Introduction to Steel Fabrication

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Why Steel?

- Top priorities for hexapod structure:
  1. Strength at scale
  2. Availability/Affordability
  3. Manufacturability
  4. Analyzability
Advantages of Steel

• Highest strength conventionally available
• Easily weldable
• Machineable... ish
• Widely available in large quantities
• Cheaper than most other metals
• Fatigues in a predictable way
• Welds are as strong as parent material
Disadvantages of Steel

• Heavy as hell
• Slow to machine/cut/modify
• Unstable in plain form (rusts over time)
Steel

• Some alloys we will be using:
  – 1018 Mild Steel
    • Most common, lowest strength (1.5x stronger than aluminum), relatively easy to form
  – 12L14 Free Machining
    • Tougher than 1018, easiest to machine due to .25% lead
  – A36 Steel
    • Weakest steel, lowest yield point – would prefer if we didn’t use any, but most commonly used in angles
  – A513 (1020-1026) Steel
    • Stronger than 1018, used in steel forms such as angles and tubes
  – 4130 Chromoly
    • Strongest steel, used in high-end thin-wall tubing
• Rolling:
  – All steel is rolled or formed into shapes
  – Hot Rolled:
    • Steel is above recrystallization temp when rolled
    • Poorer finish, weaker, but better stability
    • Used in angles and square and rectangular tubes
  – Cold Rolled:
    • Steel is below recrystallization temp when rolled
    • Shiny finish, stronger, more prone to warping
    • Used in bars and round tubes
Common Steel Shapes

- Angle
- Square/Rectangular Tubing
- Round Tubing
- Channel
Weldments

Weldment: Assembly of parts welded together
Weldment Advantages

- Low part count
- High robustness
- Geometrical strength
- Relatively low weight
Weldment Disadvantages

• Time consuming

• Low accuracy and precision

• All repairs are ad hoc

• Almost impossible to significantly change designs once made
Case Study: Ground Hawg
Case Study: Ground Hawg

Main boom right side view

Main boom top view

Boom Details

[Diagram with dimensions and parts listed]

Part # 43
1-1/4" od x 1-1/4" id x 4-7/8"

Part # 51
2 inside bushings

Part # 48
3 outside bushings

Part # 45
2-1/4" od x 1-1/4" id x 4-3/4"

Part # 60
3/8" rod bent to shape

Part # 20
Case Study: Ground Hawg
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Leg Cart