

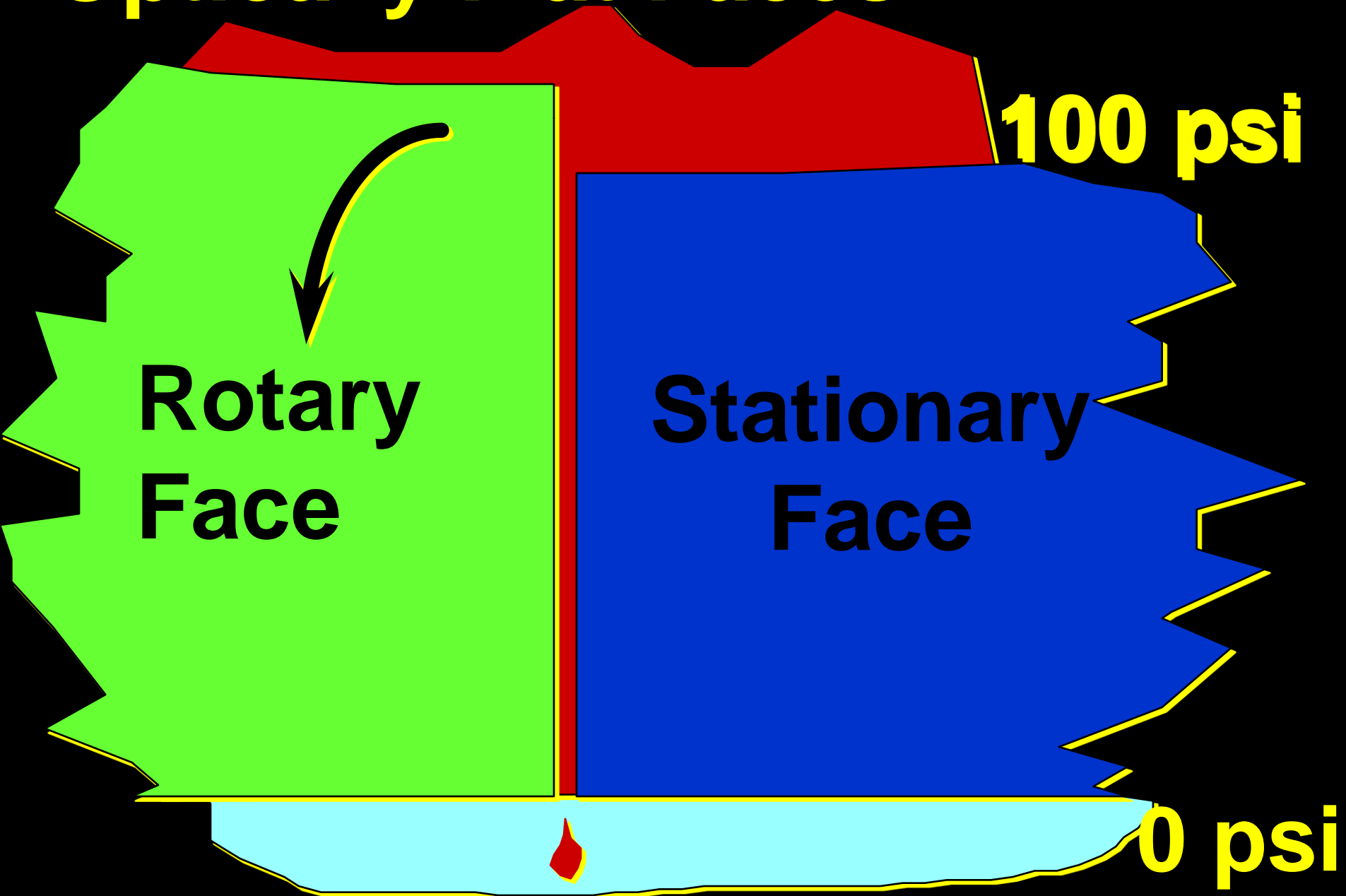
# **SEAL FACE PROPERTIES**

# **FOR A SEAL TO WORK...**

## **FACE FLATNESS**

- **SEAL FACES ARE TO BE FLAT TO ONE LIGHT BAND OF A HELIUM ARC LAMP REFLECTED THROUGH A QUARTZ REFERENCE OPTICAL FLAT**
- **ONE LIGHT BAND = 0.0000116 INCHES**
- **OR 11.6 ONE MILLIONTHS OF AN INCH**

# Optically Flat Faces

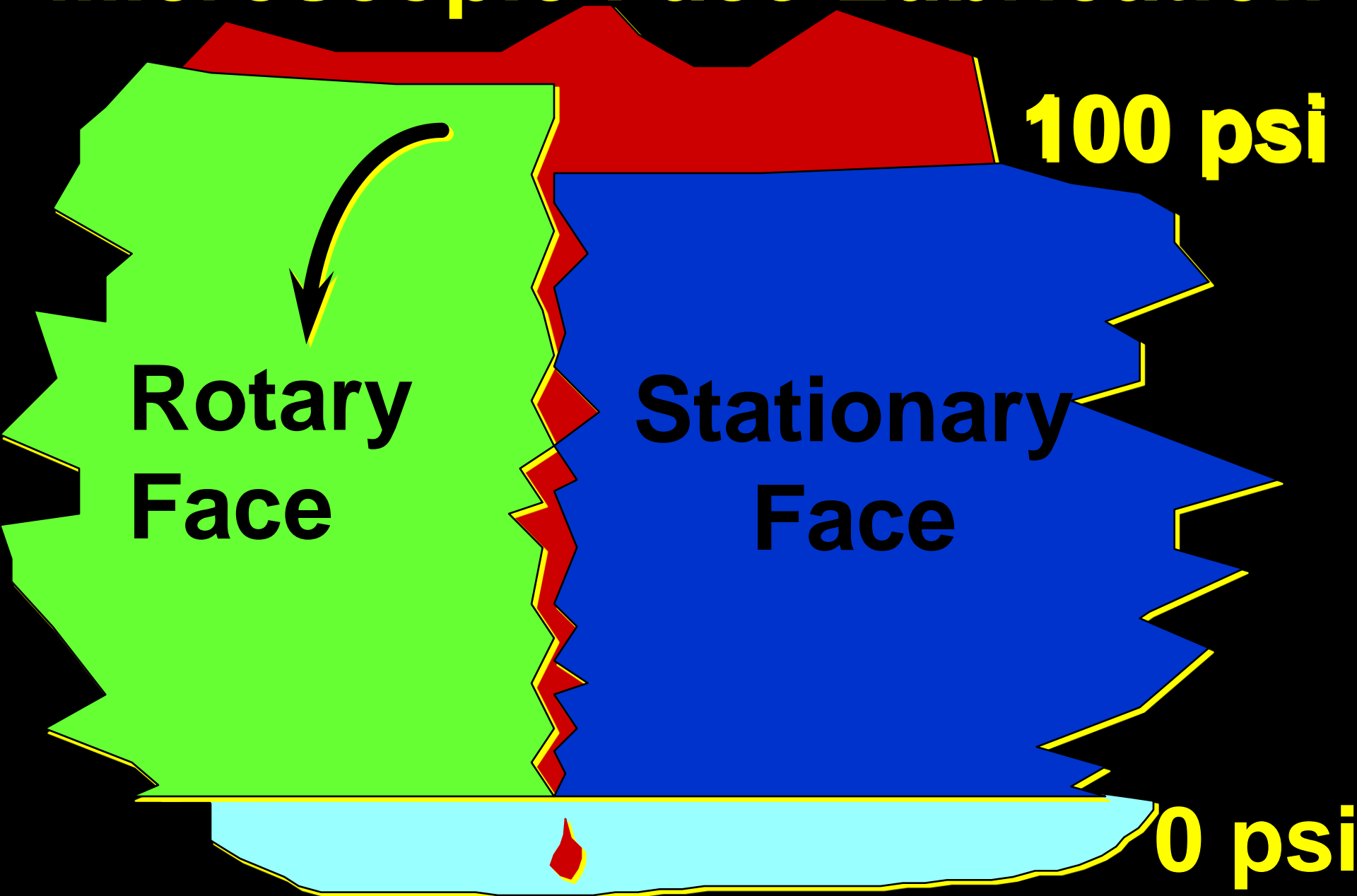


# FOR A SEAL TO WORK...

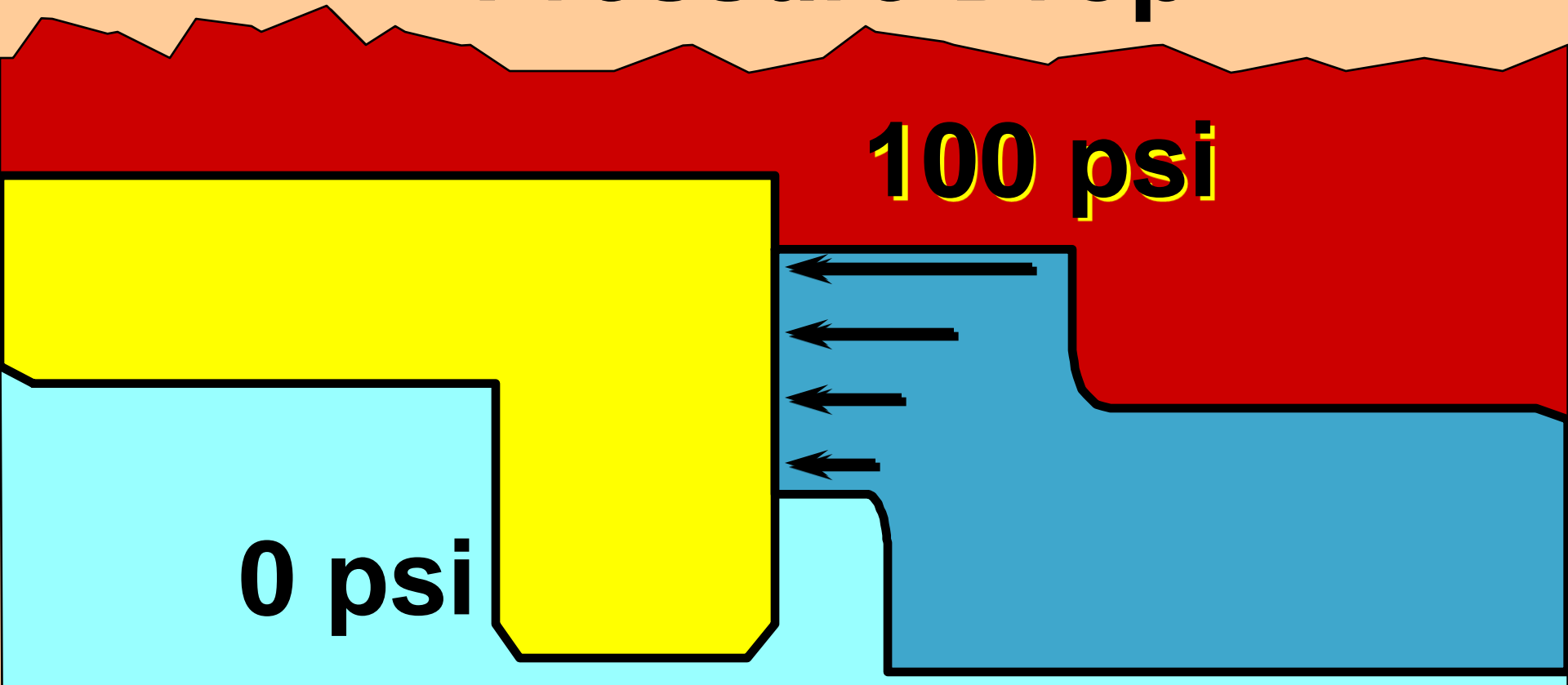
## FACE LUBRICATION

- **BOUNDARY LAYER FILM OF LIQUID FILLS PORES AND IMPERFECTIONS. IT IS PROVIDED BY THE LIQUID IN THE STUFFING BOX.**
- **DRY RUNNING OF A PUMP SEAL FOR ONLY A FEW SECONDS MAY DESTROY IT.**
- **UNLESS IT IS DESIGNED THAT WAY!**

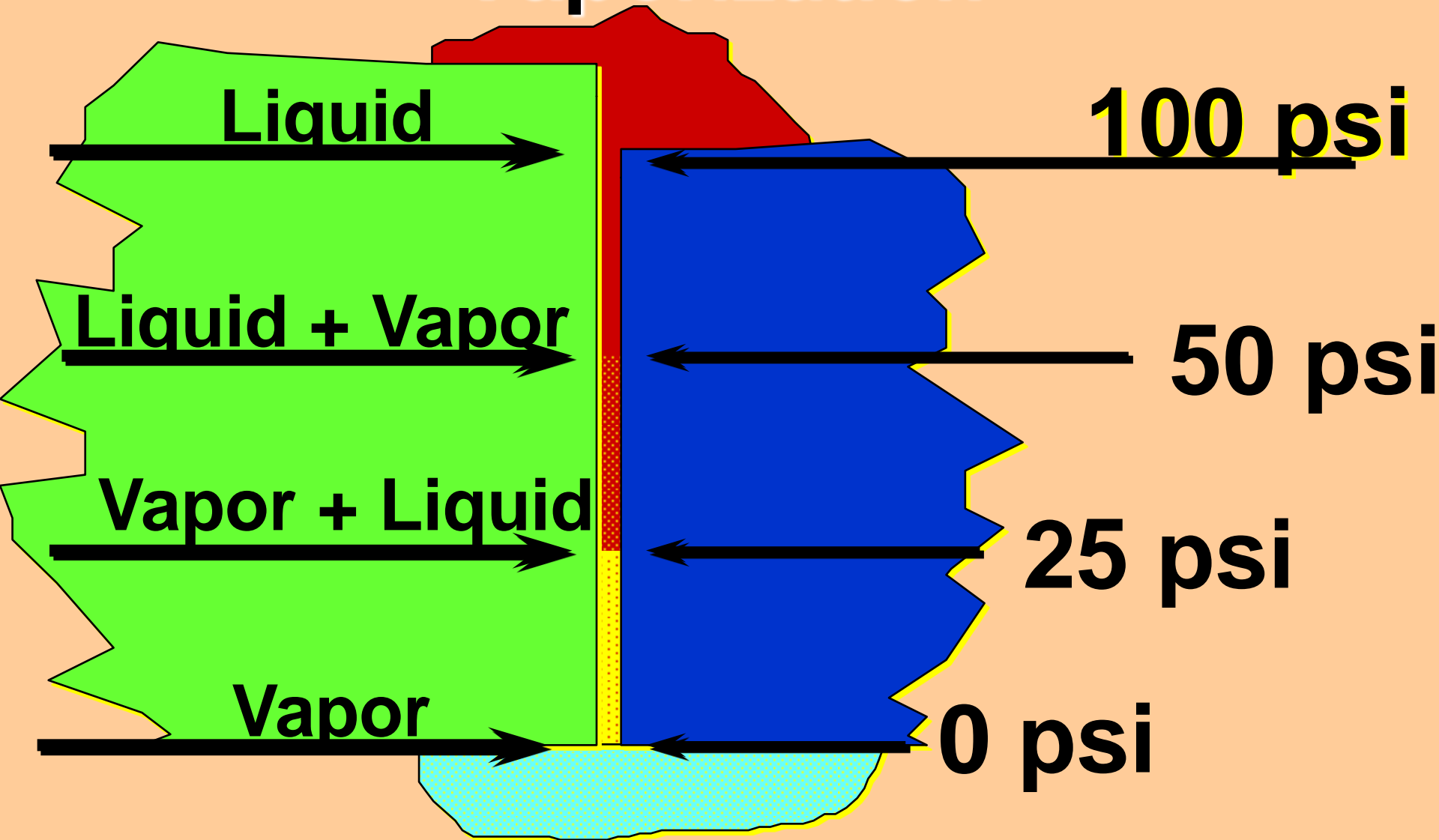
# Microscopic Face Lubrication



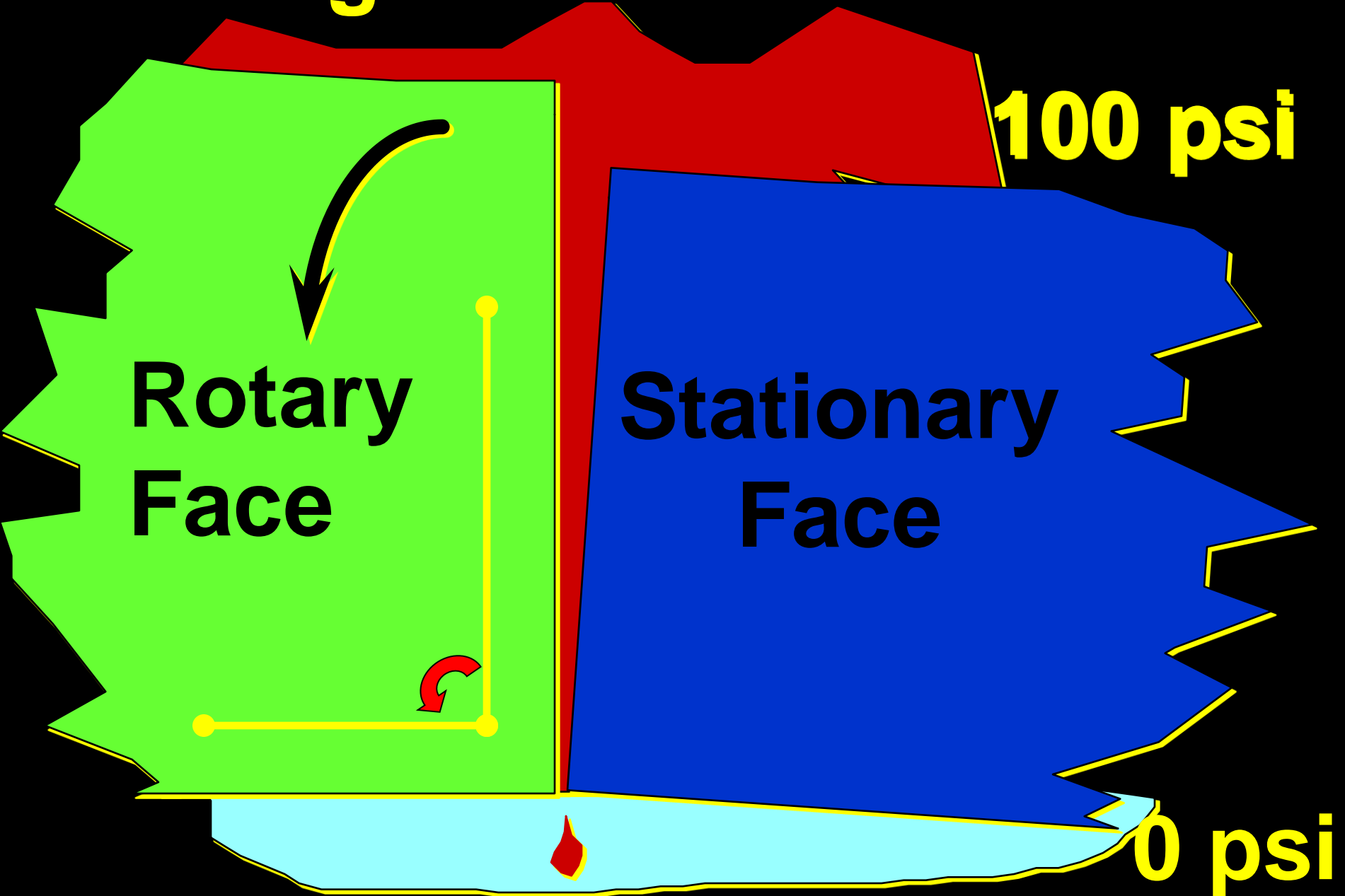
# Pressure Drop



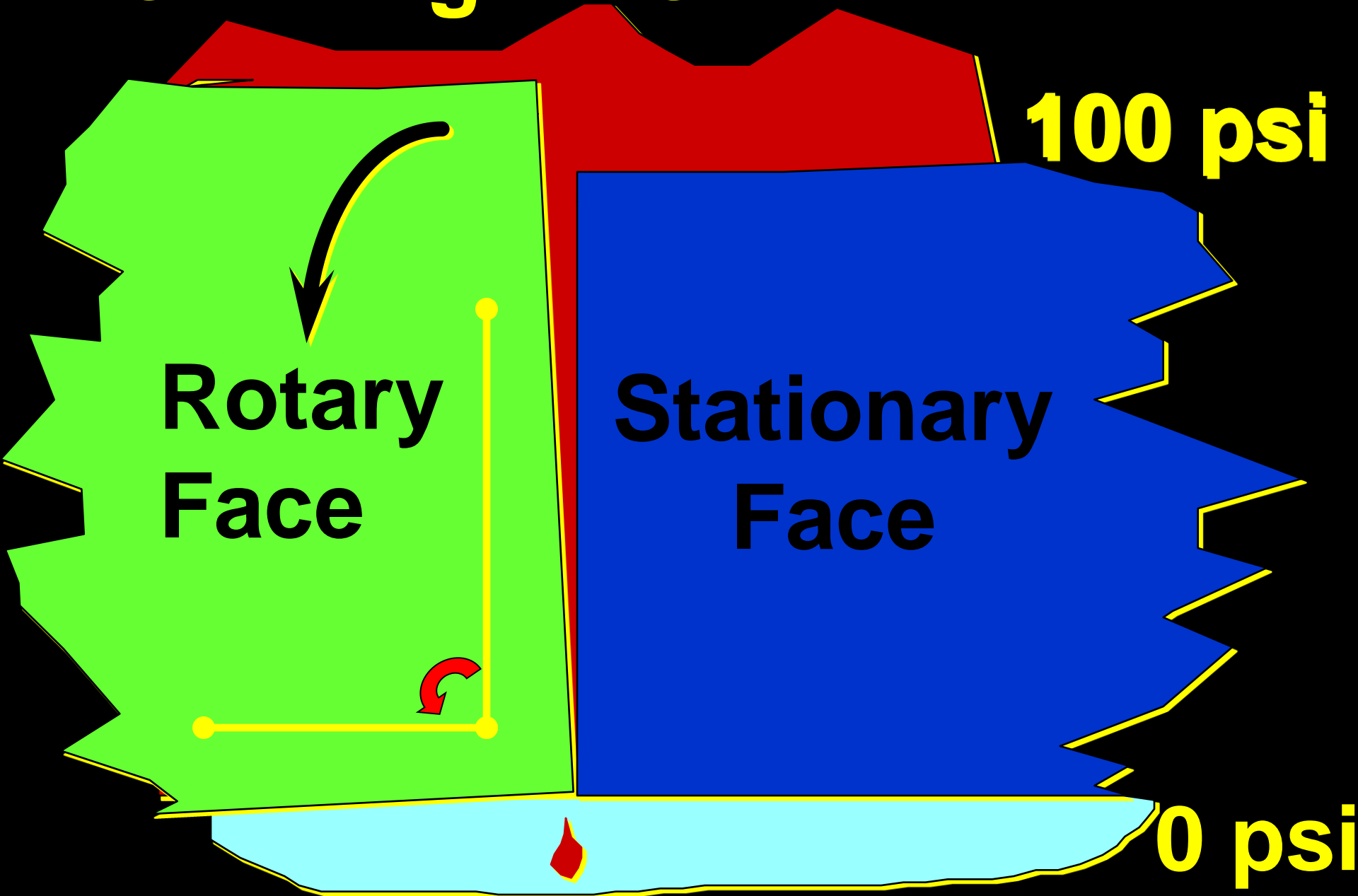
# Pressure Drop & Vaporization



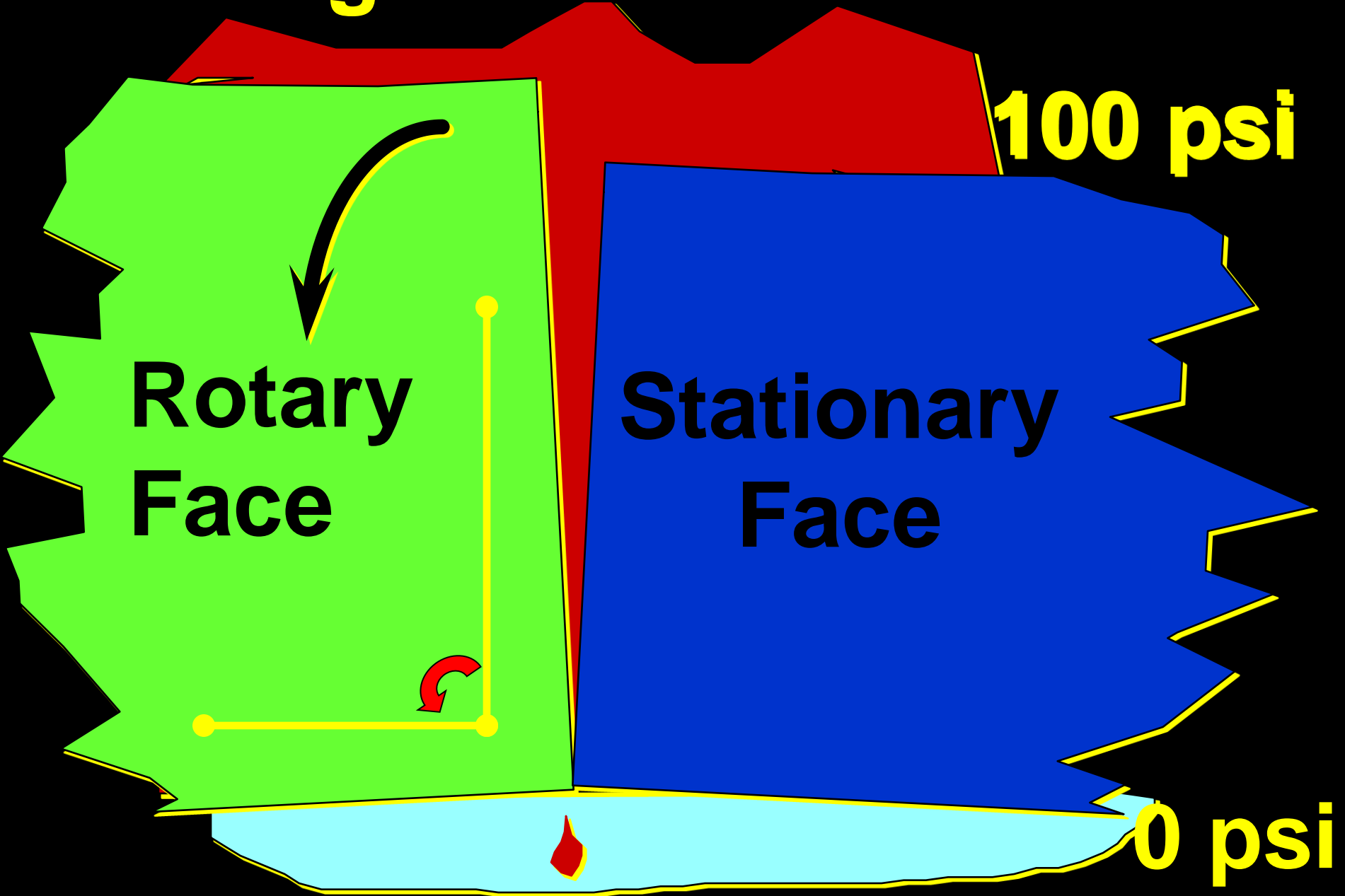
# Convergent Seal Faces



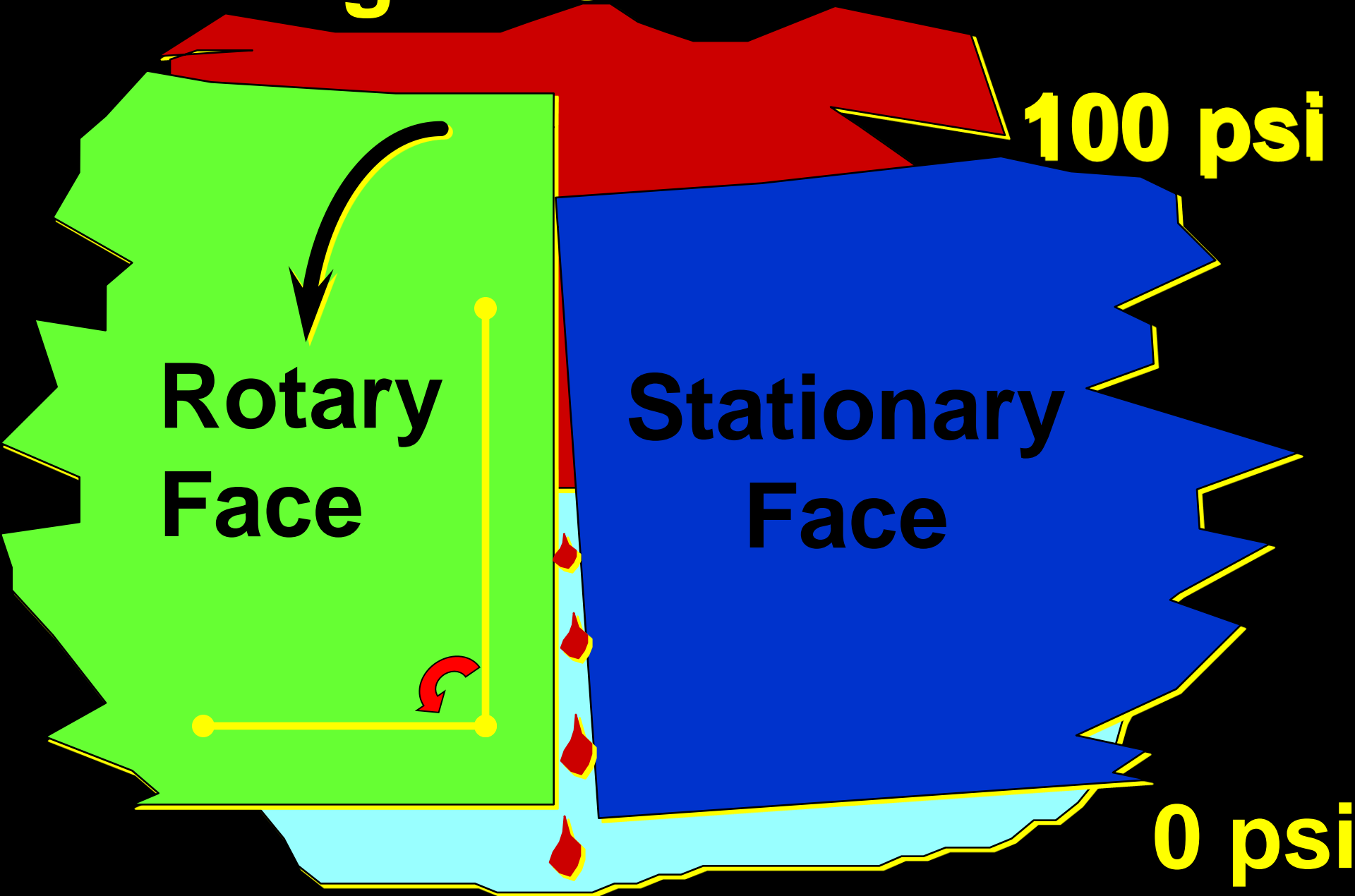
# Convergent Seal Faces



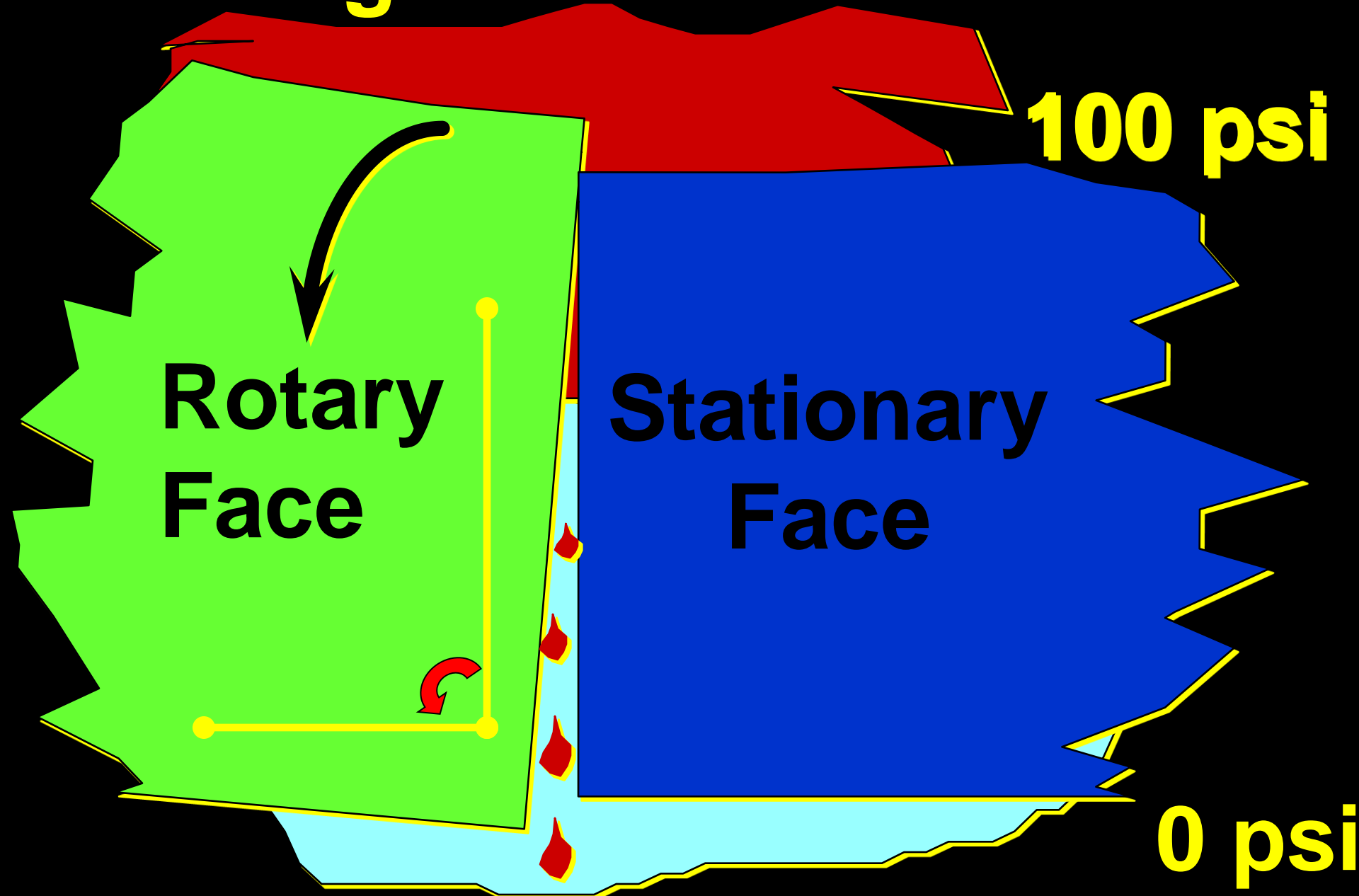
# Convergent Seal Faces



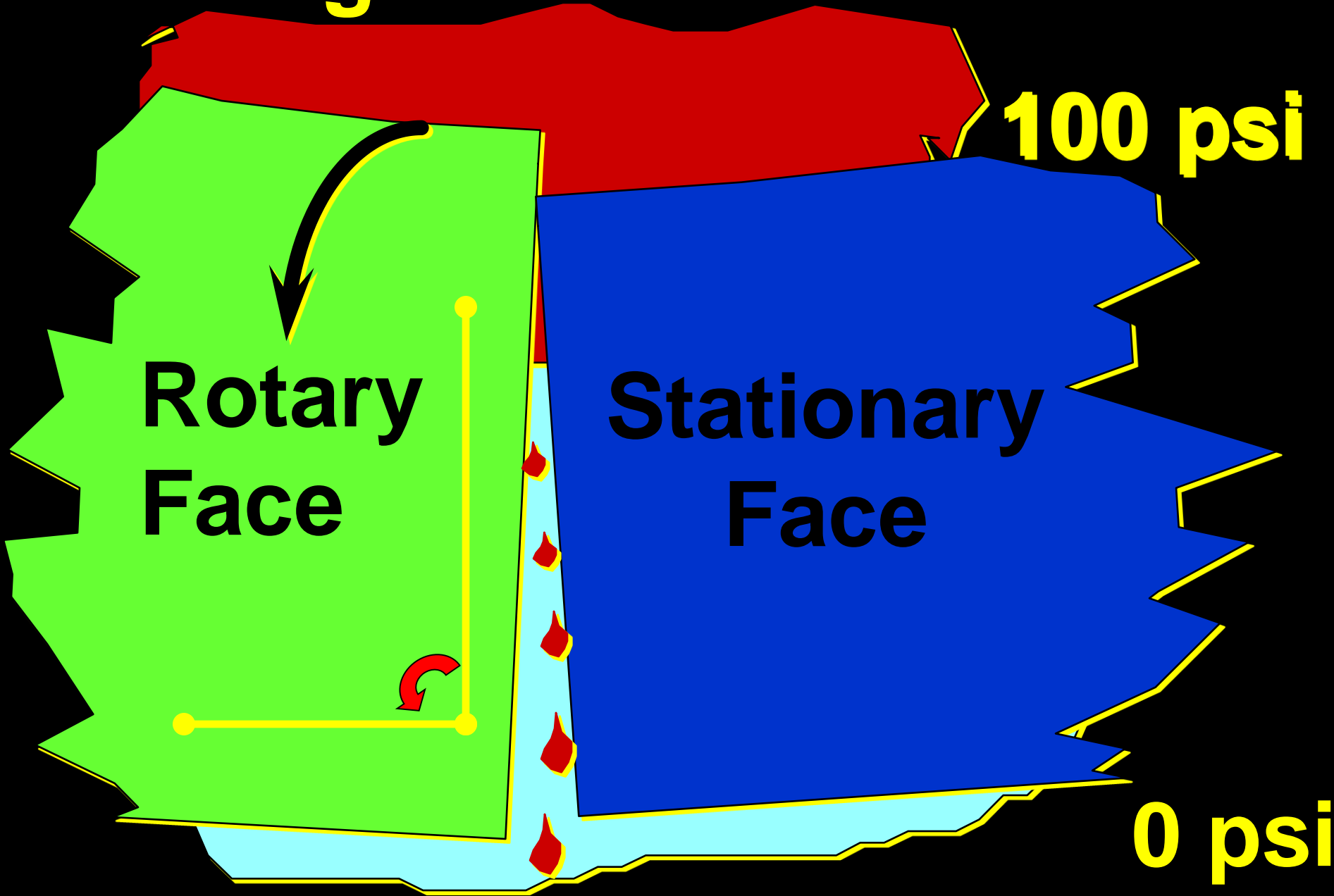
# Divergent Seal Faces



# Divergent Seal Faces



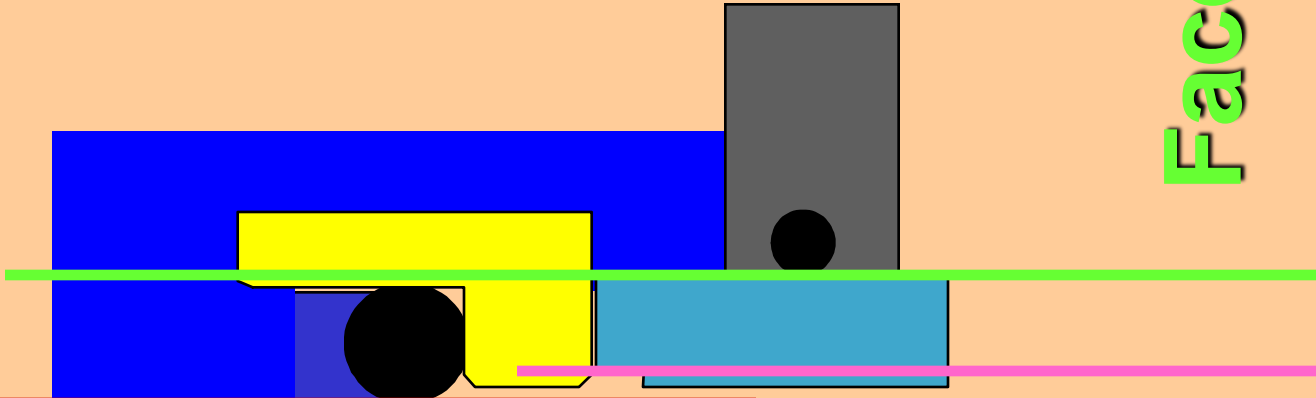
# Divergent Seal Faces



**SEAL BALANCE**

# Unbalanced Seal

Balance Line



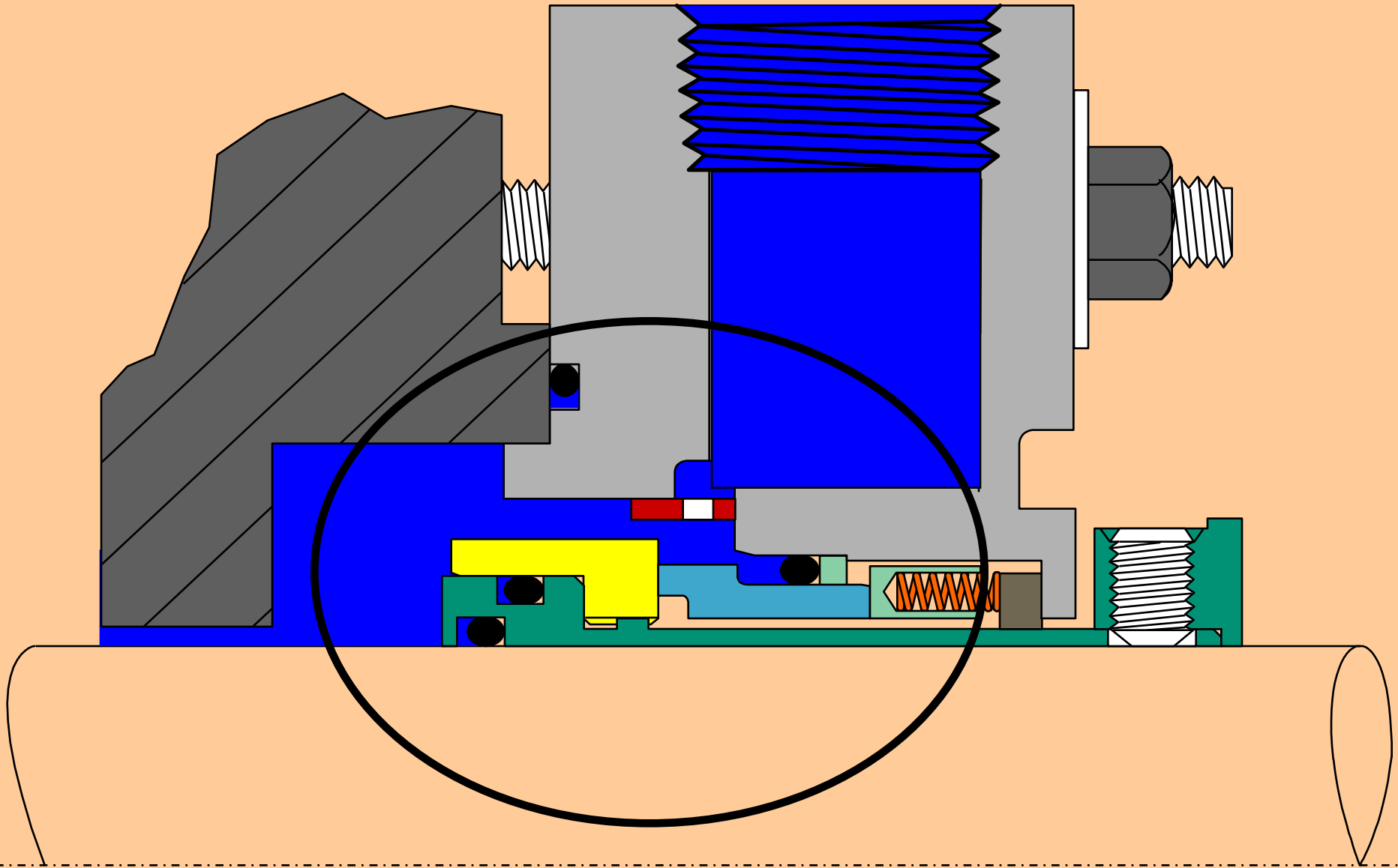
Face OD Line

Face ID Line

# BALANCED VS. NON-BALANCED

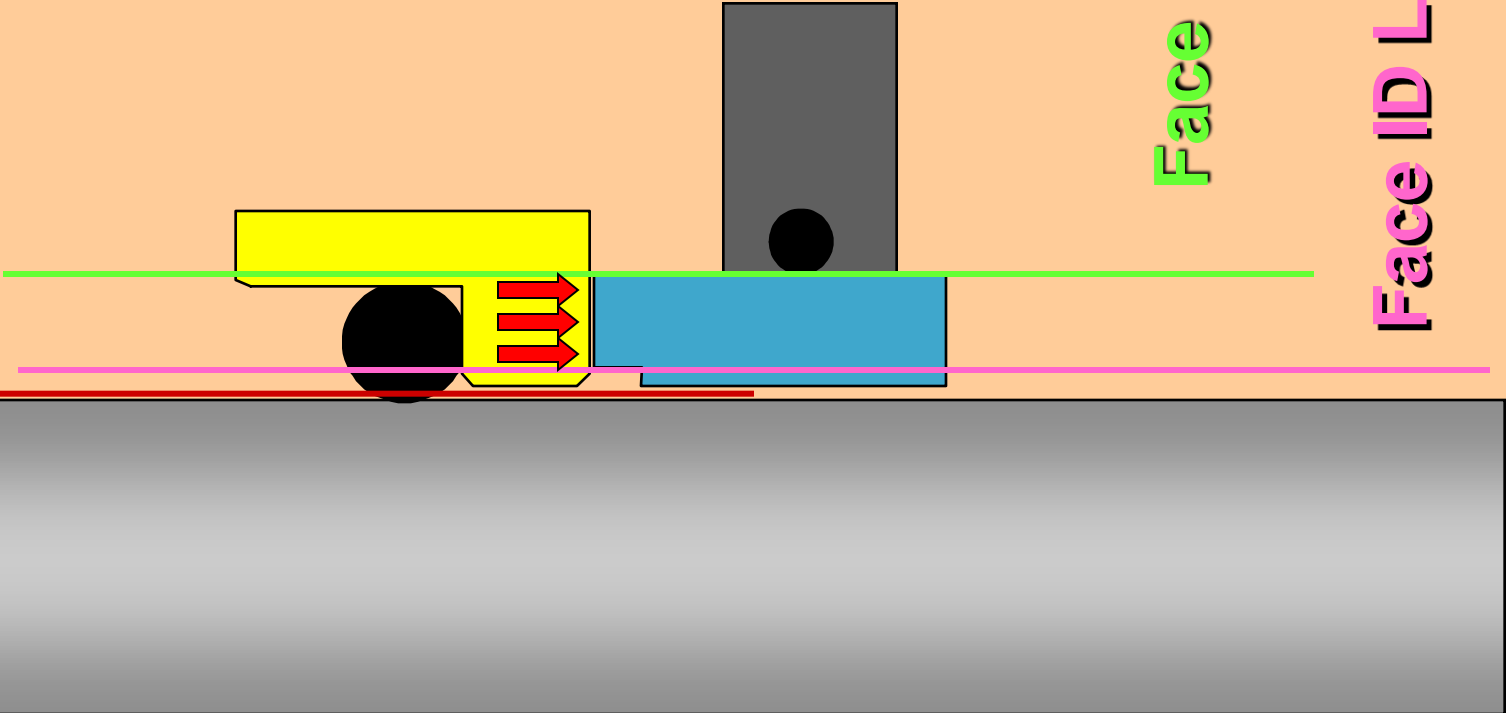
- When speaking of “Balance” in reference to mechanical seals, we are not talking about Mechanical or Rotational Balance. Instead, we are referring to Hydraulic Balance.
- Since mechanical seals are subject to stuffing box pressure, this pressure is utilized to achieve and maintain seal face closure in a non-balanced seal.
- If stuffing box pressure is very high, typically over 100psi., then the closing force may be too great to allow the “Boundary Layer Liquid” that lubricates the faces to be sufficient and the faces will wear prematurely.
- A balanced seal compensates for higher pressures by locating the seal faces such that stuffing box pressure has less effect on face closure.

# Seal Balance



A non-balanced seal has faces located outside the “Balance Diameter” of the seal. Stuffing box pressure is applied to the faces virtually evenly.

**Balance Line**



**Face OD Line**

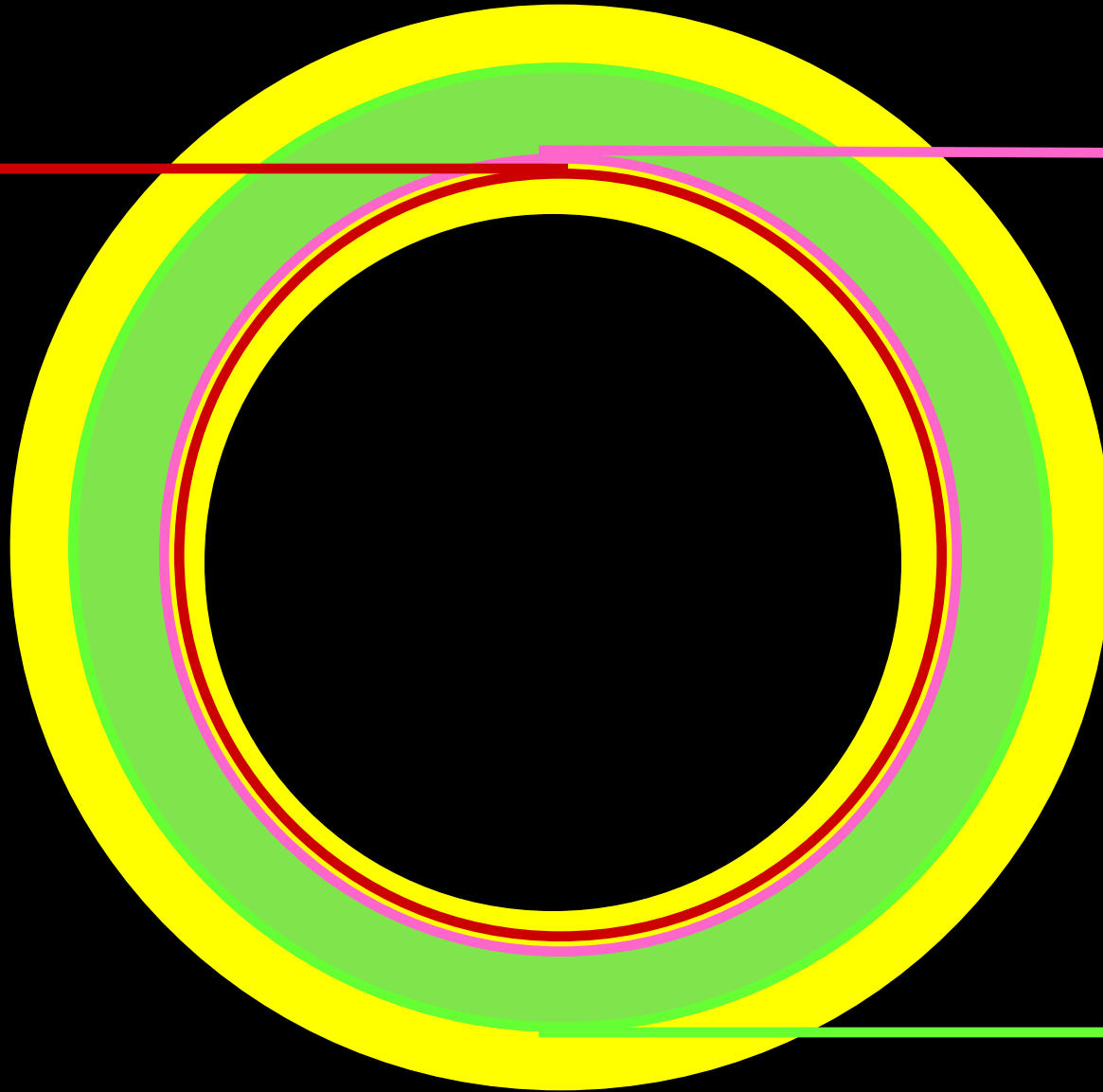
**Face ID Line**

Unbalanced Seal  
Face Areas

Green+Red=Pressure Area

Green+Purple=Face Contact Area

Balance Line



Face ID Line

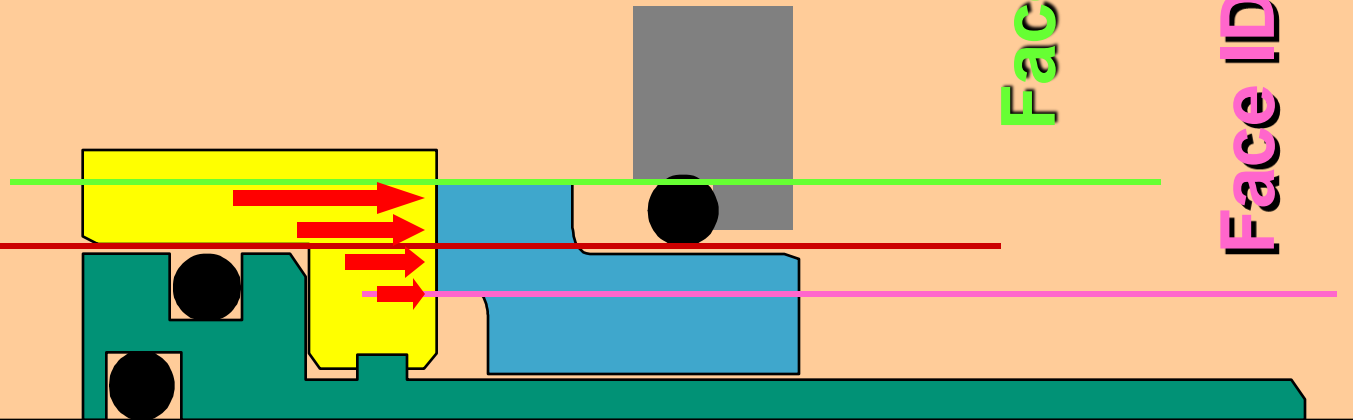
Face OD Line

The faces of a balanced seal are located so that a portion of the face contact occurs inside the balance diameter resulting in reduced closing force due to stuffing box pressure.

**Balance Line**

**Face OD Line**

**Face ID Line**

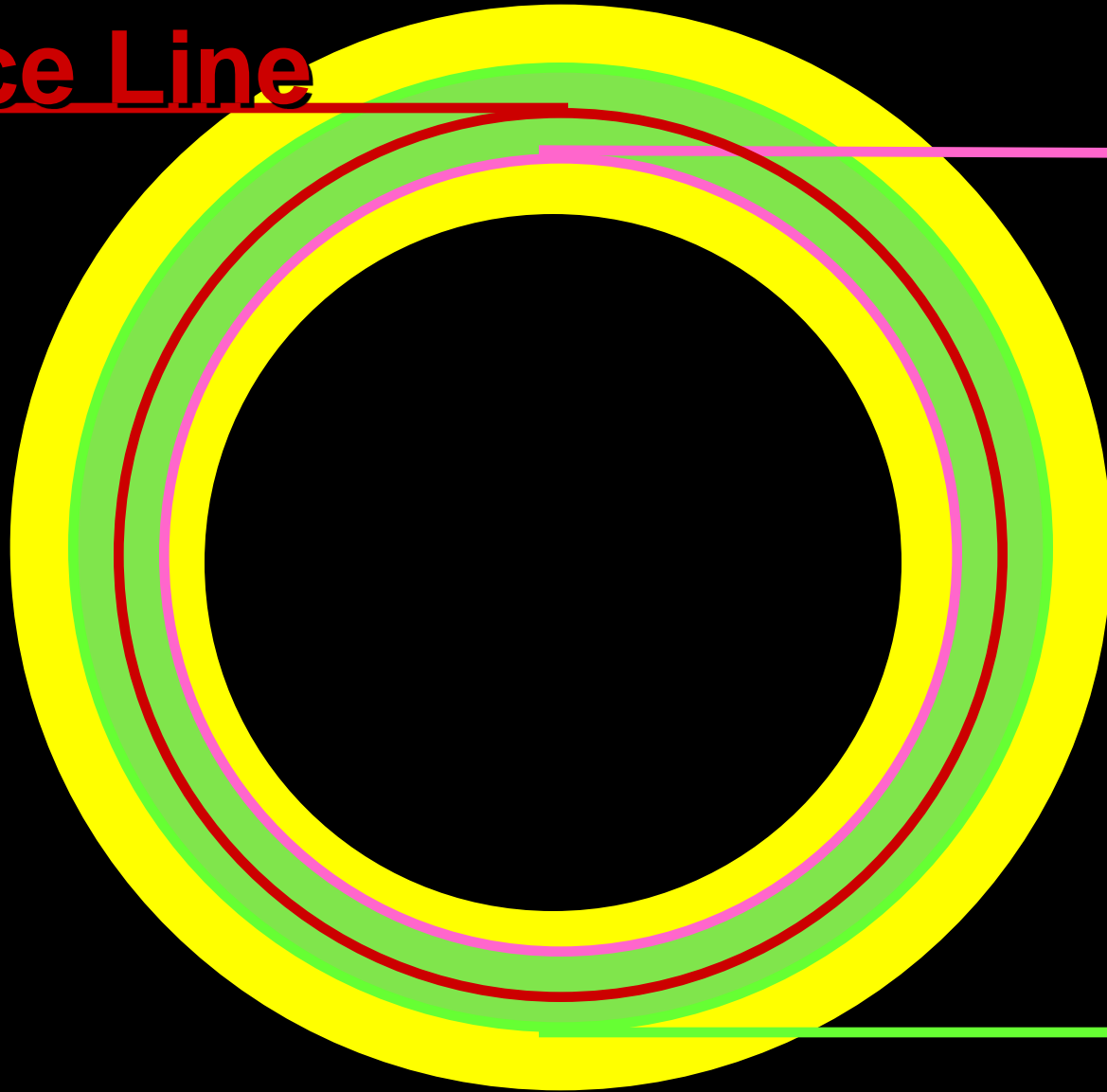


Balanced Seal  
Face Areas

Green+Red=Pressure Area

Red+Purple=Balanced Area

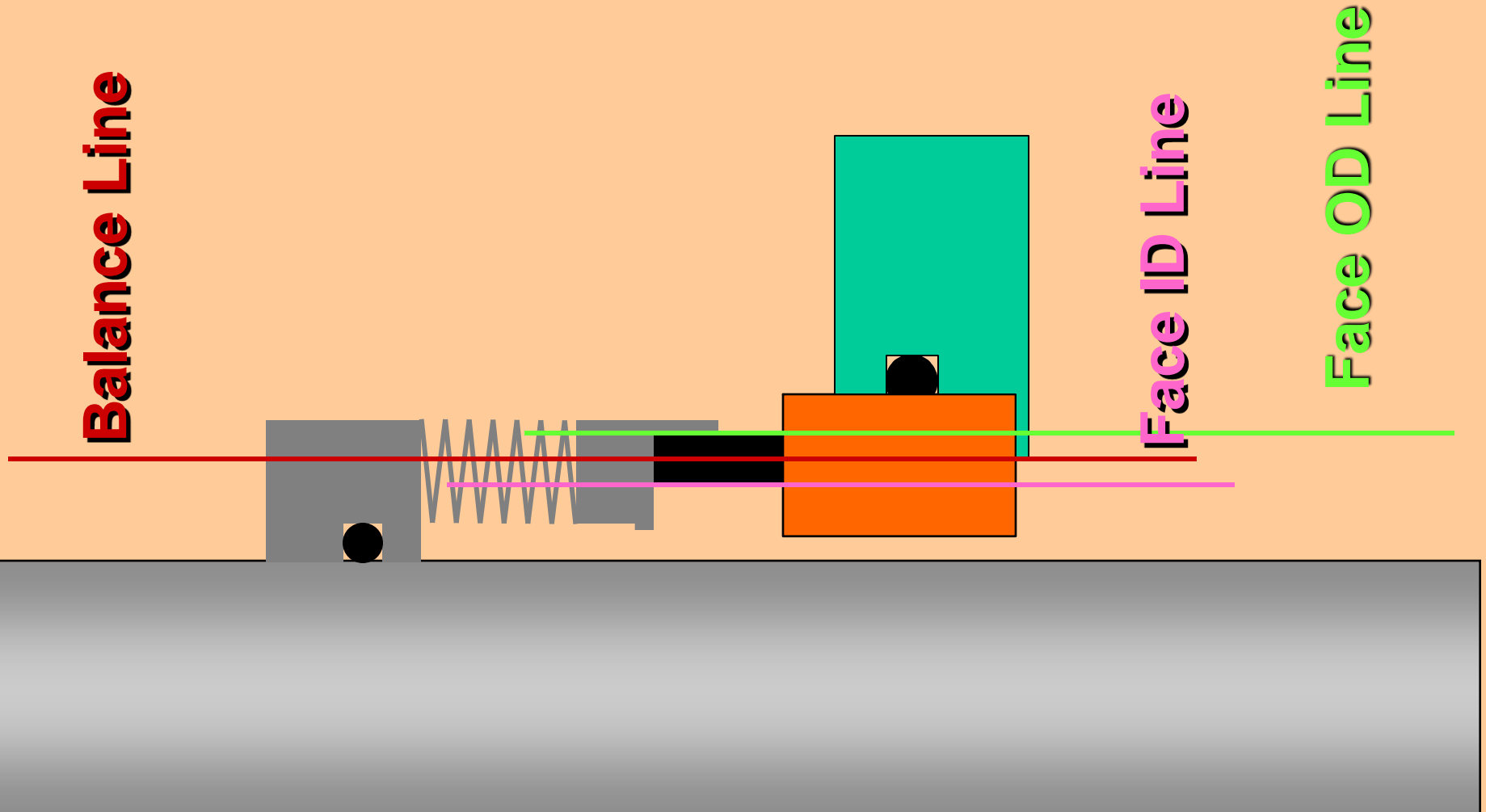
Balance Line



Face ID Line

Face OD Line

Most metal bellows seals are balanced.



**END  
SEAL FACE  
PROPERTIES**