Joint design & Welding terms

Before proceeding with any welding operation, welders must understand common welding terms.
Objectives

After completing this chapter, the student should be able to:

- List the five major types of joints
- Understand the basics of joint design
- List five major factors related to joint design
- Identify the orientations of welds
- Explain the parts of groove welds
- Explain the parts of fillet welds
Key Terms

- Joint Type
- Weld Types
- Base Metal
- Filler Metal
- Weld Bead
- Weld Pass
- Fillet (F)
- Grooves (G)
- Welding Position
- Joint Dimensions
- Edge preparation
- Face
- Root
- Leg
- Toe
- HAZ
- Throat
- Backing
• The **base metal** is the metal or alloy that is to be welded.

• **Filler metal** is the metal deposited in a welded, brazed, or soldered joint during the welding process.

• a **weld bead** is a weld that results from a weld pass.

• a **weld pass** is a single progression of welding along a weld joint.
Joint Design

• The way pieces of metal are put together or aligned with each other
  – Butt joint
  – Lap joint
  – Tee joint
  – Outside corner joint
  – Edge joint

FIGURE 20-1 Types of joints.
Weld Joint Design (cont’d.)

• Weld-joint
  – Purpose is to join parts together so stresses are distributed

FIGURE 20-5 Forces on a weld.
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<table>
<thead>
<tr>
<th></th>
<th>Fillet</th>
<th>Groove</th>
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<tbody>
<tr>
<td>Butt</td>
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<td></td>
</tr>
<tr>
<td>Tee</td>
<td></td>
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<tr>
<td>Corner</td>
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<tr>
<td>Lap</td>
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Welding Process

• Major effect on selection of joint design
  – Each welding process has characteristics that affect its performance
  – Some processes are easily used in any position
    • Others may be restricted to one or more positions
  – Rate of travel, penetration, deposition rate, and heat input also affect welds
Fillet Weld Terminology

- Heat Affected Zone
- Weld Root
- Joint Root
- Face
- Leg
- Toe
- Effective Throat
- Actual Throat
Groove Weld

Reinforcement

Face

Toe

Heat Affected Zone

Back

Weld Root

Joint Root

Root Opening

Groove Weld Terminology
Edge Preparation

• Faying surface
  – Metal’s surface melted during welding process
    • Edge preparation: faying surface is shaped before welding to increase weld strength

• Reasons for preparing the faying surfaces
  – Codes and standards
  – Metals
  – Deeper weld penetration
  – Smooth appearance
  – Increased strength
Figure 7-17.—Butt joints in the flat position.
Joint Dimensions-
The depth and/or angle of the preparation and the joint spacing can be changed to make the weld

FIGURE 20-8 Groove joint terminology.
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Metal Thickness

• Metal becomes thicker
  – Joint design must change
• Welding on thick plate or pipe
  – Groove is often needed to get 100% penetration
• Plates that are thicker than 3/8 inch
  – May be grooved inside and outside of joint
• Plates may be:
  – Grooved and welded
  – Welded on one side, back gouged, and welded
Metal Type

• Some metals have specific problems
  – Thermal expansion, crack sensitivity, or distortion,
• Joint design must help control these problems
  – Example: magnesium is very susceptible to postweld stresses
    • U-groove works best for thick sections
Welding Position

• American Welding Society Plate
  – Divided plate welding into four basic positions for grooves (G) and fillet (F) welds
    • Flat 1G or 1F
    • Horizontal 2G or 2F
    • Vertical 3G or 3F
    • Overhead 4G or 4F
## WELD JOINTS AND POSITIONS

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<th>CORNER</th>
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**Figure 3-13.** The four common welding positions are flat, horizontal, vertical, and overhead.
Welding Position (cont’d.)

- American Welding Society Pipe
  - Divided pipe welding into five basic positions

- Inclined with a restriction ring 6GR
Just what type of joint is best suited for a particular job depends on many factors...

In general there are five basic considerations:

1. Whether a load is in tension or in compression and if bending, fatigue, or an impact will be encountered.

2. How a load is applied: steady, sudden, or variable.

3. Direction of the load as applied to the joint.

4. Thickness of the load as applied to the joint.

5. Cost of preparing the joint.
Summary

• Understanding the physics of joint design
  – Essential for the welder
    • Welders will be asked to make changes in structures
      as part of a modification or repair.