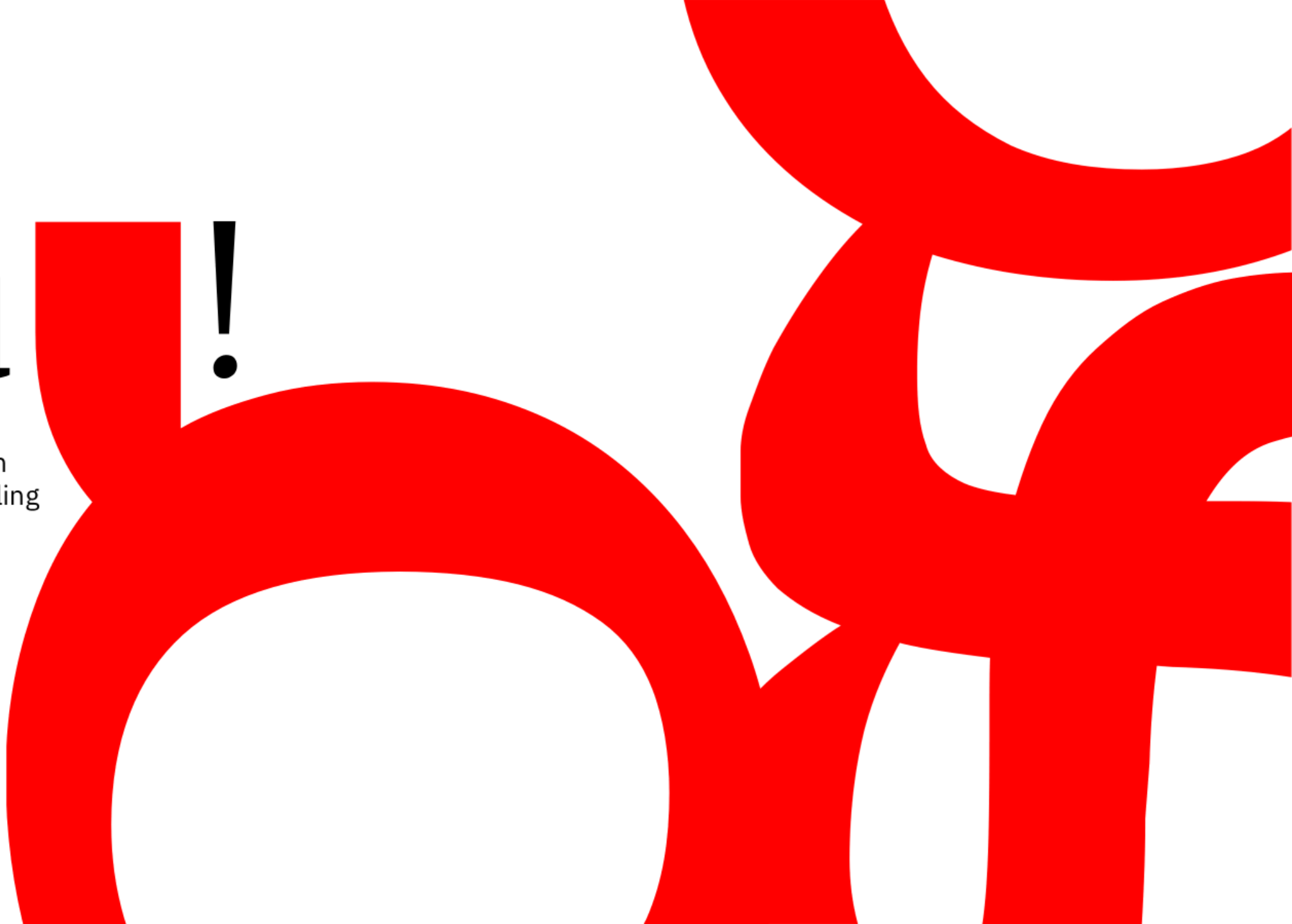


hu!

Hugg As  
Mekanisk Design  
og Produktutvikling



hu  !

**Ingen lekkasje!**

Tetningsløsninger i produktdesign

Av Lars Rimmereid

# Dedicated to help Norwegian companies make better products

- Est. 2015, originate from Nemo engineering and Kongsberg Oil & Gas Technology
- 27 Employees
- 35 MNOK yearly revenue
- Over 200 completed development projects

hu!



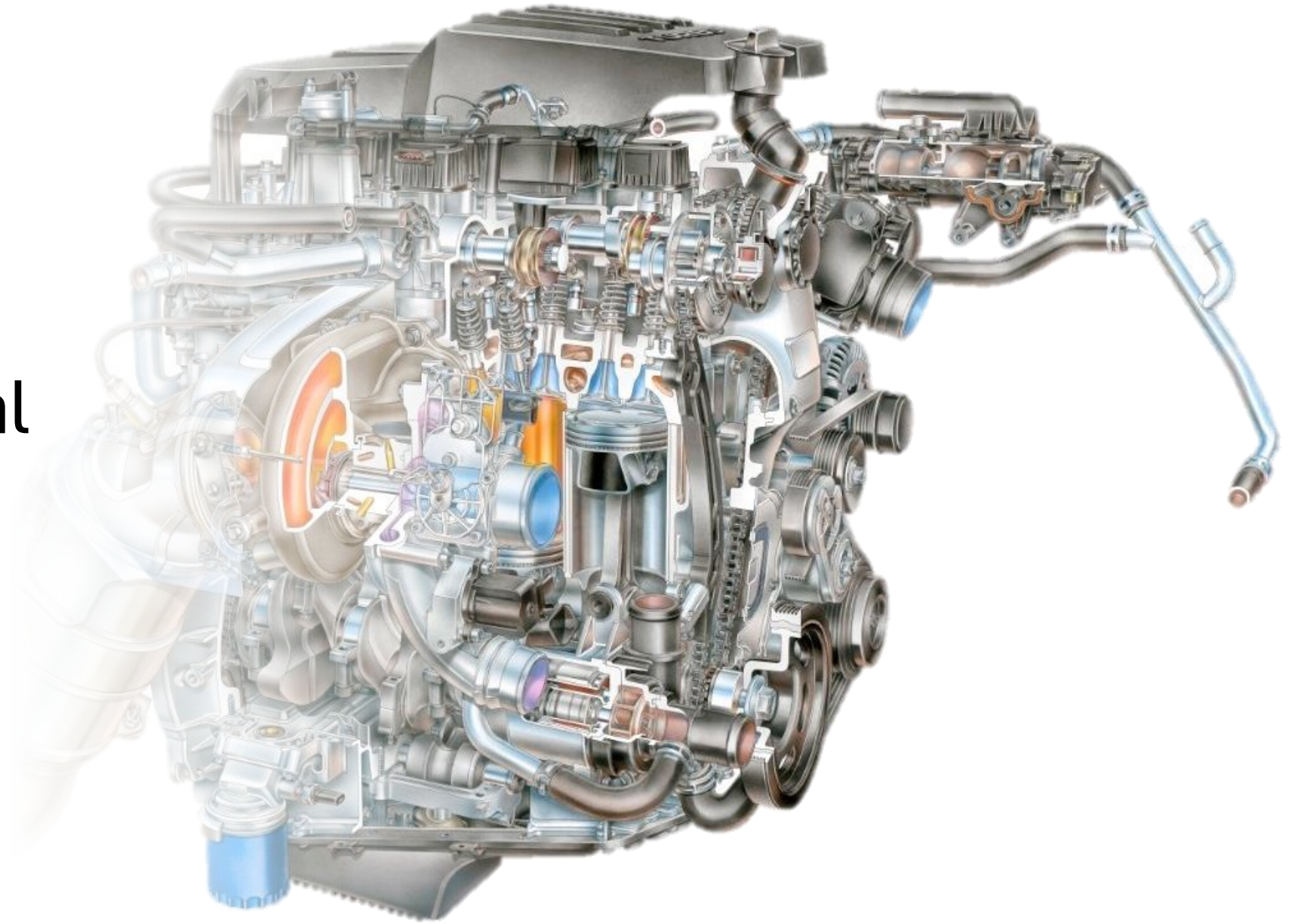
1. What is sealing?
2. Selections of seal solutions
3. Chemical compatibility
4. Different types of sealing solutions

What is sealing?

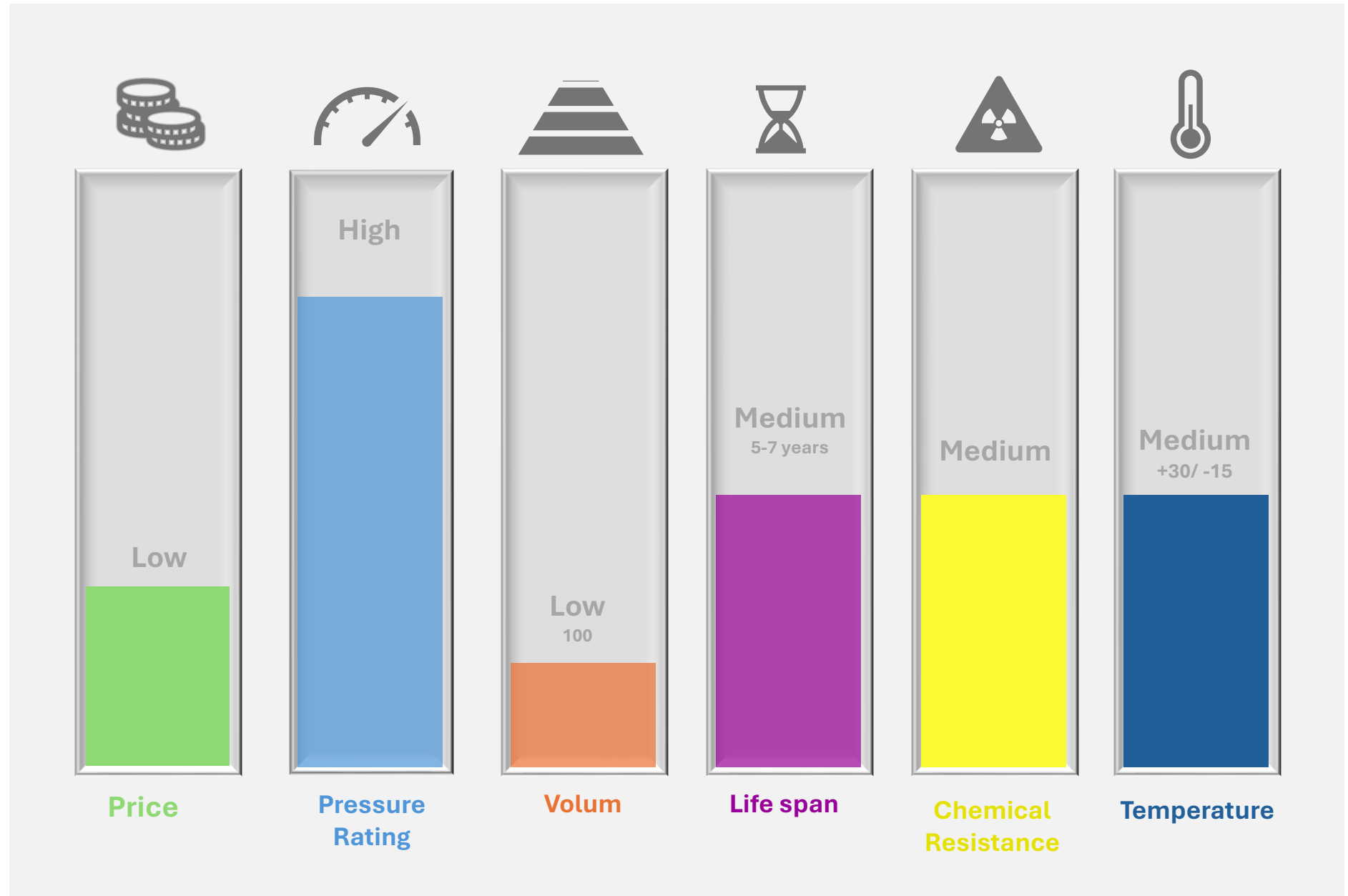
**A barrier  
against the  
environment**



Selection of seal  
solution

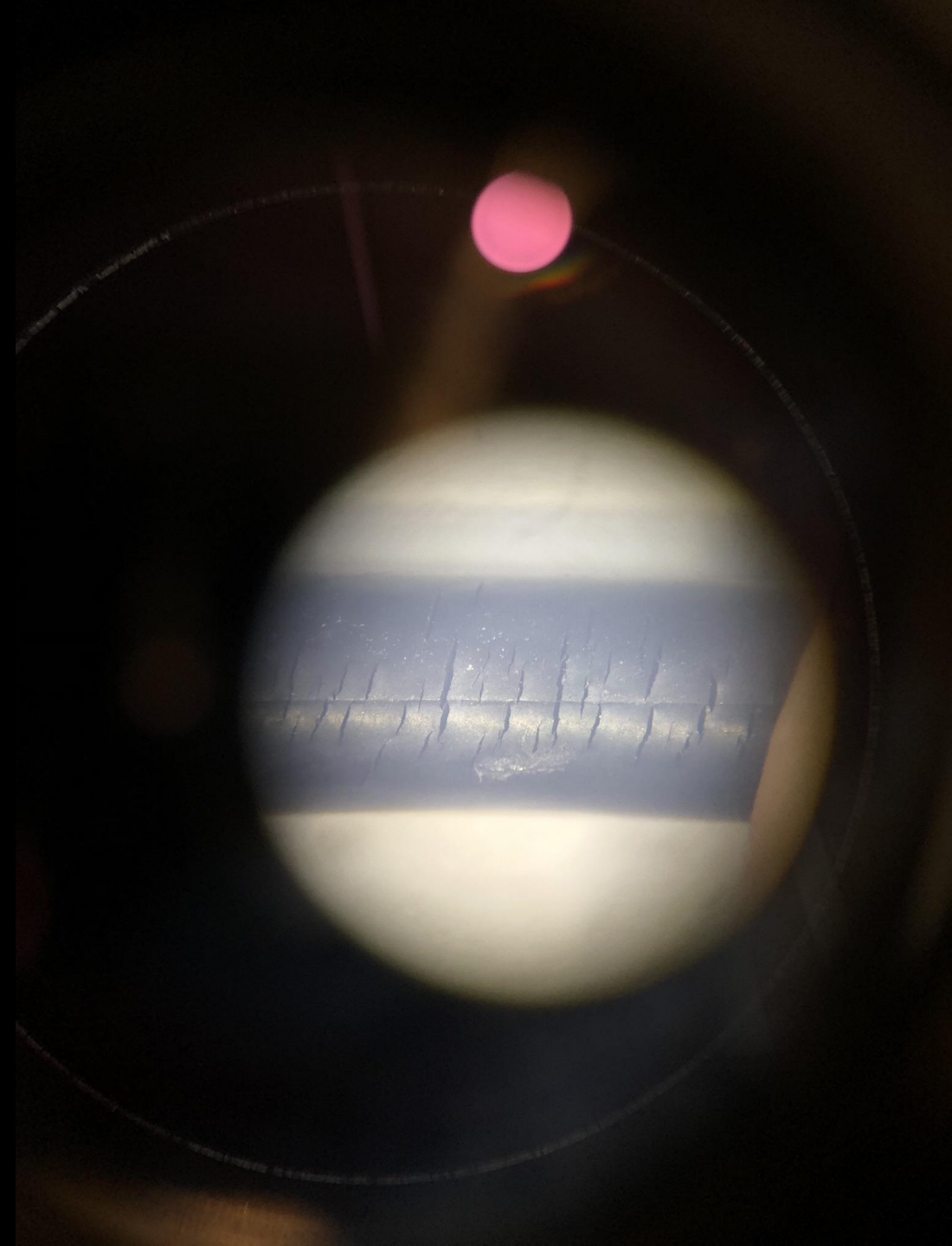


# Balancing Trade-offs in Product Development





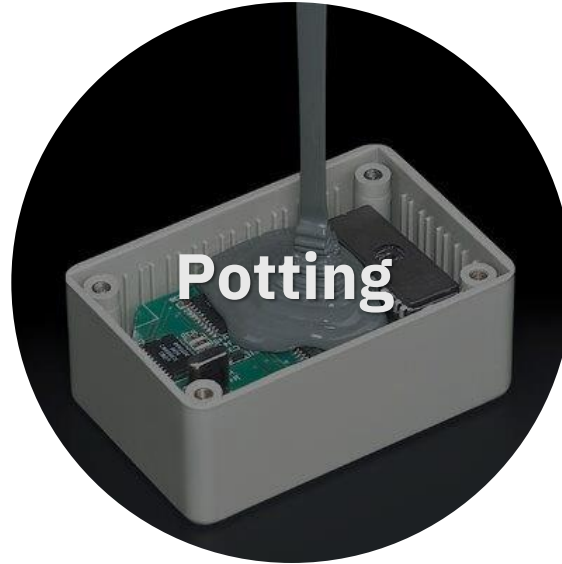
Chemical compability



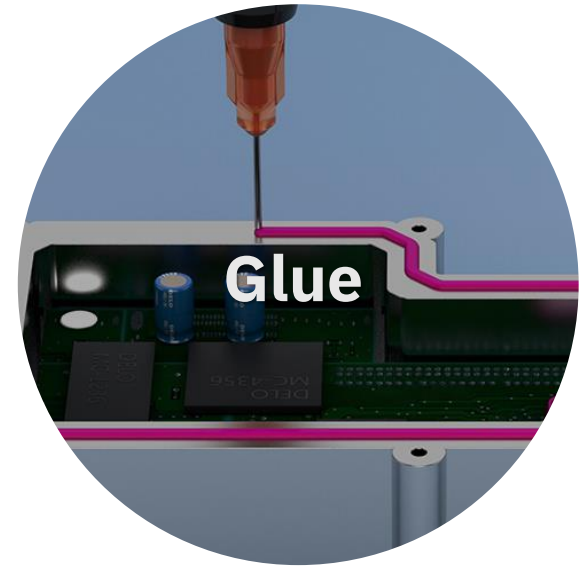




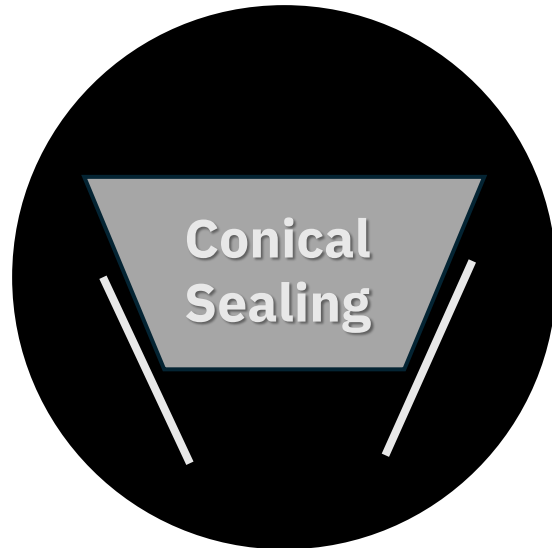
**Welding**



**Potting**



**Glue**



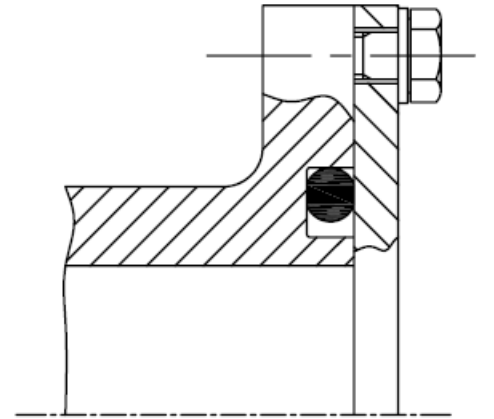
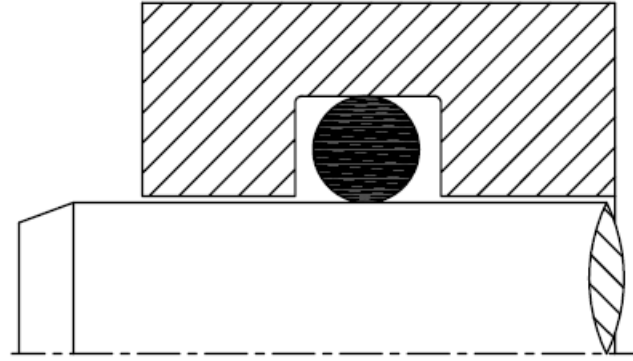
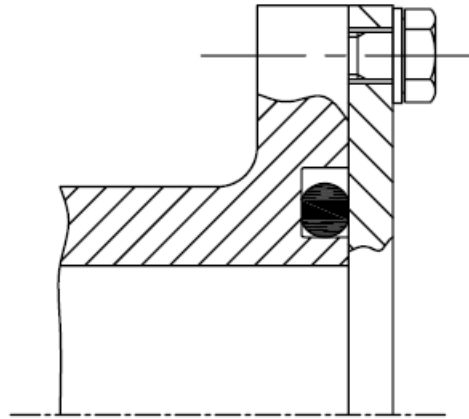
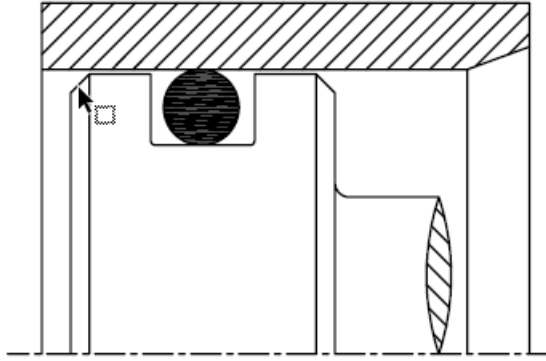
**Conical  
Sealing**



**Gasket  
Sealing**

The image displays a variety of automotive sealings and gaskets. A large, bright red O-ring is the central focus, surrounded by numerous other components in shades of grey and black. These include various sizes of O-rings, gaskets with irregular shapes and holes, and some cylindrical parts. The background is dark and textured, suggesting a collection of these parts.

# Sealings & gaskets



# High level seal calculations

**Fill prosentage:** 60-75% is recommended

$$\%Fill = \frac{O - ring\ cross\ section\ Area}{O - ring\ groove\ Area} * 100$$

**Stretch:** Should be kept under 5%

$$Stretch = \frac{Groove\ OD - O - ring\ nominal\ ID}{O - ring\ nominal\ ID} * 100$$

**Poisson's ratio** (typically 0.5 for most elastomers)

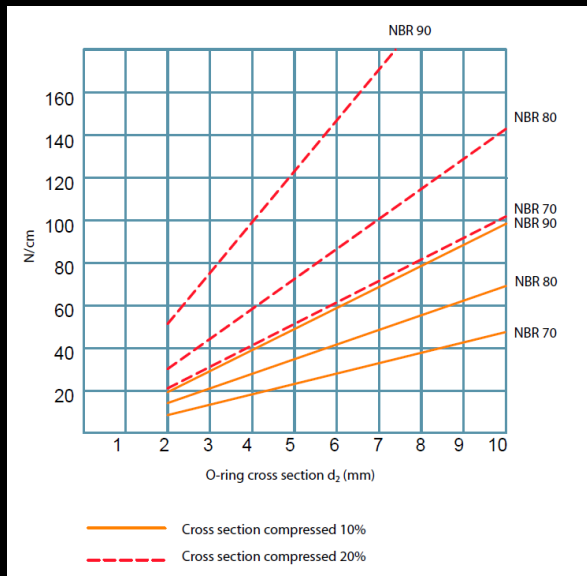
*Percent cross sectional diamter reduction = Stretch \* poision ratio*

**Squeeze (compression)** 15% to 30 % for static applications and 7-25% for dynamic applications

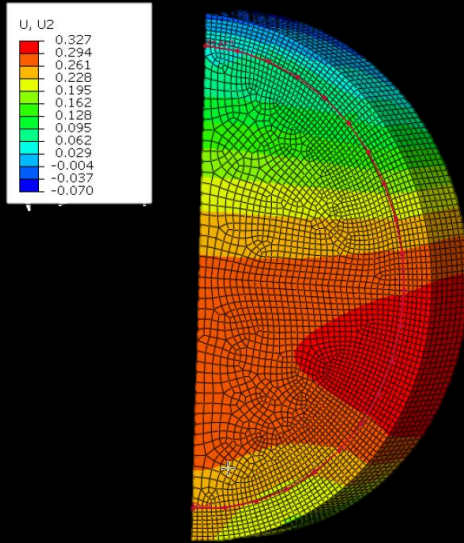
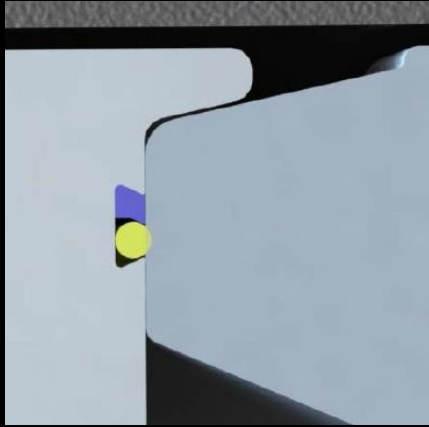
$$MIN\ Squeeze = \frac{Reduced\ o - ring\ cross\ sectional\ dia - Max.\ O - ring\ groove\ height}{Reduced\ o - ring\ cross\ sectional\ dia} * 100$$

$$MAX\ Squeeze = \frac{Reduced\ o - ring\ cross\ sectional\ dia - Min.\ O - ring\ groove\ height}{Reduced\ o - ring\ cross\ sectional\ dia} * 100$$

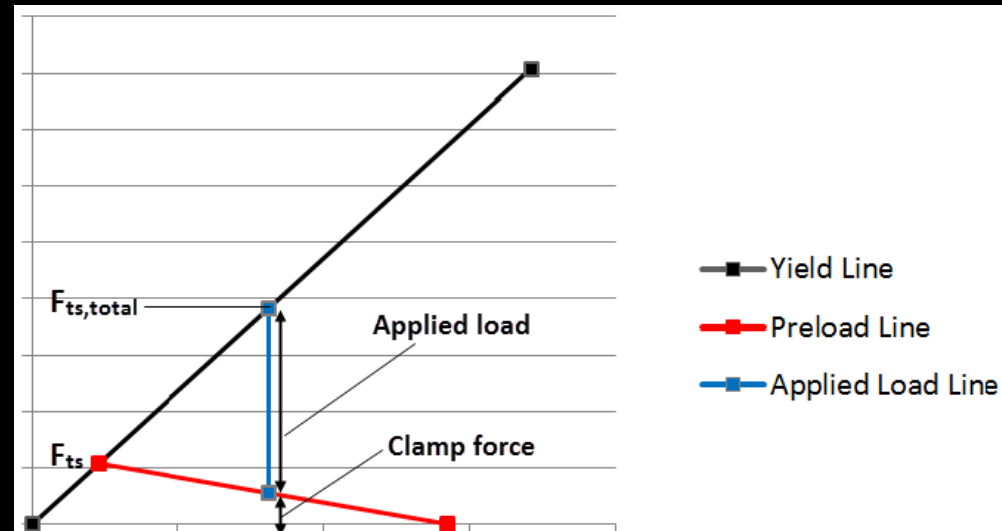
# High level seal calculations



# Seperation – Too much gap results in leak



Separation simulated by FEA

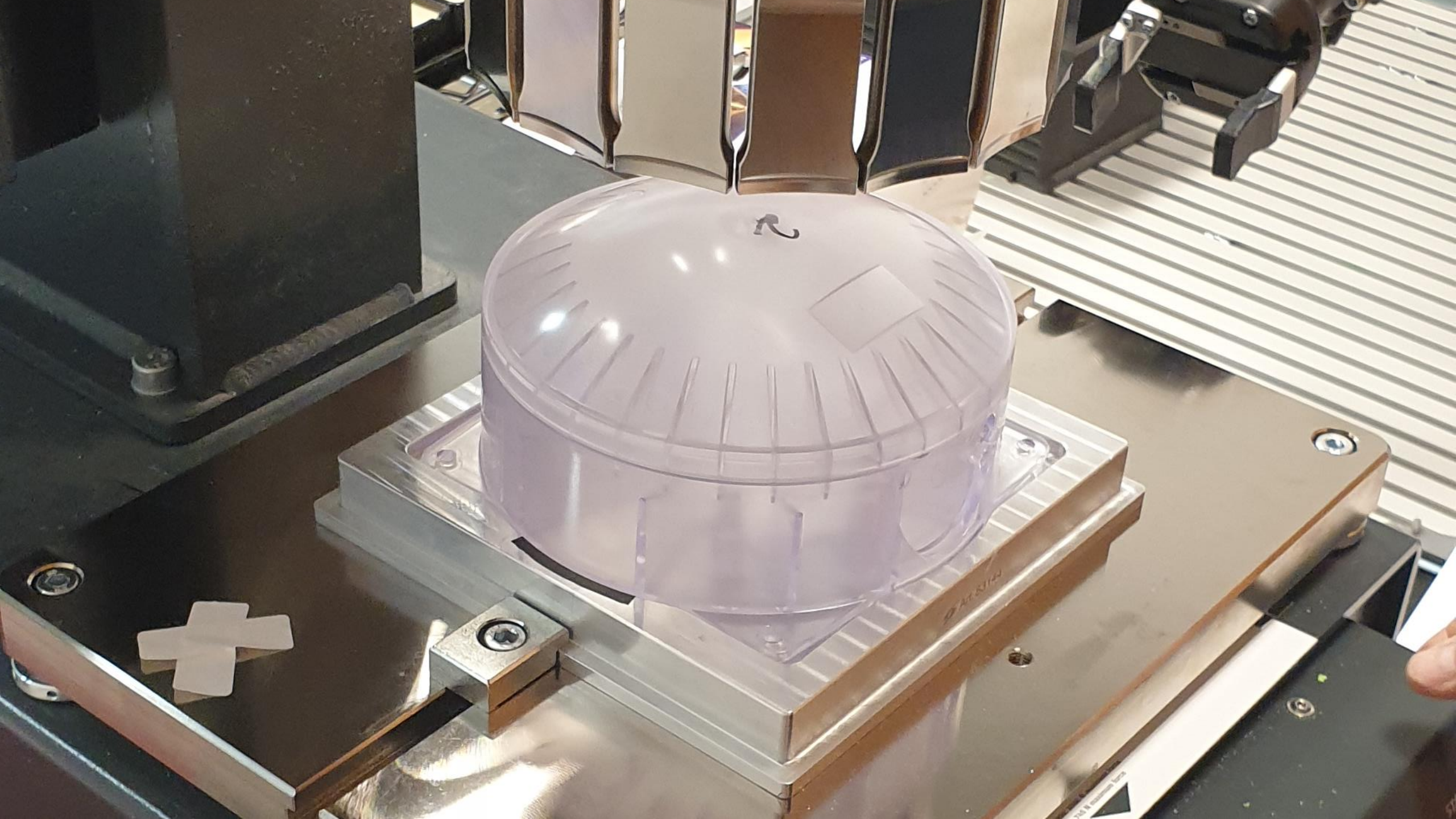


Separation calculated by a bolt load diagram

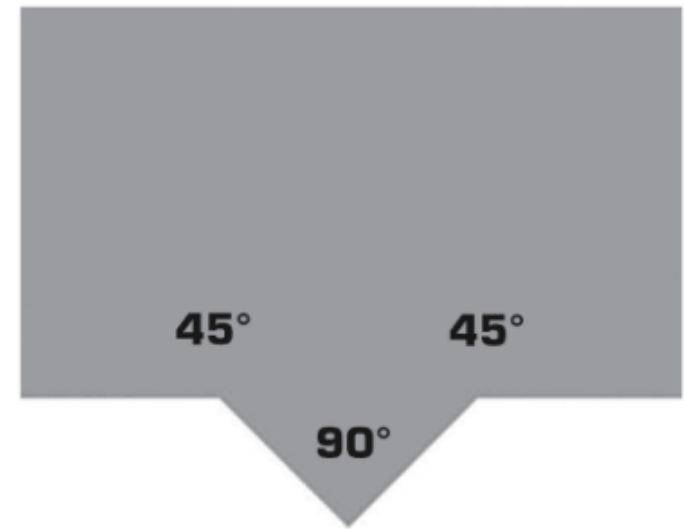
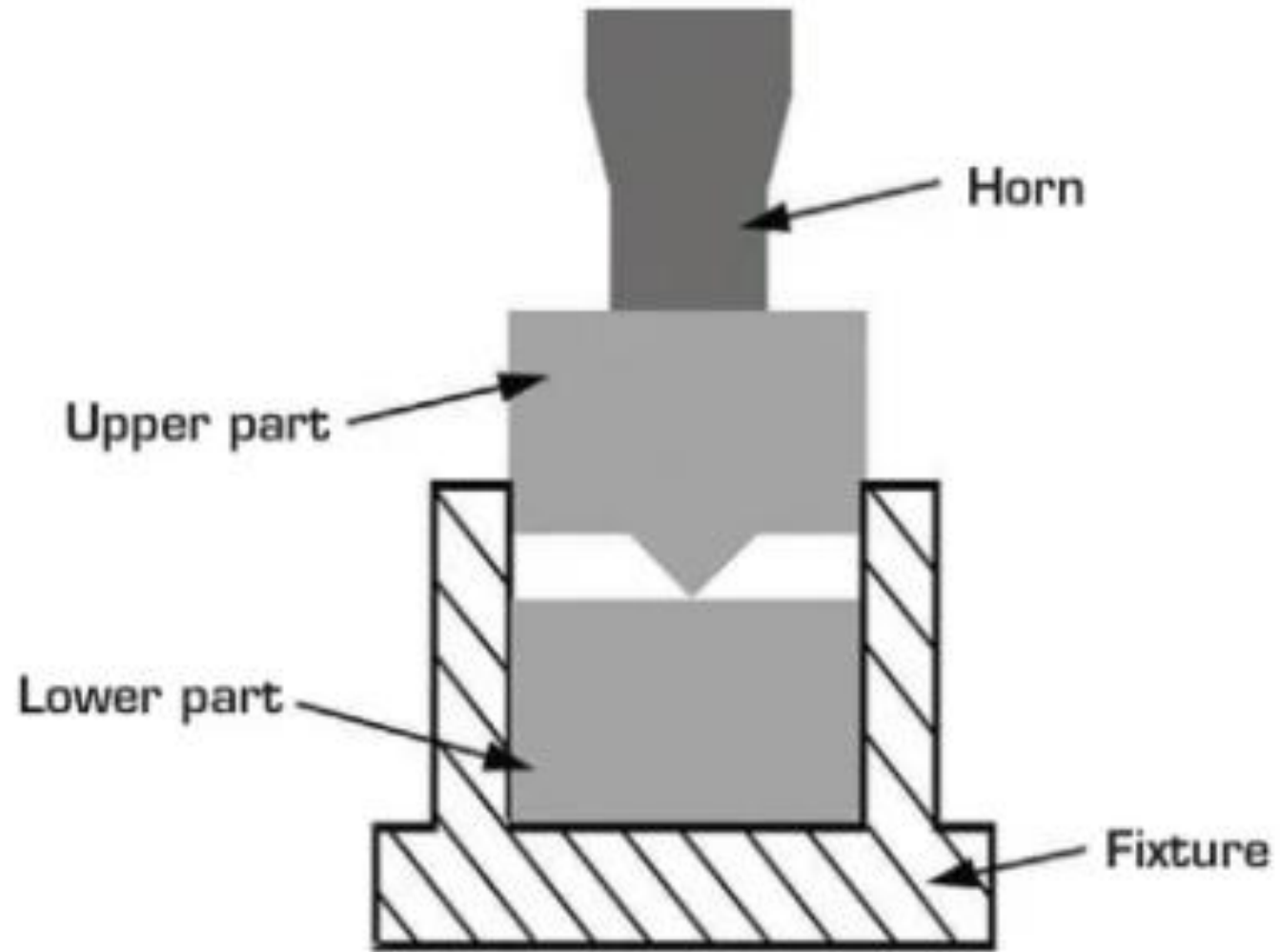




welding



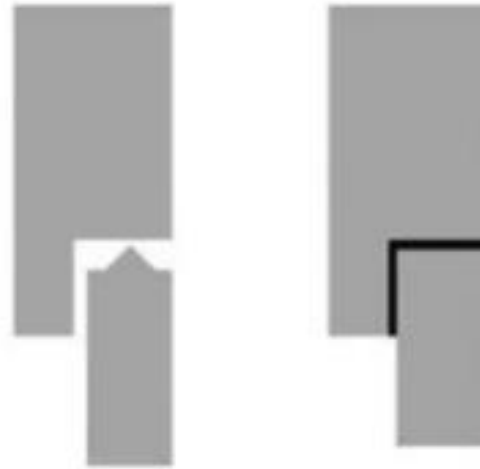
# Ultrasonic welding



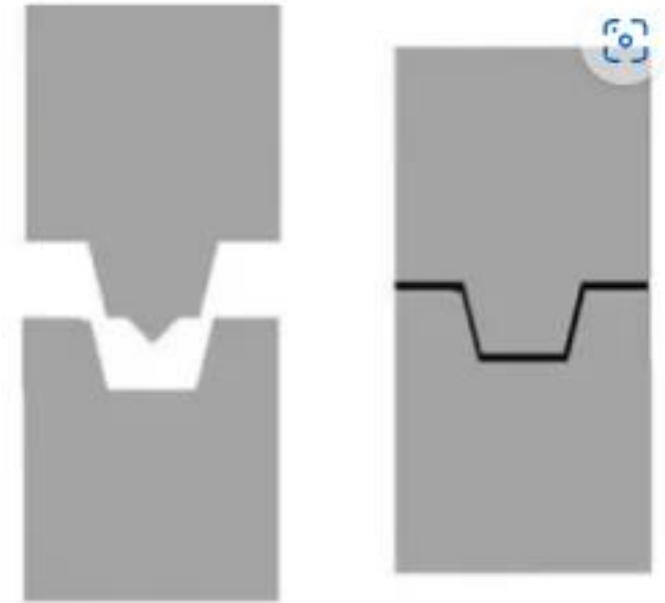
# Ultrasonic welding



A) Butt Joint

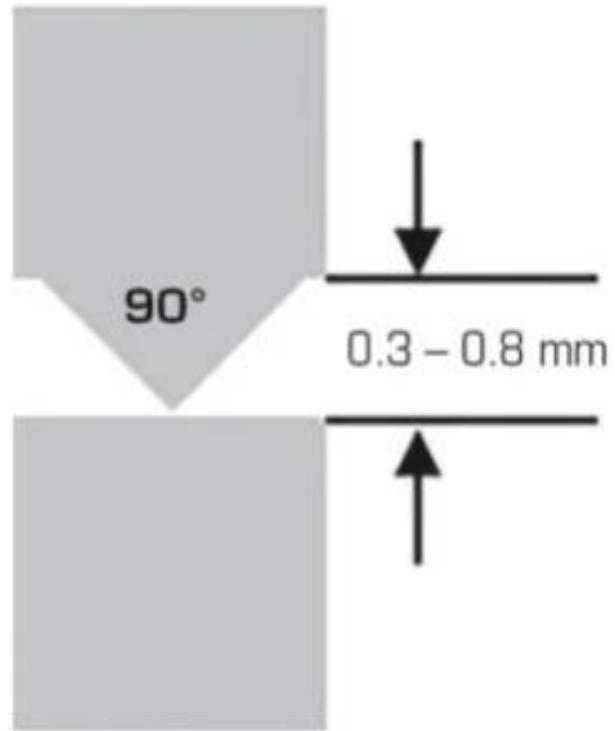


B) Step Joint



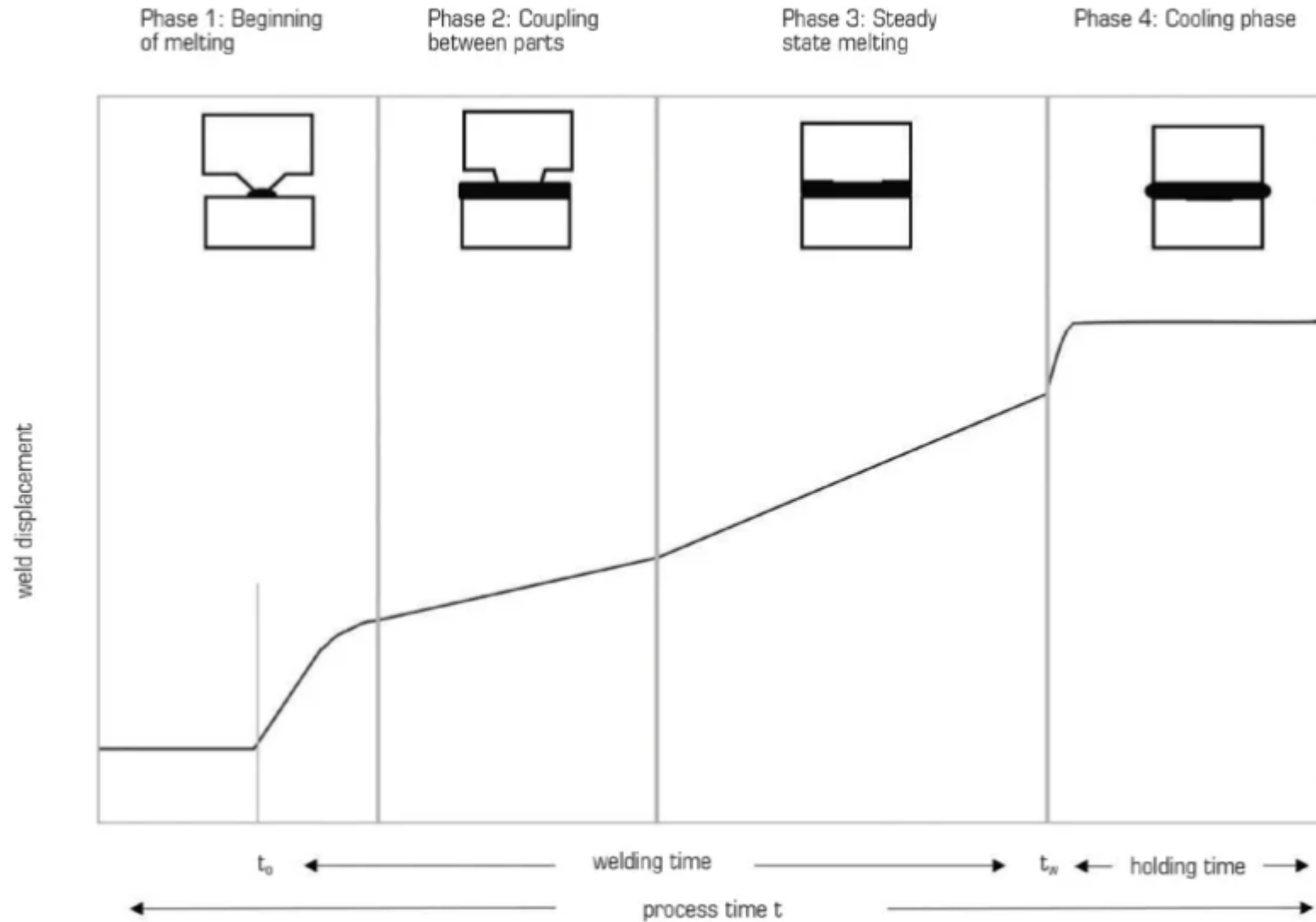
C) Tongue & Groove Joint

# Ultrasonic welding

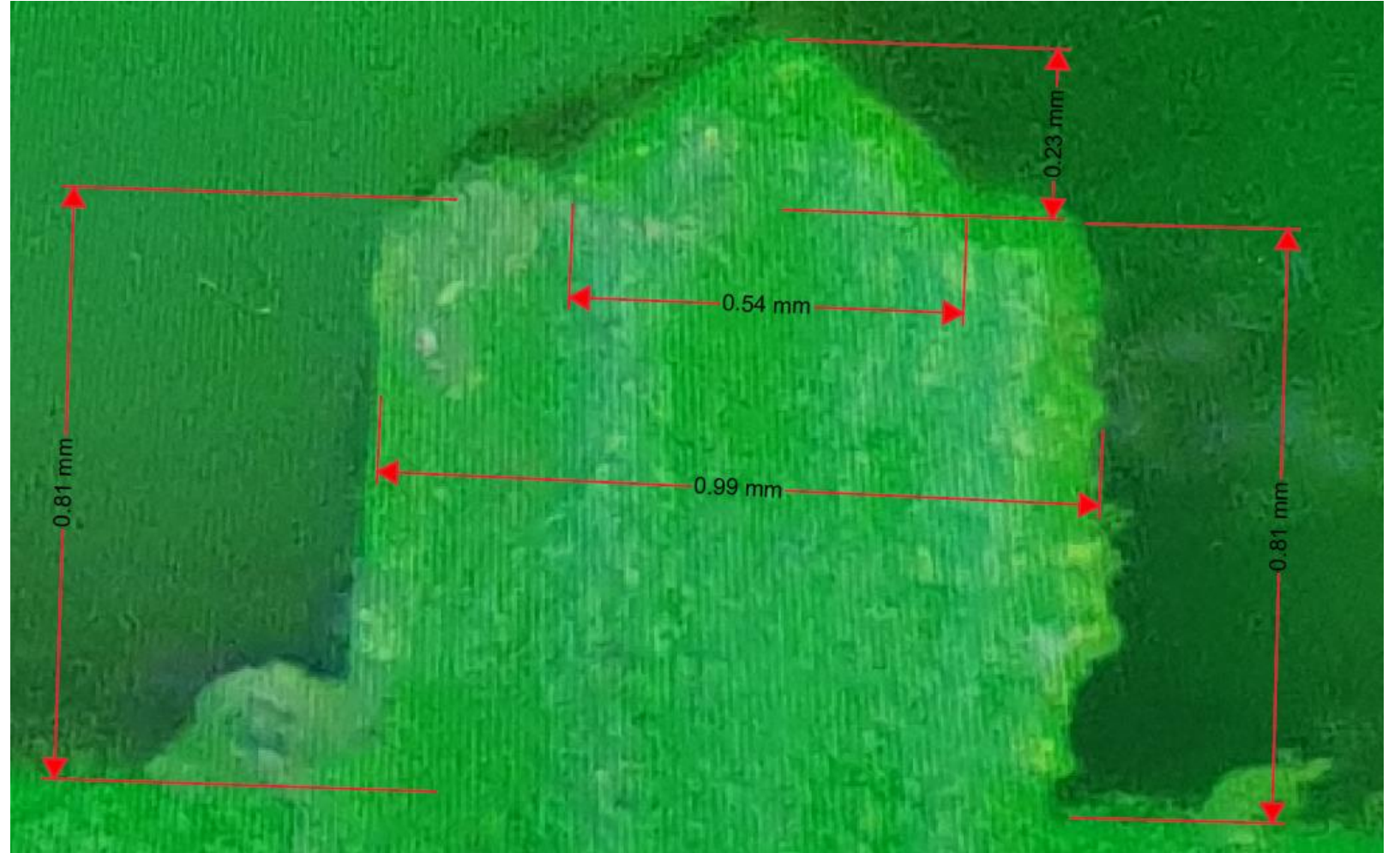
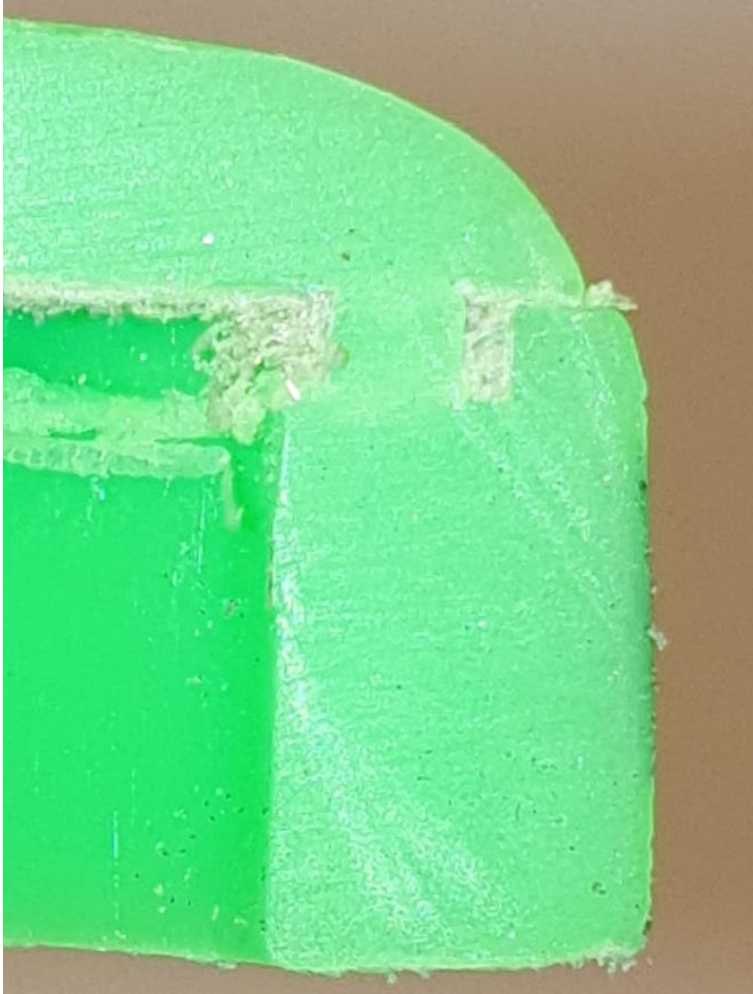


Energy director height [mm]	Energy director width [mm]
0.30	0.006
0.50	1.000
0.60	1.200
0.80	1.600

# Ultrasonic welding



# Ultrasonic welding



# Potting







# Potting mass -Failure & test



The image shows a complex mechanical assembly, likely a watch movement, viewed through a dark, semi-transparent plastic casing. The internal components are intricate, featuring various gears, levers, and plates. The word "Glue" is prominently displayed in the center in a white, sans-serif font. The overall lighting is dim, highlighting the metallic and plastic textures of the parts.

Glue



The image shows two glass vials against a dark background. The vial on the left is partially filled with a clear liquid and has a clear, conical stopper. The vial on the right is empty and has a dark, conical stopper. The text 'Conical seal' is centered over the image in a white, sans-serif font.

Conical seal

