End Forming Tooling

An Engineers Guide to End Forming Tube

TUBE FORM SOLUTIONS

What is End Forming?

- End Forming (also called End Finishing) are the types of processes that can be done to change a tube's shape.
- Examples of end forming:
  - Ram Forming
  - Flaring
  - Expanding
  - Reducing
  - IO Sizing
  - Beading

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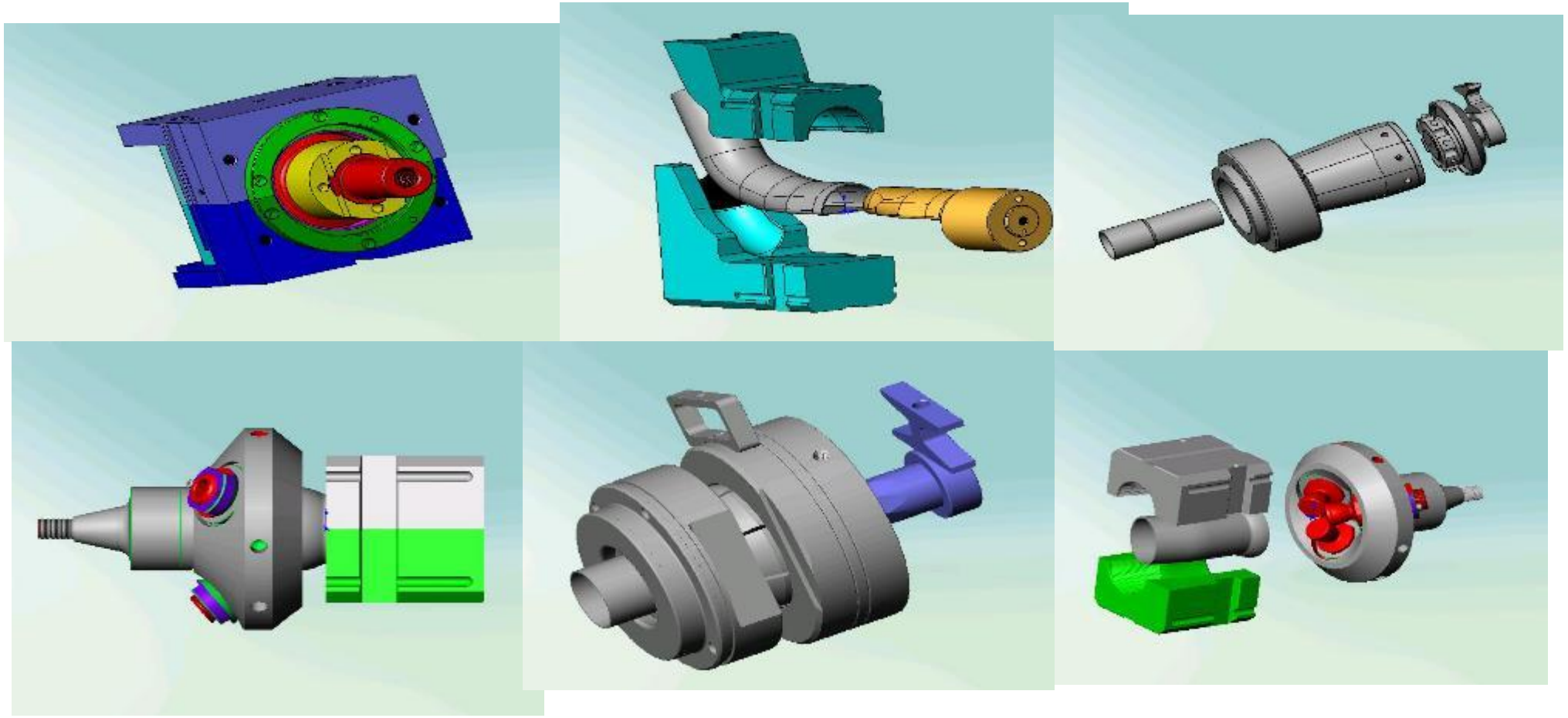
Examples of End Forming Tools



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The Basics of End Forming

Some questions that must first asked …

- What is the beginning tube shape? e.g. Round? Oval? Square?
- What is the final shape desired? e.g. Expansion? Flare?
- What Tolerance is required? e.g. ± 0.5 MM, ± 0.3MM

Knowing the answers to these questions will help select the type of machine and tooling

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The Basics of End Forming

The most basic End Form Operation is… RAM FORMING

Ram forming tooling consists of two parts:

1. Ram Form Jaws - these capture and hold the part on the outside, preventing movement during the forming operation. Also these jaws contain the final Outside shape of the part.
2. Ram Form Nose – this tool strikes the part from the inside and push the material toward the jaws to make the final shape.

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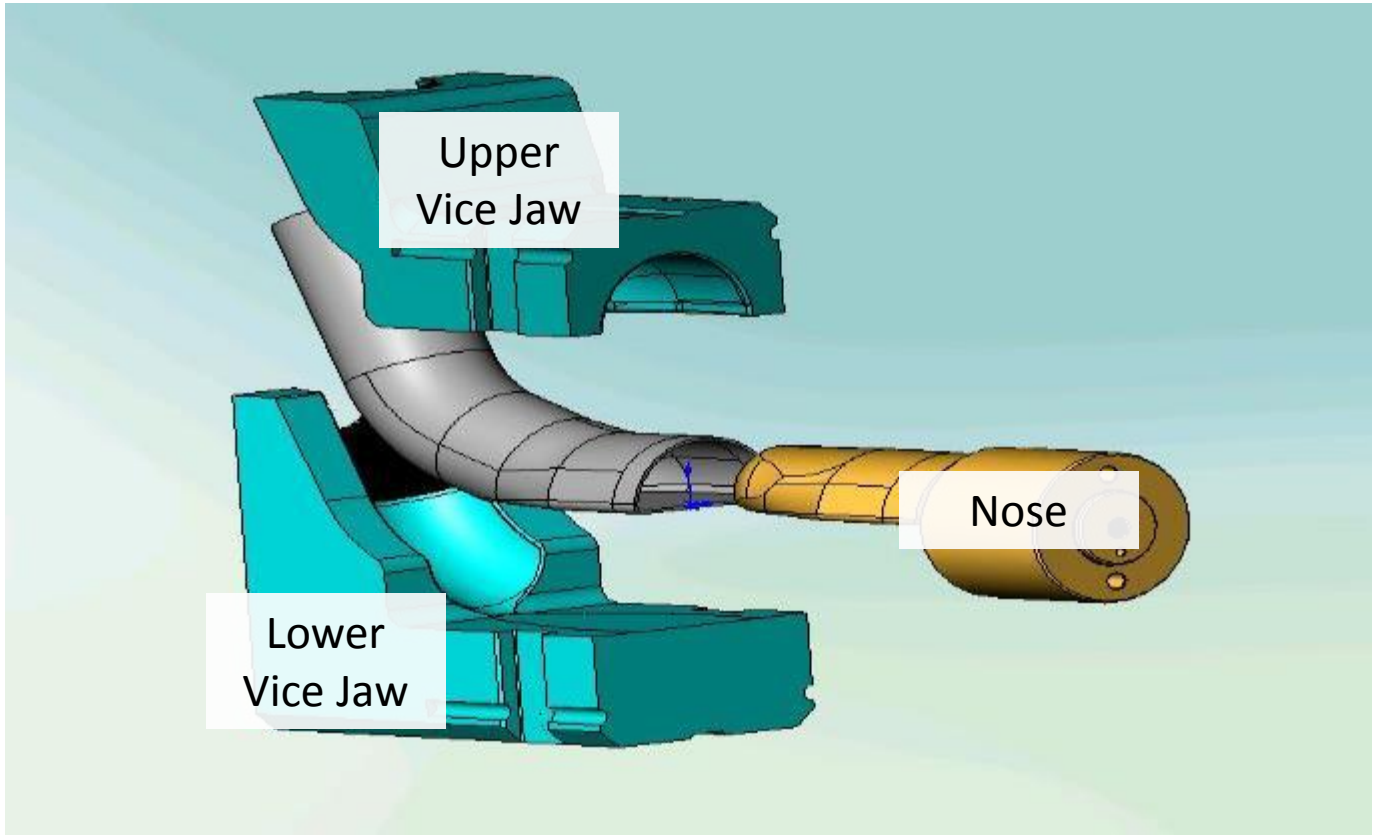
Example of Ram Forming Tooling

Can you identify which are the Ram Jaws?

Which is the nose?



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Advantages & Disadvantages of Ram Tooling

Advantages:

- Form non-symmetrical and symmetrical shapes.
- Example Shapes – Round, Oval, Square, half moon, “D”, Pie shape, Triangle
- Reduces splitting compared to segment sizing tools
- Move material greater distances
- Smaller tube sizes than segmented tools

Disadvantages:

- No adjustability in shape. If Material thickness changes, tooling will only produce shape per original design.
- Tooling Marks on inner surface
- Lubrication is usually necessary
- Ram Nose depending on # of cycles and material may require replacement due to wear

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Ram Form Machine

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Ram Form Machine

TF80 – E / F Machine Specs:

- The E machine is designed for ram forming parts up to 76 / 80 MM in diameter?
- This machine also has the option to Flare (F) using a cluster roller toolset.

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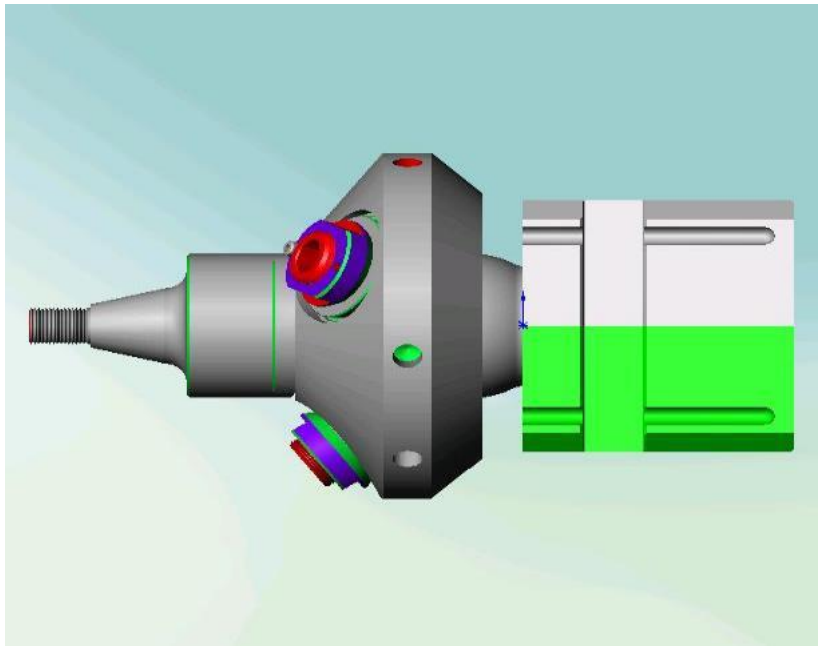
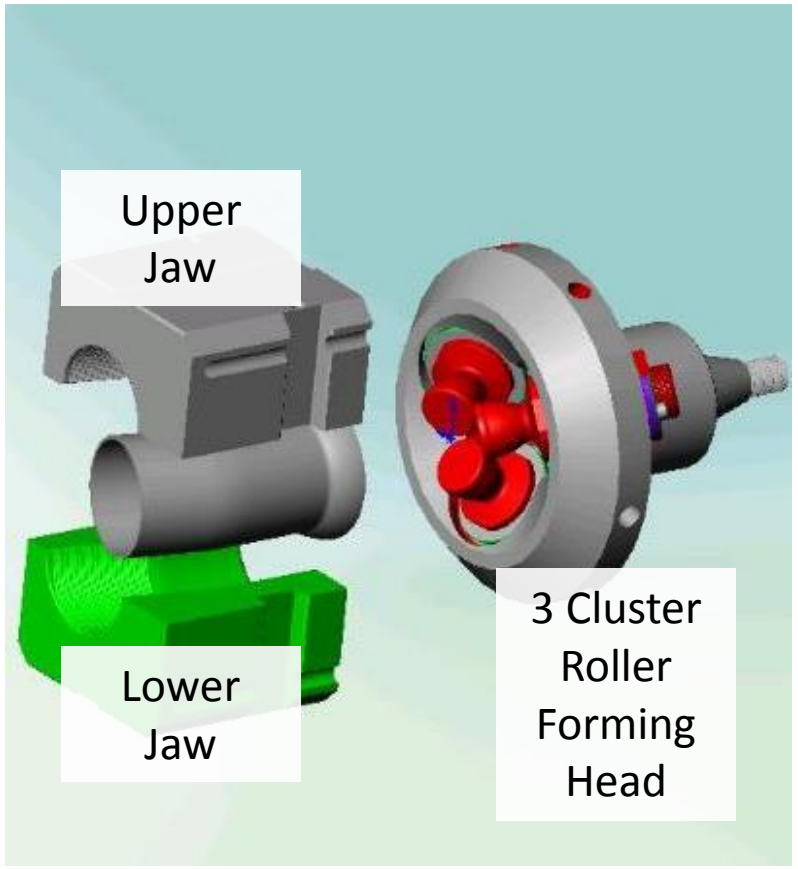
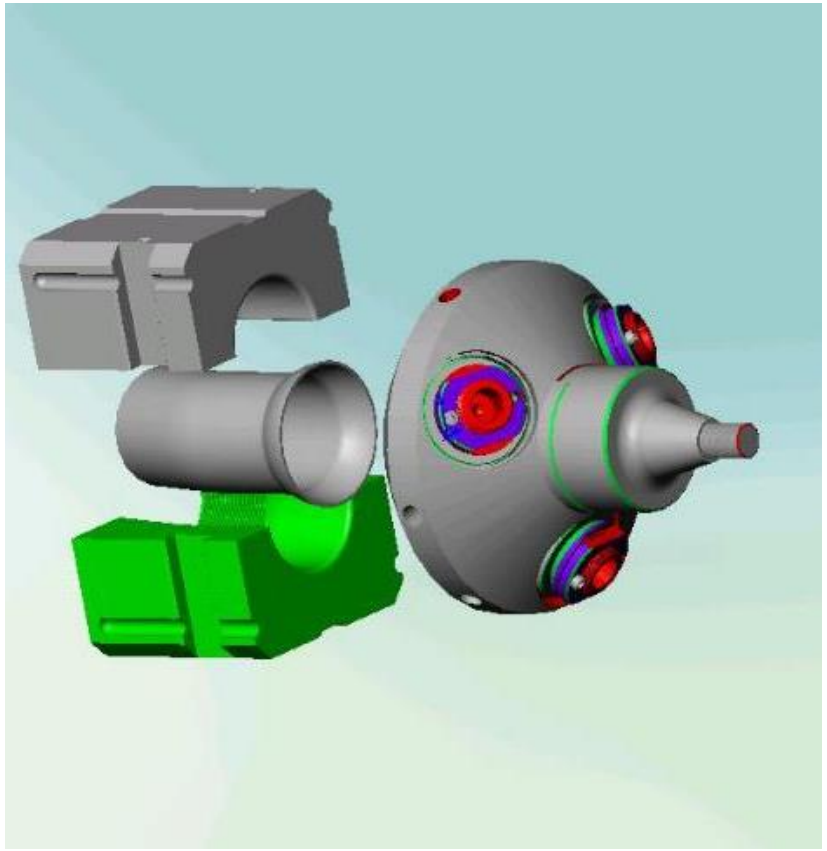
Example of Flare tooling



Similar Terminology to Ram tooling





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End Forming Basics

Your customer wants a round shape that is concentrically larger or smaller than the original shape. You would be correct to state this can be done in a Ram Former, however what if the customer does not have control over the incoming material thickness, or it varies too much for Ram forming to meet the tolerance?

What do you do?

Machines Designed for Round Sizing

Two types of machines to address round sizing:

1. E/R – Expand Reduce – This machine either expands a tube to make it a larger round size, or reduces it to make it smaller.
2. I/O – Inside Outside – This machine combines what would be separate tooling for an E/R machine, and supports the material simultaneously on the inside and outside.

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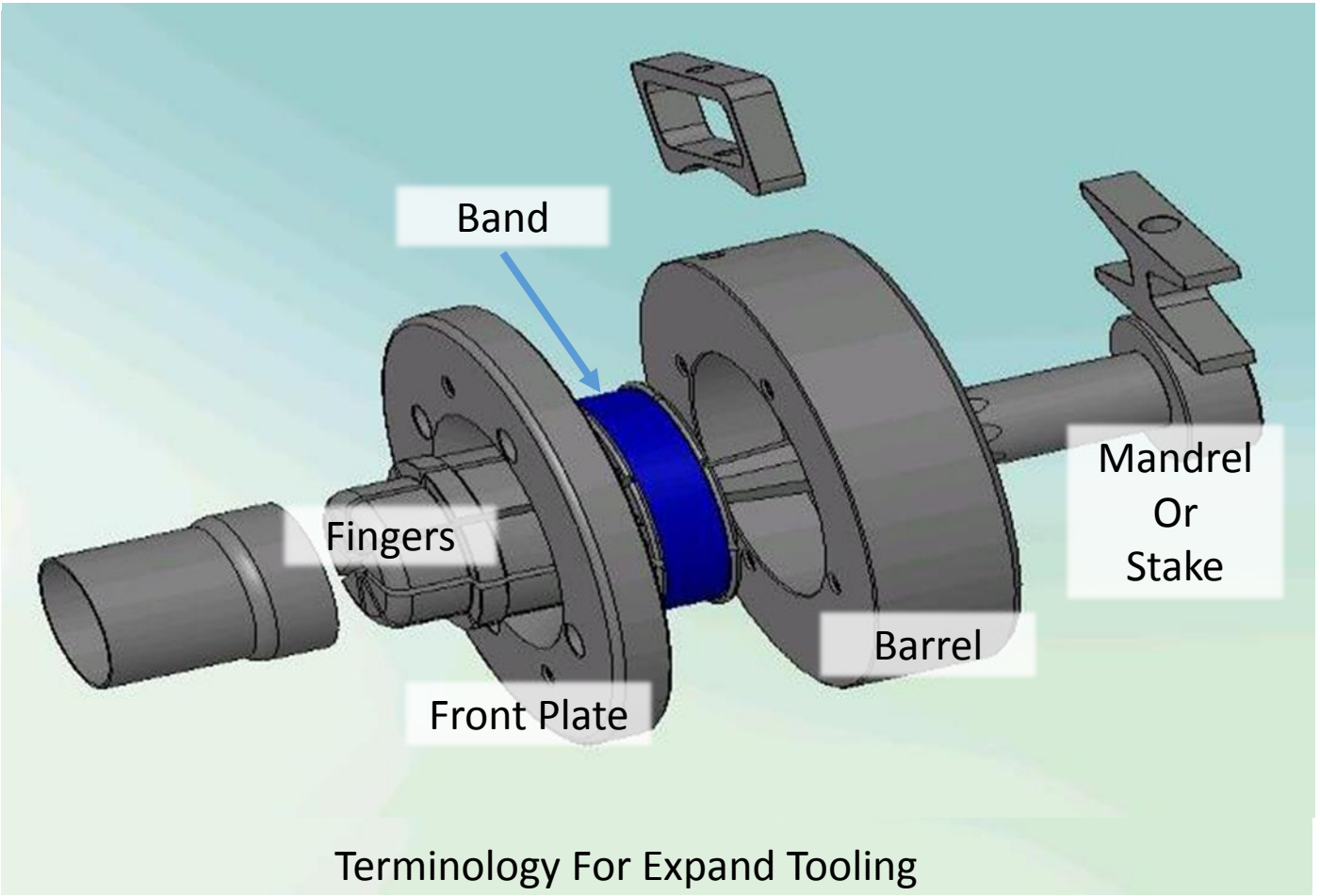
E/R – Expand Tooling



Terminology For Expand Tooling

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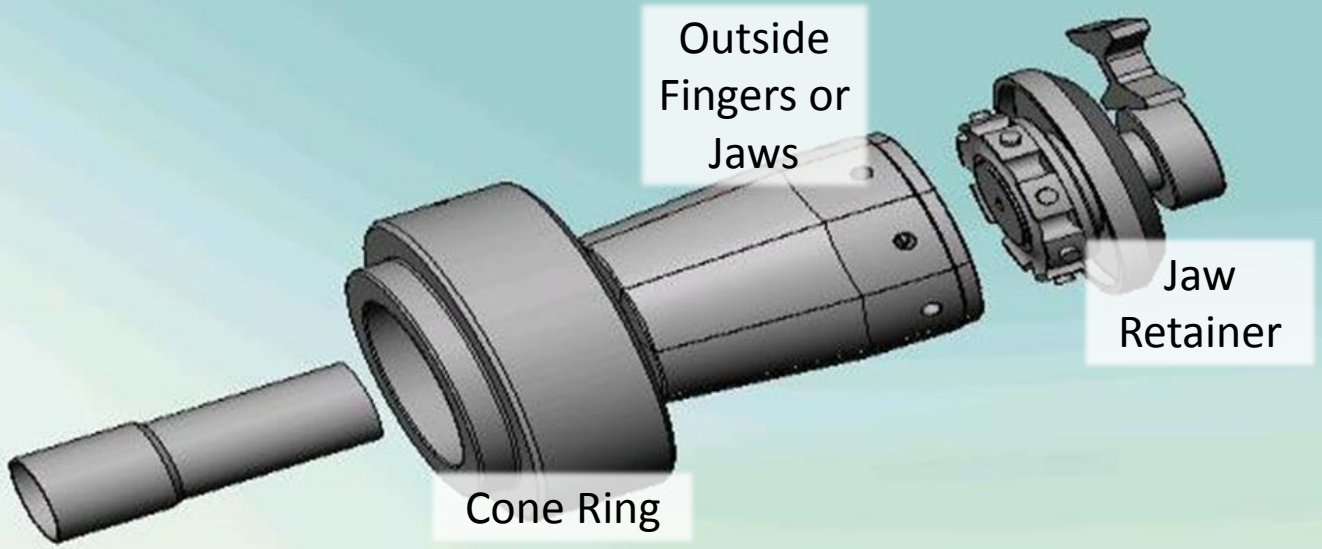
E/R –Reduce Tooling



Terminology For Reduce Tooling

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Advantages & Disadvantages of E/R

Advantages:

- Less expensive than IO
- Adjustability of tooling for final shape

Disadvantages:

- Tool is only able to touch inside or outside – not able for simultaneous support
- Maximum expansion or reduction is limited to .250” in all directions *

*Explained on next slide

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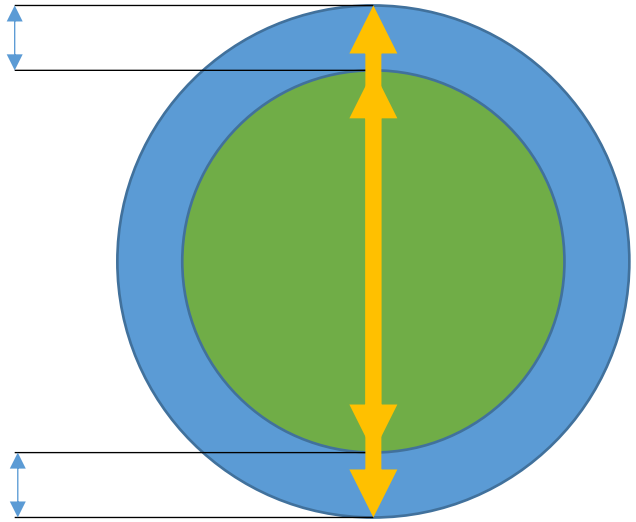
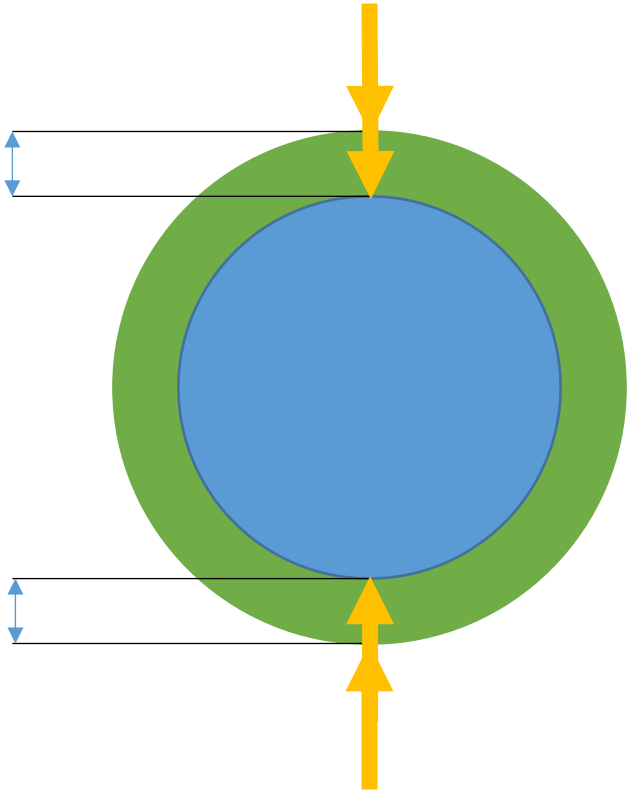
E/R – Expand Reduce Machine

Maximum Expansion:



Total Expansion or Reduction = 0.250”

Maximum Reduction:



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E/R – Expand Reduce Machine

Maximum Expansion:

Example #1 – 40 MM OD expand to 50 MM OD. WT 1.5 MM Is this possible with ER Tooling?

Answer:
50 – 40 = 10 MM
10 MM – (2x 1.5) = 7 MM
7MM / 25.4 MM/ IN = 0.276''
Not Possible.
Why: 0.276'' > 0.250''

Maximum Reduction:

Example #2 – 2.25" OD reduced to 1.95" OD. WT is 0.055". Is this possible?

Answer:
2.25'' – 2.10'' = 0.150''

Yes possible since 0.15'' < 0.250''

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E/R – Expand Reduce Machine

Maximum Expansion:

Example #3 – 40 MM OD expand to 46 MM ID. 1.5 MM Thickness. Is this possible?

Answer:
50 – 46 = 4 MM
4 MM / 25.4 MM/ IN = 0.157''
Yes Possible.
Why: 0.157'' < 0.250''

Maximum Reduction:

Example #4 – 2.25" OD reduced to 1.95" ID. WT is 0.055". Is this possible?

Answer:
2.25'' – 1.95 = 0.3''
0.3'' - (2x0.055'') = .19''

Yes possible since 0.19'' < 0.250''

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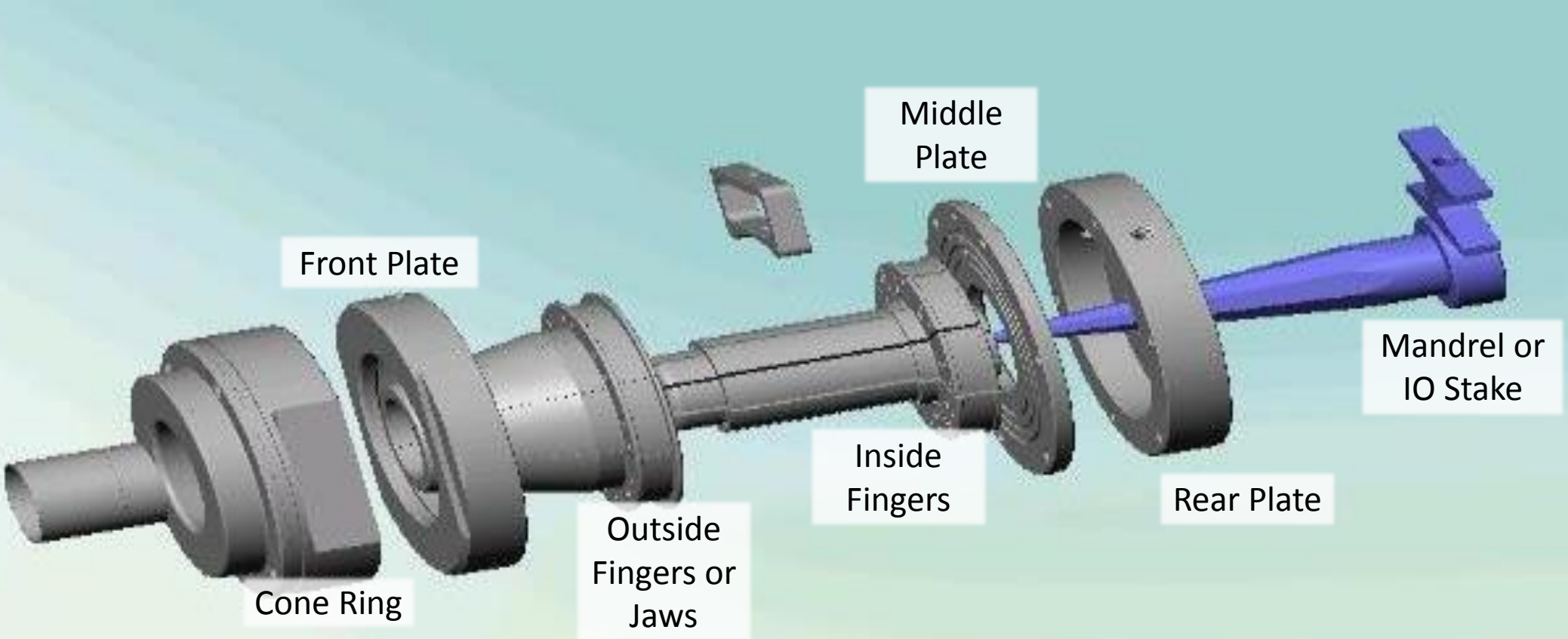
I/O – Inside Outside Tooling



Terminology For IO Tooling

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Advantages & Disadvantages of I/O

Advantages:

- ± 0.10” OD / ID tolerance
- More accurate and versatile than ER
- Provides better roundness
- Faster Cycle time than Ram Forming
- Ability to adjust tooling size slightly (± 0.010) from nominal size
- Sequencing IOIO, OIOI for trying to hold ID or OD tolerances
- Ability to make several forms: expand, reduce, pre-form, dimples, kink bend, oval expand / reduce, turn up, turn down, bead, Norma, Re-strike

Disadvantages:

- Tool Limits smallest tube to size. 1.75”(45 MM MM) OD. Minimum expansion starting with 1.5”(38MM) OD
- Material is stretched between fingers, and may split.
- To achieve roundness, Sequence is cycle, rotate cycle.

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I/O – Inside Outside Machine

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Multiple I/O Applications

- expand,
- reduce,
- pre-form,
- dimples,
- Dimple lock cones
- kink bend,
- oval expand / reduce
- turn up, turn down,
- bead,
- Norma,
- Re-strike

Need some pictures of each of these applications

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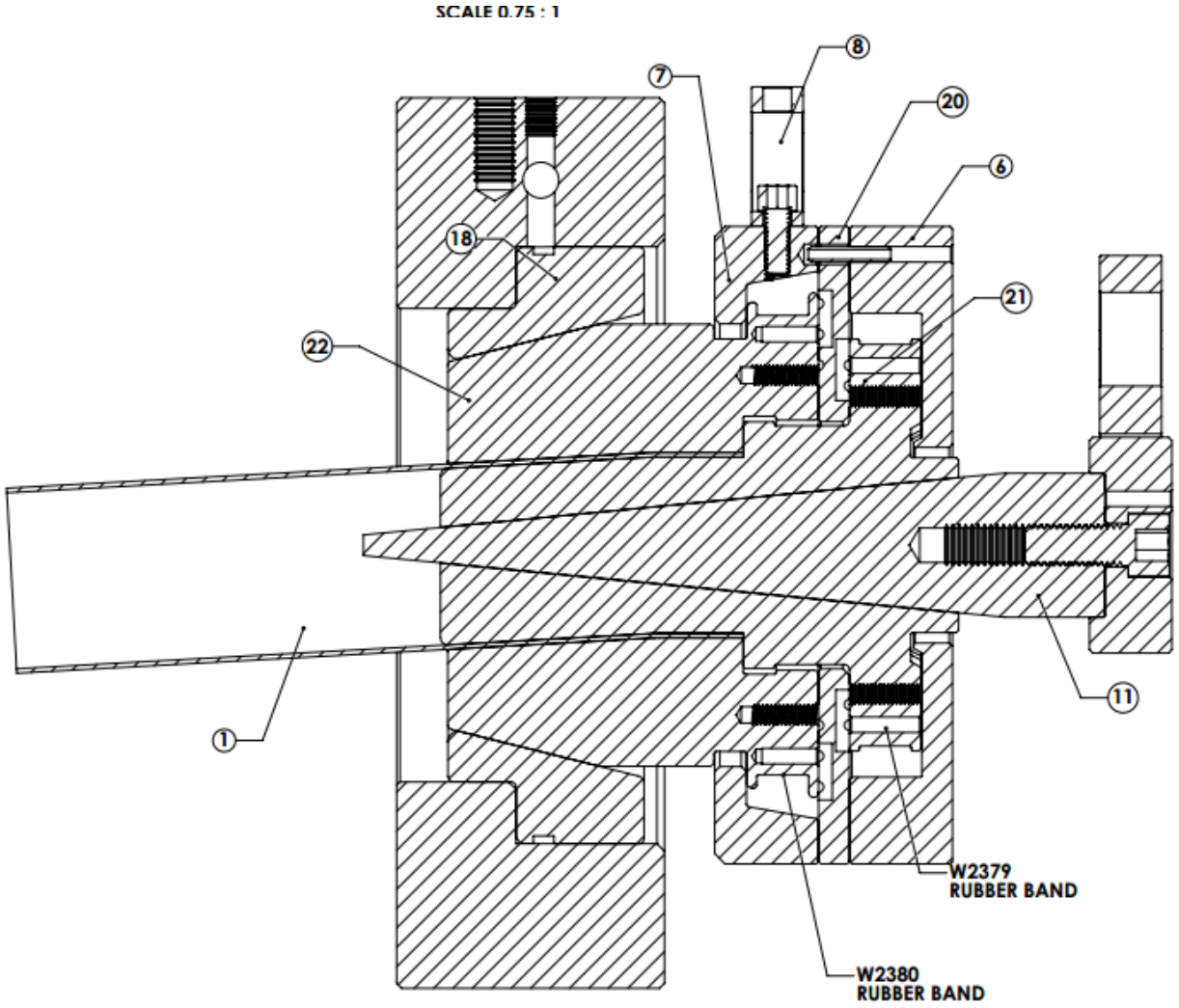
I/O Kink Bend



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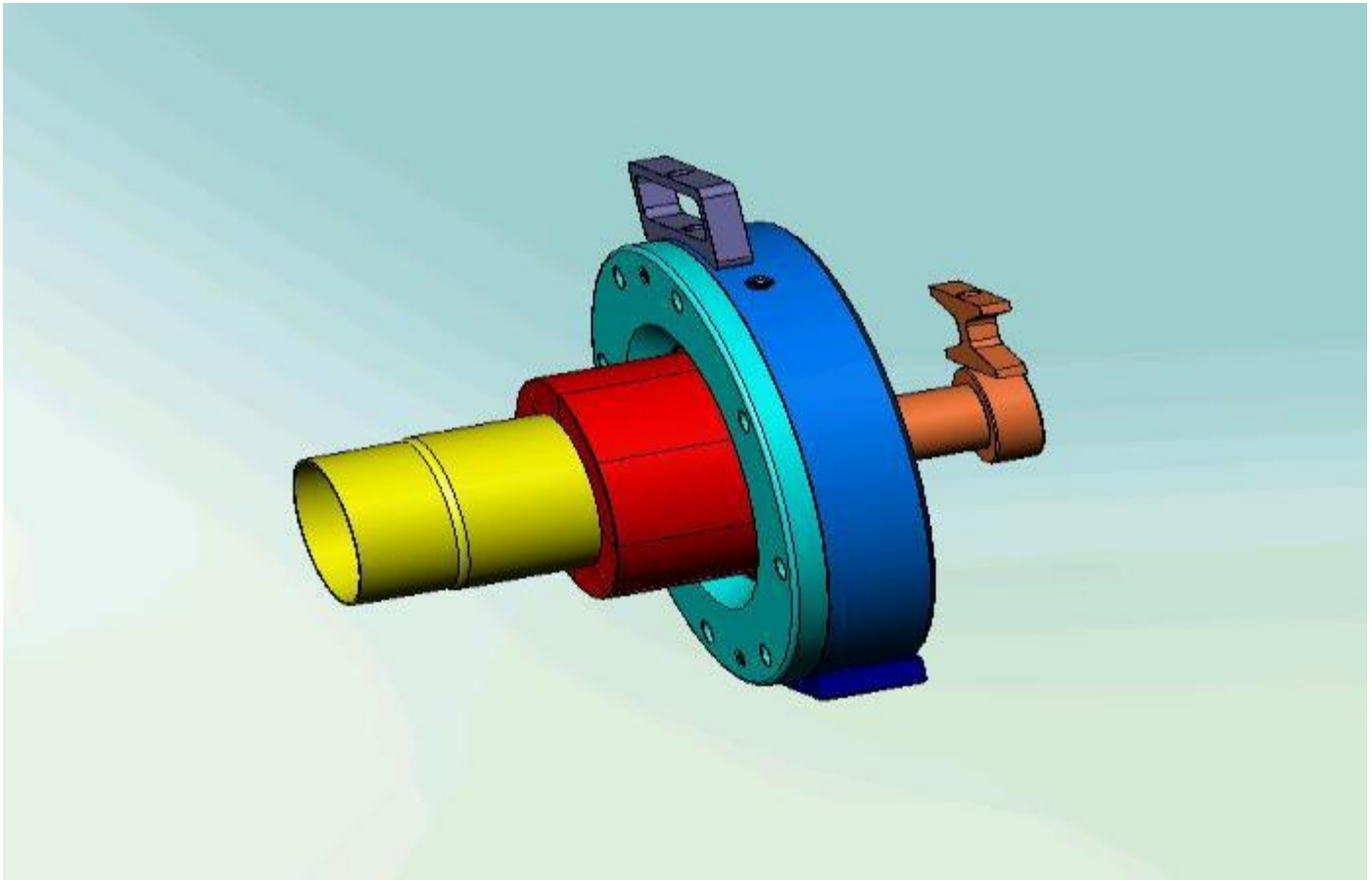
6” Expansion Assy



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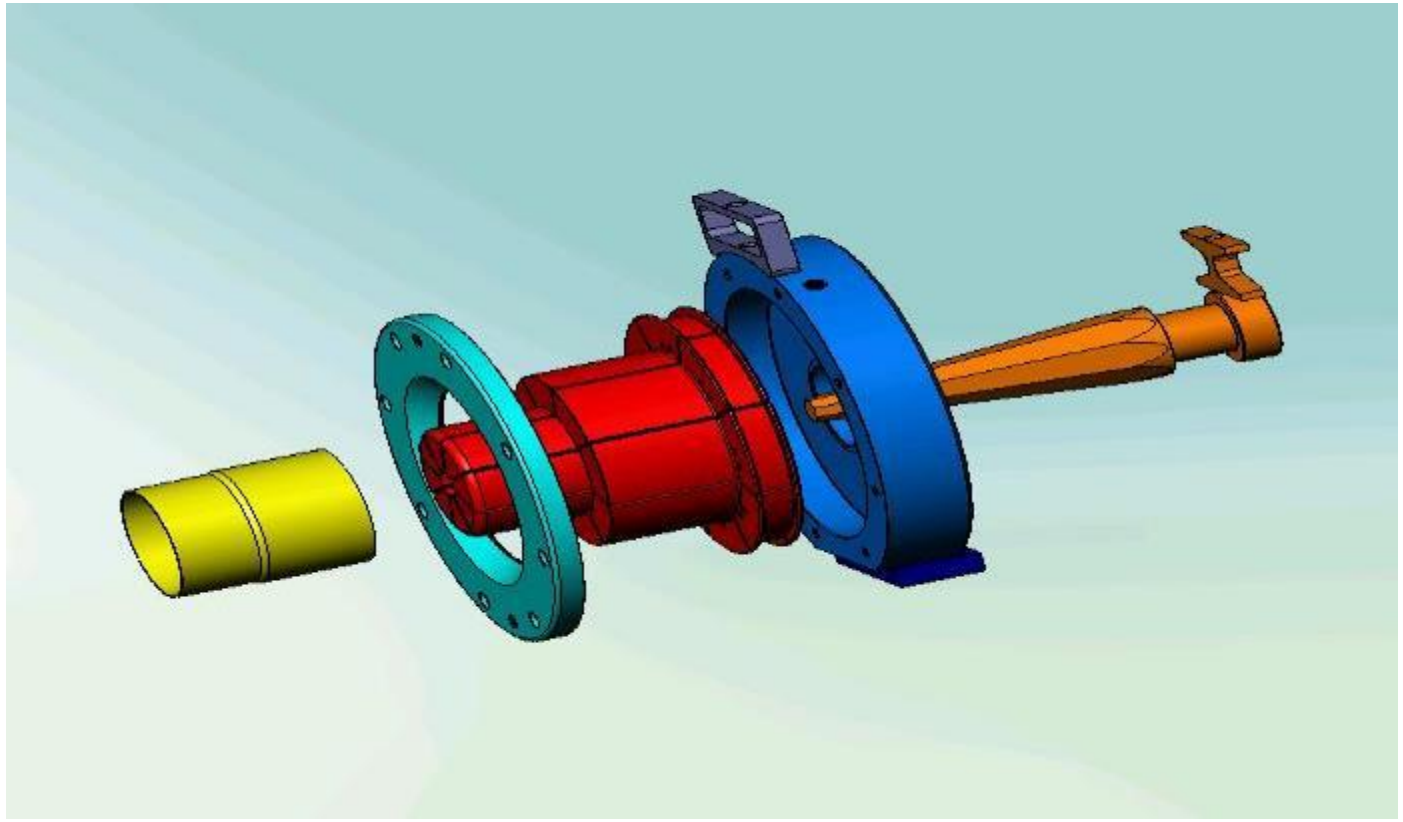

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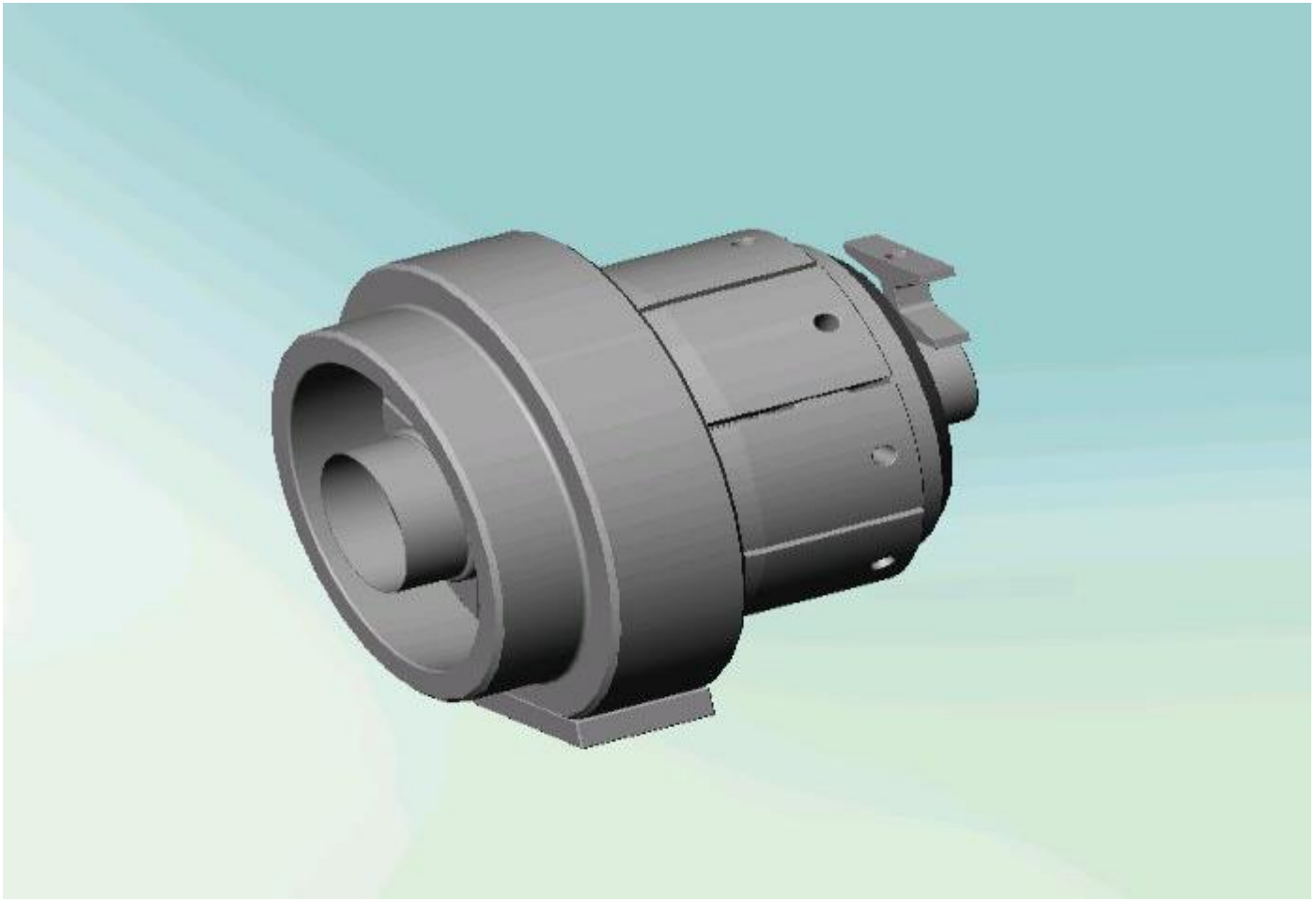
6” Reducing Assy



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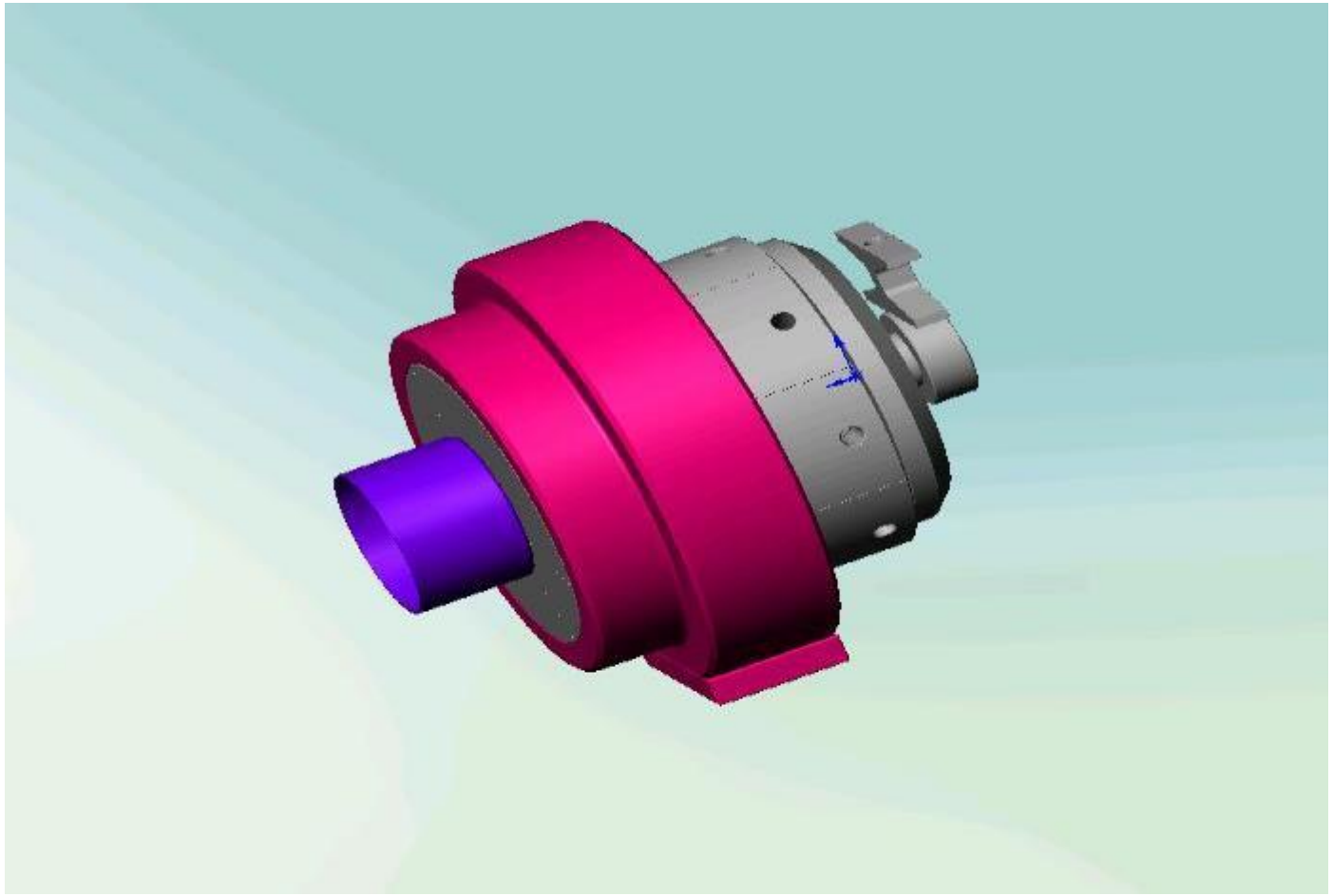

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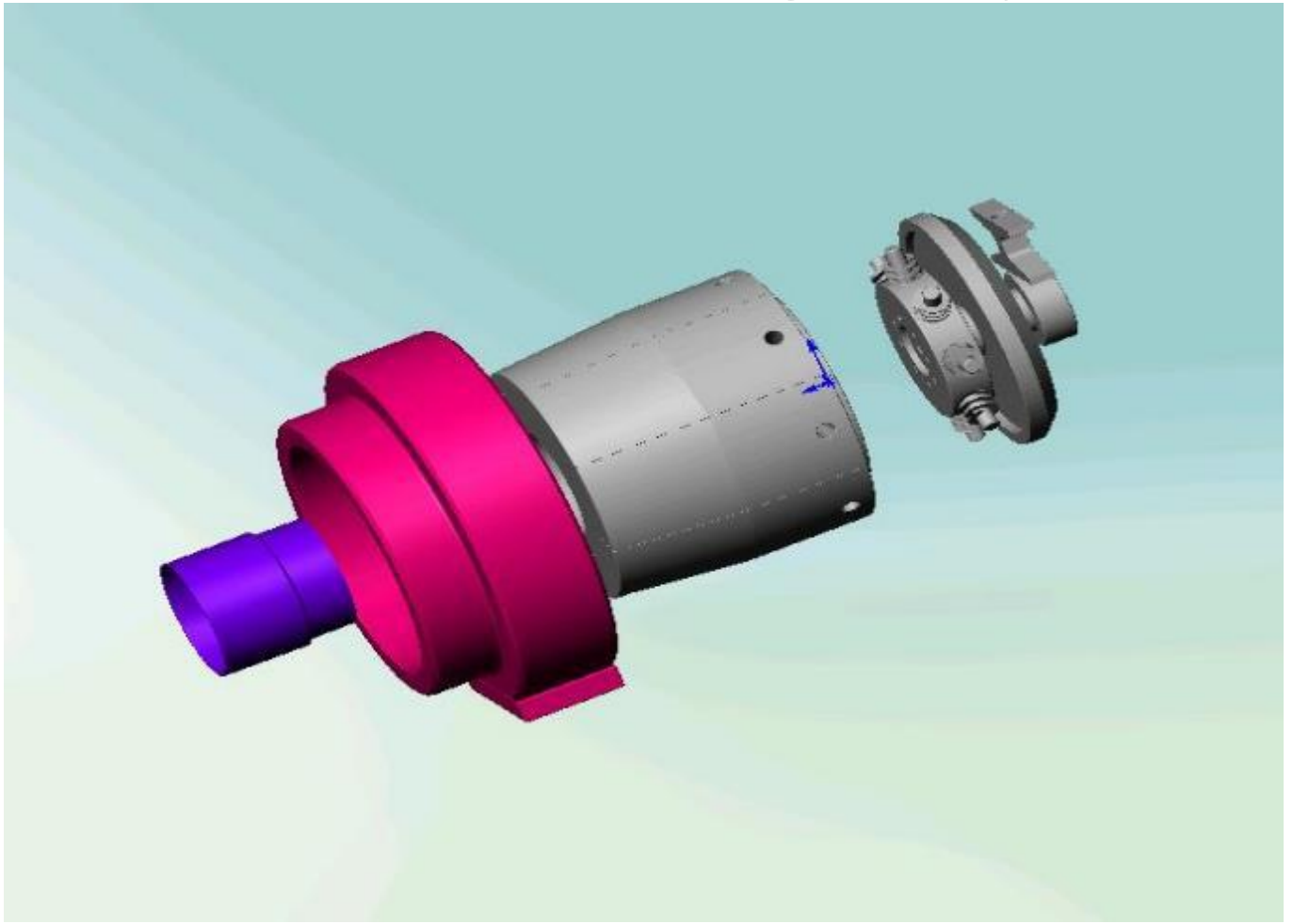

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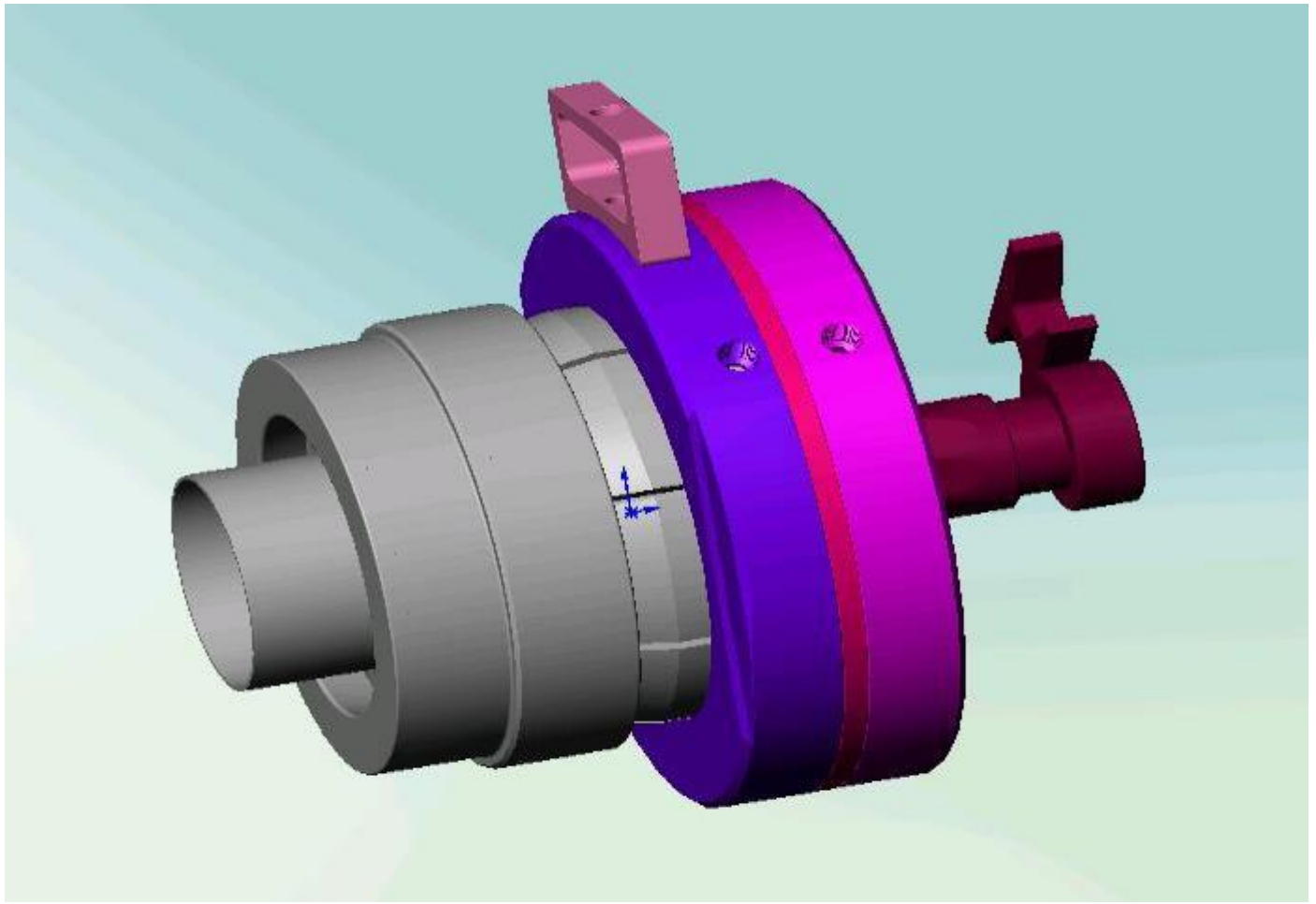
6” I/O Assy



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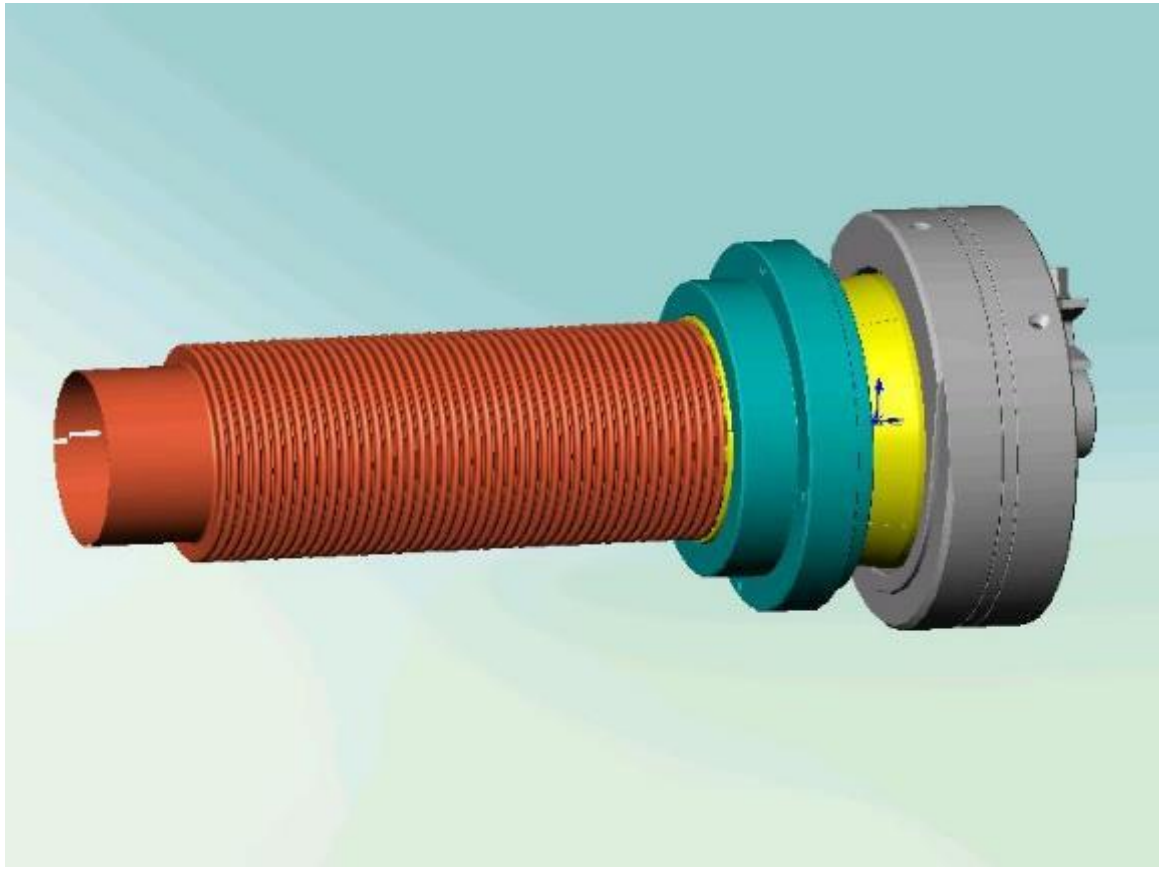
6” I/O Special Assy



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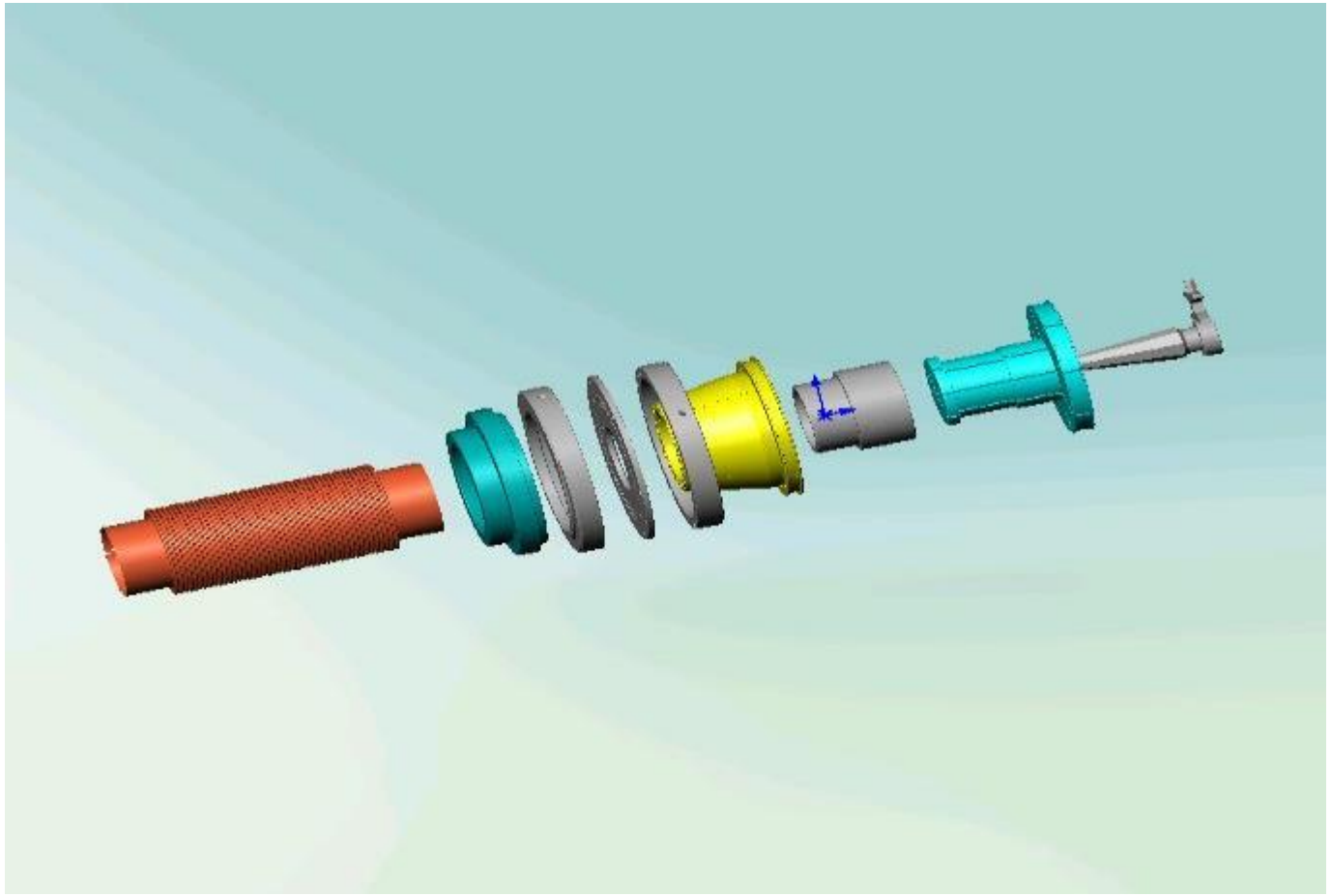

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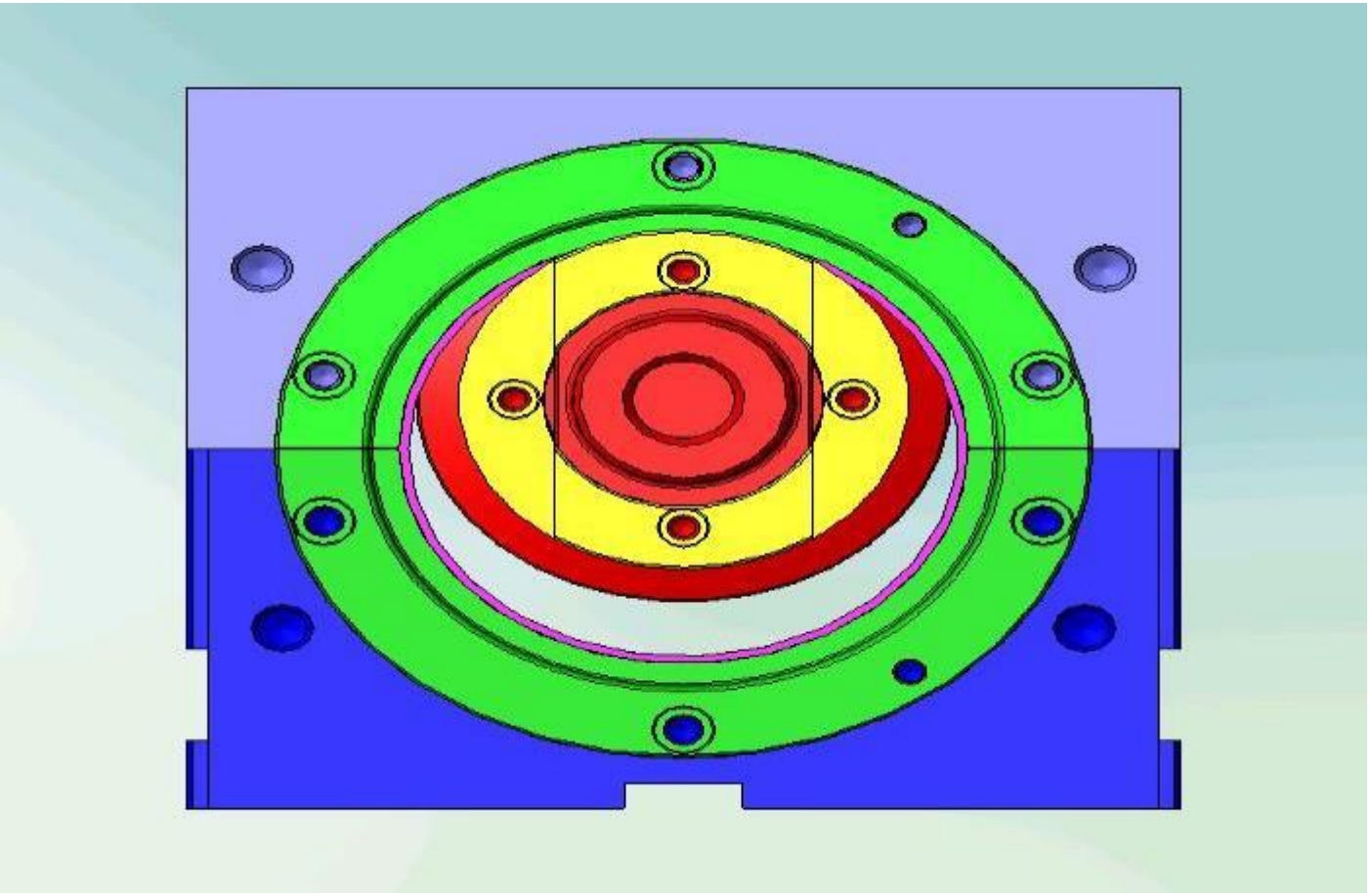
Outfeed rotary flare Assy



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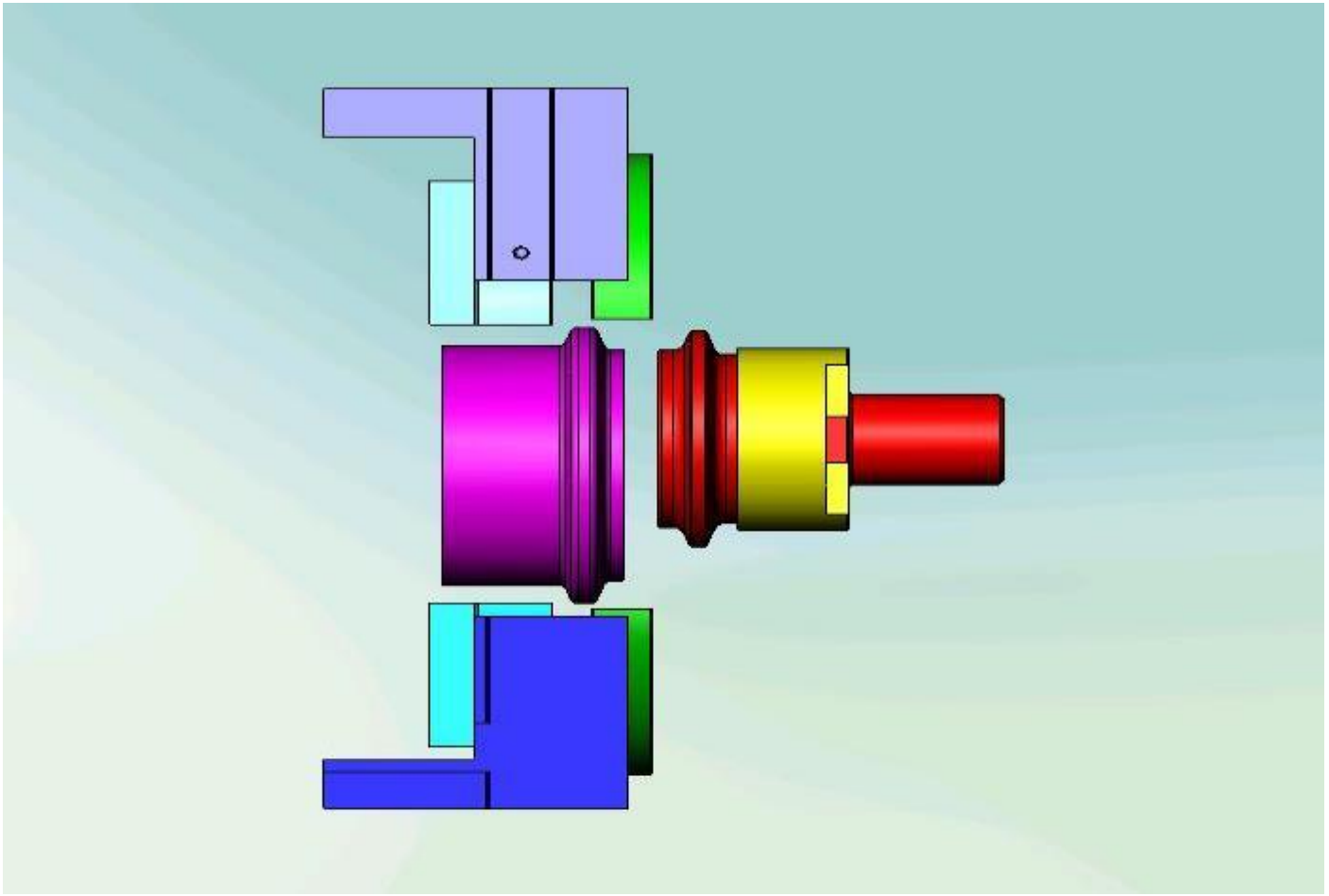

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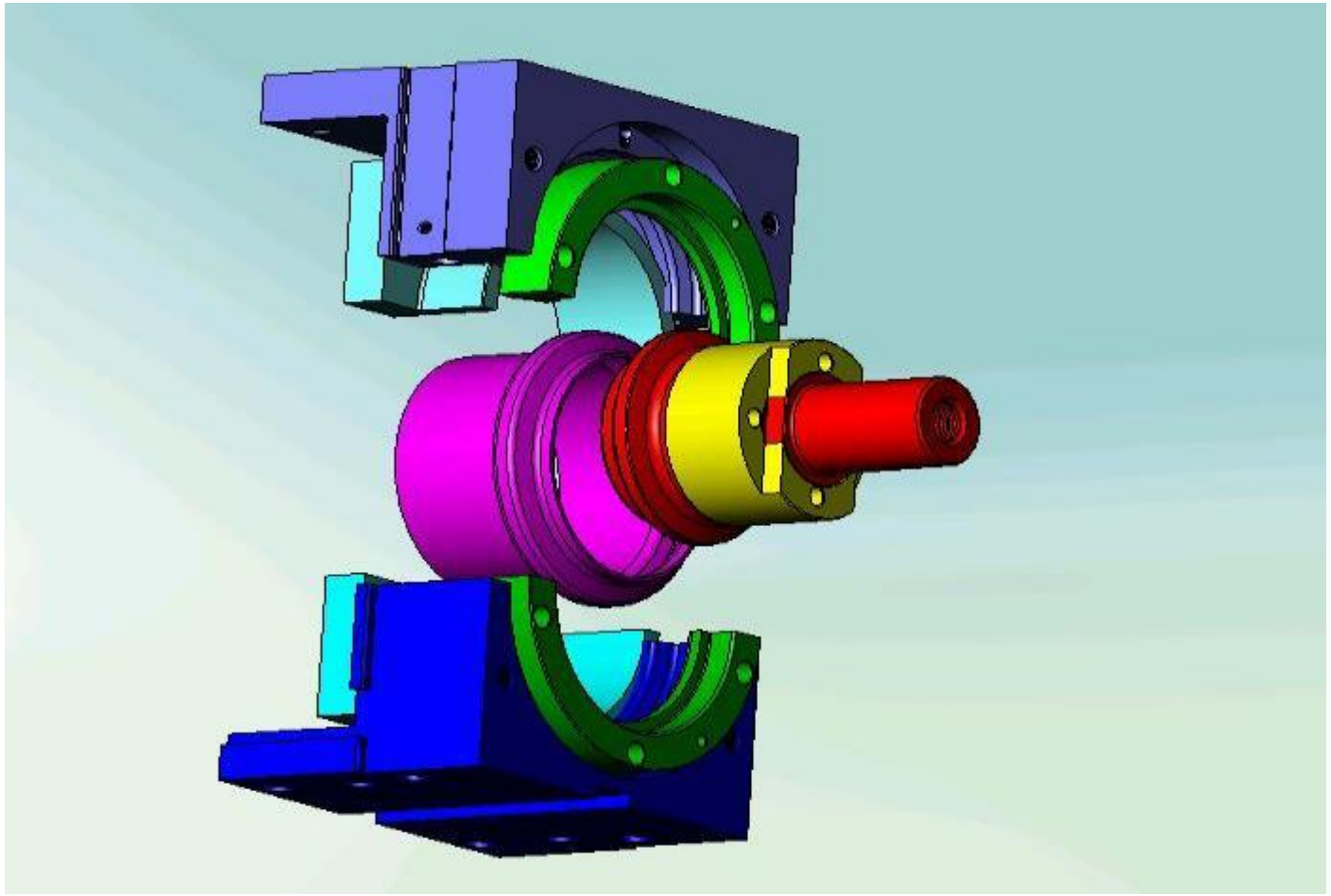

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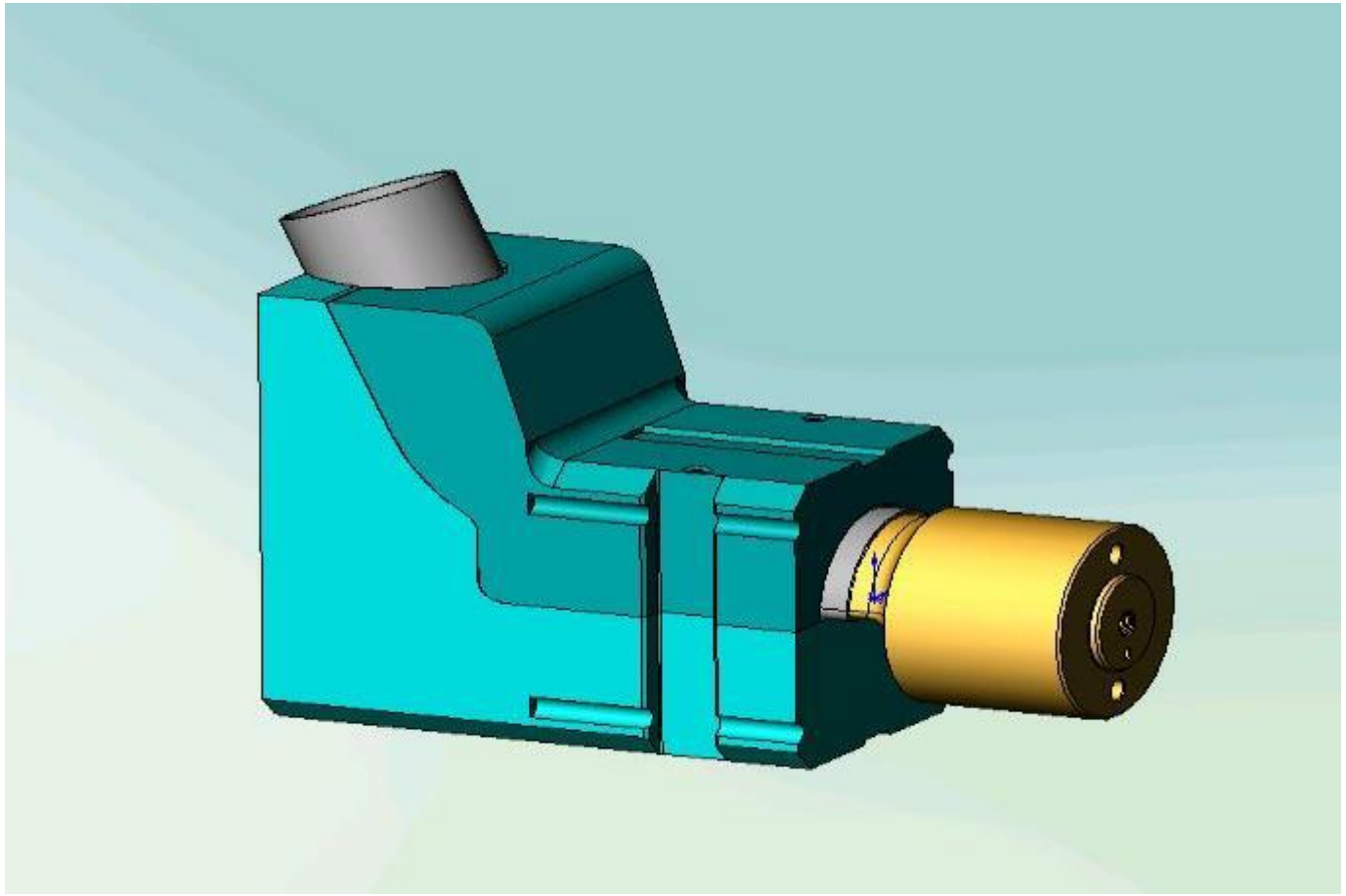
Ram form “D” shape Assy



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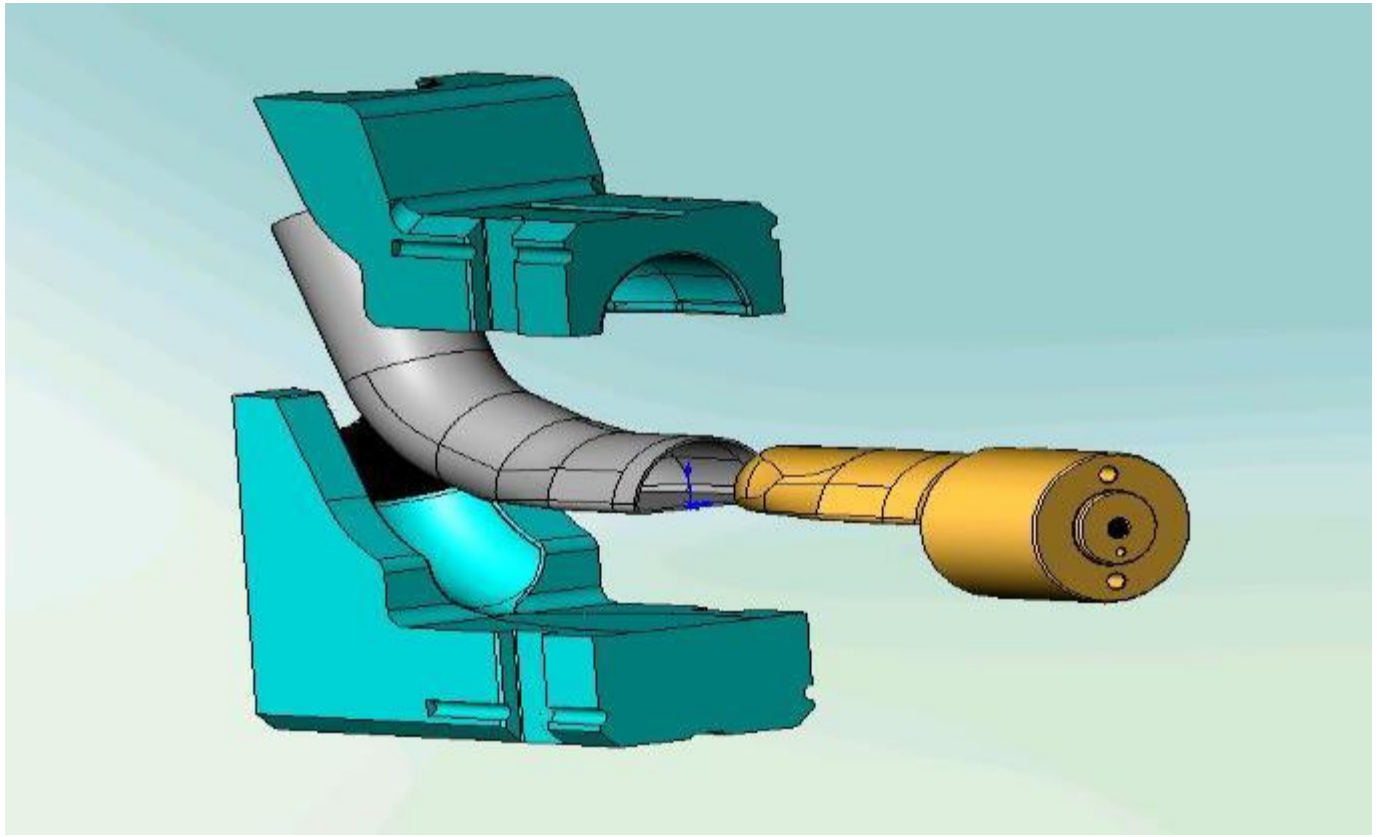

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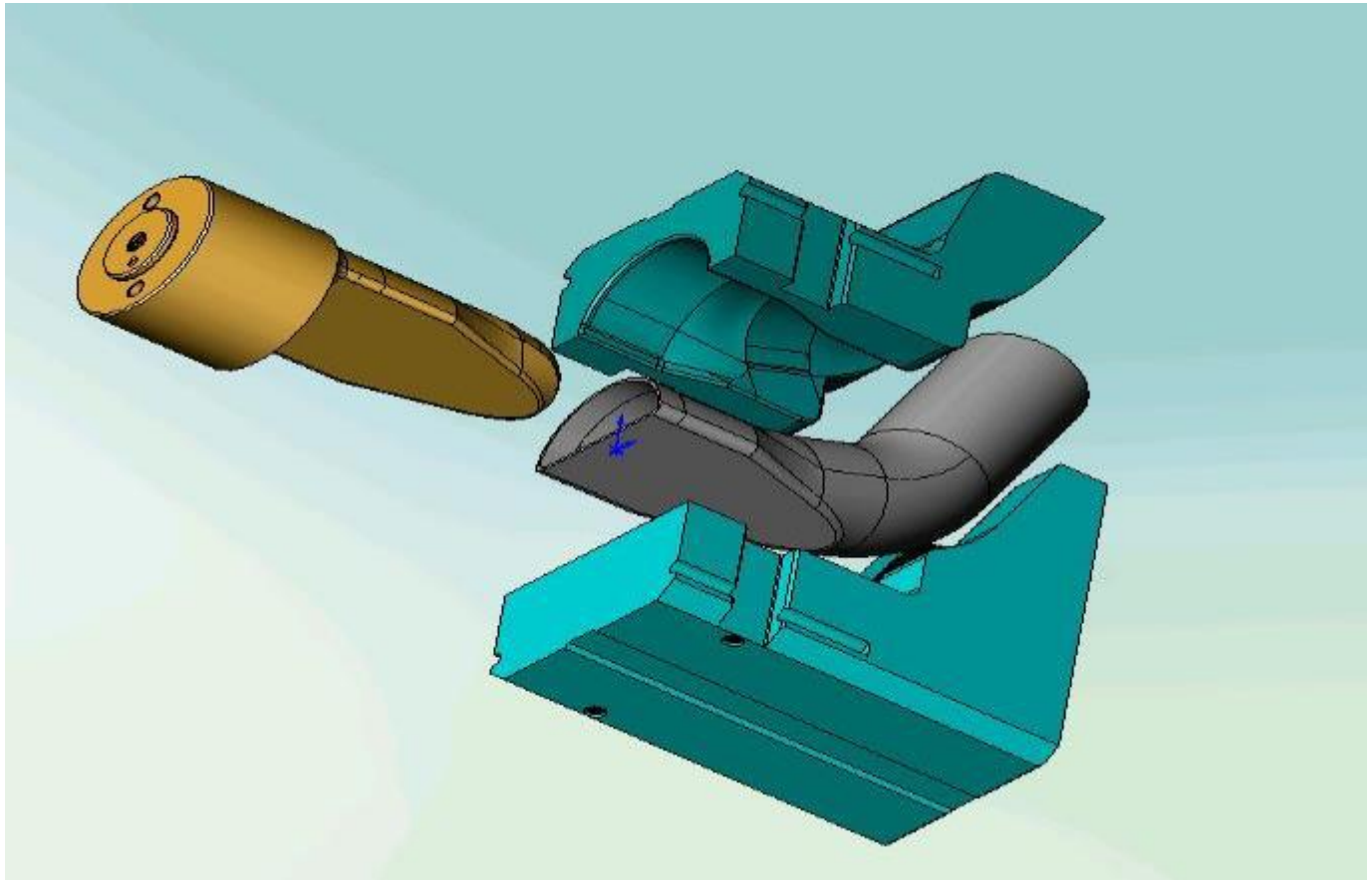

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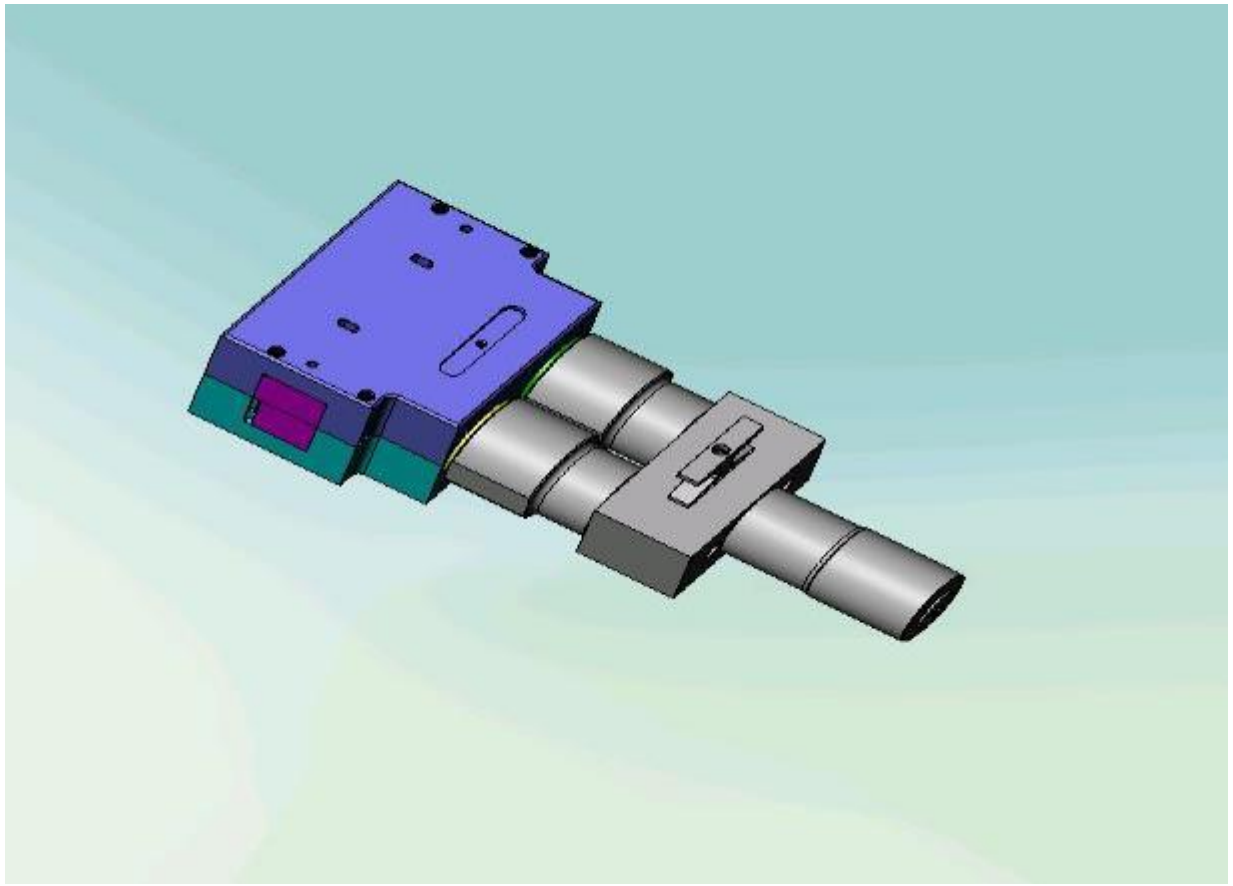
Ram form special Assy



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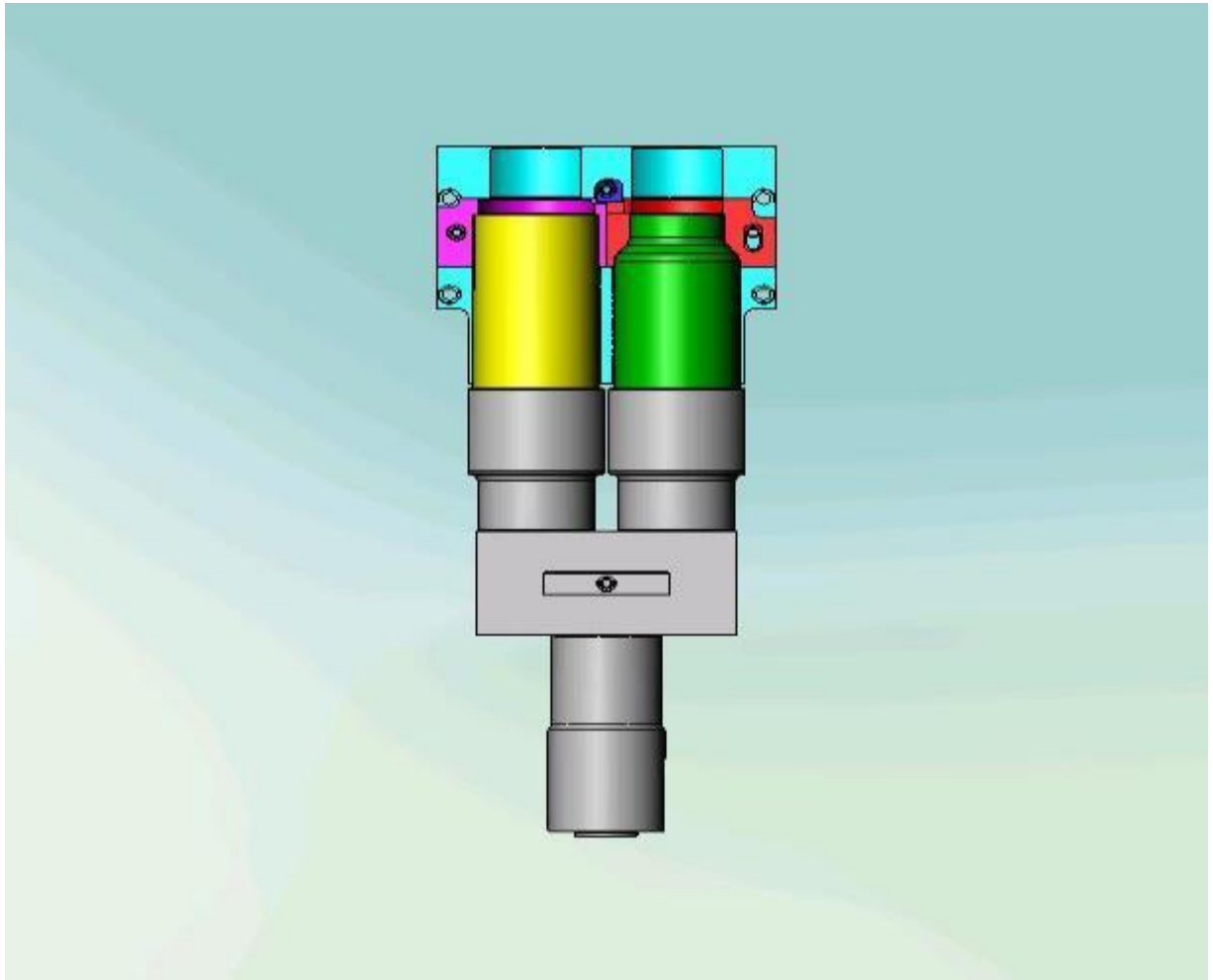

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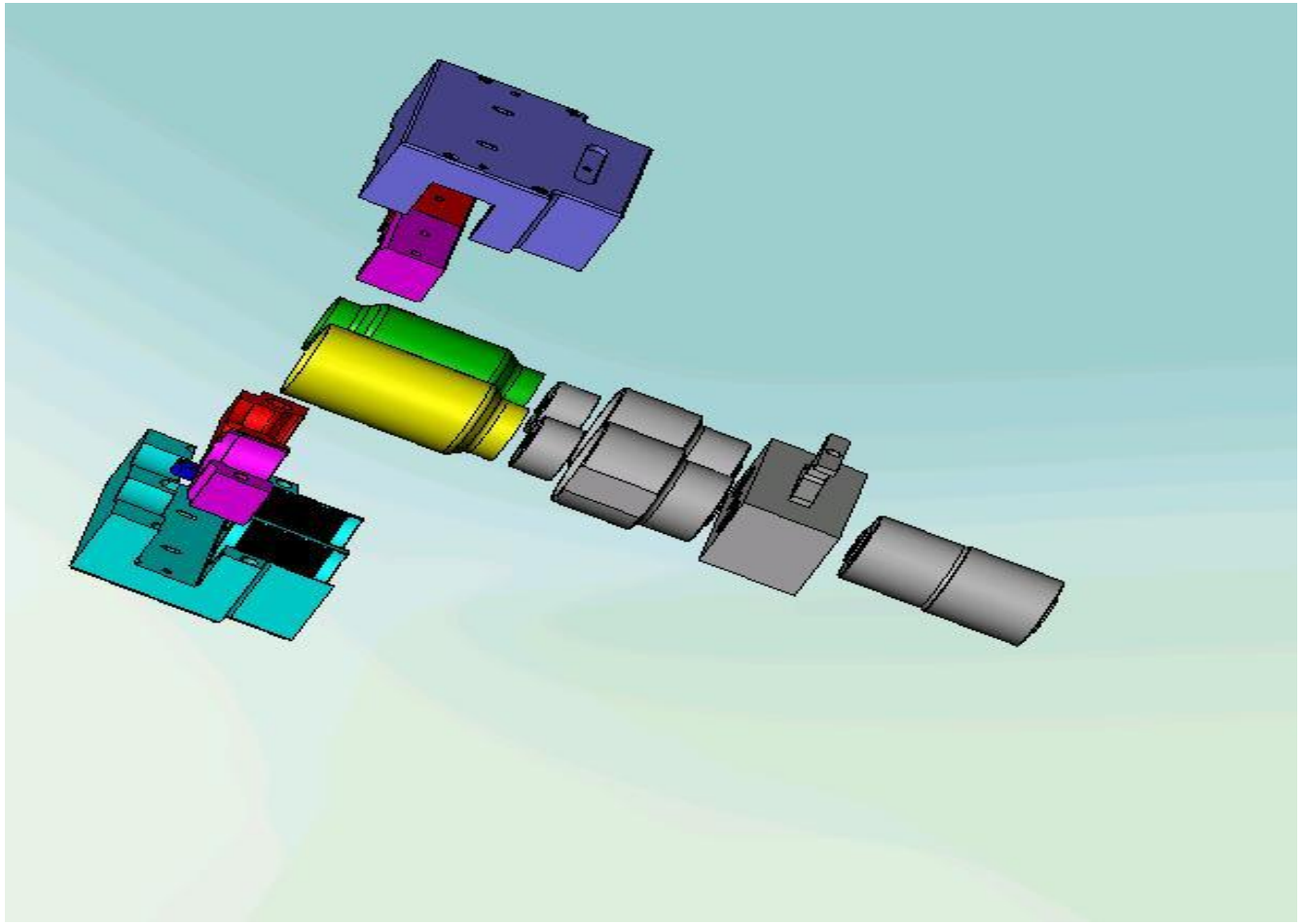

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Leading Tube Bending and End Forming Company

Our goal at Tube Form Solutions is to empower people who design. Our focus is to help our customers materialize their ideas by providing the tools and information to help them transform their concepts into reality.

We are a tube bending company dedicated to providing exceptional, innovative products, technical support, and customer service.

We do not just sell CNC Tube Benders; Tooling or Fixtures' we provide solutions to Tube Forming.

We help you get everything you need quickly and accurately for precise bending and end forming so you can continue to lead the tube forming industry