Engineering 28
University of California

• Lecture # 8
  – Fastening, rivets and screws
  – Welding
  – Specification of welds
Announcements

• *Midterm Exam #1*, Friday, 20 February
• Material Coverage:
  – Sketching
  – Pictorials
  – Coded plans
  – Object rotation, reflection, symmetry
  – Fabrication methods
  – Fabrication steps for feature creation
Midterm Exam #1

• Closed Book exam
• 7-8 PM, 60 minute exam
• Location: 390 Hearst Mining Building
• Bring: Pencil, eraser
• Do not bring: Blue book, electronics, your friends
• Q/A sessions during labs this week
Methods of Joining

• Rivets
  – Number and size by application
  – Requires holes
  – Blank rivets placed in holes
  – Heads formed by hammering
  – Moderately fast, moderate cost
  – Removable, under special circumstance
Methods of Joining

- Screws and bolts
- Number and size by application
- Requires holes
- Requires tapping unless a nut is used
- Slow and costly
- Removable
A. EXTERNAL

B. INTERNAL

- Thread depth
- Thread angle 60°
- Major DIA
- Minor DIA
- Pitch DIA
- Lead = Advance for 360° turn
- 45° Chamfer

Crest
Root

[Diagram of external and internal threads with labeled parts and dimensions]
**US Thread Spec’s**

**Diameter size**
- 00, 0, 1, 2, 3, 4, 5, 6, 8, 10, 12 inches:
- 1/4, 5/16, 3/8, 7/16, 1/2...

**Threads/inch**
- (Usually) associated with thread type and diameter
- Example:
  - 10-24 UNC
  - 10-32 UNF

**Thread type**
- UNC = Unified National Coarse Thread
- UNF = Unified National Fine Thread

**Fit/Finish quality**
- A = external
- B = internal
- 1 Good
- 2 Better
- 3 Best

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**10-24 UNC-3A**

- Good
- Better
- Best
**Metric Thread Spec’s**

**M10 x 1.5 – 5g**

- **Standard metric thread**
- **Diameter, mm**
  - 1.6, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8...
- **mm/thread**
- **(Usually) associated with diameter**
- **Example:** M8 x 1.25, M10 x 1.5
- **Fit/finish on diameter**
- **Lower number means better quality**
- **Fit/finish on pitch**
- **Lower case: external**
- **Upper case: internal**
- **Ave:** 6
- **e good**
- **g better**
- **h best**
Welding

• Method of permanently joining (similar) metals
• Fairly quick and inexpensive
• Very strong static strength
• Very weak fatigue strength
• Many different procedures, all with advantages and disadvantages
Common Weld Joints

- **T**
- **BUTT**
- **LAP**
- **CORNER**
Arc Welding Processes

• Coated electrode
  – Field work
• Metal inert gas (MIG)
  – High production
• Tungsten inert gas (TIG)
  – Aluminum welding
Arc Welding Processes

workpiece
Arc Welding Processes

- Electrode (consumable)
- Workpiece
Arc Welding Processes

Arc

electrode (consumable)

workpiece
Arc Welding Processes

- arc
- fill
- electrode (consumable)
- workpiece
Arc Welding Processes

- Workpiece
- Electrode (consumable)
- Coating
- Inert gas
Arc Welding Processes

MIG

inert gas

electrode (consumable)

workpiece
Arc Welding Processes

TIG

filler rod (consumable)

electrode (non consumable)

inert gas

workpiece
Welding Symbol

GTAW 0.5

6-12

6-12
Welding Symbol

Process

GTAW 0.5 6-12 6-12
Welding Symbol

GTAW 0.5 6-12

Size

6-12
6-12
Welding Symbol

Geometry

GTAW 0.5 6-12

6-12
Welding Symbol

GTAW 0.5

Length and pitch

6-12 6-12
Weld Symbols

0.25
Weld Symbols
Weld Symbols
Weld Symbols

0.25

T

Leg
Weld Symbols

0.25

T

Throat
Weld Symbols

0.25

T
Weld Symbols

Weld this side only

0.25
Weld Symbols
Weld Symbols

Weld this side only

0.25
Weld Symbols
Weld Symbols

Weld all around

T

0.25
Weld Symbols

0.25
Weld Symbols

Field Weld

T

0.25
Weld Symbols

0.25

3 - 10
3 - 10

T
Weld Symbols

Length of welds

0.25 3 - 10 3 - 10
Weld Symbols

Pitch of welds

0.25
3 - 10
3 - 10

T

Diagram showing the pitch of welds.
Weld Symbols

0.25
3 - 10
3 - 10
Offset welds

Weld Symbols
Weld Symbols
Weld Symbols
Weld Symbols
Weld Symbols

- 1/4
- 1/2
- 0.25"
Weld Symbols
Weld Symbols

1/4
40°
Weld Symbols

1/4
40°
Weld Symbols

1/4
40°
Weld Symbols
Weld Symbols

1/4
40°
Weld Symbols
Weld Symbols
Weld Symbols

40°
1/4
1/4
40°
Weld Symbols

40° 1/4

40° 1/4

0.25"
Weld Symbols
End

• Questions?