The Basics of Thread Rolling
Tools, Tips & Design Considerations

Liberato Pietrantoni - Director of Global Sales, ME
Fastener Fair USA - April 2018 - Cleveland, OH
liberato@cjwinter.com  www.cjwinter.com
What is thread rolling?

- Thread rolling is NOT a metal cutting process
- Rolling changes physical properties, hardening and strengthening the material

Cut Thread  Rolled Thread
What are the benefits?

- Lower costs
- Increased production
- Faster lead times
- Superior quality and accuracy:
  - Stronger threads
  - Improved finish
  - More accurate profile
Where to start:

✓ Material Selection & Properties

☐ Design Considerations
☐ Correct Tooling
☐ Speeds & Feeds
☐ Accurate Gaging
☐ Common Issues & Troubleshooting
The Formability Index

- The softer the material, the easier it is to roll threads
- Harder materials result shorter die life
- Some hard-to-roll material, such as stainless steel, produces excellent thread finish with a compromised tool life
# The Formability Index

- **Examples:**

<table>
<thead>
<tr>
<th></th>
<th>Hardness</th>
<th>Thread Finish</th>
<th>Die Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass</td>
<td>&lt; Rb 75, 70</td>
<td>Good, Poor</td>
<td>Medium/High</td>
</tr>
<tr>
<td>(345, 360)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>&lt; Rb 120, 17</td>
<td>Excellent, Good</td>
<td>High</td>
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<tr>
<td>(2024-T4, 6061-T6)</td>
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<tr>
<td>Stainless</td>
<td>&lt; Rc 32</td>
<td>Excellent</td>
<td>Medium/Low</td>
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<td>(302, 440)</td>
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<tr>
<td>Steel</td>
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<td>(1018, 12L14)</td>
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</table>
Important material factors

Different materials have different forming characteristics

- In steel, sulfur creates flakes and slivers
- In aluminum, Bismuth creates flakes and slivers
- Sulfur, Bismuth, and Lead aid in the machining process, but hinder the thread finish when cold forming.
- A tradeoff exists between machining speed and thread finish. Sulfur and Lead allow for high speeds and feeds in machining, but the thread finish can suffer.
✓ Material Selection & Properties
✓ Design Considerations
☐ Correct Tooling
☐ Speeds & Feeds
☐ Accurate Gaging
☐ Common Issues & Troubleshooting
Blank Design – part prior to rolling

Blank Diameter

Chamfer Angle

* CJWinter offers blank and thread roll design as a free service to optimize the thread roll process
Blank Diameter Properties

Blank diameter of rolled thread = Max pitch diameter - .002"

- When cutting a thread, the major diameter = the blank diameter of the threads.
- When thread rolling, material below the pitch diameter is displaced during cold form process and the excess material is squeezed up into the new major diameter.
Blank Diameter Properties

3:1 Ratio between Major and Blank Diameters

- For every .001” that the blank diameter is adjusted, the thread major diameter will change by .003”.
- This ratio only applies when rolling close to the major diameter.
Chamfer Angle

Recommended Angle: 30° from the axis of the part

- A 30° chamfer will give an approximate 45° angle after rolling.
- When rolling harder materials, a lower chamfer angle [25-28°] is preferred so thread roll life is not compromised.
Shoulder/Stock Clearance

Maintain a minimum distance of 1.25 to 1.5 X pitch, depending on shoulder configuration

- Premature wear and damage will occur to the roll if the roll contacts the shoulder.
- Stock clearance is also an important consideration especially when hex stock is used.
Thread Length vs. Roll Length

- Roll work face needs to be calculated for each part to make sure proper clearances are used.

- We offer this as a free service to our customers to make sure that the thread roll process and tooling life are optimized.

- Rule of thumb = Roll WF = (2.5 \times \text{Pitch}) + \text{Thread Length}
Thread Rolls and Associated Forming Techniques

Techniques:

- In-feed/(plunge)-helical die with radial material displacement
- Skewed Roll Axis-Annular Die (No Helix)
- Skewed Roll Axis-Helical Die
Thread Rolls and Associated Forming Techniques

Techniques:

- **In-feed (plunge)** - helical die with radial material displacement
- This can be done with a thread rolling attachment or machine...

141SA Attachment With Helical Infeed / Plunge
Thread Rolls used in a pinch type process
Thread Rolls and Associated Forming Techniques

Techniques:

- **Through-feed** - with **skewed roll axes** in machine
  >> Uses either **helical or annular** dies

*Layout Showing a skewed central roll axis in relation to the work piece (Annular Dies)*
Thread Rolls and Associated Forming Techniques

In-Feed/Plunge Skewed Roll Axis – **Helical** Rolls

- Used to create threads smaller than the Workface of Dies
- Dies are used parallel to each other, and part axis
- Used with helical - multi start Dies, which contain the entire helix angle ground into the surface
- Can employ a timed plunge cycle to ensure accurate parts
- NO Axial part movement relative to dies
Thread Rolls and Associated Forming Techniques

Skewed Roll Axis - Annular Rolls

- Typically used to create parts with threads longer than die workface ➔ Through Feed
- Part is fed axially through tilted dies
- Helix angle is same as machine skew, also limited by max machine skew
- Feed rate is equal to die pitch*rpm
- Die helix angle = 0°
Thread Rolls and Associated Forming Techniques

Skewed Roll Axis - **Helical** Rolls

- Typically used to create parts with threads longer than die workface ➔ Through Feed
- Similar to Annular Rolls with skewed axis, but Added helix on rolls can be used to manipulate feed rate/ helix conditions ➔ Speed up/Slow Down Dies
- Can make threads with helix angles exceeding allowable machine skew
Thread Rolls and Associated Forming Techniques

Skewed Roll Axis-Helical Rolls

• **Speed up Dies** - Roll helix in opposite direction as slow down helical roll, at increased machine skew
  - Same Hand helix as part
  - Feed faster than annular dies at similar RPM

• **Slow down Dies** – some of Desired Helix angle on part is ground into the roll, remainder is tilted in machine skew
  - Opposite Hand helix as part
  - Decreased operating loads
  - Slower feed rate

*(both examples can be used to make the same thread on part)*
Thread Rolls and Associated Forming Techniques

Comparison of Roll and Helix Orientation

FOR ALL CASES:
Helix on Part = Skew angle of Roll Axes + Die Helix Angle

A) Plunge / Infeed Roll

B) Helical Slow Feed Roll

C) Annular Groove Roll

D) Helical Fast Feed Roll

Green - Rolled Part

Ordered by increasing feed rate →
Thread Rolls and Associated Forming Techniques
Comparison of Roll and Helix Orientation

A) Plunge / Infeed

- Die parallel to part
- Opposite hand thread as part
- Complete helix angle on dies
- NO Axial part movement relative to dies
Thread Rolls and Associated Forming Techniques
Comparison of Roll and Helix Orientation

B) Helical Slow Feed Roll

- Some of Part Helix on die, some in machine skew
- Opposite hand thread as part
- Axial part movement relative to dies = Feed rate less than thread pitch*RPM
Thread Rolls and Associated Forming Techniques
Comparison of Roll and Helix Orientation

C) Annular Groove Roll

- Die is Skewed to Helix Angle of Part
- No Roll Helix
- Feed rate = thread pitch * RPM
Thread Rolls and Associated Forming Techniques
Comparison of Roll and Helix Orientation

D) Helical Fast Feed Roll

- Die skewed
- Same hand thread as part
- Feed rate > thread pitch * RPM
Thread Roll Tapers

Wide range of taper options to accommodate any application

Continuous Minor

Tapered Minor

Single Taper

Double Taper

O.D. Taper Length can be varied for either Continuous Minor or Tapered Minor Rolls.
Tooth Forms

Standard

<table>
<thead>
<tr>
<th>Taper Pipe Threads</th>
<th>Straight Threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSPT, ISO-7, G</td>
<td>UNR, UNC, UNS, UNF</td>
</tr>
<tr>
<td>NPT, NPTF</td>
<td>UNJ</td>
</tr>
<tr>
<td>Taper Angle: 1° 47'</td>
<td>60°</td>
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</table>

<table>
<thead>
<tr>
<th>Straight Pipe Threads</th>
<th>Metric Threads</th>
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</thead>
<tbody>
<tr>
<td>BSPP, BSF, BSW</td>
<td>ISO, M Series</td>
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<tr>
<td>NPSM, NPS</td>
<td>MJ</td>
</tr>
<tr>
<td>55°</td>
<td>60°</td>
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<tr>
<td>60°</td>
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</tbody>
</table>
Tooth Forms

Standard

Taper Pipe Threads

BSPT, ISO-7, G

Taper Angle: 1° 47'

55°

NPT, NPTF

Taper Angle: 1° 47'

60°
Tooth Forms

Standard

Straight Threads

UNR, UNC, UNS, UNF

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60°
Tooth Forms

Standard

Straight Pipe Threads

BSPP, BSF, BSW

NPSM, NPS

55°

60°
Tooth Forms

Standard

Metric Threads

MJ

ISO, M Series

60°
Tooth Forms

Special

Our multi-axis CNC machines allow us to produce a wide range of forms...
Tooth Forms

Special

- Commonly used in Power Screws / Lead Screws
- Handle higher Loads
Tooth Forms Special

MAThread

- Used to Prevent thread Damage/ Cross-Threading
- Better Screw alignment/ Ease of Assembly
- CJWinter is a worldwide licensed supplier of MAThread & MATpoint thread dies

Image From:
Tooth Forms

Special
(Metric Electrical Thread)

- Used in Thin walled/Low thread depth Applications
- Electrical Fittings/Conduit Connections

Tooth Forms

**Special**

Burnish

Used to finish Ball and Rounded end products to precision surface finishes
Tooth Forms
Special
Radius Forms

Commonly Used to increase to surface area/ increase fluid movement for greater efficiency in heat exchanger components

Image From: http://www.globalsources.com/gsol/I/Copper-tube/p/sm/1133828772.htm#1133828772
Tooth Forms

Special

Barb

Commonly used in Hose Fittings
Tooth Forms

Special

Fine Form

Commonly Used to increase to surface area/ increase fluid movement for greater efficiency in heat exchanger components

Image From: http://www.globalsources.com/gsol/I/Copper-tube/p/sm/1133828772.htm#113382877200
✓ Material Selection & Properties
✓ Design Considerations
✓ Correct Tooling
☐ Speeds & Feeds
☐ Accurate Gaging
☐ Common Issues & Troubleshooting
Correct Tooling – Rolls

Considerations:

- Styles
- Material/Coating Options
Correct Tooling – Rolls

Styles

- Different styles depend on part orientation to the collet
- Some rolls are reversible; others are not
- In the configurations shown, the thread roll style required will be affected by roll/part orientation
- Send your part print to CJWinter to ensure correct style is calculated

CJWinter | www.cjwinter.com
Correct Tooling – Rolls

Options

<table>
<thead>
<tr>
<th>Heat Treating</th>
<th>Special Materials</th>
<th>Coatings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toughness vs.</td>
<td>Different substrate materials can improve roll life</td>
<td>Improves die life and increases lubricity when rolling. Slightly more costly, but cost is outweighed by the increase in roll life.</td>
</tr>
<tr>
<td>Hardness</td>
<td>depending on application.</td>
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<tr>
<td></td>
<td></td>
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</tbody>
</table>

Toughness implies longer roll life. Hardness has its own special applications.

Improves die life and increases lubricity when rolling. Slightly more costly, but cost is outweighed by the increase in roll life.
Relationship of Roll to Blank

Rolls are designed to incorporate the maximum number of starts allowed to fit in attachment.

- More starts = Higher RPM allowed
- More starts = Longer roll life

Depending on the roll design, the roll WF should always overhang the part by at least 2-2.5 threads.
Correct Tooling – Cylindrical / Machine Dies

CJWinter manufactures the premier line of machine dies and tooling.

- We manufacture both Helical and Annular machine dies in various styles for your thread rolling machine, including Through-Feed, Double-Taper, Speed-Up, Plunge, and Slow-Up.

- CJWinter also offers overhung die holders and double support die holders for both straight threads and taper pipe threads.
Correct Tooling –
Cylindrical / Machine Dies

Die Materials – Air Hardening

• **D2** - Moderate toughness and intermediate wear resistance. Supplied on dies for machine screw threads.

• **DC53** - General-purpose cold work die offering twice the toughness of D2 with superior wear resistance and higher fatigue strength.
Correct Tooling –
Cylindrical / Machine Dies

Die Materials – High Speed

• M2 - High-speed steel with excellent toughness and wear resistance. Optimal for cold work dies.

• M42 - Super high-speed tool steel designed for machining high-strength and pre-hardened steels and nonferrous alloys. Ideal for aerospace and oil and gas industries.
Correct Tooling –
Cylindrical / Machine Dies

Die Materials – Options

- High performance coatings are also available for the different materials used
- Other materials available upon request. Contact us for details.
Edge Finishing >> **KEY for performance and improved life**

Recommended Angle: 30° from the axis of the part

- Standard 30°, 45°, 60° Chamfer angles
- A 30° chamfer will give an approximate 45° angle after rolling
Edge Finishing – **KEY for performance and improved life**

Recommended Angle: 30° from the axis of the part

- When rolling harder materials a lower chamfer angle [25-28°] is preferred so thread roll life is not compromised
- Custom R3 *Radius Root Runout Chamfer*
- Special chamfers and edge finishes may be specified with order
CJWinter manufactures thread rolls to fit attachments from all major manufacturers, some of which are listed below:

- Escofier
- Izpe
- Landis
- Nissei
- ORT Italia
- Reed
- Seny
- Steinle
- Tesker
- Tsugami

ORT CNC Cold-Forming machine
Machines/Manufacturers

**Escofier**

Image From:

**Izpe**

Image From:
https://www.apexauctions.co.uk/auction/itemDetails/75177
Machines/Manufacturers

Landis

[Image of Landis machine]

http://www.bwgroupinc.com/EquipImages.aspx?EquipGUID=789828ca-e606 4904a012fb91e0ace943&SelectedImage=4fb7f643-b30b-4ed6-8005-766e6e10c4

Nissei

[Image of Nissei machine]

Image From: https://www.equipmatching.com/used_equipment/6/104/352840.php
Machines/Manufacturers

ORT Italia

Image From: http://www.sanyo-seira.co.jp/EN/setubi.html

Seny

Machines/Manufacturers

Reed

Die Holders

Overhung (Keyway)

Double Support (spline)

Images From: http://adamsmachinery.com/threadro/th472.htm
Machines/Manufacturers

Steinle


Tesker

Image From: http://www.tsamfg.com/equipment/threading/
Machines/Manufacturers

Tsugami

Image From: http://www.sanyo-seira.co.jp/EN/setubi.html
Correct Tooling – Attachments

Considerations:

- Radial Pinch
- Axial End Rolling
- Tangential Attachments
- Axial Rotary Transfer
- Applications
Correct Tooling – Attachments

Radial Pinch

- Attachment advances rapidly over part in an open position and then rolls penetrate into work piece radially.
- Pitch diameter adjustments on the fly are possible without any tooling and without the removal of the attachment.
- Only one dwell cam is required to roll the entire thread rolling range.
- Penetration (Roll Feed) Rate is quickly adjusted via an air control valve.
- Equalized thread rolling pressure virtually eliminates spindle wear and part deflection.
Correct Tooling – Attachments

Axial End Rolling

- Attachment traverses axially from tail stock / end, working spindles into workpiece centerline
- Allows forming of parts that are longer than the roll width if required.
Correct Tooling – Attachments

**Tangential**

- Attachment approaches part radially and straddles work piece to produce threads.
- The fixed distance between the rolls is set to the minor diameter of work piece. Some models require manual adjustment of pitch diameter while others are controlled by a pitch adjusting knob.
Correct Tooling – Attachments

Tangential

- Tangential attachments are designed to roll threads at a controlled feed rate. Typically, different cams are required to modify feed rate — this can be costly and time consuming.

- The side pressure produced by the pushing tangential action can cause the part being tolled to deflect and accelerated spindle wear.
Correct Tooling – Attachments

Axial Rotary Transfer

- The attachment advances over the part in an open position and then the rolls penetrate into the work piece radially.
- Attachment can also be used to produce threads behind the shoulder.
- The part thread length is less than the rolling length.

CJWinter 234-SA Axial Attachment
# Correct Tooling – Attachments

## Application Chart

<table>
<thead>
<tr>
<th>Attachment</th>
<th>Type</th>
<th>Size/Model</th>
<th>Position</th>
<th>Travel</th>
<th>REQUIRED COMPONENTS</th>
<th>REFERENCE INFO.</th>
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<tr>
<td></td>
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<td>STD</td>
<td>Adapter &amp; Hardware Assembly</td>
<td>Setting Gage</td>
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<td>Rear</td>
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<td>SD-35F</td>
<td>4th or 5th</td>
<td>1.250</td>
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<td>160150</td>
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<td>Schuste</td>
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<td>5th or 6th</td>
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<td>3rd</td>
<td>2 2.375</td>
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<td>Wickman</td>
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<td>3rd</td>
<td>2 2.375</td>
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<td>6th</td>
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<td>160079</td>
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</tbody>
</table>
✓ Material Selection & Properties
✓ Design Considerations
✓ Correct Tooling
✓ **Speeds & Feeds**
  ❎ Accurate Gaging
  ❎ Common Issues & Troubleshooting
Speeds & Feeds

- Thread rolling tends to be the fastest operation
- Faster is usually better
- Rule of thumb:
  - **Part RPM:** ~ 300 RPM per start of roll
- Typically does not constrain the cycle time

* See Appendix for handy Speed & Feed calculations
✓ Material Selection & Properties
✓ Design Considerations
✓ Correct Tooling
✓ Speeds & Feeds
✓ Accurate Gaging
☐ Common Issues & Troubleshooting
Accurate Gaging

Types

- Go / No-Go Ring gages
- Micrometers / Pitch micrometers
- Tri Roll [Johnson Gage]
- Functional Segments
- Pitch Diameter Rolls
- Pipe Threads
- 6 Step
- 1L, 2L Ring Gages

“To yield useful repeatable data, it is critical to align inspection methods to part geometry based on customer requirements, part geometry, and GD&T”
Gaging

Rolling a Straight Thread

- Machine part blank diameter to ~ Max Pitch Diameter -.002
- Roll the thread until the pitch diameter is within specification – between Pitch Diameter max & min
- Adjust the blank diameter until the Major diameter is within specification - between Major diameter max & min
Gaging

Measuring features on a Straight Thread

- Blank diameter – use micrometers and/or comparator
- Pitch diameter – use pitch micrometers and/or over pins
- Major diameter – use micrometers and/or comparator

Micrometers

Pitch Micrometers

Comparator or Shadowgraph
Gaging

Rolling on a Tapered Pipe Thread

- Machine part blank diameter to specifications outlined in chart
  - Included angle of blank is 1°47’.
  - Verify blank diameter at location Y [column “Y” and “B.D.@Y”]
- Roll the thread until the pitch diameter gages within the L1 & L2 gage specifications.
- Adjust the blank diameter, until the Major diameter gages within 6 – Step gage specifications - if required

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>NPT &amp; NPTF</th>
<th>Y</th>
<th>L2</th>
<th>B.D. @ Y</th>
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<tr>
<td>1/16-27</td>
<td></td>
<td>.130</td>
<td>.261</td>
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<td>1” -11 1/2</td>
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<td>.341</td>
<td>.683</td>
<td>1.235</td>
</tr>
<tr>
<td>1 1/4-11 1/2</td>
<td></td>
<td>.353</td>
<td>.707</td>
<td>1.579</td>
</tr>
<tr>
<td>1 1/2-11 1/2</td>
<td></td>
<td>.362</td>
<td>.724</td>
<td>1.818</td>
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</tbody>
</table>
Gaging

Measuring features on a Tapered Pipe Thread

- Blank diameter – Use micrometers and/or comparator
- Pitch diameter
  - Use L1 gage to verify pitch E1 location
  - Use L2 gage to verify pitch E2 location
- Major diameter – Use 6-Step to verify major diameter
Gaging

Measuring features on a Tapered Pipe Thread

- **NPT L1** rings inspect the functional size or hand tight engagement of pipe threads. Parts are acceptable when they generally acceptable when they come flush to end of ring +/- one turn.

- **NPTF L1**: Same as NPT; thread tolerances are more closely controlled, requiring an L2 thick ring gage as well as the L1 ring.
Gaging

Measuring features on a Tapered Pipe Thread

- **NPTF L2** ring inspects the wrench engagement threads and is to be used in conjunction or relationship with the NPTF L1. Thread tolerances are more closely controlled requiring an L2 thick ring gage as well as the L1 ring.

- **NPTF 6** step ring gages are used to check external threaded parts. NPTF 6 gages check the crest truncation or profile of the external threads and are used in conjunction or relationship with the L1 L2 ring gages.
✓ Material Selection & Properties
✓ Design Considerations
✓ Correct Tooling
✓ Speeds & Feeds
✓ Accurate Gaging
✓ Common Issues & Troubleshooting
Common Thread Rolling Problems

- Thread Filled Out in Center
- Tapered Threads
- Out of Round Threads
- Poor Thread Form
- Thread with Expanded Lead
- Off-size Threads
- Thread with Contracted Lead
- Drunken Threads
- Poor Finish on Threads
- Slivers or Flakes on Threads
- Hollow Work, Tapered Threads
- Hollow Work, Hole Closed In
- Relationship of Roll to Blank
Top 10 Common Issues

1. Slivers/Flakes in Threads
2. Incorrect Pitch/Lead
3. Mismatched Helix Angle
4. Different Rolling Conditions
5. Hollow Work, Closed Hole, or Out of Round Conditions
6. Thread Filled out in Center, but Not End
7. Poor Finish
8. Poor Thread Form
9. Crests Not Filled Out
10. Scuffed Crests
Common Issue #1: Slivers/Flakes in Threads

- Are rolls in match?
  - Resynchronize

- Is the centerline of rolls parallel with work centerline?
  - Check slide for alignment

- Is cross slide adapter worn or loose?
  - Check slide gib and springs; tighten adapter if used

- Are rolls overfilled?
  - Reduce blank diameter

- Is roll diameter correct?

- Is material adaptable to cold working?
  - Check with material supplier/customer
  - Change material if possible

- Does blank have a rough finish?
  - Regrind tooling

- Is stock seamy?
  - Not suitable for thread rolling

- Do rolls slip on work?
  - Feed rate is too slow; increase penetration rate
Common Issue #2: Incorrect Pitch/Lead

1. Measure in a comparator
   - Measure over as many full threads as possible
   - \( \frac{\text{Number above}}{\text{Number of threads measured}} = \text{Pitch} \)

2. Use Rolls Modified Lead (ML)
   - Used when thread is rolled on the part, and pitch has increased, causing a gaging problem
   - Measure pitch/lead, then adjust pitch/lead to compensate part’s stretch

3. Order new rolls
   - For ML rolls, it is best to send sample parts that have been rolled to confirm pitch/lead error. Your manufacturer can then design rolls to correct ML error and product a part that gages properly
Common Issue #3: Mismatched Helix Angle

What happens when the roll contacts the blank?

• “Screw jacking” – If kept on part for too long, attachments/rolls get pulled into collet.

➢ Optimize rolling time. Enter and exit as fast as possible. Allow thread to form properly and fully, then remove. The longer the roll remains in contact with the part, the greater the chance of problems developing.
Mismatched Helix Angle (cont.)

1. **Roll OD first touches blank diameter.**
   The roll helix angle is larger than the helix at the blank diameter.
   ➢ Roll pushes away from the collet.

2. **Roll OD is halfway between blank diameter and minor diameter.**
   The helix on the part and roll will match and track perfectly.

3. **Roll OD is at minor diameter of part.**
   The roll helix angle is smaller than the part.
   ➢ Roll pulls threads toward the collet (screw jacking).
Common Issue #4: Different Rolling Conditions

Forgings
- Grain flow is a concern when rolling these parts. The grain structure material is not consistent within a section of material.

Work Hardening
- Occurs on different materials when tooling (form/shave) dulls
- Increase the penetration rate when rolling the thread
Common Issue #5: Hollow Work, Closed Hole, or Out of Round Conditions

- Is wall thickness sufficient?
  ➢ Drill later in cycle
- Is mandrel supported?
- Is feed rate too high?
  ➢ Slow down penetration rate

<table>
<thead>
<tr>
<th>Threads per Inch</th>
<th>Blank Diameters in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to ½</td>
</tr>
<tr>
<td>32</td>
<td>0.040 – 0.050</td>
</tr>
<tr>
<td>24</td>
<td>0.055 – 0.069</td>
</tr>
<tr>
<td>20</td>
<td>0.065 – 0.081</td>
</tr>
<tr>
<td>18</td>
<td>0.070 – 0.088</td>
</tr>
<tr>
<td>16</td>
<td>0.080 – 0.100</td>
</tr>
<tr>
<td>14</td>
<td>0.095 – 0.119</td>
</tr>
<tr>
<td>12</td>
<td>0.110 – 0.138</td>
</tr>
<tr>
<td>10</td>
<td>..</td>
</tr>
<tr>
<td>8</td>
<td>..</td>
</tr>
</tbody>
</table>
Common Issue #6: Thread Filled out in Center, but Not End

- Does blank maintain diameter throughout?
  - Check blank for taper or shave tool not reaching center
- Is roll center line parallel with work center line?
  - Check slide for alignment
- Is thread long enough?
  - Generate concave blank, .0002 - .0003
- Is thread too long?
  - Generate convex blank, .0002 - .0003
Common Issue #7: Poor Finish

- Are rolls overfilled?
  - Check if blank diameter is oversized

- Are rolls synchronized?
  - Resynchronize thread rolls

- Has material accumulated in threads?
  - If material cannot be removed, replace rolls

- Is material ductile enough for cold working?
  - Change material if possible

- Are there chips from other operations?
  - Ensure a good jet of clean oil is reaching rolling position

- Are rolls worn or broken?
  - Replace rolls
Common Issue #8: Poor Thread Form

- Is work bending during rolling?
  - Support part during rolling
- Does rolls’ timing match?
  - Resynchronize rolls
- Are there too many work revolutions?
  - Increase roll penetration
  - Most coming thread rolling issues are due to rolling too slow
- Is centerline of rolls parallel with center line?
  - Check slide for alignment
  - Check attachment/mounting hardware
Common Issue #9: Crests Not Filled Out

- Is blank too small?
  - Increase blank diameter
- Is thread on roll too deep?
  - Replace with rolls of correct depth
  - *Note: Special truncated rolls are available if burnish crest or round crest are required on your part

*Many users do not consider crests a serious problem, and allow thread forms to be produced with crests not completely filled out — avoiding roll overload and prolonging roll life.
Common Issue #10: **Scuffed Crests**

- Is the attachment retracting too slowly?
  - Increase speed of roll retraction
- Are rolls and gear train binding?
  - Check gear train, remove any foreign matter
- Is the rolling set off the center line of work?
  - Reset slide with gage
- Are materials accumulating in threads?
  - Check coolant flowing on rolling position and make sure a good jet of clean oil is flushing and lubricating this position properly.
NEW Products in Thread Rolling

Precision Involute Knurls and Splines

192 Series Tool Size and Capacity
NEW Products in Thread Rolling

192-ES: Precision Involute Knurls and Splines

- Overall dimensions for the standard tool are illustrated to the right.
- Capacity of the tool includes most parts in the following ranges:

<table>
<thead>
<tr>
<th>Knurl Major Diameter:</th>
<th>$0.630^\text{&quot;} \text{min} \text{ to } 1.250^\text{&quot;} \text{max}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knurl Lengths up to:</td>
<td>$0.813^\text{&quot;} \text{all diameters}$</td>
</tr>
<tr>
<td></td>
<td>$2.0^\text{&quot;} \text{for } 0.80 \text{or less}$</td>
</tr>
<tr>
<td>Typical Involute Pitches:</td>
<td>16 D.P. to 128 D.P.</td>
</tr>
</tbody>
</table>

*Note: Not all pitches can be rolled on all size parts without interference. Contact CJWinter engineering for an evaluation of your application.*
About CJWinter

- Thread Rolling Attachments
  - PNEUMATIC
  - END ROLLING
  - CNC
  - TANGENTIAL
  - MATCH TAPER
  - OUTBOARD
- Thread Rolls
- Cold Root Rolling
- Machine Dies
- Specialty Dies
- Tools Holders & Slides
- Learn more at [www.cjwinter.com](http://www.cjwinter.com)
Better Tools, Faster Turnaround

• CJWinter has proven that speedy delivery, flawless quality and competitive prices can all be delivered simultaneously for our machine dies.

• Our team of dedicated engineers focuses on solving every customer’s thread rolling and machine die challenges. Our specialty is providing superior products in the industries shortest lead time.
From CJ Winter, you get:

- Half a century of leading-edge service to the machining industry
- Individual attention
- Superior service
- Flexibility
- Meticulous attention to detail
- Innovation and quality
- Intensive hands-on training and experience
- We understand what you need, and are able to customize jobs to meet your exact specifications.
Questions?

Visit us at [www.cjwinter.com](http://www.cjwinter.com)

Contact:
Lib Pietrantoni
Sales Engineer
lpietrantoni@brinkmanproducts.com

Paul Allart
Product Engineer
allart@brinkmanproducts.com
Appendix
Appendix

Image Sources:


Additional Thread Rolling Issues
Common Issue #11: Hollow Work in Tapered Threads

- Is wall thickness uneven or insufficient?
  - Drill later in cycle

- Is mandrel offering enough support where needed?
  - Check mandrel for size with hole

- Is high feed rate causing rapid penetration?
  - Slow penetration rate

- Does taper of rolls compensate for tendency of work to taper?
  - Use correct rolls for job
Common Issue #12: Drunken Threads

- Do rolls match?
  - Resynchronize rolls

- Is roll centerline set off from centerline of work?
  - Check slide for alignment

- Are rolls inaccurate?
  - Replace rolls

- Is work bending during rolling?
  - Support part during rolling operation or slow penetration rate
  - Check centerline of rolls to part
Common Issue #13: **Split Thread Axially**

- Is stock seamy?
  - Change stock
- Are there marks from shave tool or hollow mill?
  - Regrind tooling
- Is tubing material welded?
  - Use seamless tubing material
Common Issue #14: Off-size Threads

Are any of the following oversized?

- **Blanks**
  - Reduce blank diameter

- **Pitch diameter**
  - If major diameter is correct size, oversize the blanks
  - If major diameter is undersize, increase roll penetration

- **Major diameter**
  - If pitch diameter is correct size, reduce blank diameter

If pitch diameter and major diameter are both undersize, increase the blank diameter.
Common Issue #15: **Undersize Threads**

Are any of the following undersized?

- **Blanks**
  - Increase blank diameter

- **Pitch diameter**
  - If major diameter is oversize, reduce roll penetration
  - If major diameter is correct size, increase blank diameter

- **Major diameter**
  - Increase blank diameter
Common Issue #16: Off-of-Round Threads

- Is blank out of round?
  ➢ Shave tool is not reaching center, or not cleaning up rough form diameter
- Is roll centerline set off from centerline of work?
  ➢ Check slide for alignment
- Is feed rate too high?
  ➢ Reduce penetration rate
- Are there insufficient work revolutions?
  ➢ Reduce penetration rate
- Is material ductile enough for cold working?
  ➢ Change material, check with supplier
- Is the attachment off the centerline of work?
  ➢ Reset the cross slide with gage
Common Issue #17: **Tapered Threads**

- If pitch diameter is straight, major diameter is tapered and not filled out on small end:
  - Straighten blank
- If pitch diameter and major diameter are both tapered in the same way:
  - Straighten blank
  - Taper adjust roll pins
- If pitch diameter and major diameter are tapered in opposite directions and thread is not filled out on end:
  - Support part during rolling. Part deflecting out of contact with center of rolls
Common Issue #18: Thread with Expanded Lead

- For expanded lead in rolls:
  - Use correct rolls (Modified Lead)

- For extruding material on short length of blank:
  - Use longer blank; remove excess in another position
Other Thread Rolling Problems

Get answers on CJWinter.com’s troubleshooting guide
## Calculating Speeds & Feeds

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SFM ÷ .262 ÷ Diameter = RPM</strong></td>
<td><strong>RPM ÷ .262 ÷ .50 = 1450 RPM</strong></td>
</tr>
<tr>
<td><strong>RPM × .262 × .50 = SFM</strong></td>
<td><strong>Machine RPM ÷ Attachment RPM = Ratio</strong></td>
</tr>
<tr>
<td><strong>Stroke ÷ Feed = Revolutions</strong></td>
<td><strong>Working Re vs. ÷ 150 Degrees = Re vs. Per Degree</strong></td>
</tr>
<tr>
<td><strong>Revolutions × 60 Sec. ÷ RPM = Machining Cycle</strong></td>
<td><strong>Re vs. Per Degree × Degree of Cam = Total Re vs.</strong></td>
</tr>
<tr>
<td><strong>Machine RPM ÷ 60 × Actual Cycle Time = Working Re vs</strong></td>
<td><strong>Stroke ÷ Total Re vs = Feed</strong></td>
</tr>
<tr>
<td><strong>Stroke ÷ Re vs = Feed Rate</strong></td>
<td><strong>Example:</strong> 125 Stroke ÷ 19.5 Re vs = 0.0064 Feed</td>
</tr>
</tbody>
</table>

---

**Example:**
- SFM: 190 ÷ .262 ÷ .50 = 1450 RPM
- RPM: 1450 × .262 × .50 = 190 SFM
- Stroke ÷ Feed = 250 Re vs.
- Revolutions ÷ 60 Sec. ÷ RPM = 10.3 Sec.
- Machine RPM ÷ 60 × Actual Cycle Time = 248.9 Working Re vs.
- Stroke ÷ Re vs = 0.002 Feed