

AREA: Farm Mechanics
UNIT: Arc Welding
JOB 9: Controlling distortion

SITUATION:

OBJECTIVES:

1. To develop an understanding of why the forces of expansion and contraction result in distortion of metal.
2. To provide methods which the welding operator can use to reduce the effects of distortion.

MOTIVATION:

1. Ask class to define "distortion."
2. Show motion picture. Recommended motion picture, "Prevention & Control of Distortion." Lincoln Electric Co., Cleveland, Ohio
3. Show samples of distortion.

STUDY GUIDES:

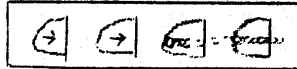
1. Does metal expand or contract when heated?
2. What happens when metal is upset?
3. Why does the use of excessive heat result in distortion?
4. What practical methods can be used to reduce the effects of shrinkage forces?
5. Why is it possible to reduce distortion by use of "back stepping" procedure of welding?
6. How is tack-welding of metal done?
7. Explain how peening can be used to reduce shrinkage forces.
8. How can pipe which has been distorted be straightened by use of heat?

References:

1. Arc Welding Lessons; Harold L. Kugler
2. Farm Mechanics Text & Handbook; Phipps, McColly, Scranton, Cook

ANALYSIS:

1. Expansion or contraction with heat.
 - a. Expands.
 - b. The effects of expansion and contraction forces depend upon the volume of metal heated and the amount of heat which is applied.
2. Metal upset
 - a. The metal in the heated area tends to expand in all directions.
 - b. The cold metal surrounding the spot heated acts similar to a vise.
 - c. Hot metal is soft, and due to the forces of the cold metal pushing against it, tends to pile up.
3. Excessive heat
 - a. Hot metal is soft, thus piling of metal.
 - b. When the metal cools in this heated area, the contraction forces are greater because the metal has piled up while hot and is thicker in this particular spot.
4. Reducing the effects of shrinkage forces.
 - a. Do not overweld.
 - b. Use proper edge preparation.
 - c. Use fewer passes.
 - d. Place weld near neutral axis.
 - e. Use intermittent welds.
5. Reduction by use of back setting.
 - a. Use of short beads joining the previously-run bead.
 - b. Each bead run moves the heat toward the area previously welded, thus reducing the amount in the unwelded area.



6. Tack-welding metal.
 - a. Place the first tack-weld in the center to prevent the ends from pulling together.
 - b. Place the second tack-weld on end to be welded last.
 - c. The third tack-weld can be the beginning of the bead.
7. Peening.
 - a. Peening the surface of the metal at a point where distortion is, stretches the metal causing it to take the natural shape.
 - b. When peening, the metal compresses in one direction and expands in another under the blows of the hammer.
8. Straightening distorted pipe with heat.
 - a. Heat spots 1" in diameter on the opposite side toward which the bend correction is to be made.
 - b. Alternate heating from one end of bend to the other.
 - c. Quench with cold water one spot at a time.