

the microgroove™ advantage

Manufacturing ACR Coils with MicroGroove Tubes



COPPER
International Copper Association, Ltd.

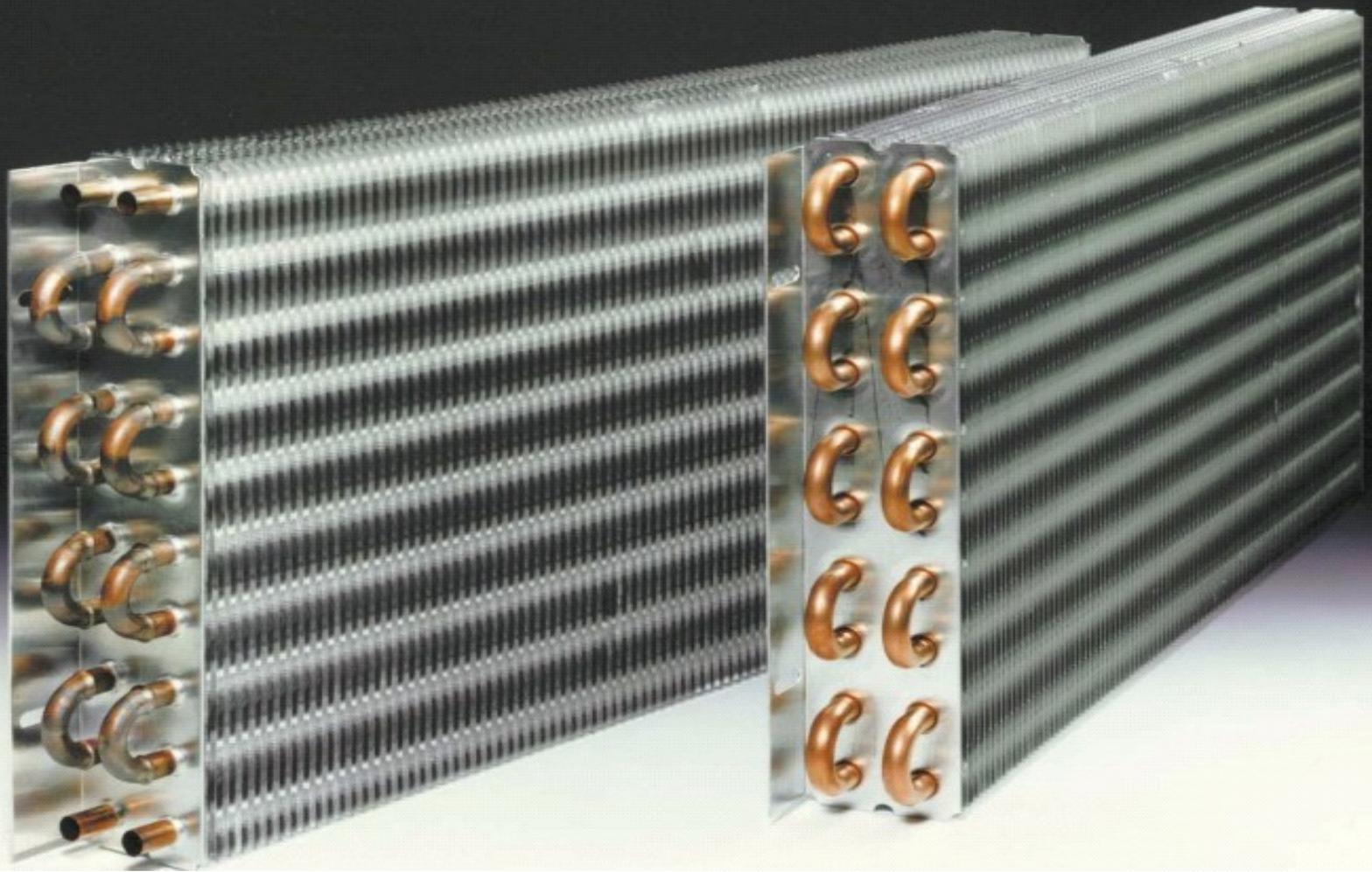
Special Thanks to:

A world map in shades of blue and black is the background. The Burr OAK Tool Inc. logo is centered over the map. The logo consists of the word "Burr" in white, "OAK" in white inside a red rounded rectangle, and "Tool Inc." in white. The text has a reflection effect below it.

Burr OAK Tool Inc.

Global Experience...Local Solutions

Round Tube Plate Fin Coils

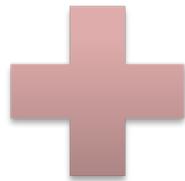


Residential, Commercial & Industrial Applications



MicroGroove Technology Advantages

Reduction
of
Boundary
Layers

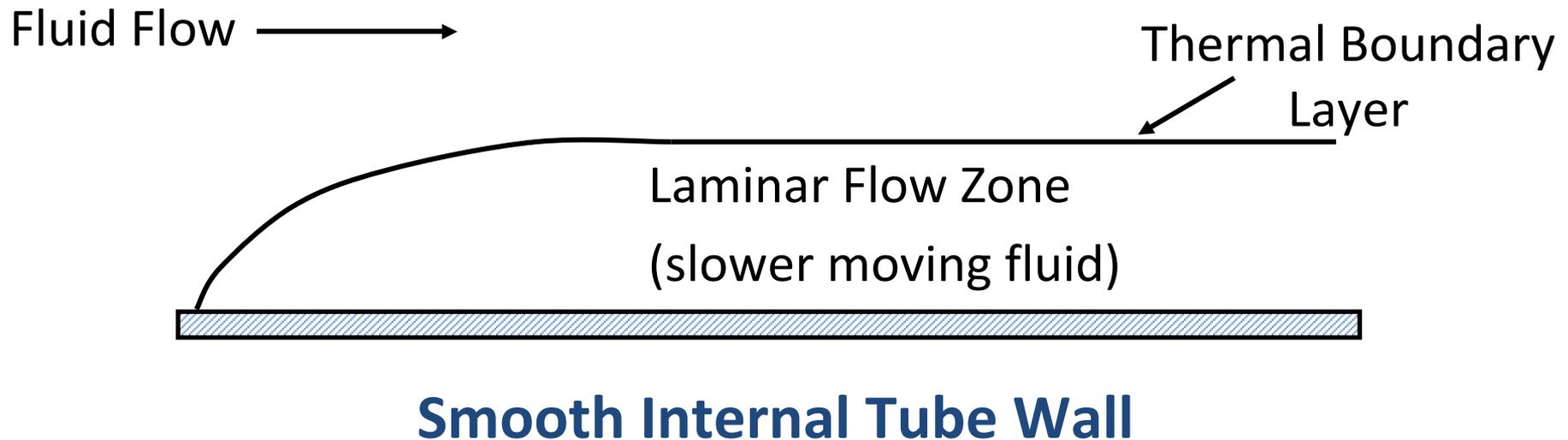


Increased
Surface
Area

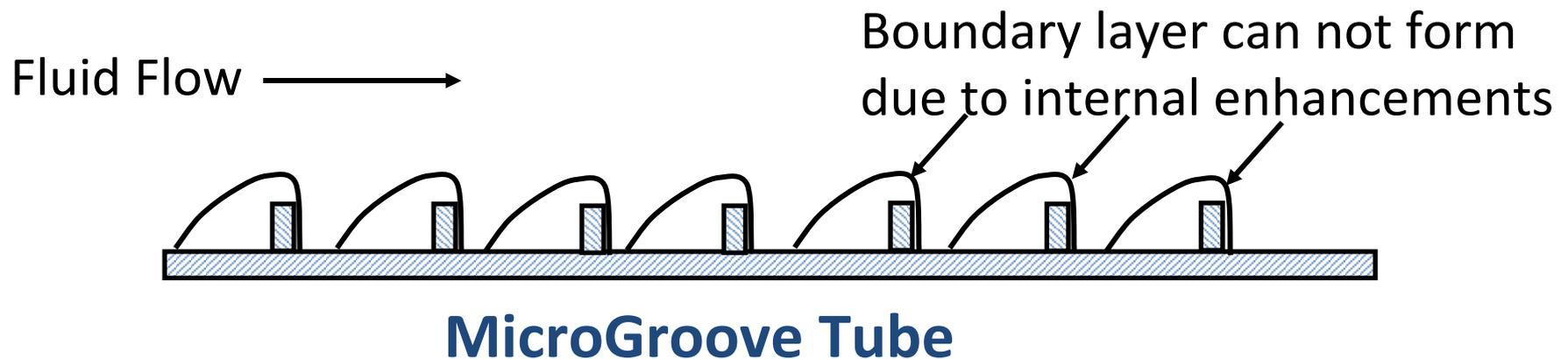


Increased
Heat
Transfer

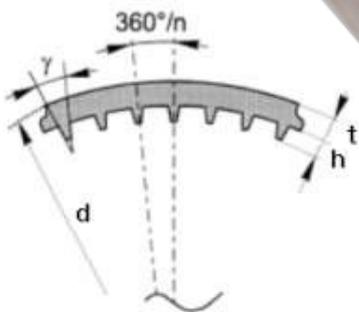
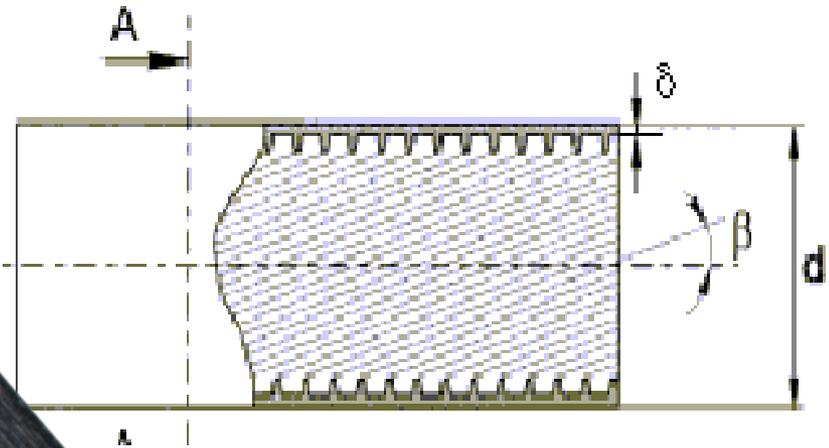
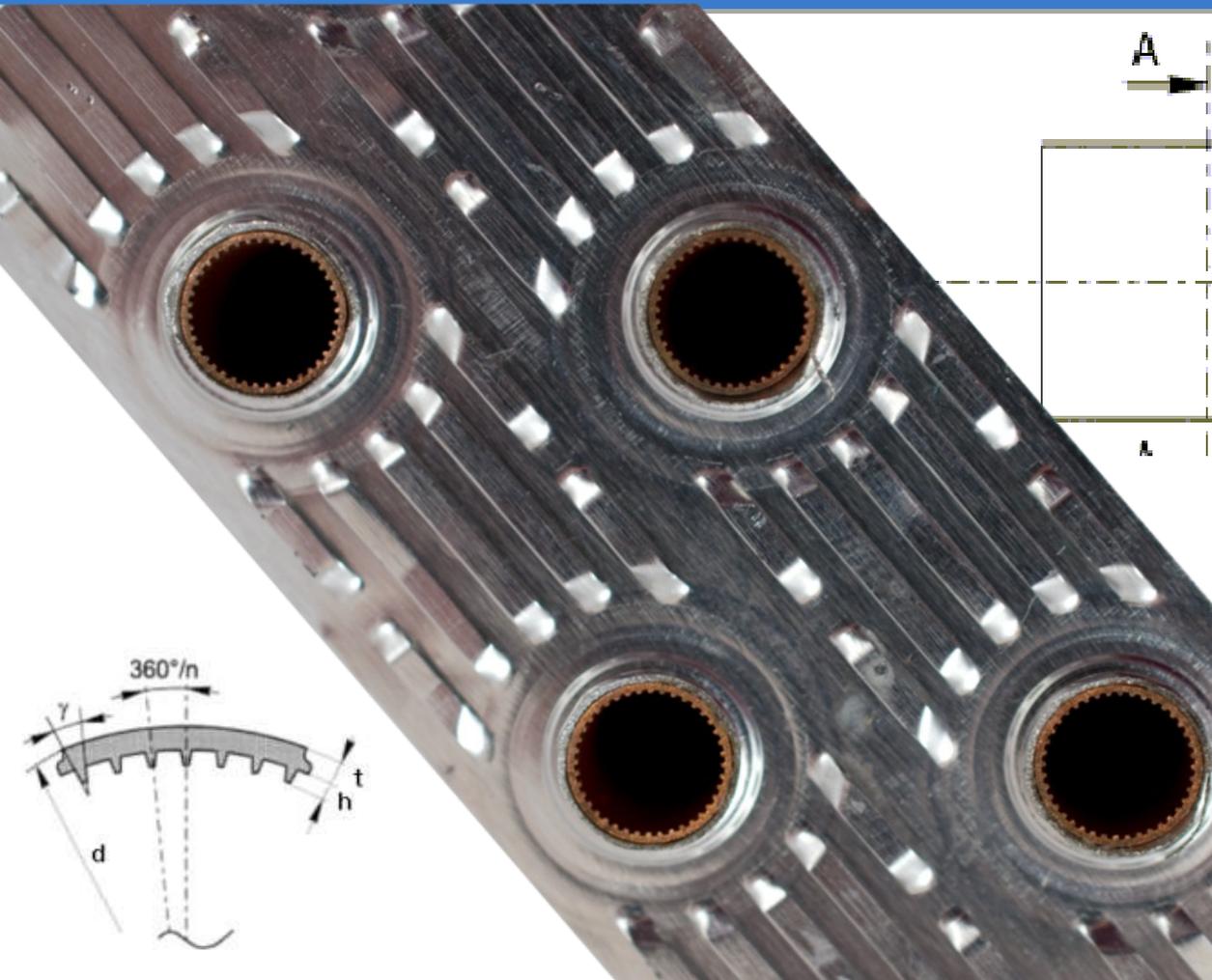
Development of Boundary Layers



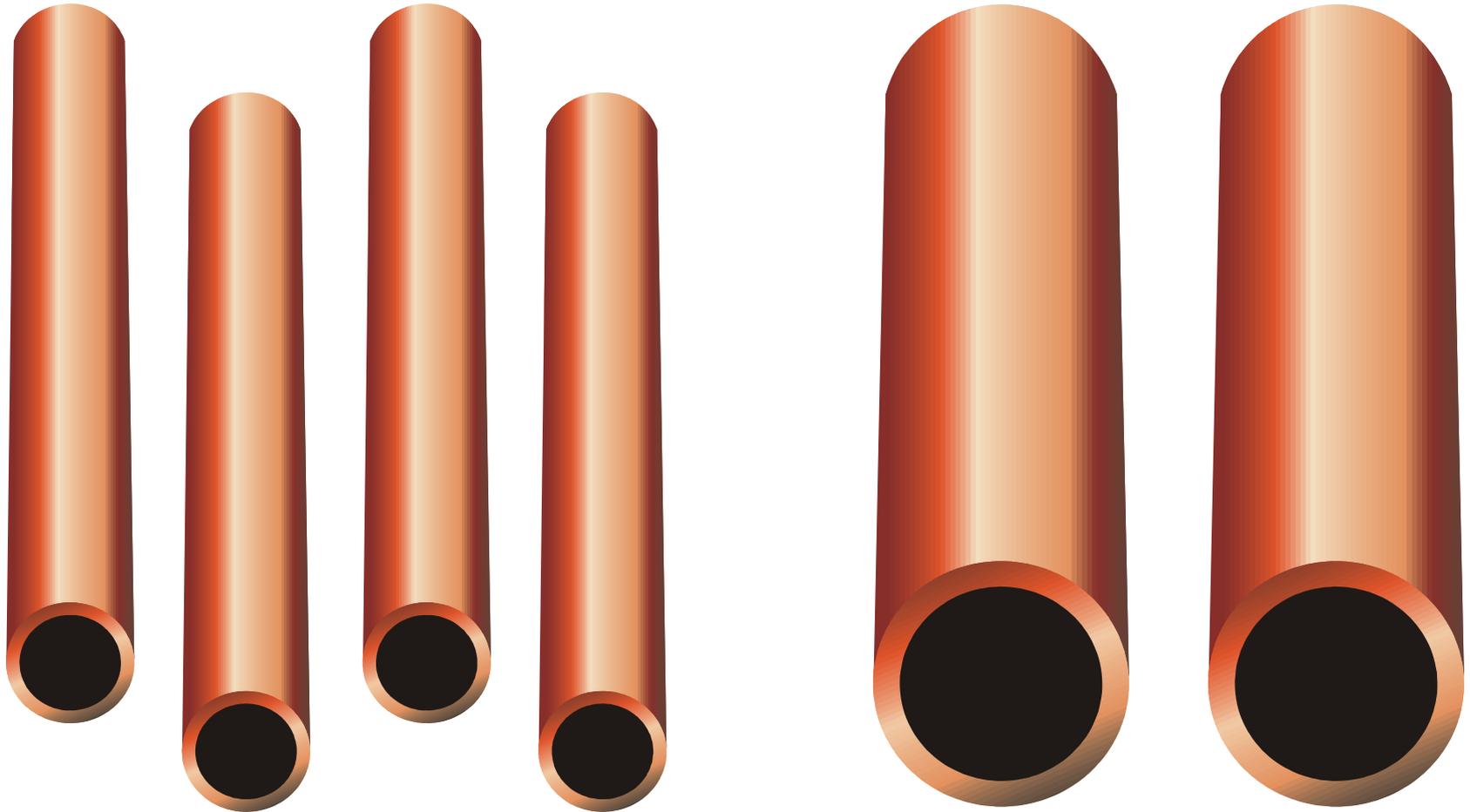
Reduction of Boundary Layers



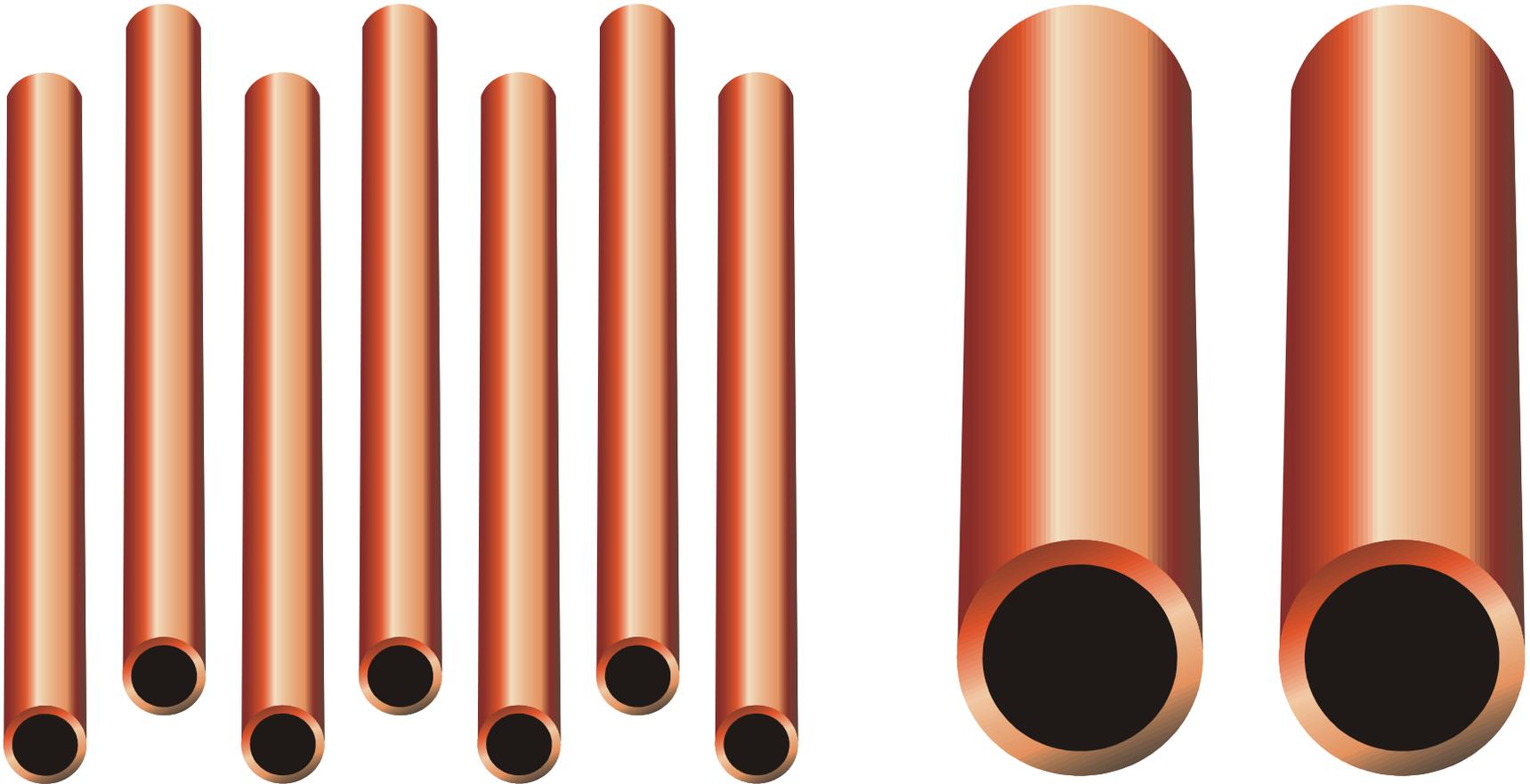
MicroGroove Features



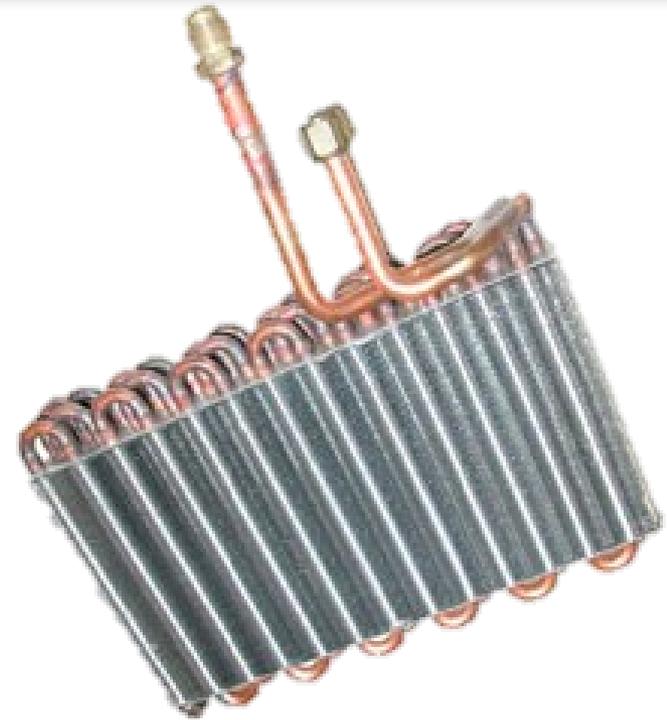
Reduced Tube Diameters = Increased Heat Transfer



Increased Heat Transfer with Less Material



Small diameter
copper tubes
are replacing
conventional,
large diameter
tubes for
good reasons.



New Design 35% more passes!

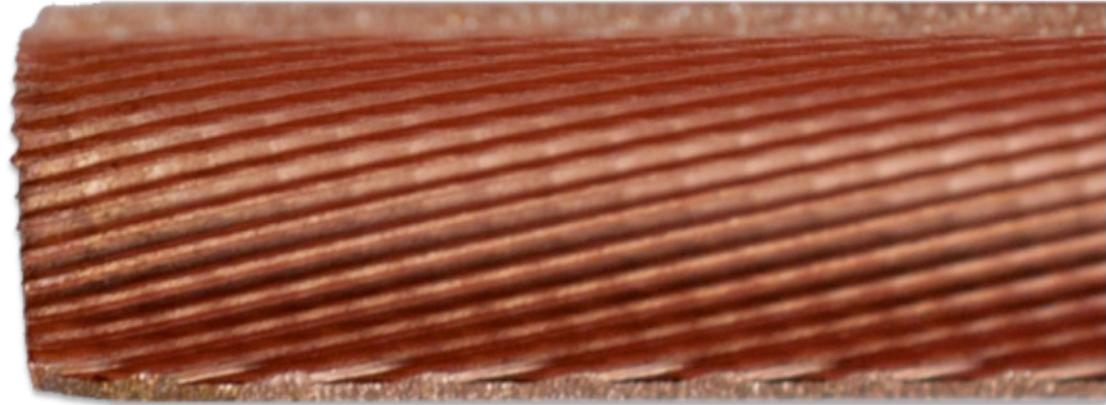


Old Design.



Benefits of MicroGroove Small Diameter Copper Tubes

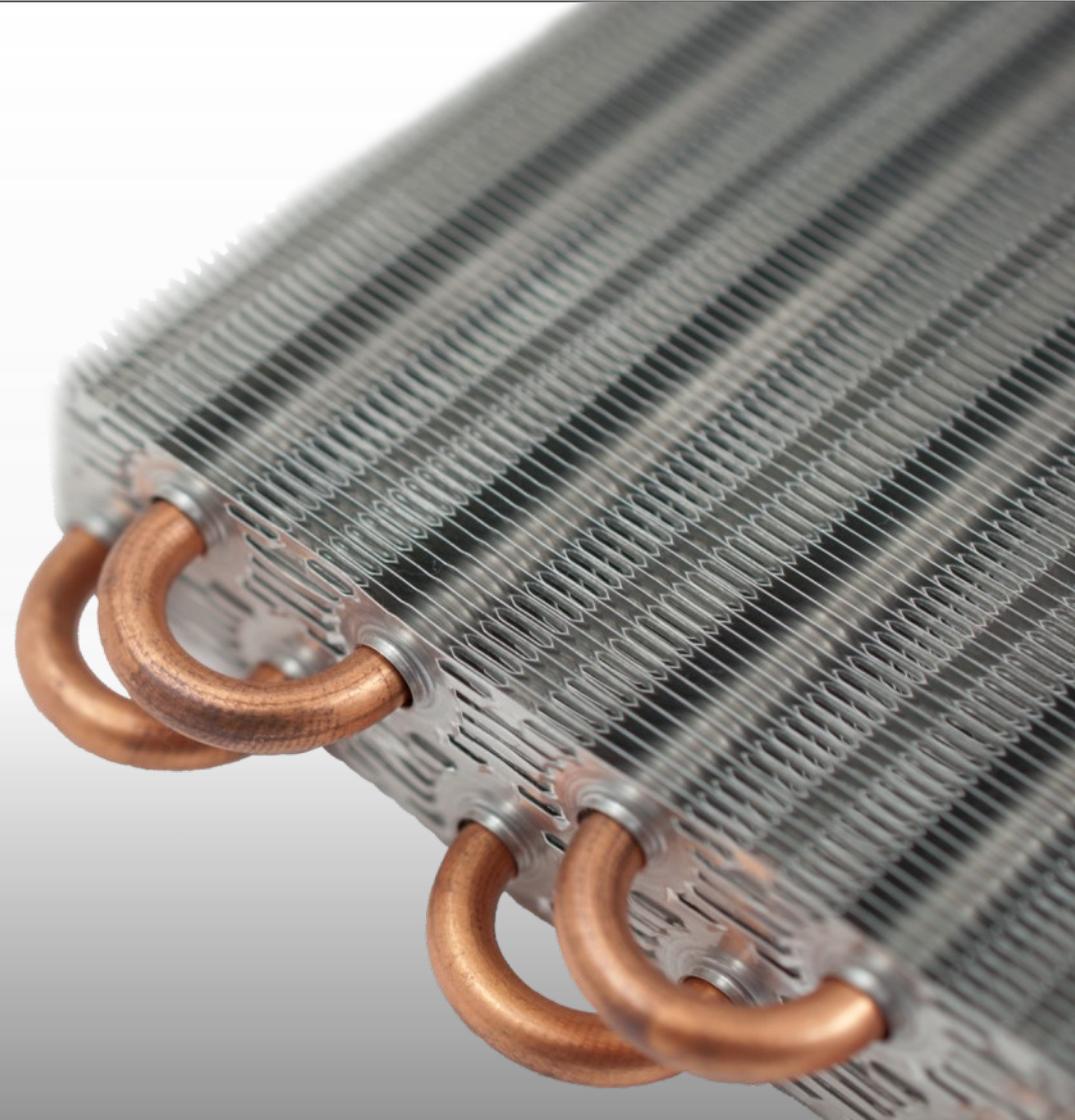
- **Energy Efficient**
- **Less Material**
- **Less Refrigerant**
- **Durability**
- **Design Flexibility**
- **Proven, Economical Manufacturing Process**



Coil Manufacturing

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

**Providing
machines, tools
and expertise
to the heat transfer
and tube processing
industries
for over 65 years.**



Typical Process

Burr **OAK** Tool Inc.
Global Experience...Local Solutions



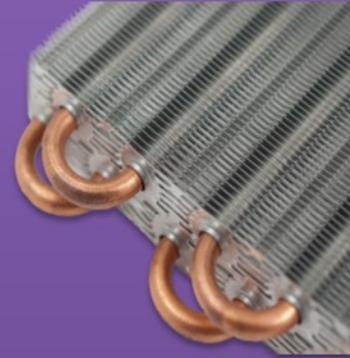
Fin Stamping

- uncoiler
- lubricator
- fin die/press
- suction unit/stacker



Tube Processing

- cutoff machine
- hairpin bender
- return bender



Handling & Assembly

- fin removal
- assembly



Expansion

- mechanical expander



Typical Process

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Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Fin Line

Uncoil



Lubricate



Stamp



Stack



Typical Process

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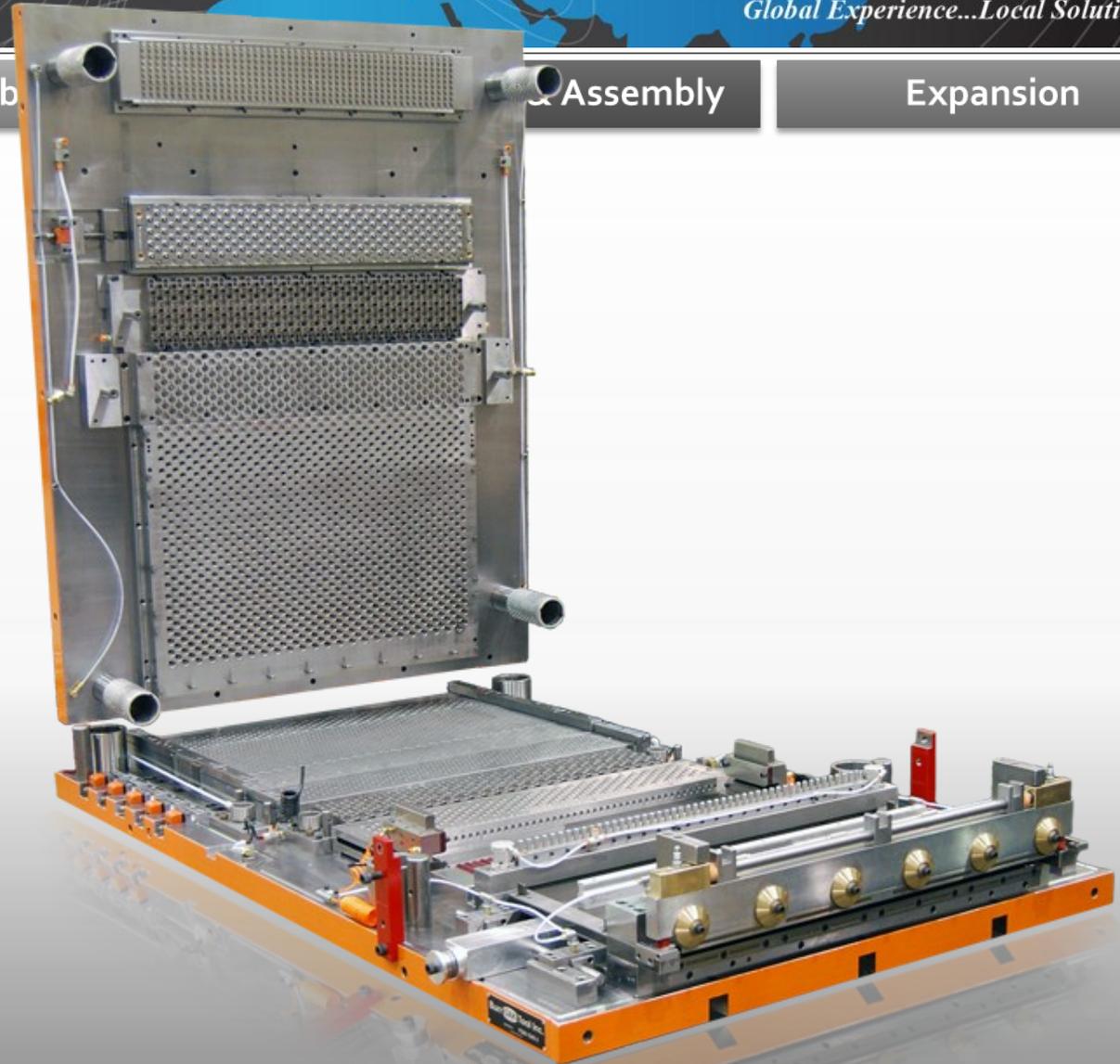
Fin Stamping

Tub

Assembly

Expansion

Fin Die



Typical Process

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Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Standard Transitions of a Progressive Die

Draw

Pierce

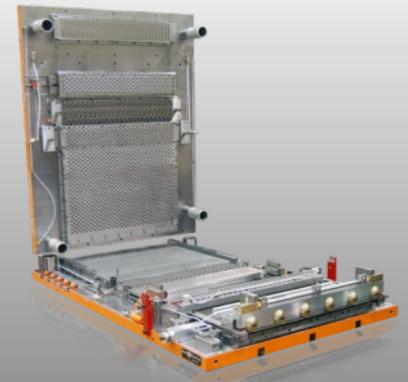
Reflare

Edge
trim

Slit

Feed

Cutoff



Typical Process

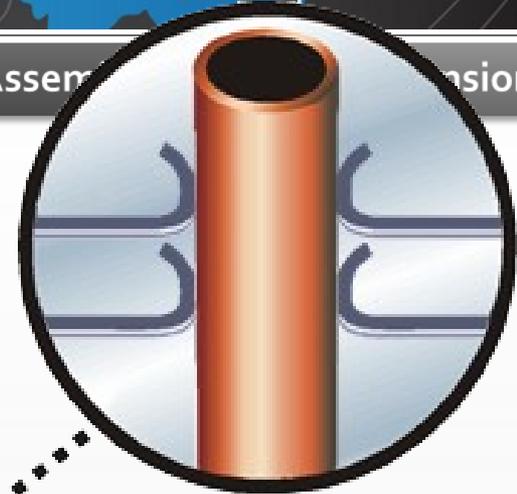
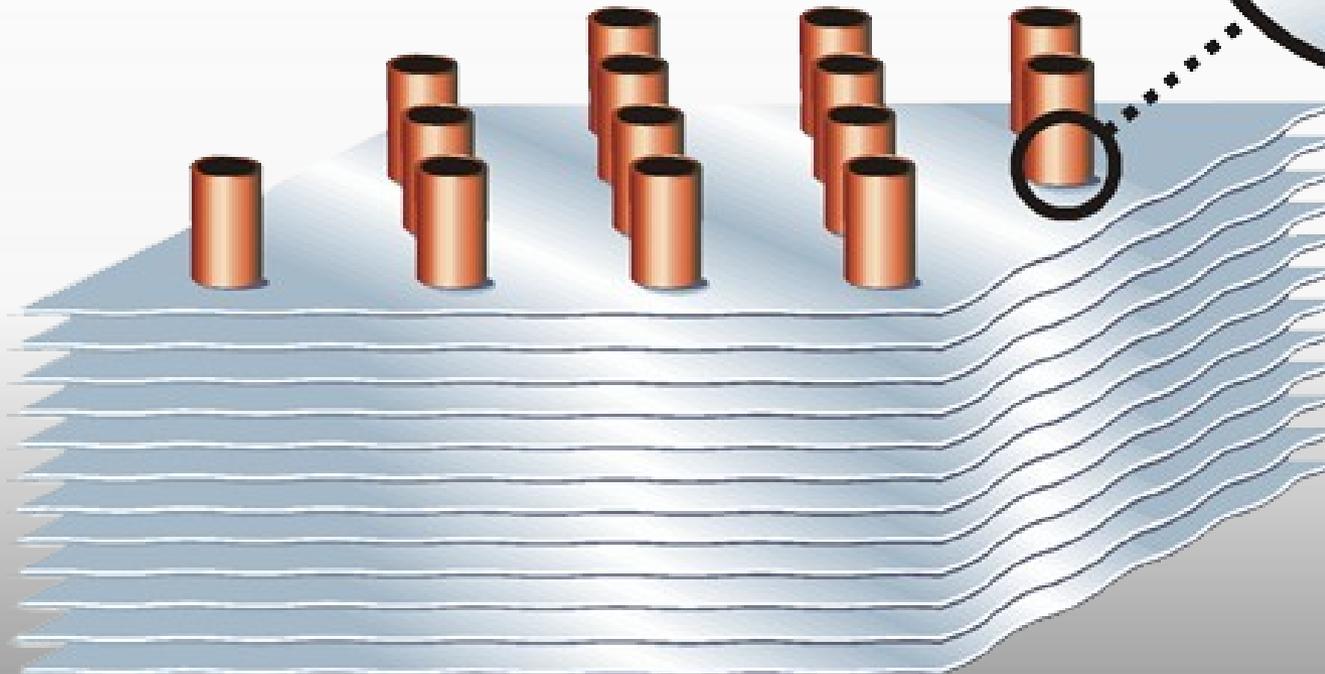
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Fin Stamping

Tube Processing

Handling & Assembly

Collars Maintain Fin Spacing



Typical Process

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion

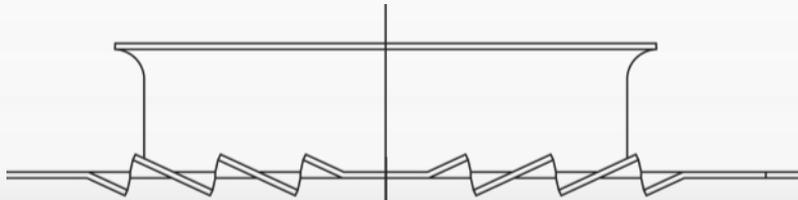
Fin Surface Configurations



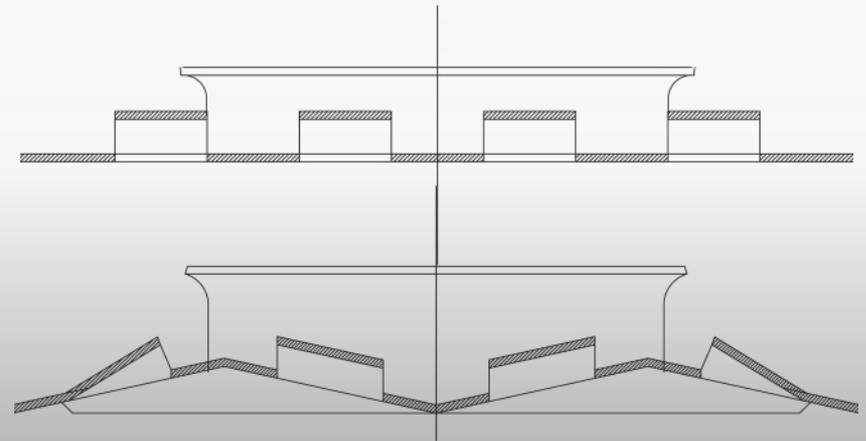
Sine Wave



V-Waffle



Louver



Lance

Typical Process

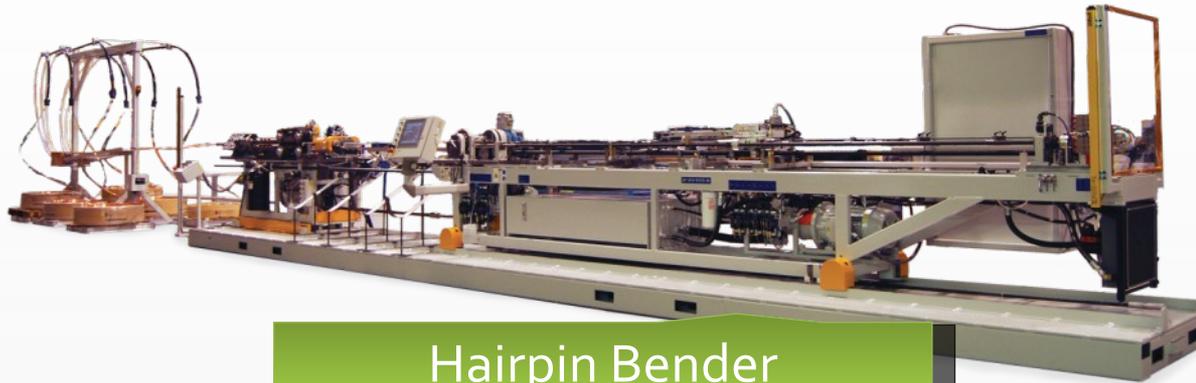
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Fin Stamping

Tube Processing

Handling & Assembly

Expansion



Hairpin Bender



Straight Tube Cutoff



Return Bend Production

Typical Process

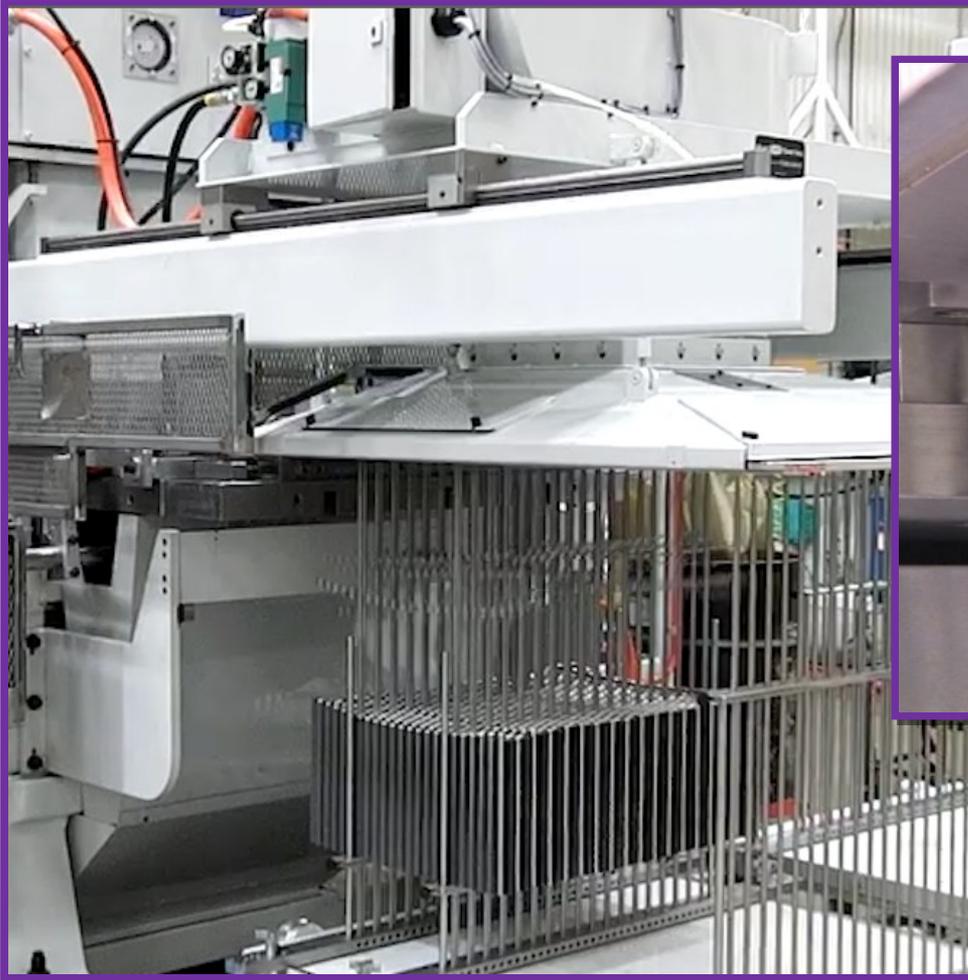
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Fin Stamping

Tube Processing

Handling & Assembly

Expansion



Typical Process

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

Fin Stamping

Processing

Handling & Assembly

Expansion



**Tube Expansion
Provides
Tube-to-Fin
Contact**

Typical Process

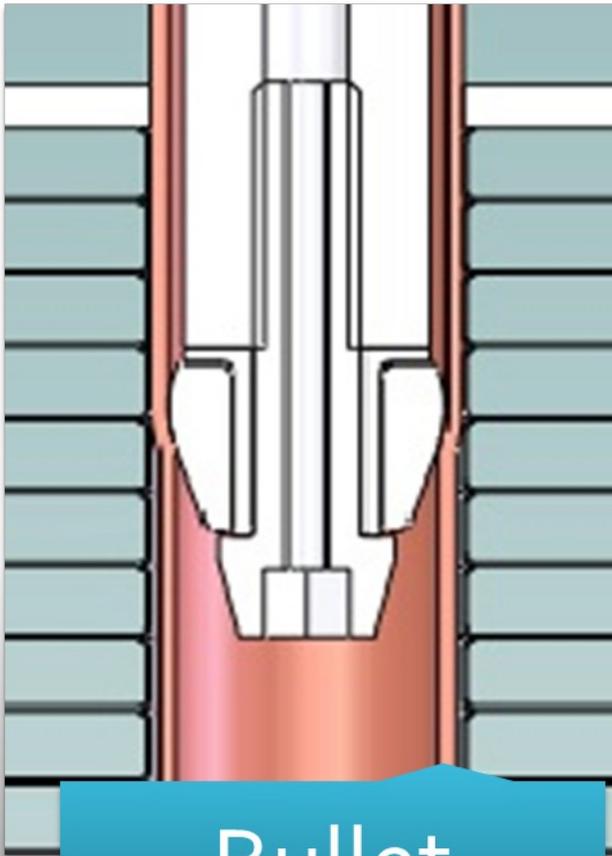
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Fin Stamping

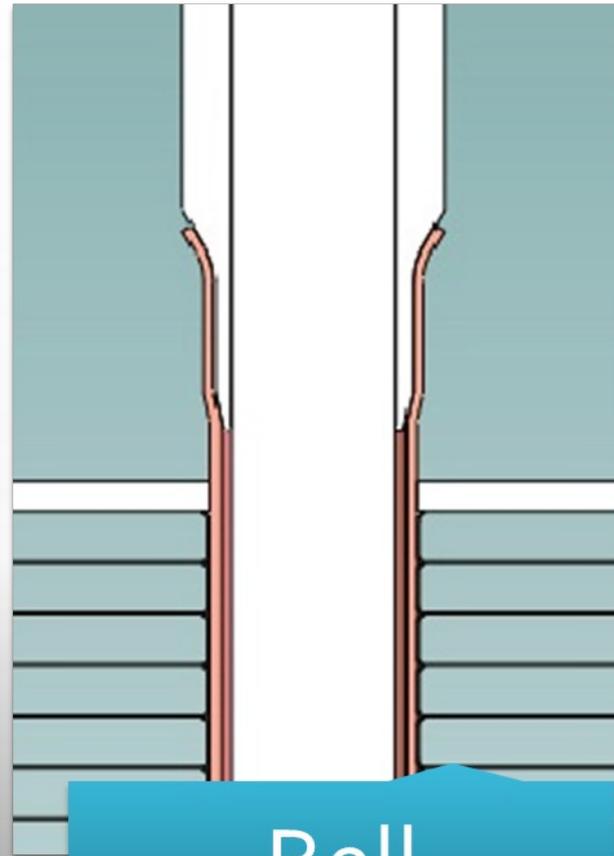
Tube Processing

Handling & Assembly

Expansion



Bullet



Bell



5mm Solutions

Burr **OAK** Tool Inc.

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Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Fin Press & Die

- Dense hole pattern
- Maximize collar height capability
- Higher tonnage presses



5mm Solutions

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Suction Unit

- Accurately position the fins on the stacker rods



5mm Solutions

Burr **OAK** Tool Inc.
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Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Stacking Unit

- High-rigidity stacker elevator system
- Specially designed stacker rods



5mm Solutions

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Hairpin Bender

- Tooling accuracy and alignment
- Finished tube handling
- Retrofitting of older machines
- Overhead spiral uncoiler system



5mm Solutions

Burr **OAK** Tool Inc.

Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion

Straight Tube Cutoff

- More susceptible to deflection
- Servomotor feed and control system



5mm Solutions

Burr **OAK** Tool Inc.

Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion



New Electric Hairpin
Bender

5mm Solutions

Burr **OAK** Tool Inc.

Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion



New CNC Controlled
Straight Tube Cutoff
Machine

5mm Solutions

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion

New "Fin Harvesting" system

- Reduce fin and tube damage
- Continuous press operation
- Uninterrupted flow of fins
- Ergonomic and lean
- Automatic tube lacing system

5mm Solutions

Burr **OAK** Tool Inc.
Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion

5mm Expander

- Support and align fragile expander rods
- Alignment and retaining systems
- Reduce tube end splits
- New expansion technologies



5mm Solution

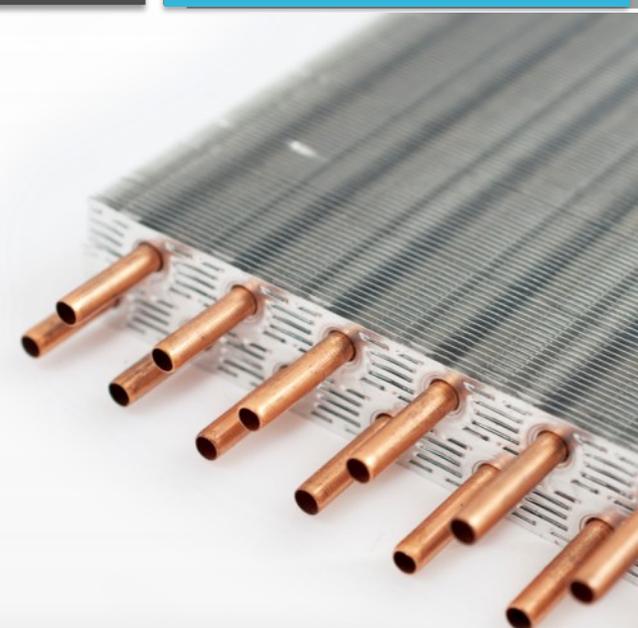
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Global Experience...Local Solutions

Fin Stamping

Handling & Assembly

Expansion



5mm Solutions

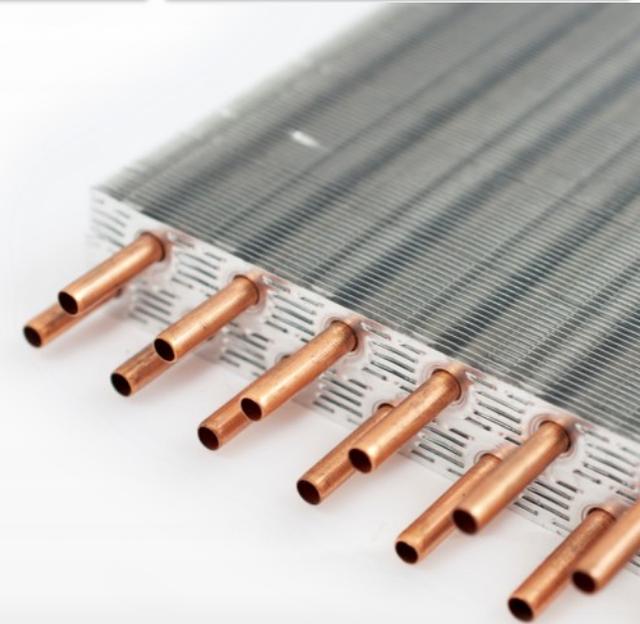
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Global Experience...Local Solutions

Fin Stamping

Tube Processing

Handling & Assembly

Expansion



Coil Design Considerations

Corrosion - Internal and External

Pressure Drop

Design Flexibility

Serviceability

Water-Shedding

Refrigerant Charge

Benefits of Manufacturing Coils with Small Diameter MicroGroove Tubes

Durability

Familiarity

Minimal Equipment and Process Changes

Established World-Wide Support

Burr OAK Tool Inc.

Global Experience...Local Solutions

**Burr Oak Tool Inc.
is committed to helping
the ACR community
make the transition
to small diameter tubing.**

**Each ACR manufacturer
has challenges unique
to their own application,
and we stand ready to
provide custom local
solutions.**

**For more information visit:
www.burroak.com**

the microgroove advantage



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information visit:
www.microgroove.net**

Please submit questions.





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