LESSON PLAN

Date_____ Trade:- Welder

Name_____ Week No:- Twelve

Subject :- Arc blow –causes and methods to controlling. Distortion in arc and gas welding and methods employed to minimized distortion, Arc welding defects –causes, and remedies.

Motivations:- in previous week we learned Oxy-acetylene gas welding system (low pressure and high pressure) Difference between gas welding blow pipe(LP and HP) and cutting blow pipe. Gas welding technique (right ward and left ward..

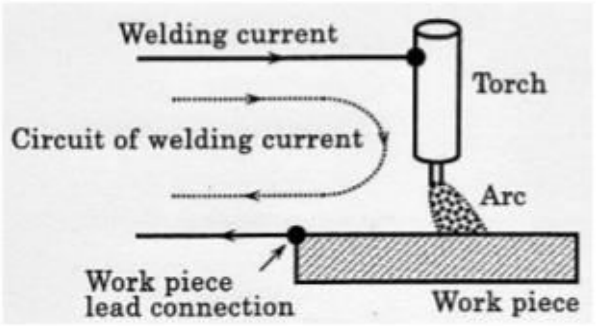
PREPARATION: - Teaching Aids:-Chalk, Charts,

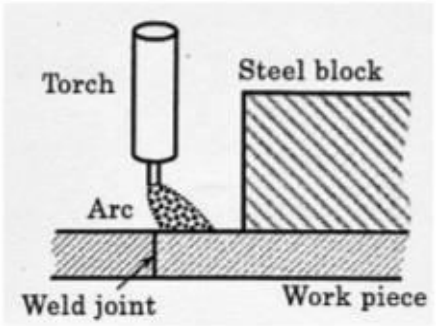
INTRODUCTION: -Arc blow is defects which falls in DC welding . In dc welding due to dc current , arc cannot run straight. Distortion means job get changes in length width and thickness due to heat produce during welding.

PRESENTATION:-

Topic	Information Point	Spot Hint

Arc Blow





(a) Effect of Work Piece Lead Connection (b) Effect of Work Piece Shape

- Arc deflects from its intended direction by asymmetric magnetic field and welding current circuit (residual magnetic field) – Arc Blow.
- Arc Blow tends to occur at DC welding of easily magnetized material, e.g. ferritic steel.
- Elimination: Managing workpiece connection, leads (cables) & demagatizing workpieces.

Welding for Engineers 25

What is "arc blow" and what can we do to reduce it?

Arc Blow is caused by a distorted magnetic attraction of the electric arc to the base metal.
The arc "curves" to one side.
Or "jumps" from side to side in an inconsistent pattern.
Generally a problem when using DC welding current
Causes metal to be deposited to one side of the weld.
How to control?
- Switch to AC.
- Move the ground clamp
- Use intermittent welds
- Use a weave pattern.

Introduction: Distortion in Welding

4

- **Main Causes of Distortion**
  - Non-Uniform Expansion and Contraction, i.e. Shrinkage due to plastic thermal strain, of the weld metal and base metal during the heating and cooling cycle
  - Internal stresses formed in base metal due to removing restraints given to welds by fixed components surrounding it

  So, both Welding processes & procedures and Material properties
  affect the extent of distortion

- **Effects of Distortion:**
  - Complicate further fabrication
  - Reduced application of the structure
  - High cost of rectifying deformations

Introduction: Distortion in Welding

3

Q. **What is Distortion ?**

- Any unwanted physical change or departure from specifications in a fabricated structure or component, as a consequence of welding

Figure: Distortion in Sheet due to Welding

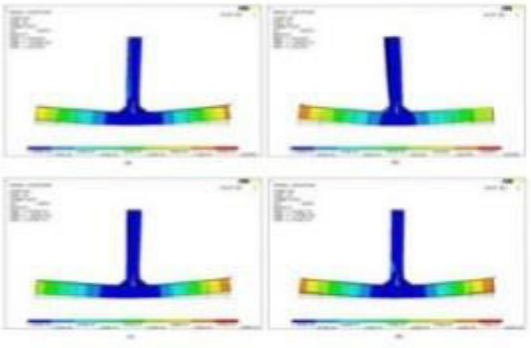
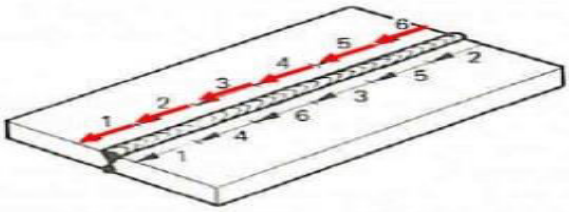


Figure: Simulation for T-Joint Welding

Remedies for Longitudinal distortion

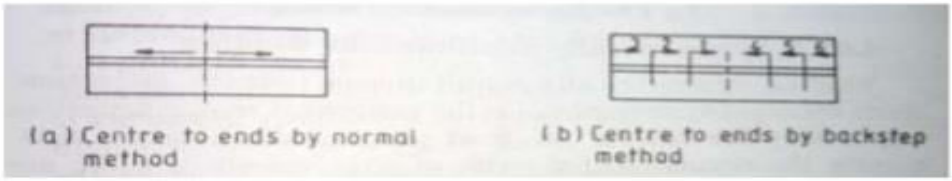
- Welding short lengths on a planned or random distribution are used to controlled this problem
- Mechanical methods: straightening press, jacks, clamps
- Thermal methods : local heating to relieve stresses (using torches)



Sequences for welding short lengths of a joint to reduce longitudinal bowing

Control of Distortion in Weldments

- **Back- Step Welding Sequence :**
  - Measure to counteract the wedge shaped-opening and closing(rotational distortion)
  - Reduces transverse and longitudinal shrinkage
  - Used widely in fabrication of large structures, such as ships, storage tanks



Control of Distortion in Weldments

- **Distortion control in Thin Plates and Sheets**
  - Used in light gauges
  - Copper abstract heat from weld reducing heating and warpage or buckling of the plates
  - Water-cooled jig, Copper Clamps, Copper tubes used

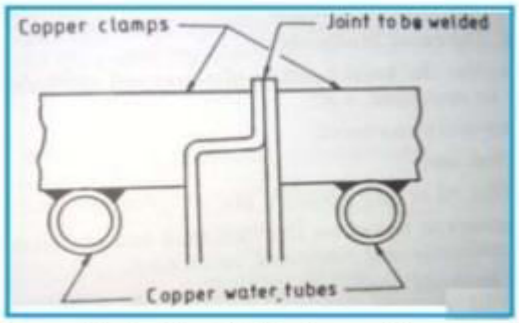
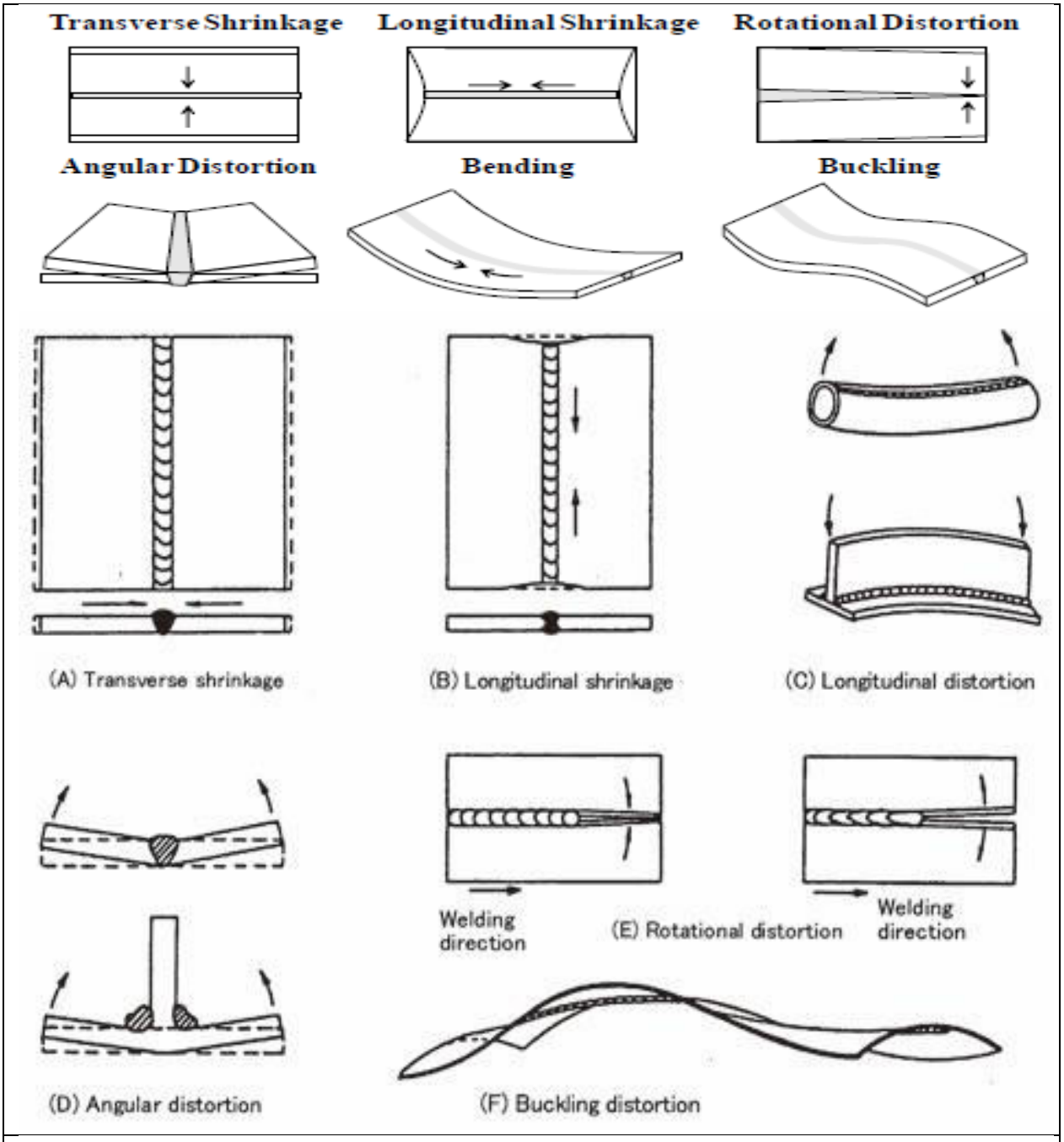


Figure: Water Cooled Jig for rapid removal of heat to control distortion in welding shheet metal

- **Fixing :**
  - Fixing parts, to be joined by welding, in a frame or rigidly as possible
  - To reduce back-spring shrinkage



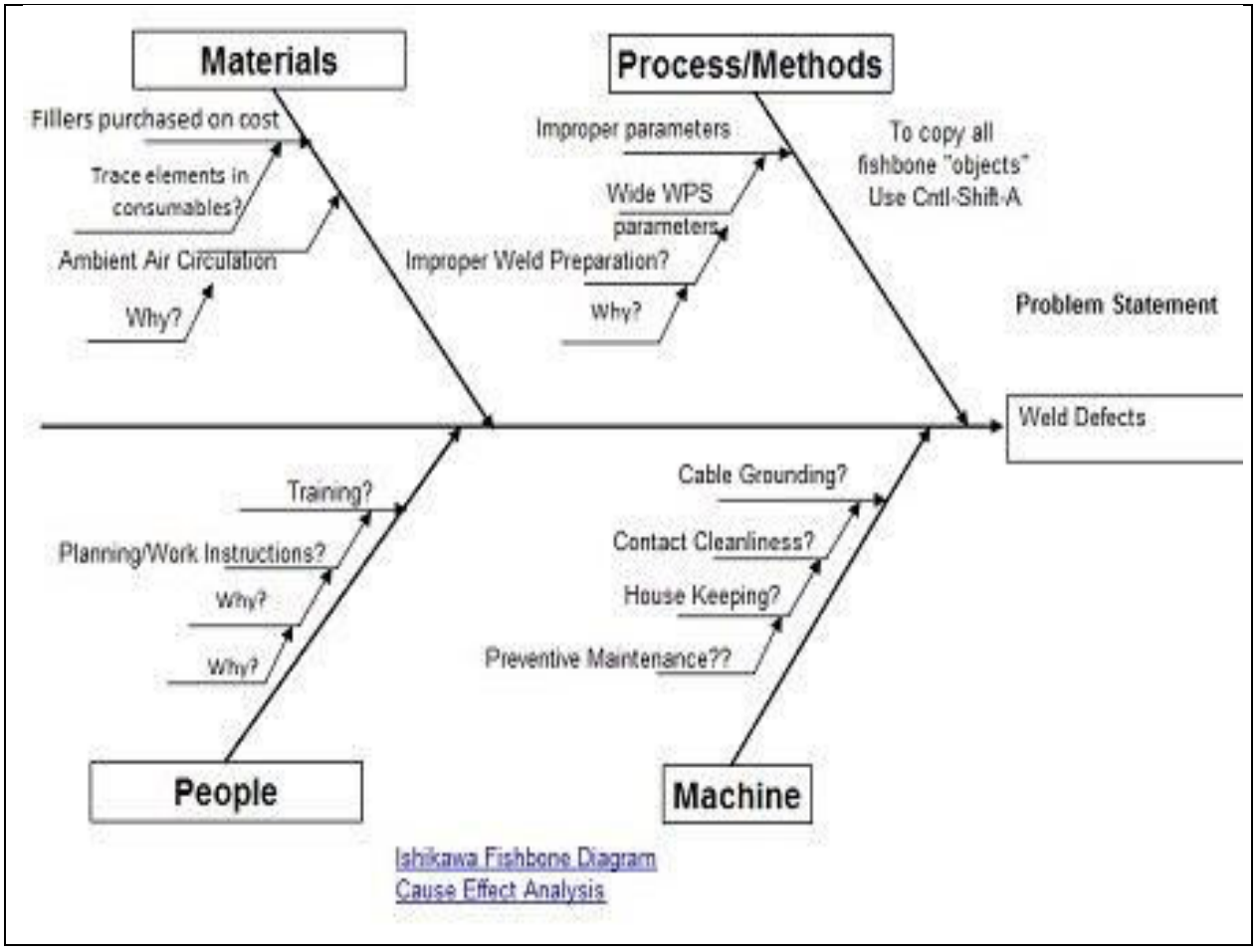
1. Porosity
a. Types
   1. uniformly scattered porosity
   2. cluster porosity
   3. linear porosity
b. Causes
   1. dirt, grease, rust, oil, moisture on base metal
   2. excessive current
   3. moisture in shielding gas
   4. moisture in filler metals
c. Controlling methods
   1. clean base metal properly
   2. dry base metal and/or filler materials
   3. proper welding technique
d. Corrective methods
   1. removal of defective area and subsequent re-welding
e. Effect
   depending on nature and type can propagate into a crack

Defects	Probable cause	Remedy
1. Porous welds	a. Short arc	Hold longer arc. Use proper electrode.
	b. Insufficient puddling time	Allow sufficient puddling time for gases to escape.
	c. Impaired base metal	Remove impurities in base metal.
	d. Incorrect current	Use proper current.
	e. Improper welding technique	Use weaving motion to eliminate pin holes.
2. Incomplete penetration	a. Speed too fast	Weld slowly enough to get good root penetration.
	b. Electrode too large	Select electrode according to welding groove size.
	c. Current too low	Use sufficient current.
	d. Faulty preparation	Calculate electrode penetration properly. Leave proper free space at bottom of weld.
3. Warping	a. Shrinkage of weld metal	Use intermittent welds. Control cooling.
	b. Faulty clamping of parts	Clamp parts properly.
	c. Faulty preparation	Peen joint edges before welding. Space parts properly.
	d. Overheating at joints	Increase travel speed. Use high speed, moderate penetration electrodes.
4. Poor fusion	a. Incorrect speed	Use correct speed.
	b. Current improperly adjusted	Use proper current to allow deposition and penetration.
	c. Faulty preparation	Use proper cleaning, edge preparation, and positioning.
5. Poor fusion	a. Improper electrode size	Select proper electrode.
	b. Improper welding technique	Weave must be sufficient to meld sides of joint. Prevent weld metal from curling away from plates.

Welding Defects & Prevention

Defects	Causes	Preventive Measure
Fibrous Structures	There are columnar structures present in the fractured part of weld metal, which arise when the properties of weld metal are inferior (rich C, P and S) and the cooling rate of weld metal is too fast .	1. Select the electrode suitable to base metal. 2. Make the travel speed to be slower, and avoid the rapid cooling of weld metal.
Cracks of Weld Metal	There is one kind of crack which is caused by shrinkage of metals accompanying cooling of metals. When the properties of steels, restraint of joints and shape of bead are inferior, or when the cooling rate of weld metals is too rapid, or improper electrodes are used, these defects are liable to arise.	1. Do not use excessive current. 2. Avoid rapid cooling of weld metal. 3. When the rigidity of joints is great, preheating and peening is required. As another method it is considered to change welding order. 4. Select the electrode suitable to base metal. Especially when Si and C are rich, use the low hydrogen type electrodes. 5. Don't use the electrodes which absorb moisture.
Occurrence of blow holes	There are two types of blowholes. One which arises inside of weld metals, the other arises on the surface. If the arc length is not proper, excessive current is used, dirty or inferior base metal is adopted and improper electrodes is used, these defect are liable to occur.	1. Use the correct welding current. 2. Make the arc length proper. 3. Remove the rust, oil and moisture which adhere to the base metals. 4. Use the correct electrodes.
Fish eyes	These defects are the silver grey parts of fish eyes which appear in the fracture parts of weld metals, they are produced when moisture absorbing electrodes are used and cooling rate is too fast.	1. Avoid rapid cooling of weld metals. 2. Don't use the electrodes which absorb moisture. 3. Use the low hydrogen type of electrode. 4. Pre-heat the job.
Inclusion of Slag's	These are the defect are the condition that the slag's are occluded in the weld metals or between weld metals and the base metal. They are produced when welding current is low, speed of manipulation is improper and groove configuration or root interval are improper.	1. Raise the welding current. 2. Operate with proper welding speed 3. Widen the root interval. 4. Select the proper electrodes.

Defects	Causes	Preventive Measures
Undercutting	These defects are deeply cutted groove. When welding current is too excessive, manipulation method of electrodes is improper, they are liable to occur.	1. Use the correct welding current. 2. Select the proper manipulation speed. 3. Avoid the excessive heating of base metal. 4. Make the arc length proper.
Overlapping	They are produced when welding speed is too slow at the state that weld metals does not melt with base metal sufficiently and weld metal put over the surface of base metals.	1. Use the correct welding current. 2. Use the correct manipulation speed. 3. Select the proper electrodes.
Poor Fusion	Too low a welding current, Improper weaving, Incorrect electrode size.	1. Increase current with plate thickness. 2. Weave sufficient to melt sides. 3. Use electrode small enough to reach the bottom of the vee.
Porosity	Too fast a travel speed, Excessive weld currents, Moisture in electrodes coating.	1. Puddle molten so gas can escape. 2. Use recommended current values. 3. Protect the electrode as per instruction of manufacturer.
Poor weld Surface	Improper weaving of electrode. Excessive weld currents. Overheated work.	1. Use a more uniform weave. 2. Reduce current. 3. Keep work at lower temperatures
Slag inclusions	Using extremely short arc. Improper electrode manipulation. Too low a current.	1. Use medium arc length 2. Obtain ample molten metal pudding. 3. Use recommended current at moderate weld speed.
Weld cracks	Welds too small. Rigid joints Improper penetration Fast cooling of weld metal.	1. Use a larger weld between heavy plates. 2. Use design that does not have rigid joint 3. Avoid stringer beads for heavy welds. 4. Ensure good fusion.



Questions:-

1. What is arc blow and how it occurs?
2. What is distortion and how we control it?
3. Write five weld defects?

Next Week:- specifications of pipes, various types of pipe joints, pipe welding position and procedure. Difference between pipe and plate welding.

Assignments:- Arc blow –causes and methods to controlling. Distortion in arc and gas welding and methods employed to minimized distortion, Arc welding defects –causes, and remedies.

Instructor…….. G.I……