\$/piece) Cost incurred to make <u>entire</u> structure (includes all of above plus summation of all the weldments and raw material costs)</b></p> <ul style="list-style-type: none"> <li>• Used to bid on a welding job</li> </ul>	
<p>Welding procedure for cost estimation</p> <p><b>This is the starting point for cost estimating. Procedure should include:</b></p> <ul style="list-style-type: none"> <li>• Joint details • Welding process • Type of filler • Type of gas/fluxes</li> <li>• Welding current • Position (operator factor) • Travel speed • Post weld treatment</li> </ul>	
<p><b>INDIVIDUAL PART OF ESTIMATE</b></p> <p><b>(Look at each item individually) Cost of Joint Prep Cost of Materials (Consumables) • Cost of Materials (Flux &amp; Shielding) • Labor Costs • Power Costs</b></p> <ul style="list-style-type: none"> <li>• Post Weld Costs • Overhead Costs</li> </ul>	

Topic	Information Point	Spot Hint
Weld quality inspections	It is very important process to check weld quality. Weld inspection is final step to use weld joint.	
Why inspection needed	Every weld joint are important due to use. So if joint failed in quality test it causes an accident.	
Common welding Mistakes	<ol style="list-style-type: none"> <li>1. Improper edge preparation.</li> <li>2. Wrong choice of filler materials.</li> <li>3. Wrong welding process.</li> <li>4. Wrong welding parameters.</li> <li>5. Unskilled welder.</li> </ol>	

Weld gauge	Weld gauge is use for measure weld.	
<p data-bbox="268 241 730 309"><b>1. TO DETERMINE THE SIZE OF A FILLET WELD</b></p>  <p data-bbox="240 685 767 842">Place the gauge against the toe of the fillet weld and slide pointer out until it touches structure as shown. Read "Size of the Fillet Weld" on face of gauge as indicated by arrow.</p>	<p data-bbox="868 241 1362 309"><b>2. TO CHECK THE PERMISSIBLE TOLERANCE OF CONVEXITY</b></p>  <p data-bbox="842 651 1401 842">After the size of a convex weld has been determined, place the gauge against the structure and slide pointer until it touches face of fillet weld as shown. The maximum convexity should not be greater than indicated by "Maximum Convexity Scale" as indicated by arrow for the size of fillet being checked.</p>	
<p data-bbox="252 898 746 987"><b>3. TO CHECK THE PERMISSIBLE TOLERANCE OF CONCAVITY AND UNDERFILL</b></p>  <p data-bbox="240 1323 767 1480">Place gauge against structure and slide pointer out until it touches the face of the fillet weld as shown. If the pointer does not touch as shown, the fillet requires additional weld metal.</p>	<p data-bbox="868 898 1394 965"><b>4. TO CHECK THE PERMISSIBLE TOLERANCE OF REINFORCEMENT</b></p>  <p data-bbox="858 1335 1390 1458">Place gauge so that reinforcement will come between legs of gauge and slide pointer out until it touches the face of weld as shown.</p>	

Questions:-

1. What is visual inspections?
2. What is bend test?
3. What is weld cost estimation and how its estimated?

Assignments:-

Types of inspections methods. Classification of destructive and non destructive methods. welding economics and cost estimation.

Checked by.....

Instructor.....