ITP 329

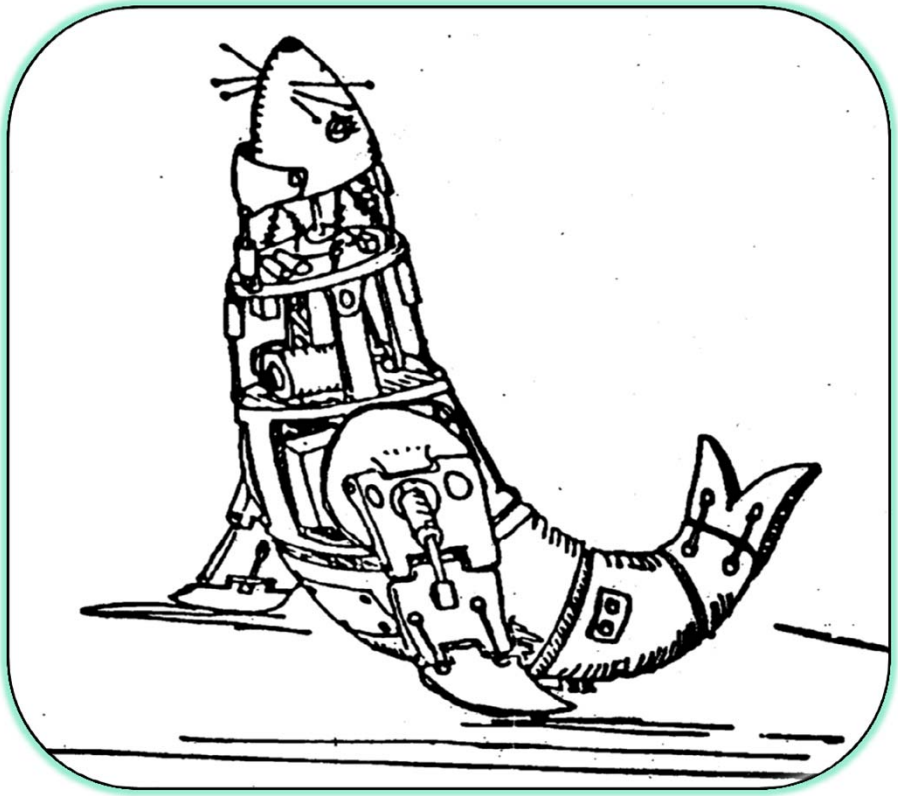
Pump Service And Maintenance

2017

Mechanical Seals

Mechanical Seal Agenda

- **Fluid Sealing Devices**
  - *Packing*
  - *Mechanical Seal*
- **Auxiliary Equipment**
  - *Cartridge Filter*
  - *Sediment Separator*
  - *Heat Exchanger*
  - *Seal Configuration*
- **Seal Life**
  - *Key Factors*
  - *Corrosion*



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Fluid Sealing Devices

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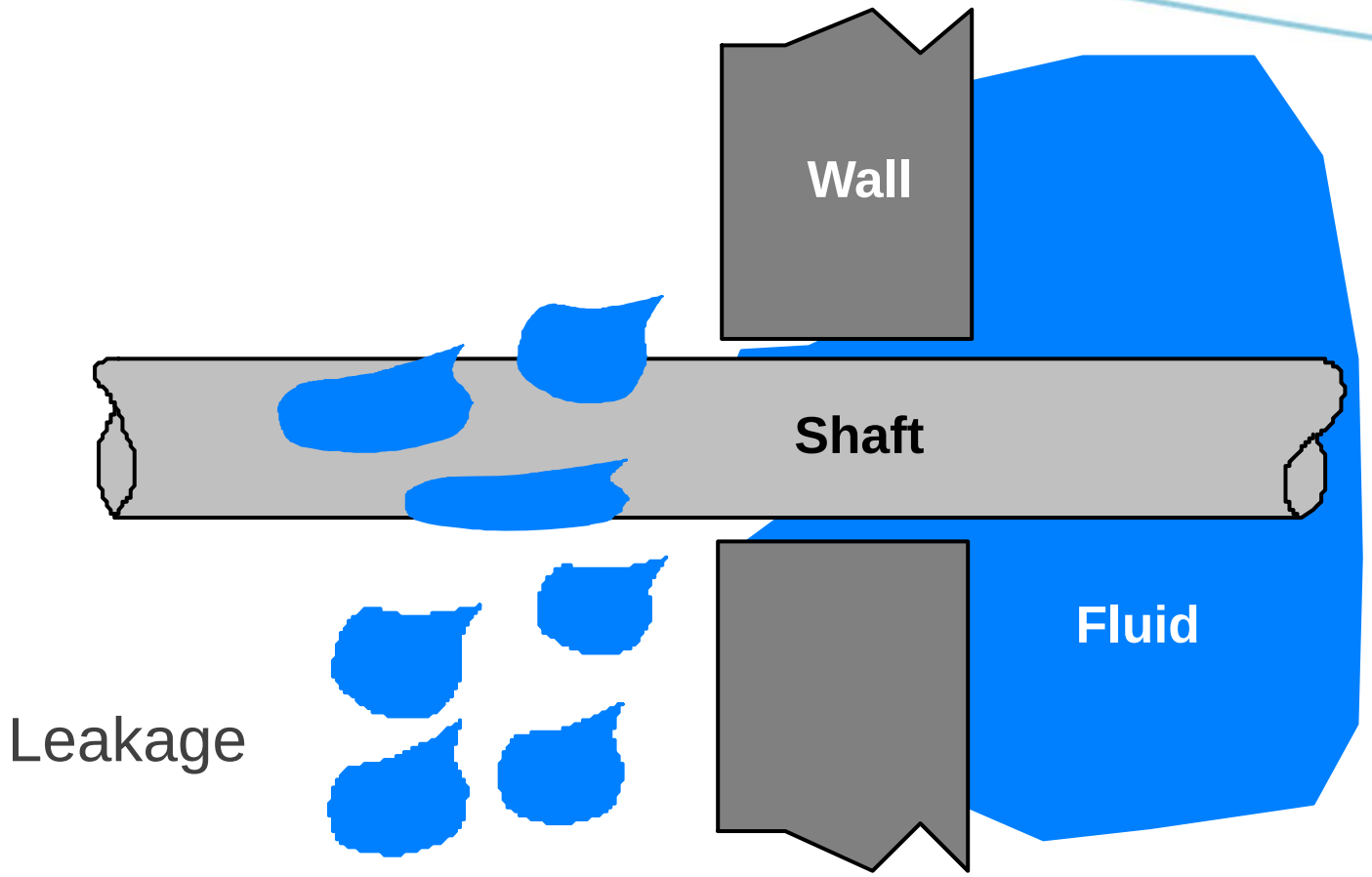
Why Seal?



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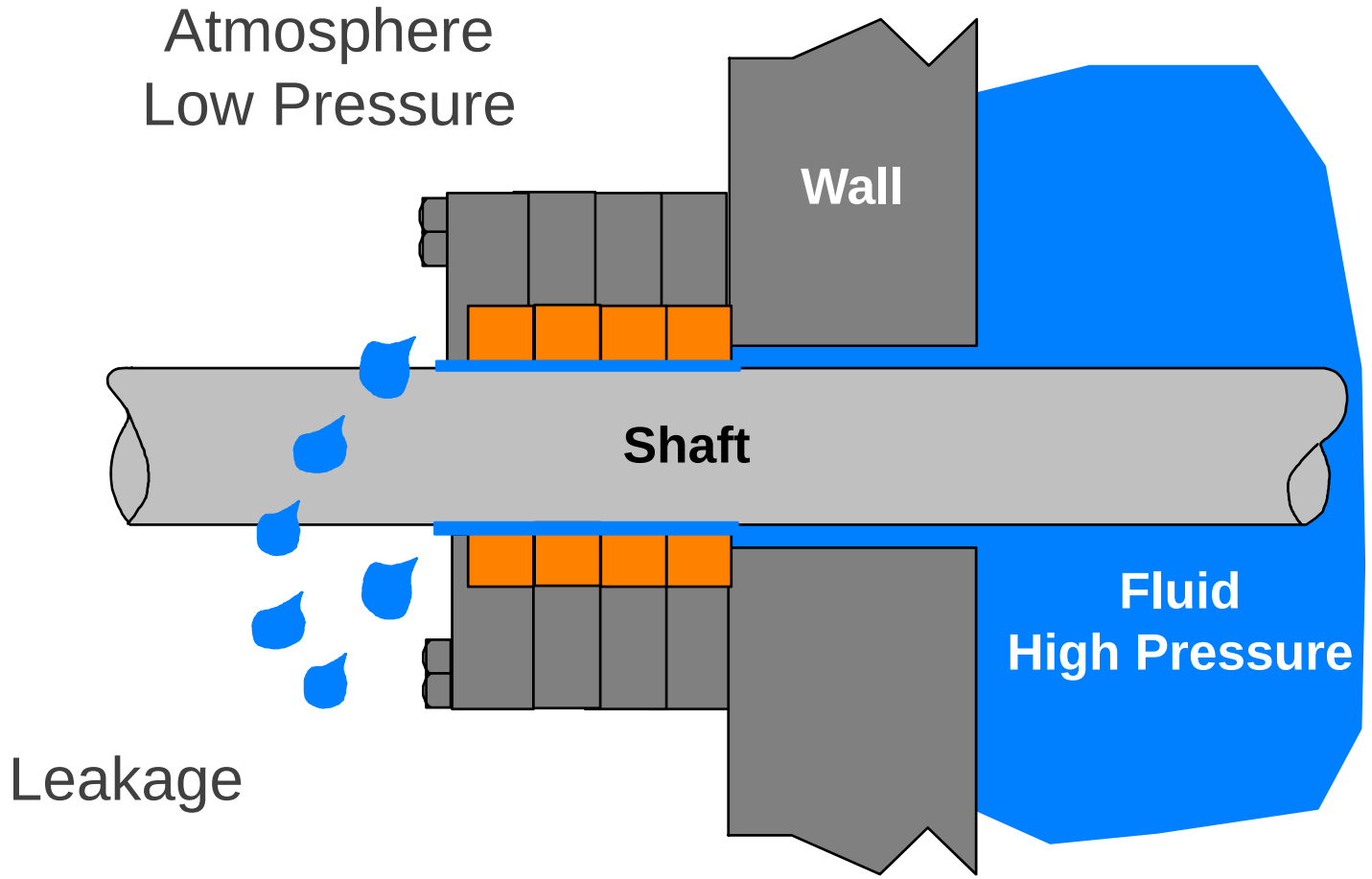
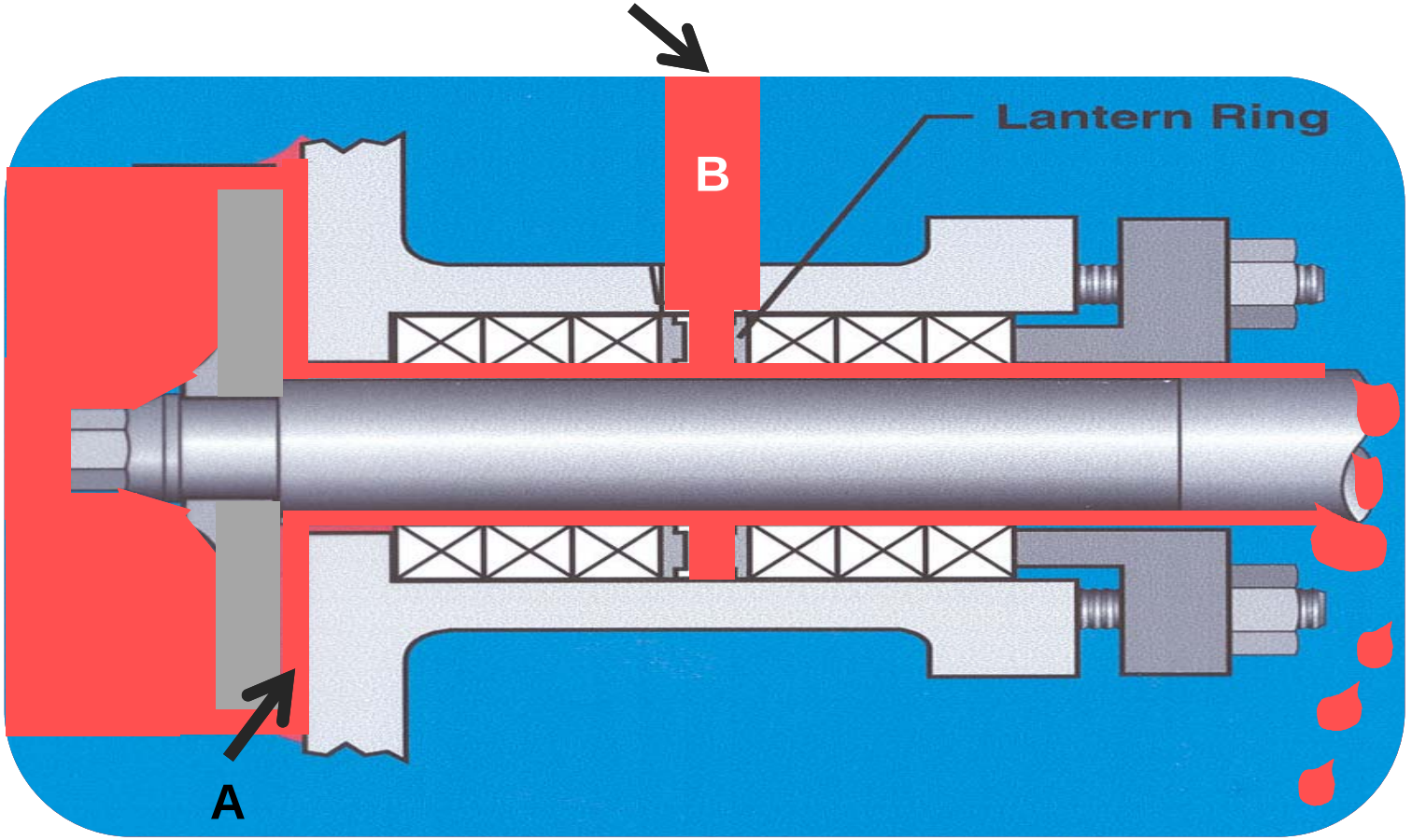
Packing – Controlled Leakage



Lantern Ring – Pathway for Fluid

Flush Injection (Flush Line)



Flush Injection Pressure (B) is Greater than Chamber Pressure (A)

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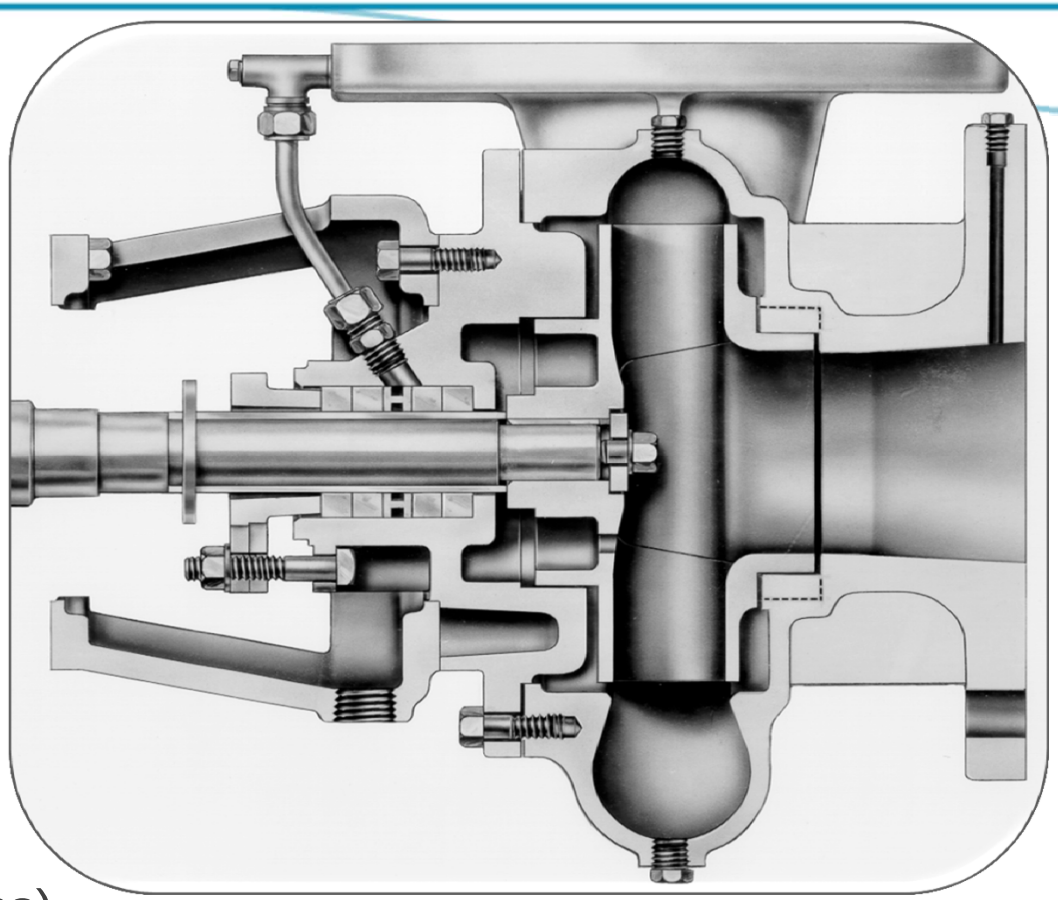
Stuffing Box with Packing (“-PF”)



- Initial Start Up
  - 60 - 80 Drops per Minute
- Adjust After 48 Hours
- Adjusting
  - Not Quantity Related
  - Temperature Related
- Excessive Leakage
  - Packing Worn (6-8 Months)
  - Incorrect Installation of Packing
  - Flush Injection Blocked

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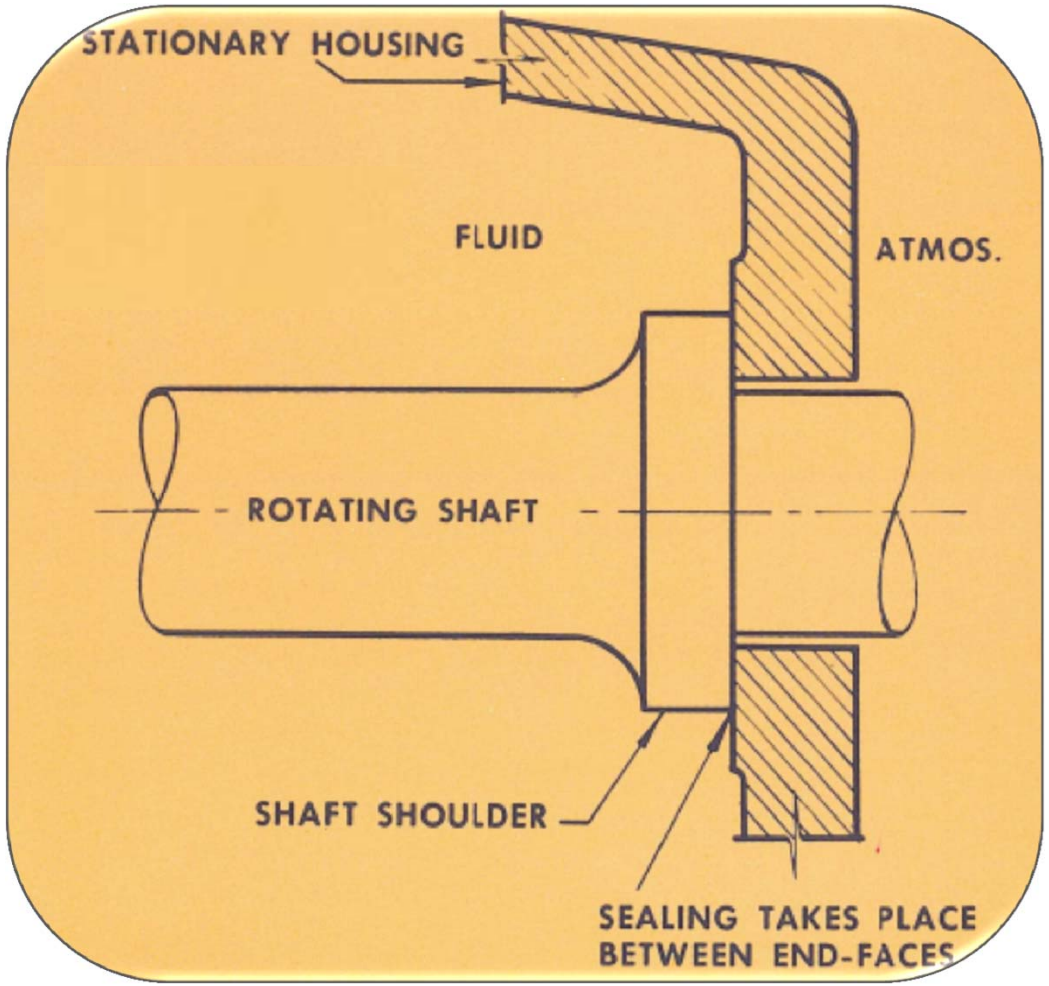
Fundamental Principles of End Face Seals



- Dynamic Sealing
- Not a Practical Seal

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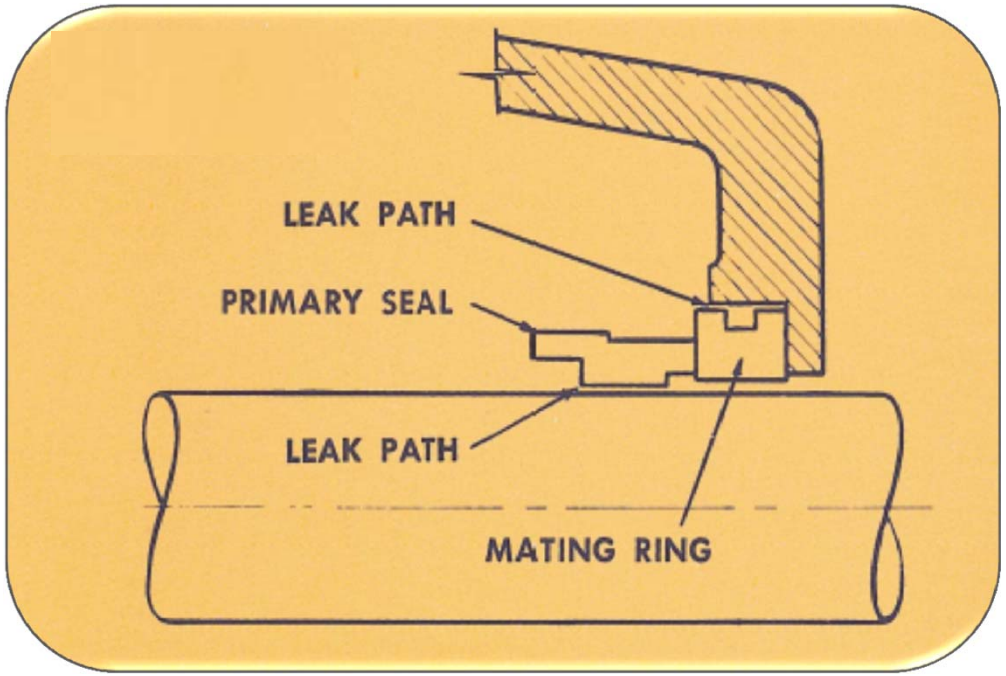
Heart of Mechanical Seal

- Primary Ring
  - Replaces Shaft Shoulder
- Mating Ring
  - Inserted Into Housing



- Precision Lapped Faces
- Material Interchangeability
- Created Leak Paths

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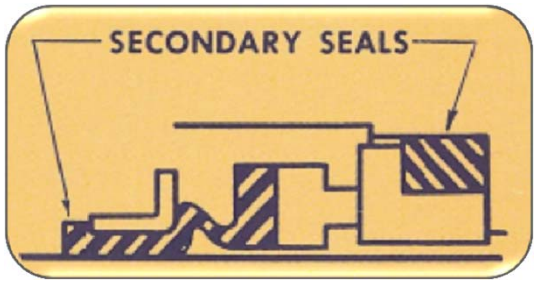
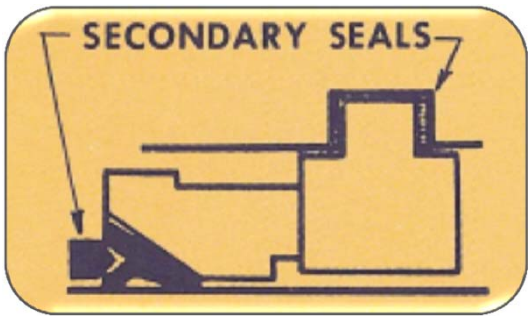
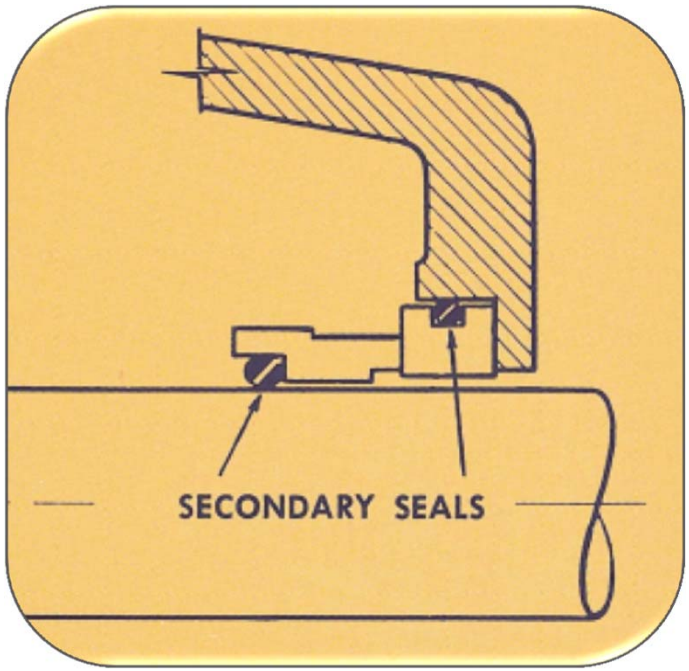
Secondary Seals







- Bellows
- Cup
- “O” Ring
- Wedge

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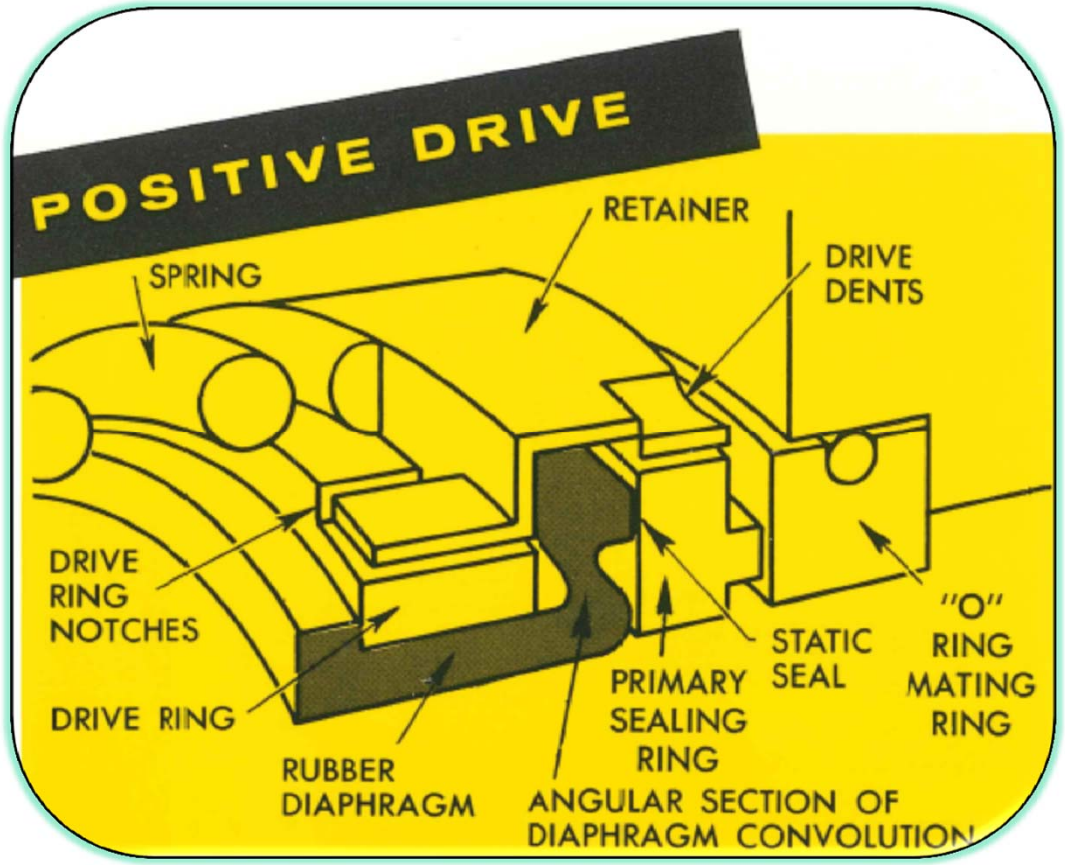
Secondary Seal Provides Drive



- Acts as Sealing Gasket
- Aids in Alignment
- Drive Mechanism

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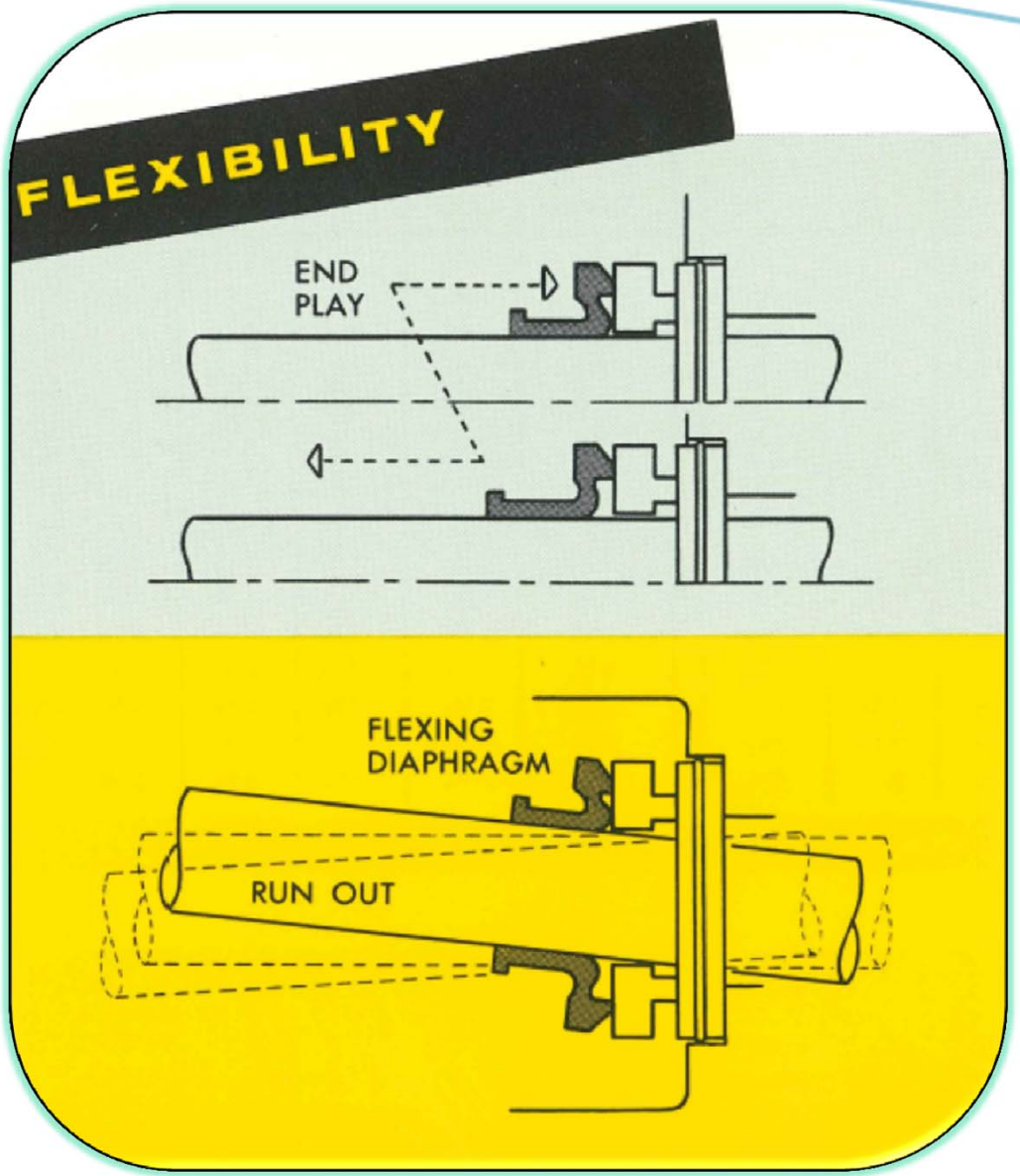
Secondary Seal Provides Flexibility



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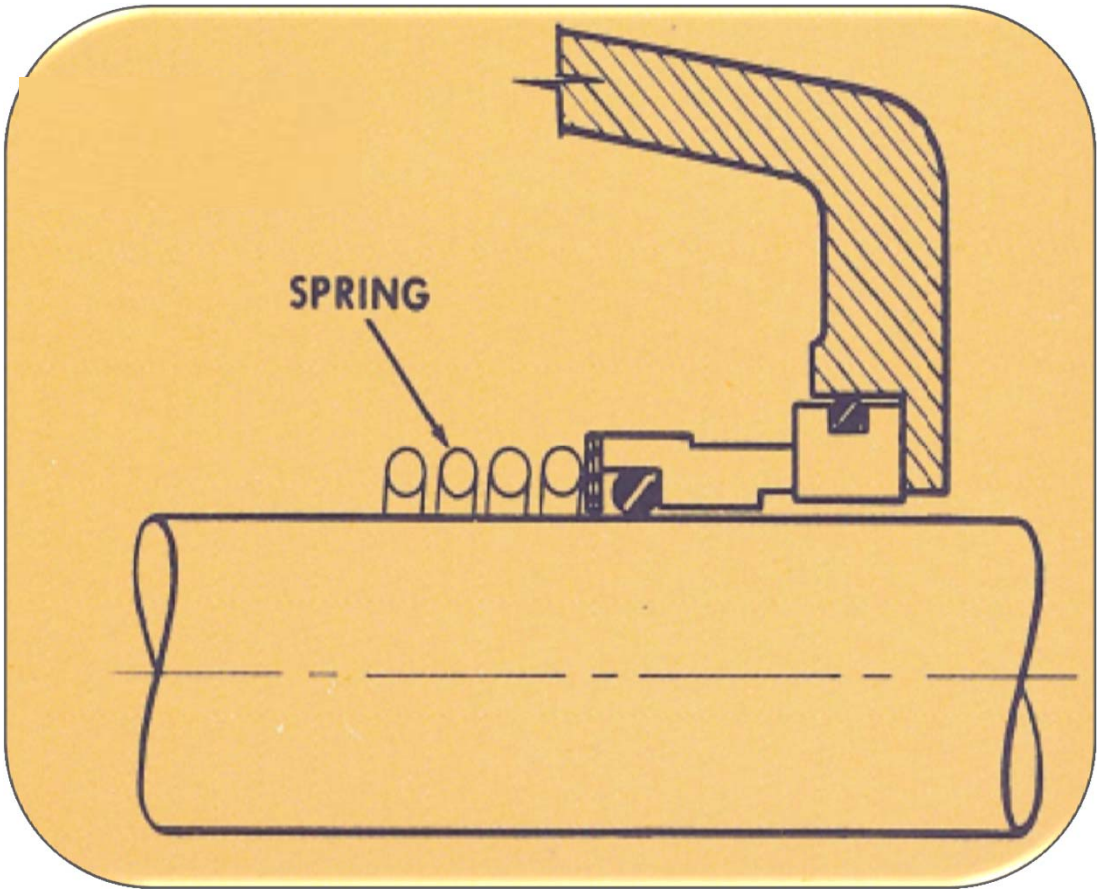
Force Applied to Rings



- Single Spring
- Multiple Springs
- Hydraulic Pressure

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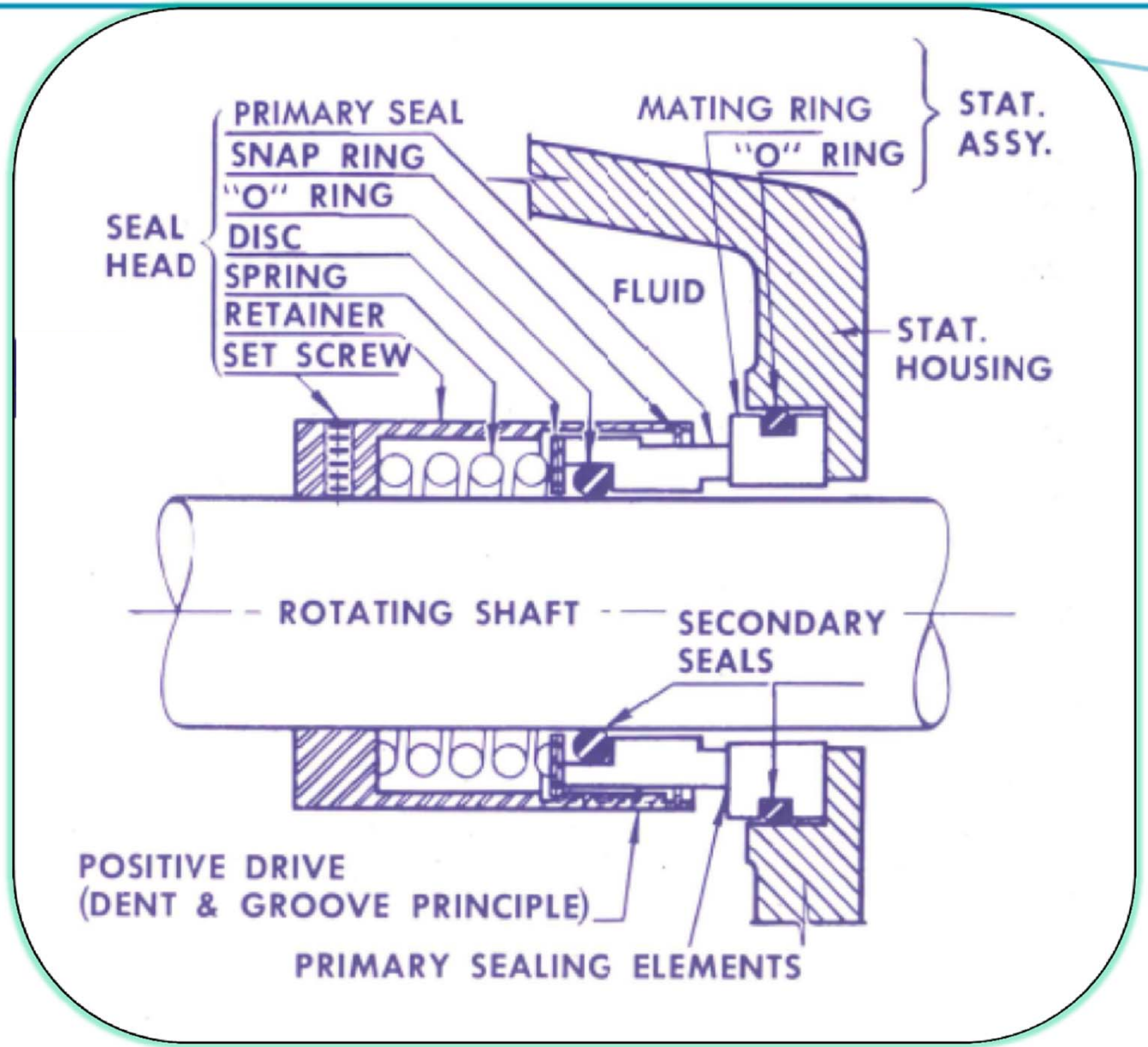
Typical Mechanical Seal



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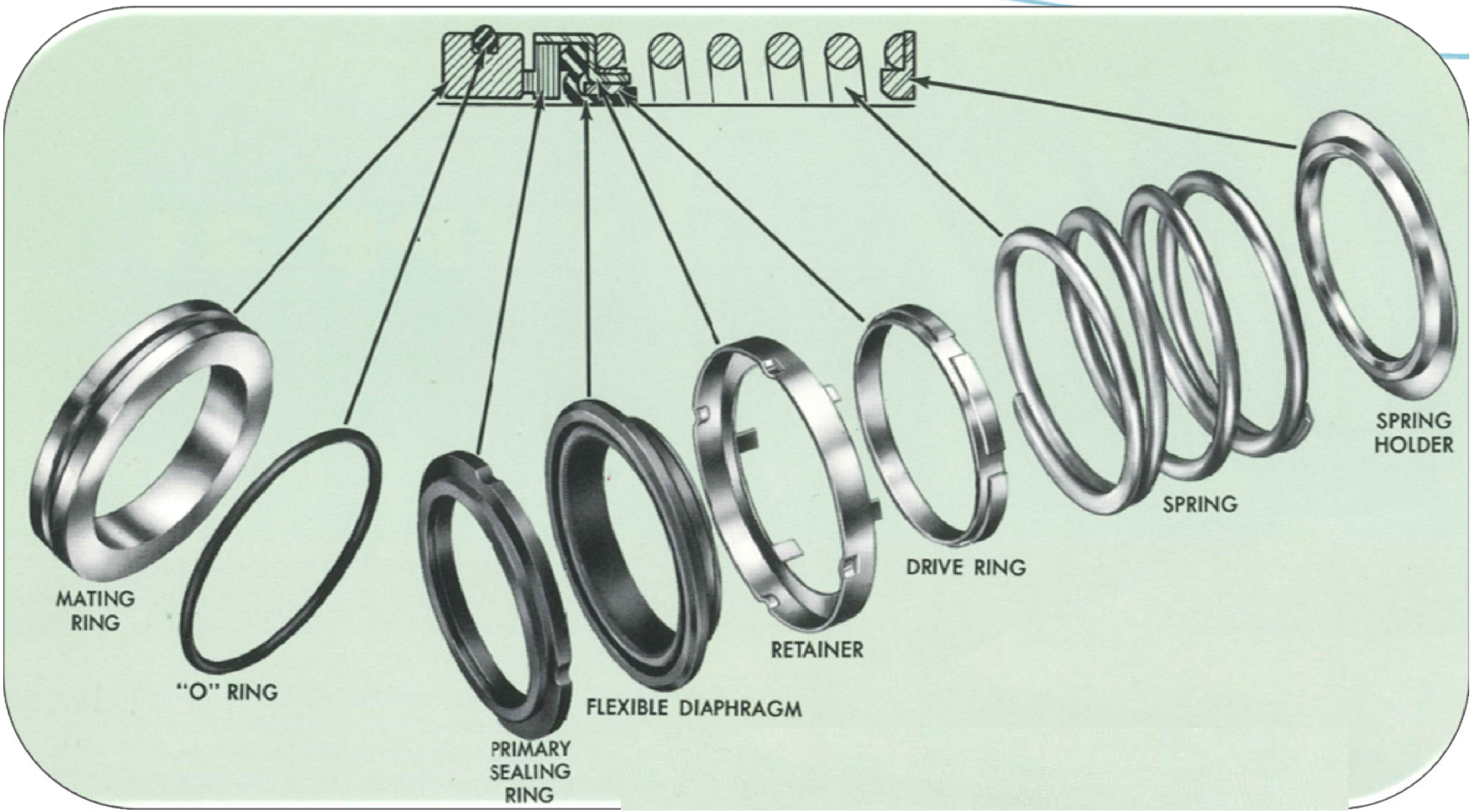
Typical Mechanical Seal – Exploded View



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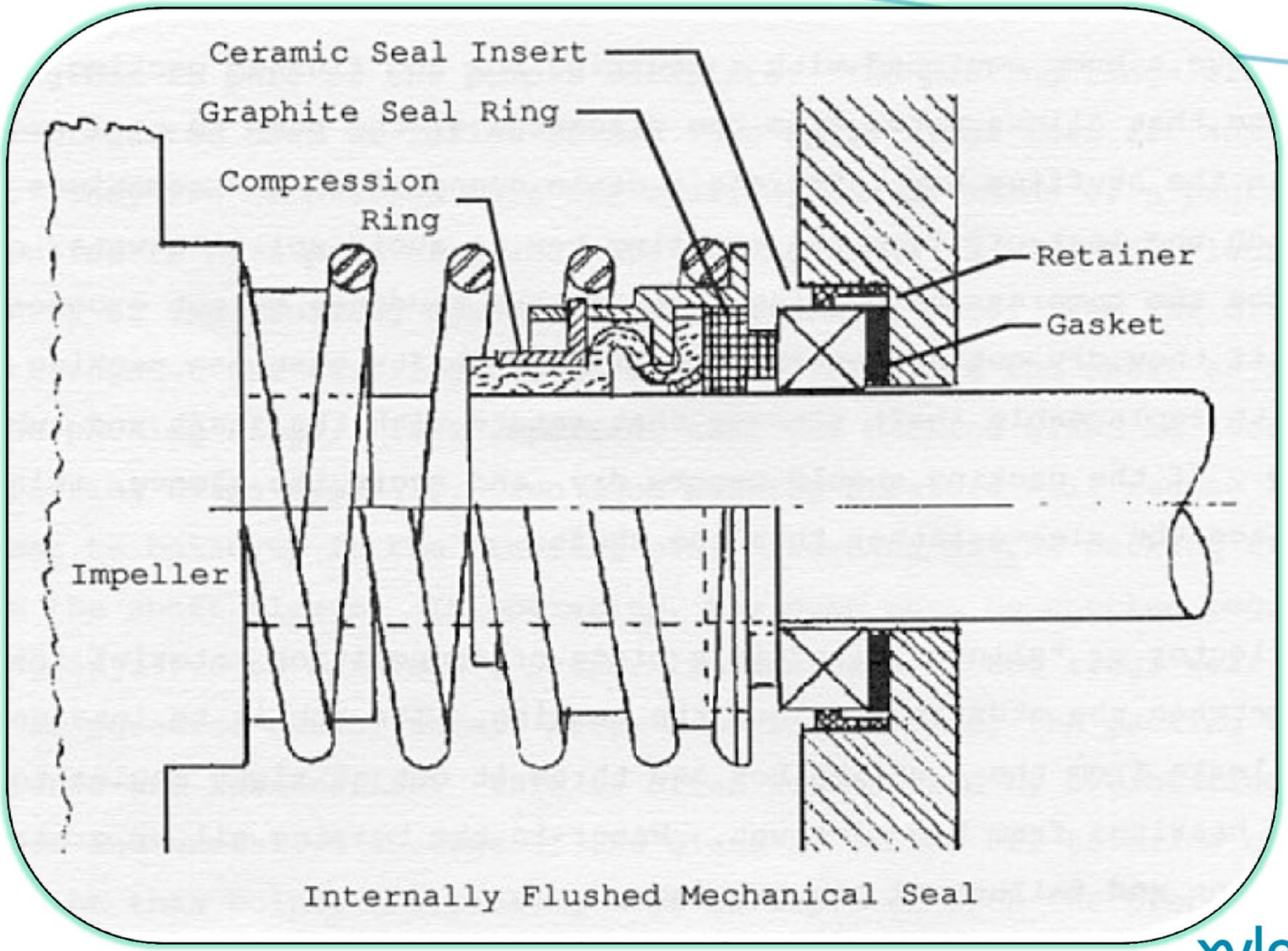
Typical B&G Mechanical Seal



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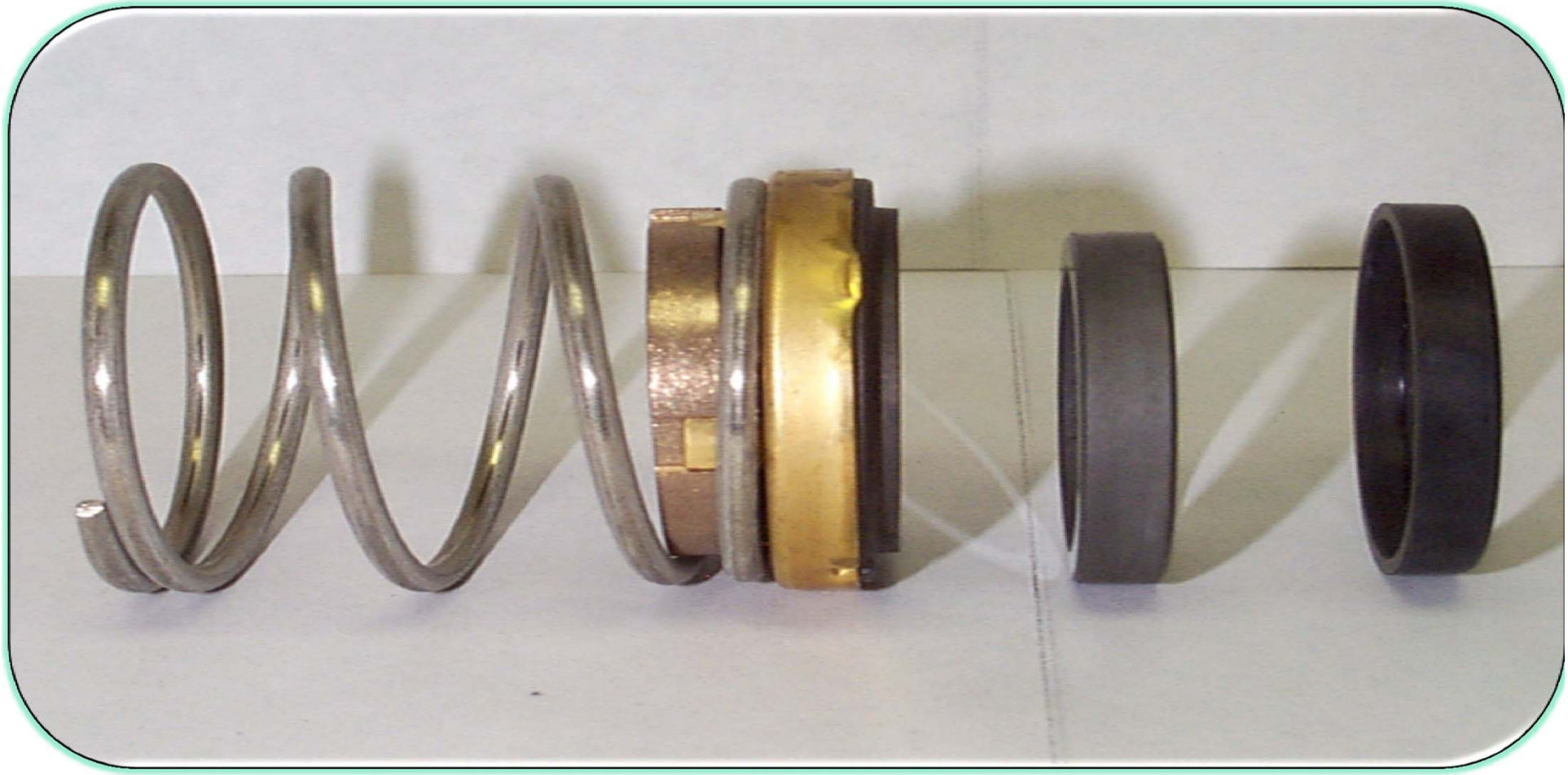
Typical B&G Mechanical Seal



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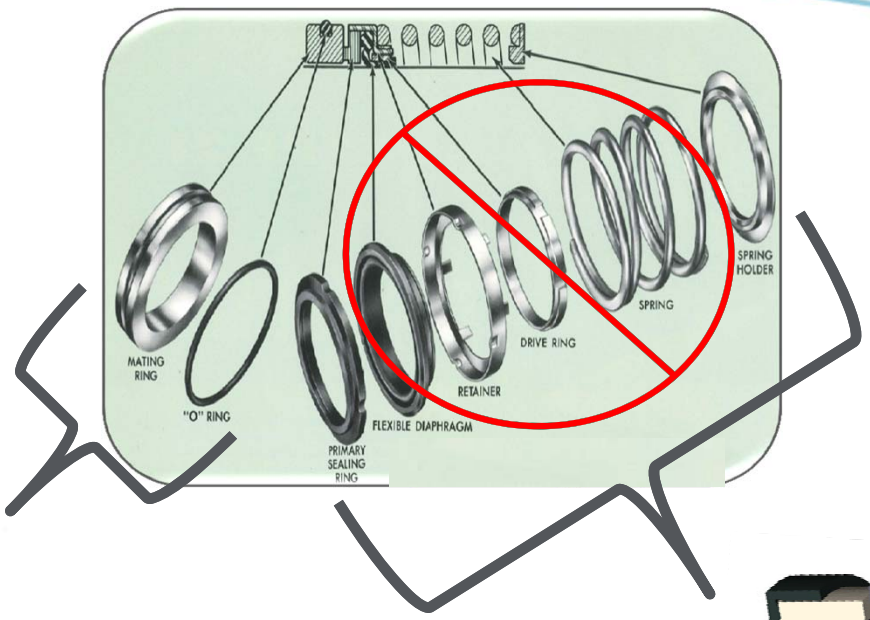
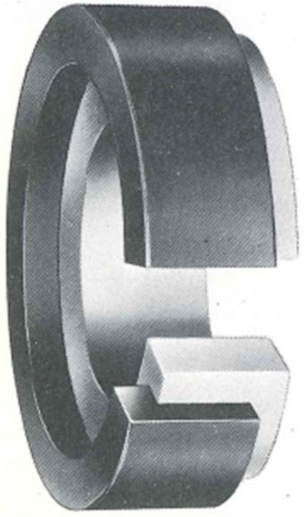
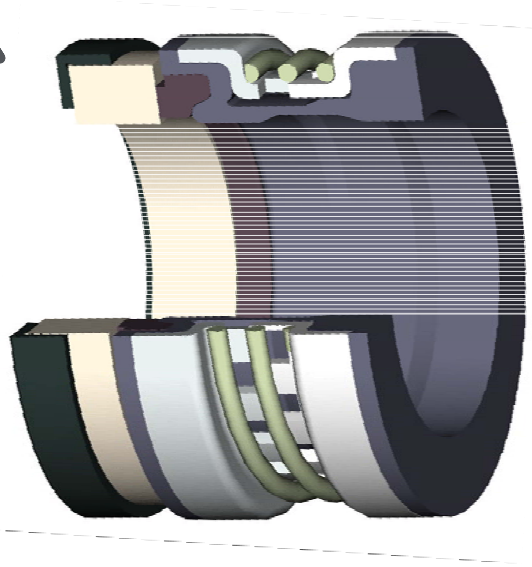
Unitized Mechanical Seal







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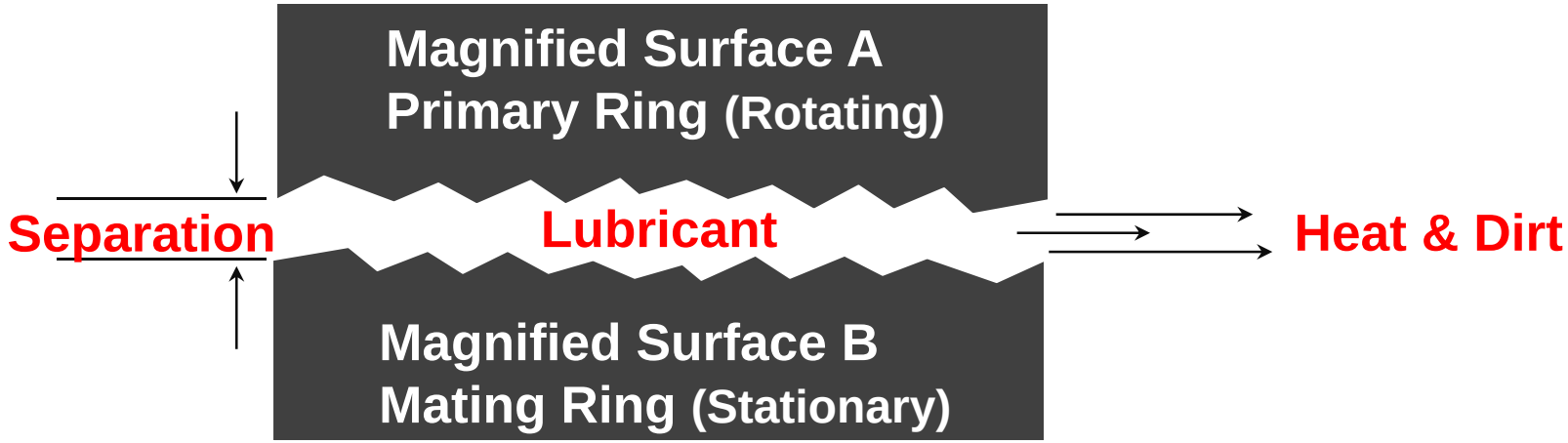
Seal Faces - Controlled Leakage

- Separate Surfaces
- Prevent Contact of High Surface Points
- Reduce Friction & Heat Generation
- Debris Removal



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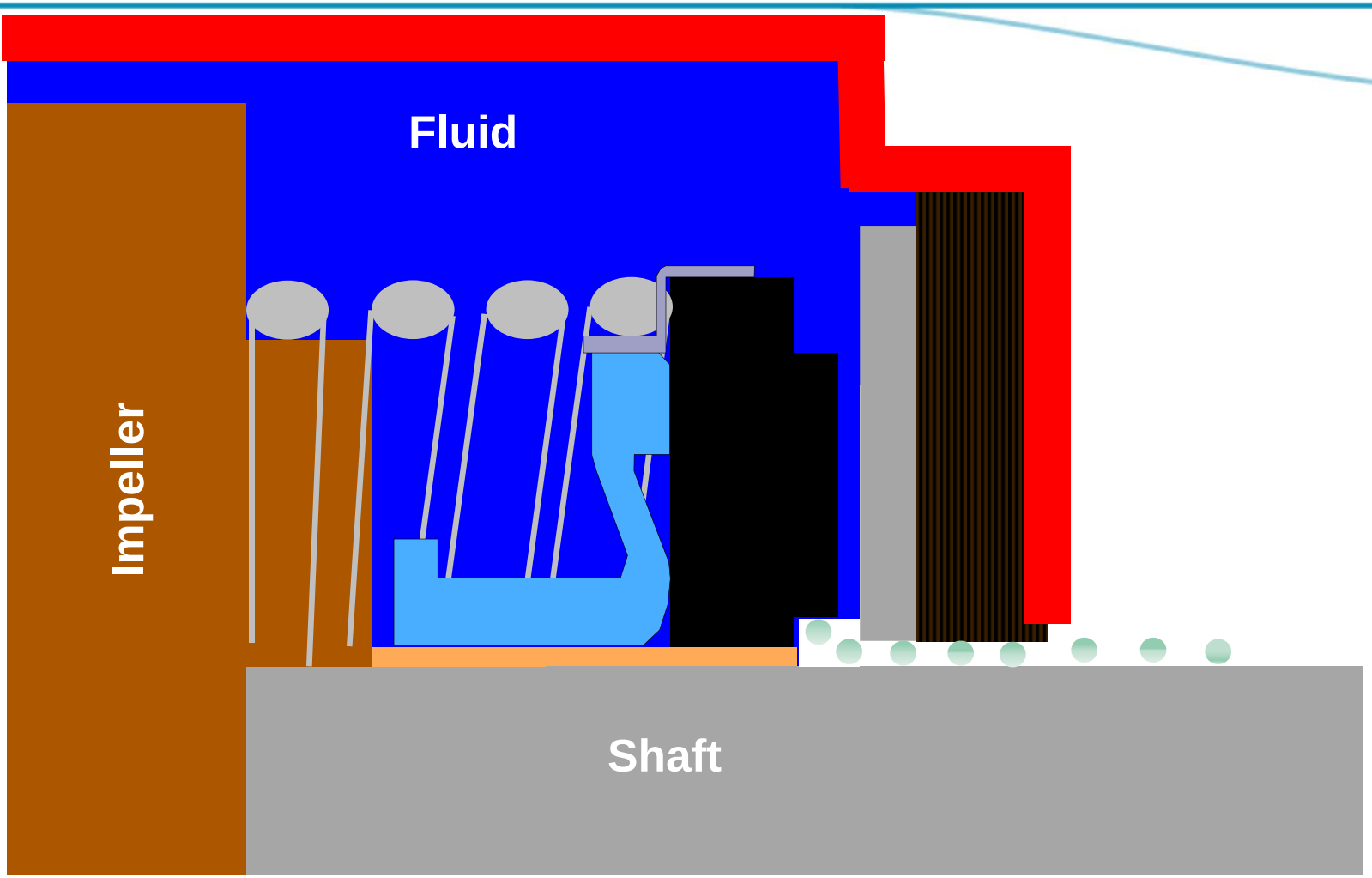
Fluid Acts as Lubricant & Coolant



Invisible Controlled Leakage:
Fluid Evaporates Upon Reaching Atmosphere

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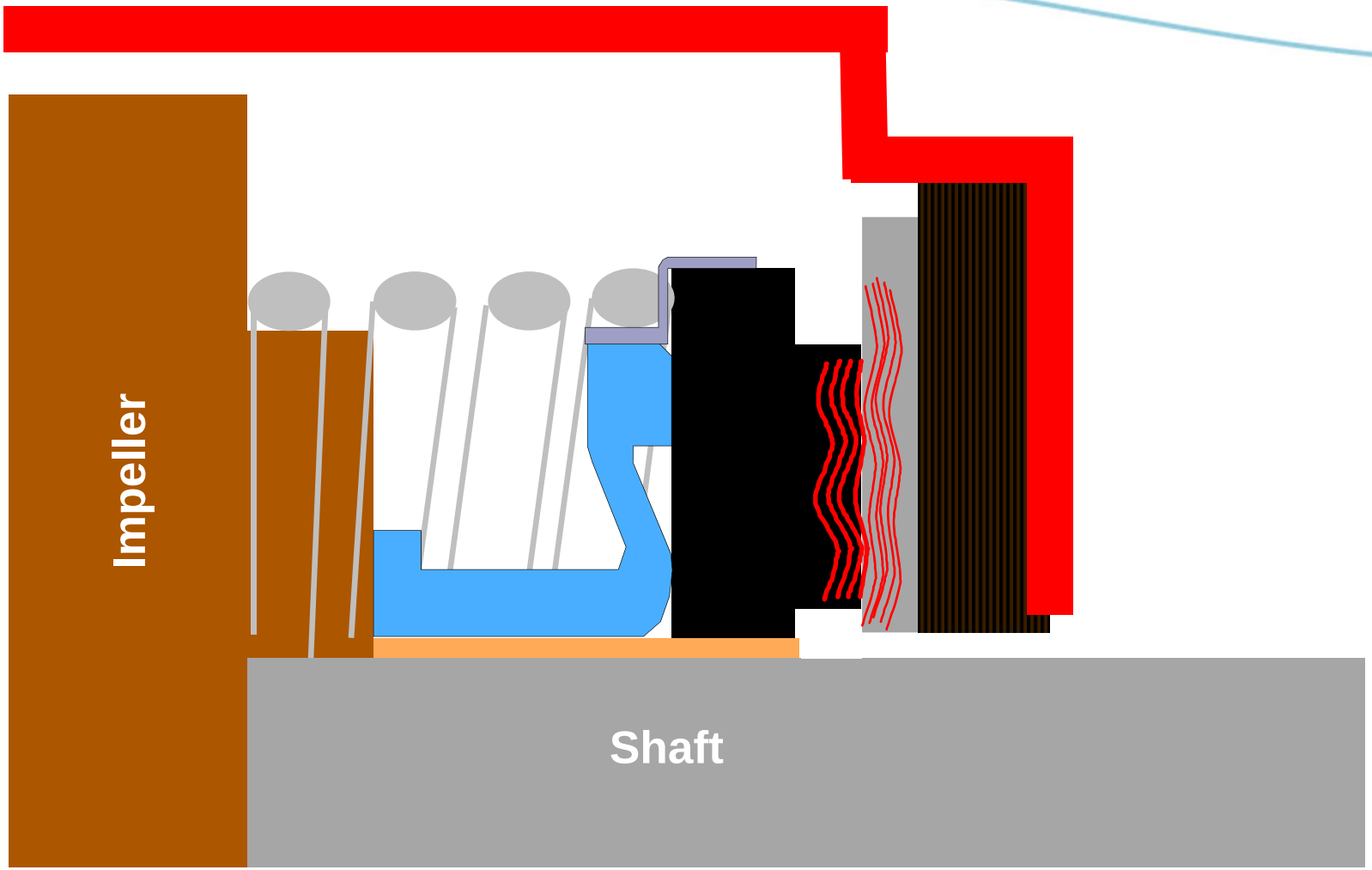
Dry Running Over Heats Seal



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Dry Run Damage

- Notches Misaligned
- Carbon Face Blistered
- Elastomer Torn

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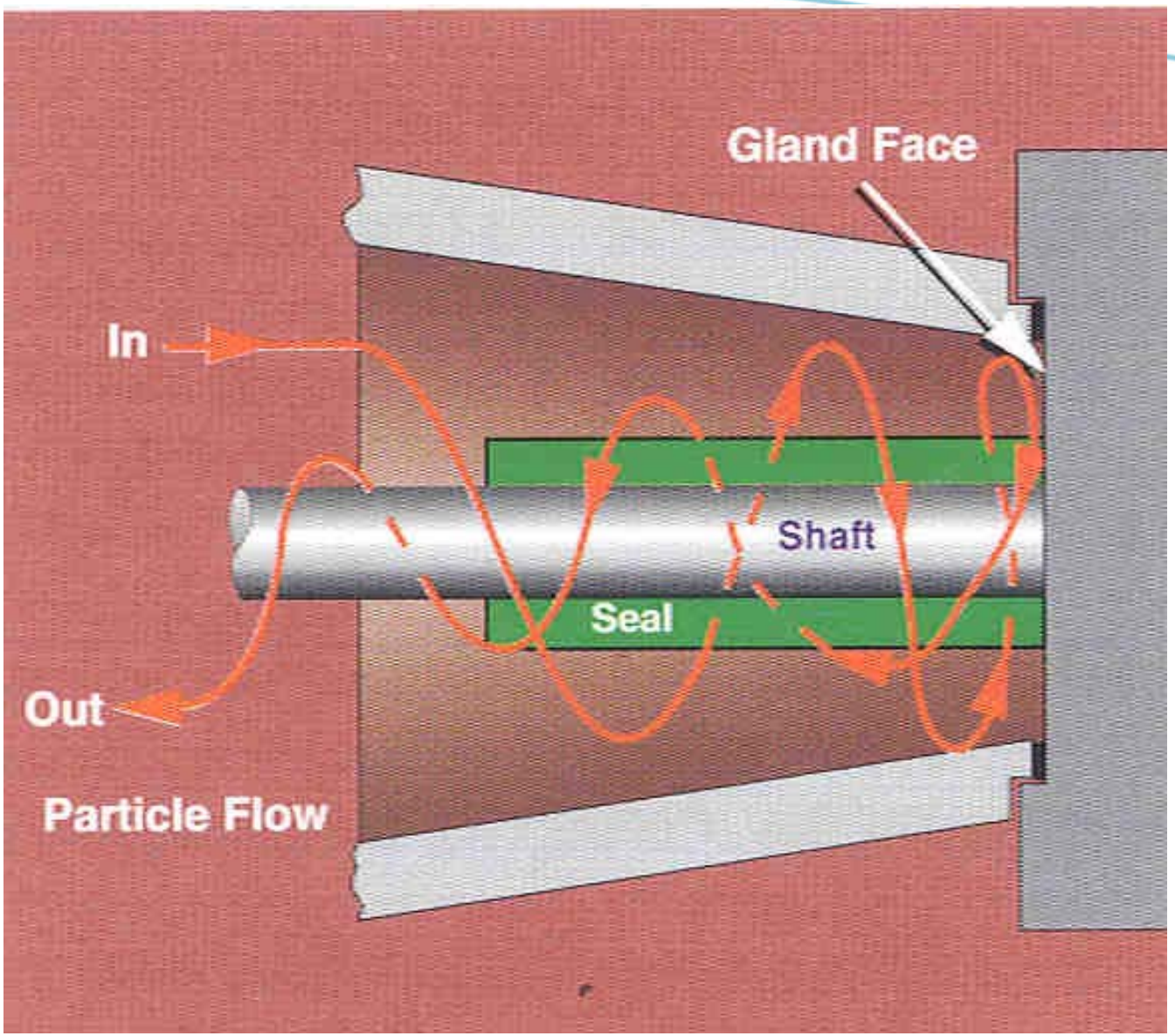
Enlarged-Bore Seal Chambers



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Auxiliary Equipment

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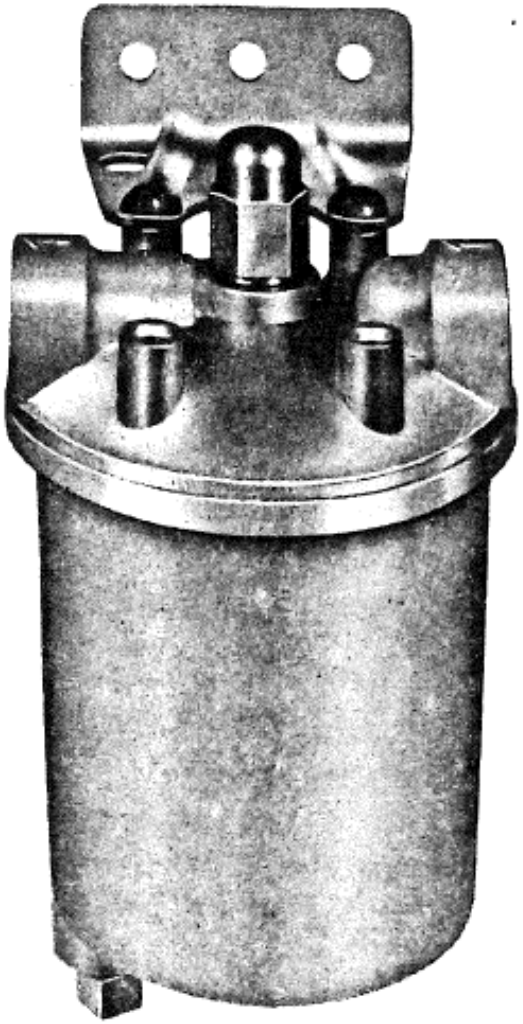
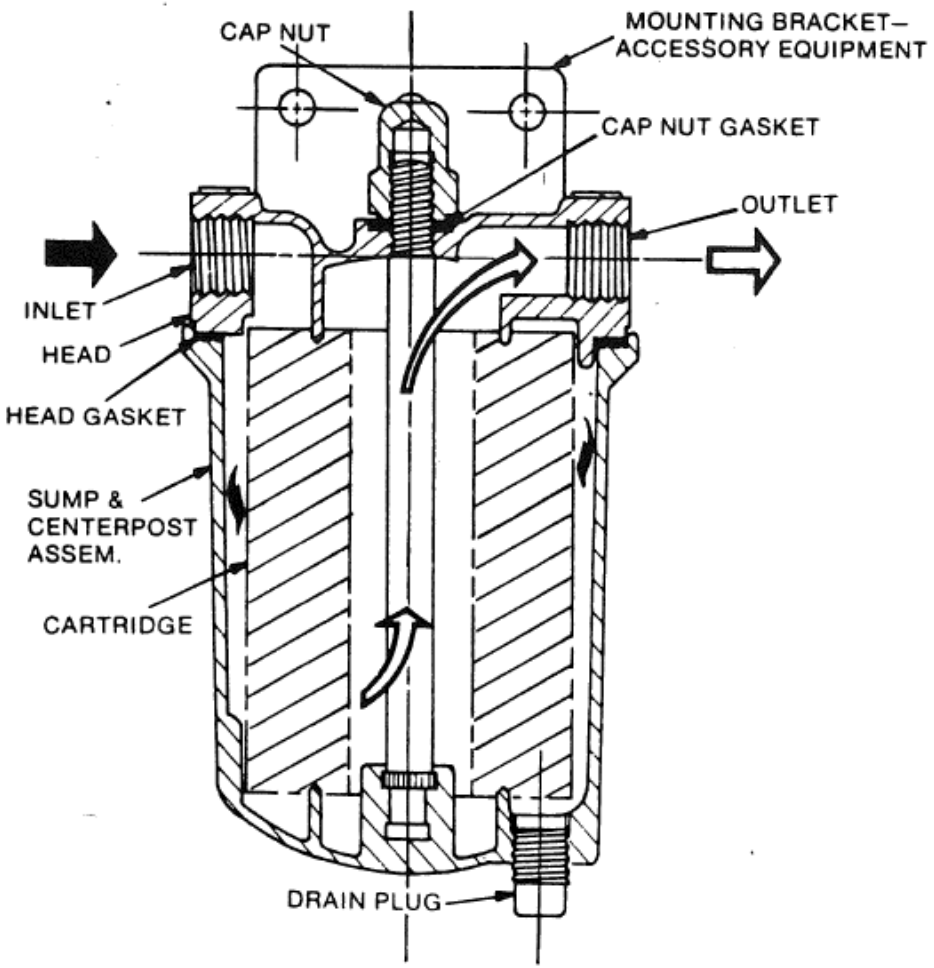
Cartridge Filter





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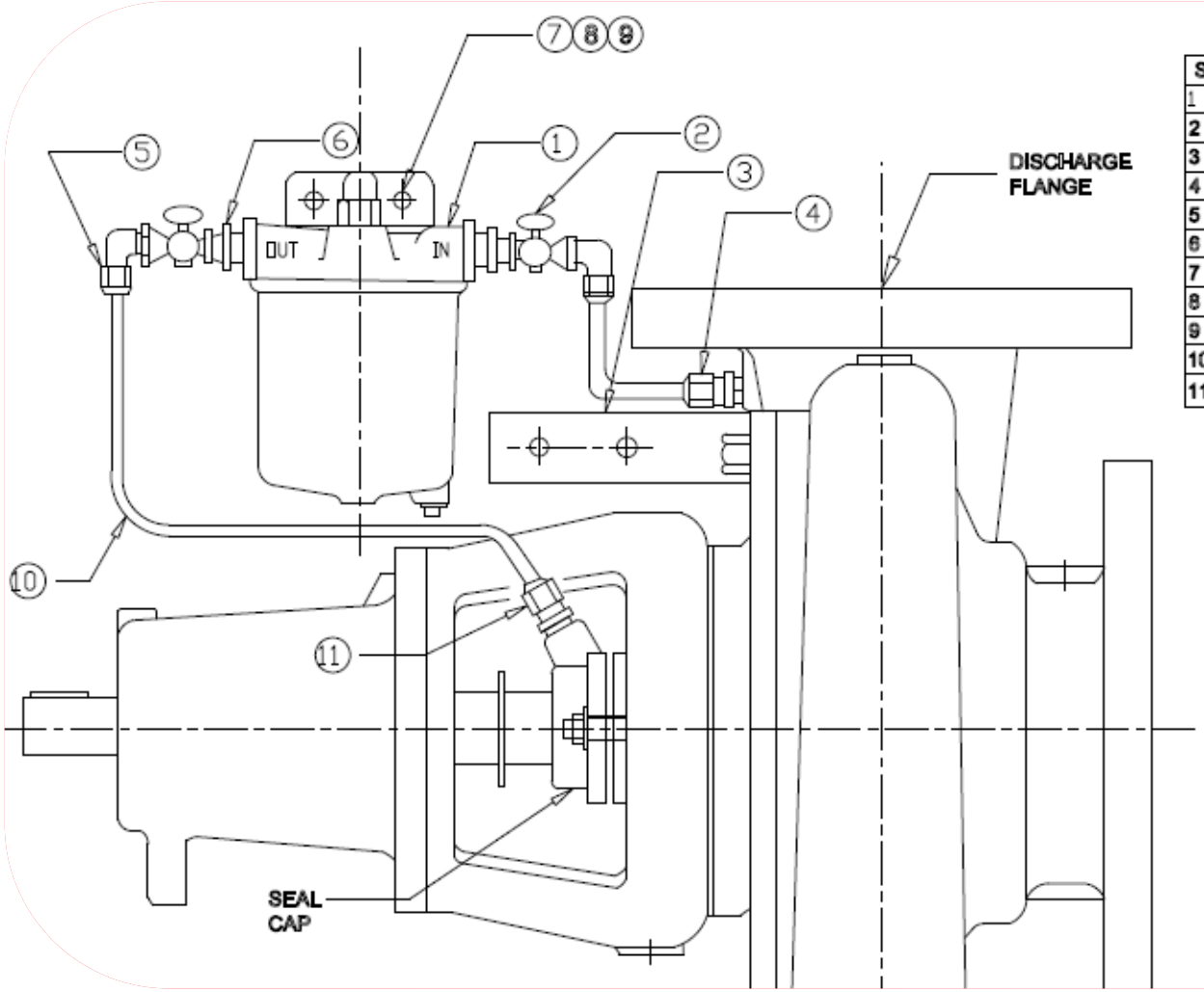
Cartridge Filter Typical Installation



SR. NO.	PART DESCRIPTION	QTY
1	CUNO FILTER	1
2	GAUGE COCK	2
3	BRACKET 10 GA STL(.134")	1
4	CONNECTOR	2
5	ELBOW	2
6	BUSHING	2
7	CAP SCR	2
8	LK WASHER	2
9	HEX NUT	2
10	COPPER TUBE	2.5
11	CONNECTOR $\frac{1}{8}$ X $\frac{3}{8}$ TUBE	1

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Cartridge Filter & Sight Flow Indicator Installation

Cartridge Filter

Sight Flow Indicator

Mechanical Seal
(Low Pressure)

Discharge Flange
(High Pressure)

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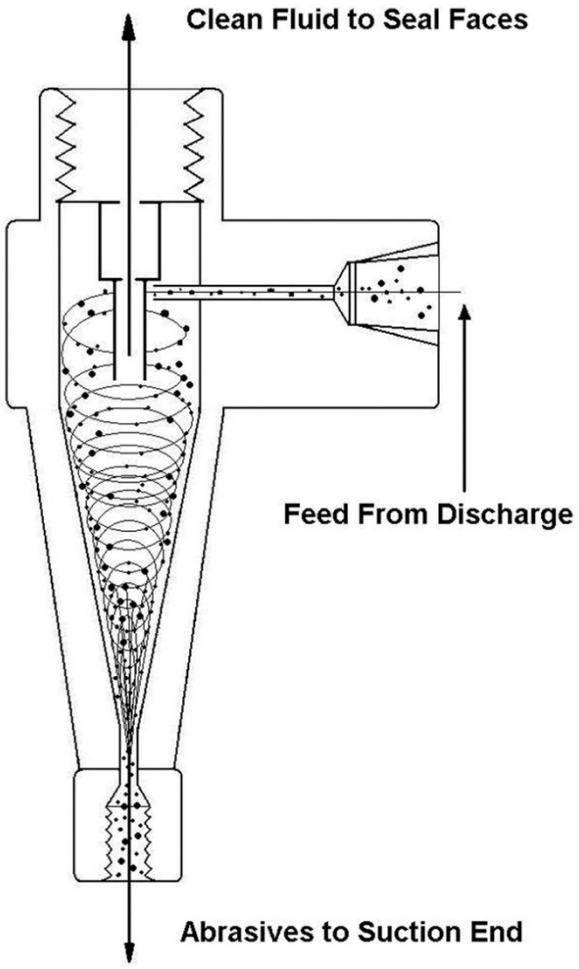
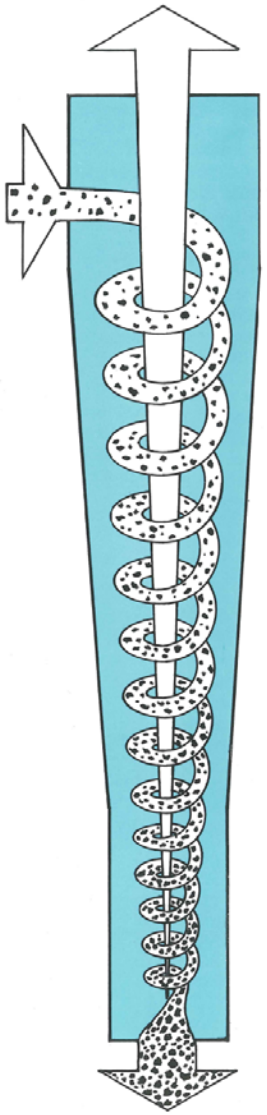
Sediment Separator





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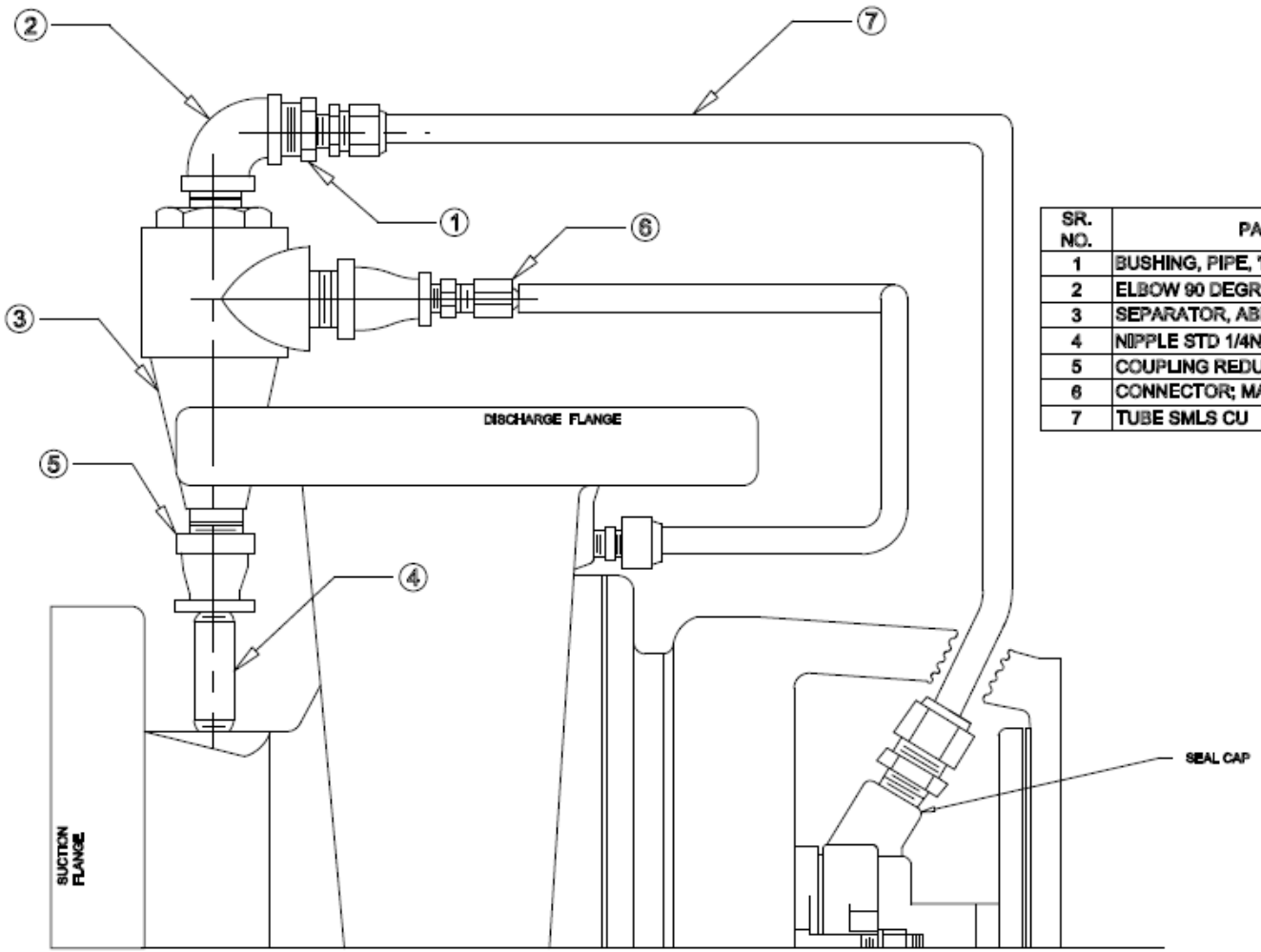
Sediment Separator Typical Installation



SR. NO.	PART DESCRIPTION	QTY.
1	BUSHING, PIPE, 'HEX TYPE'; 1/2" NPT X 1/4"NPT	1
2	ELBOW 90 DEGREE 150# 1/2" NPT	1
3	SEPARATOR, ABRASIVES. 1/2"NPT NYLON	1
4	NIPPLE STD 1/4NPT X 3"LG	1
5	COUPLING REDUCER 1/2"NPT X 1/4" NPT	2
6	CONNECTOR; MALE COMP 3/8OD X 1/4MPT	4
7	TUBE SMLS CU 3/8-.032X50 FT	4

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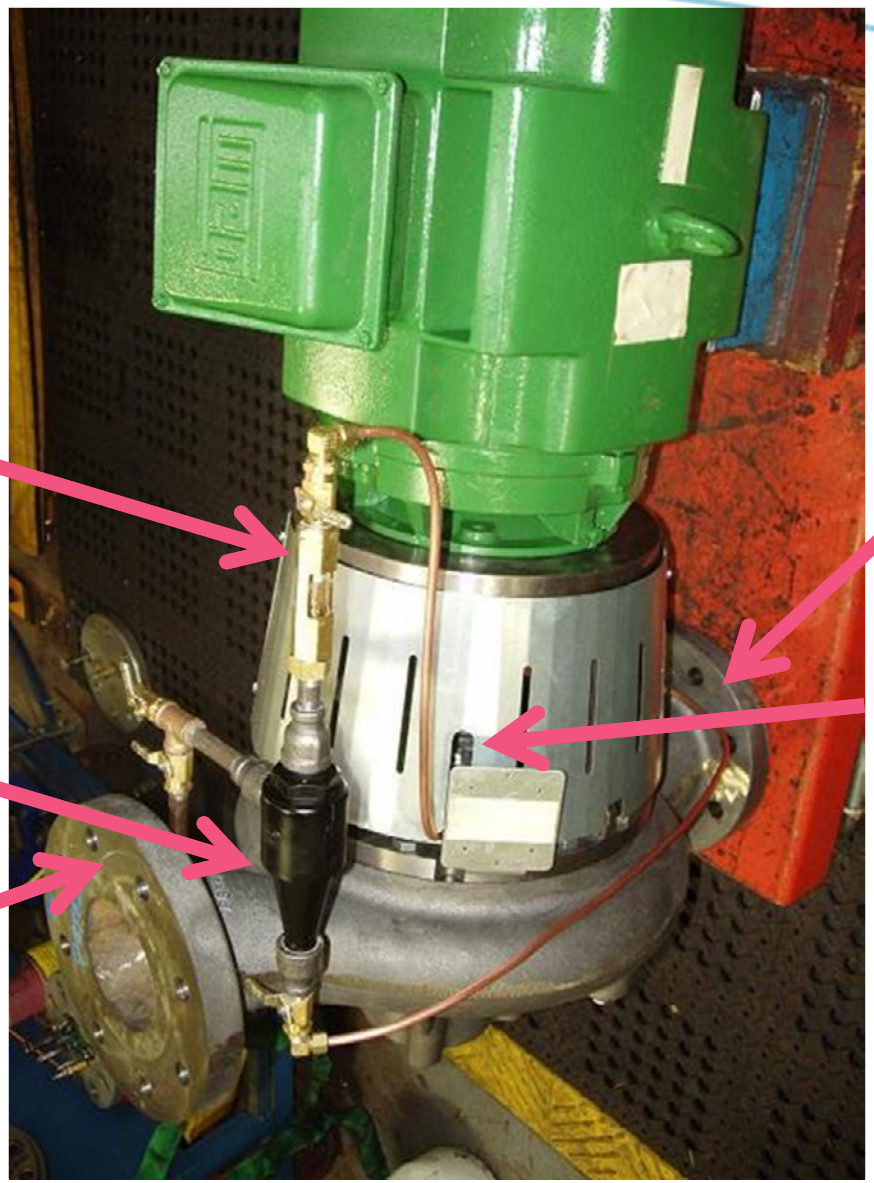
Sediment Separator & Sight Flow Indicator



Sight Flow Indicator

Sediment Separator

Discharge Flange
(High Pressure)

Suction Flange
(Low Pressure)

Mechanical Seal
(Low Pressure)

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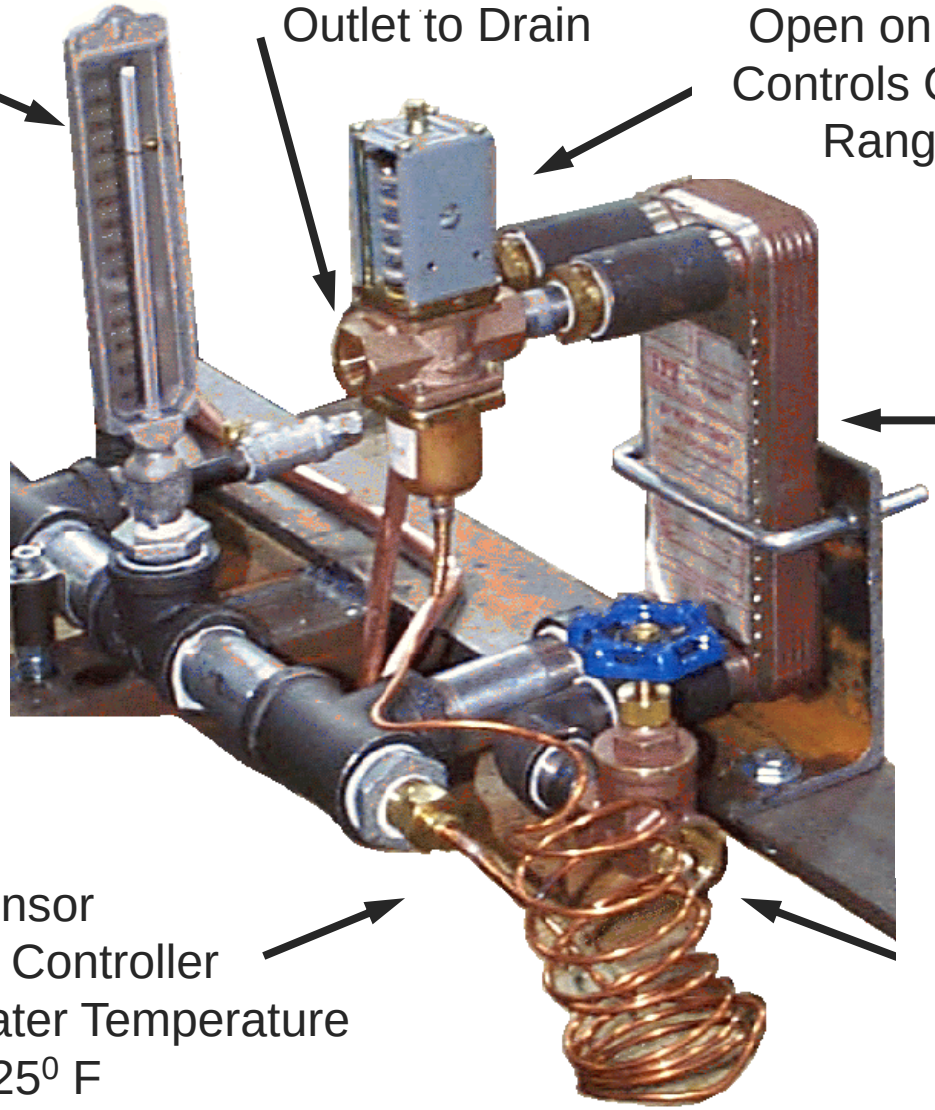
Brazed Plate Heat Exchanger



Thermometer

Outlet to Drain

Valve, Temperature Controller
Open on Temperature Rise
Controls Cooling Water Flow
Range: 115 - 180^0 F

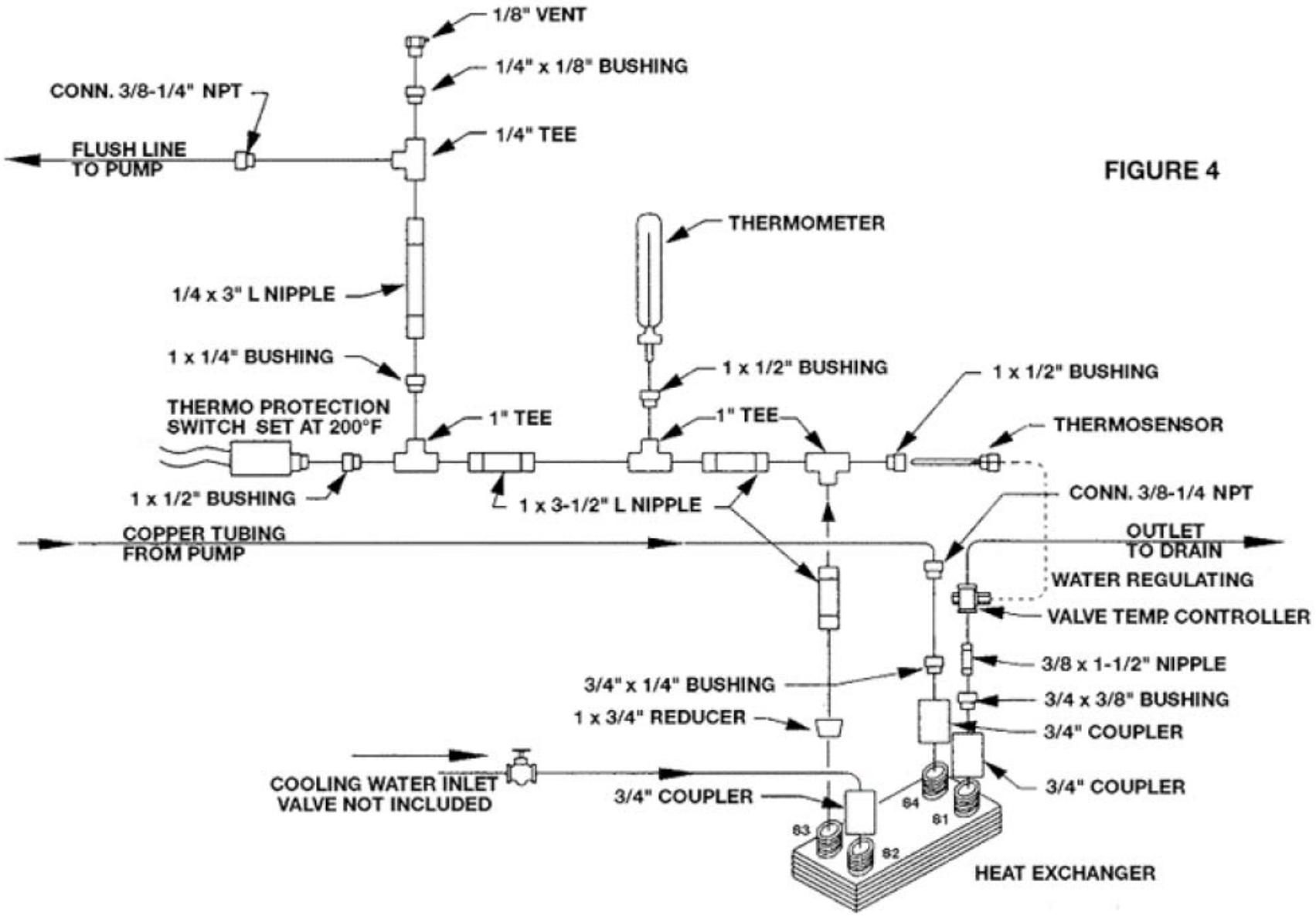
Thermo Protection
Switch
Set at 200^0 F
Shuts pump down
if temperature
exceeds limit

Brazed Plate Heat
Exchanger

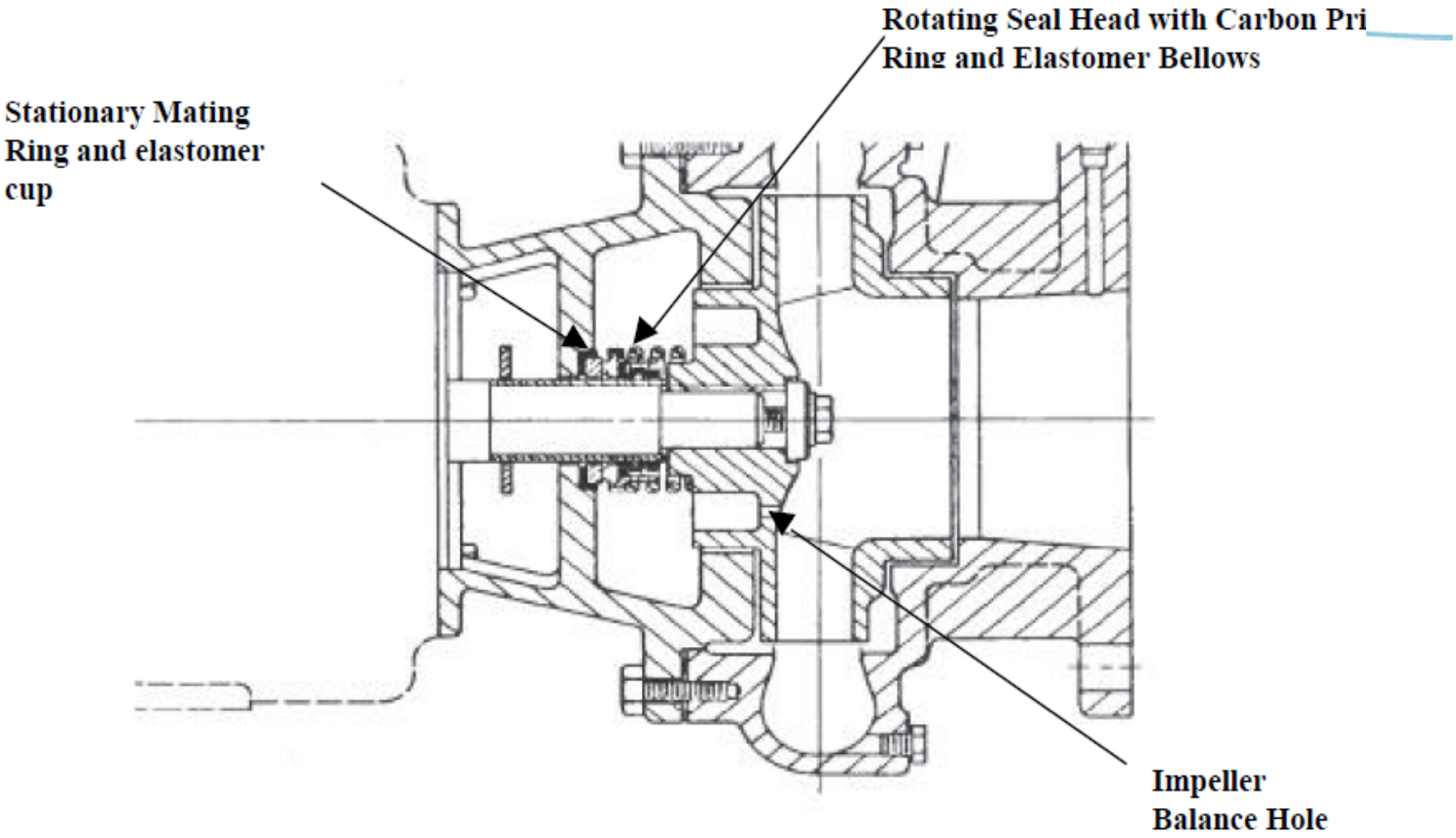
Thermosensor
for Temperature Controller
Senses Seal Flush Water Temperature
Open at 125^0 F

Cooling Water Inlet
1 GPM
Service Valve Not
Included in Kit

Heat Exchanger Typical Installation



Standard Seal Configuration



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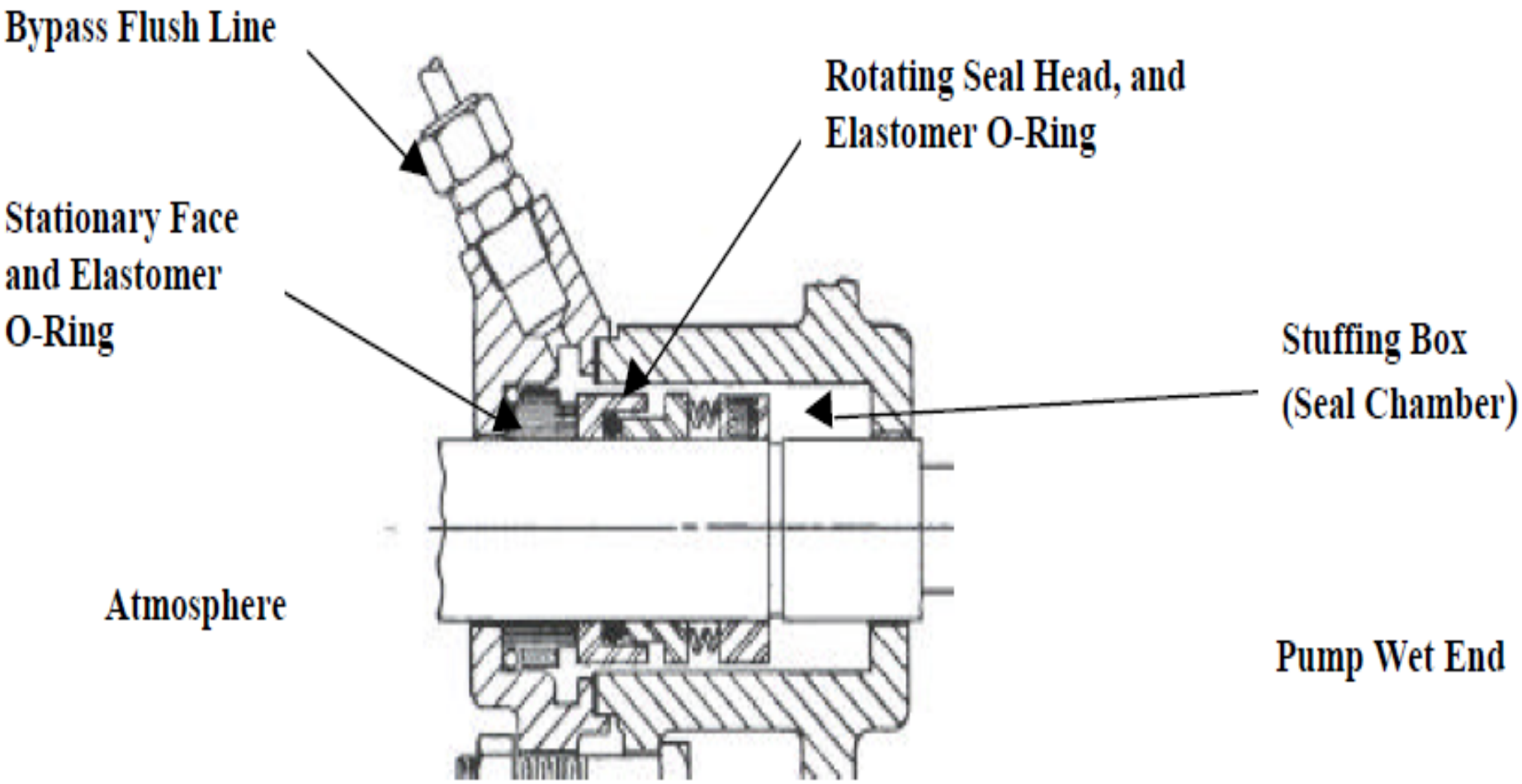
“-S” Stuffing Box Seal Configuration



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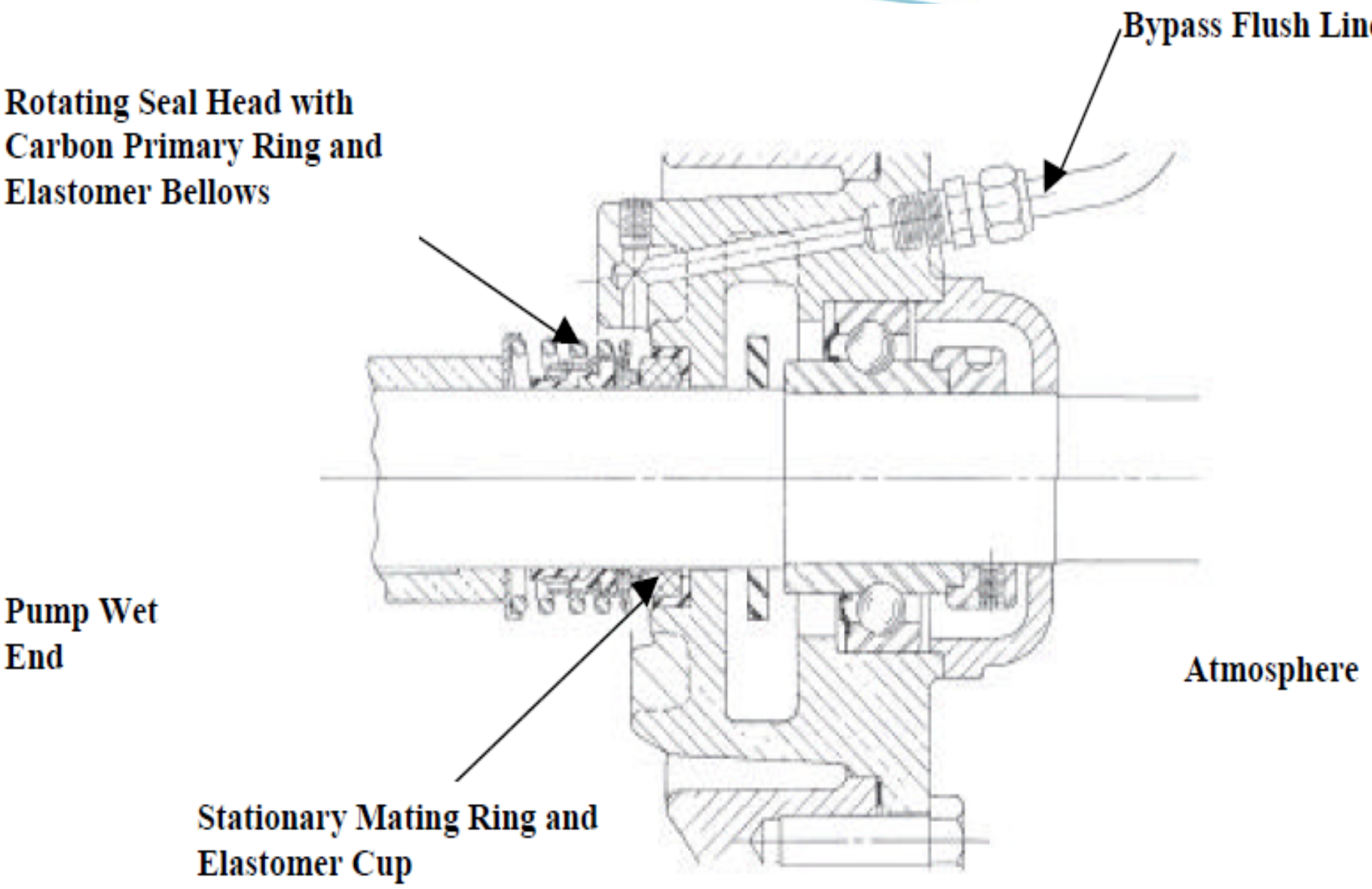
“-F” Standard Seal Configuration



Seal Life

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Why Mechanical Seals Fail

Results of a Seal Failure Study at a Major Chemical Plant

5%	Normal Life
15%	Application Life
20%	Installation Errors
60%	Operational Errors

95% of Seals Fail for Reasons Outside of the Seal Manufacturer's Control.

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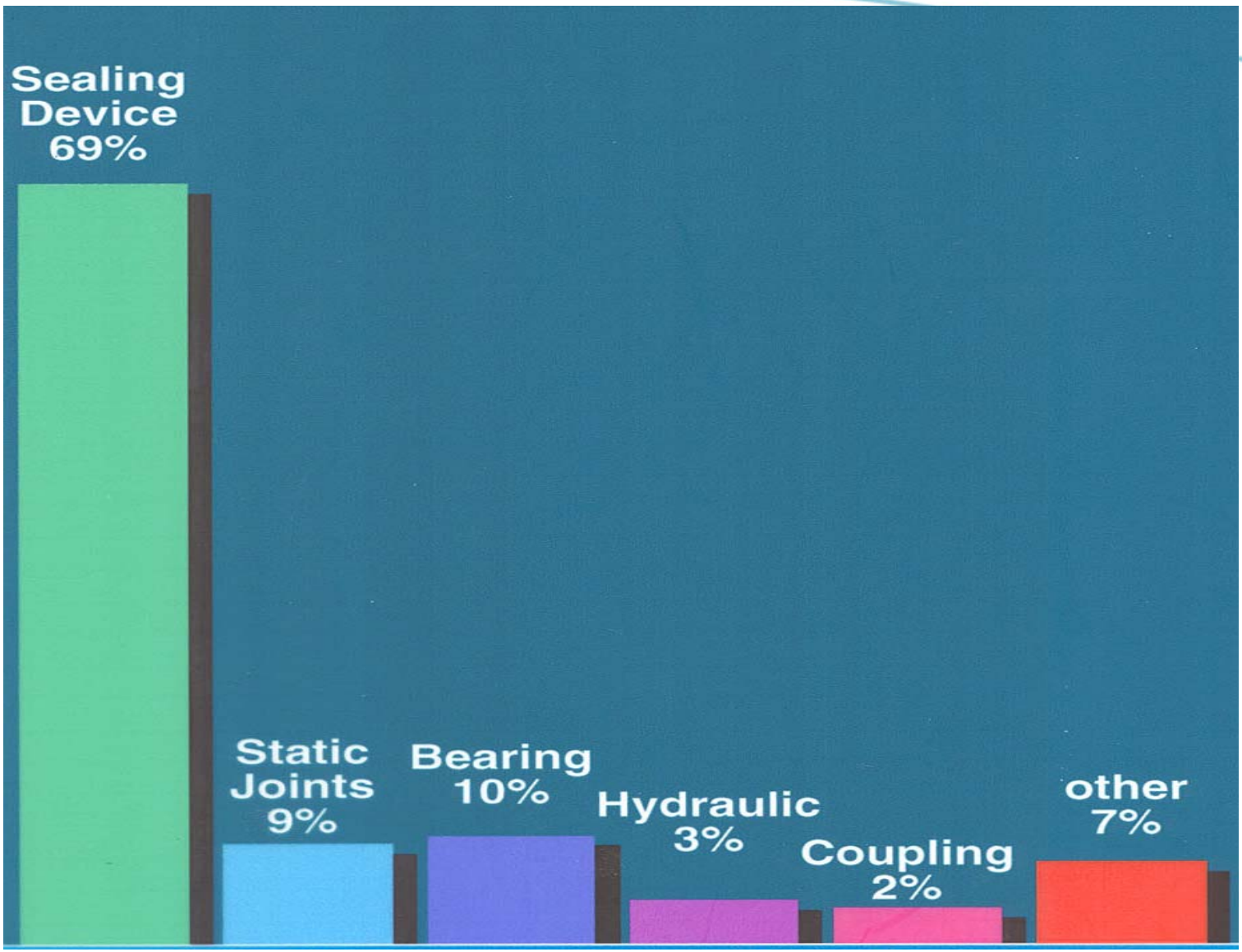
Causes of Rotating Equipment Failure



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Yikes!

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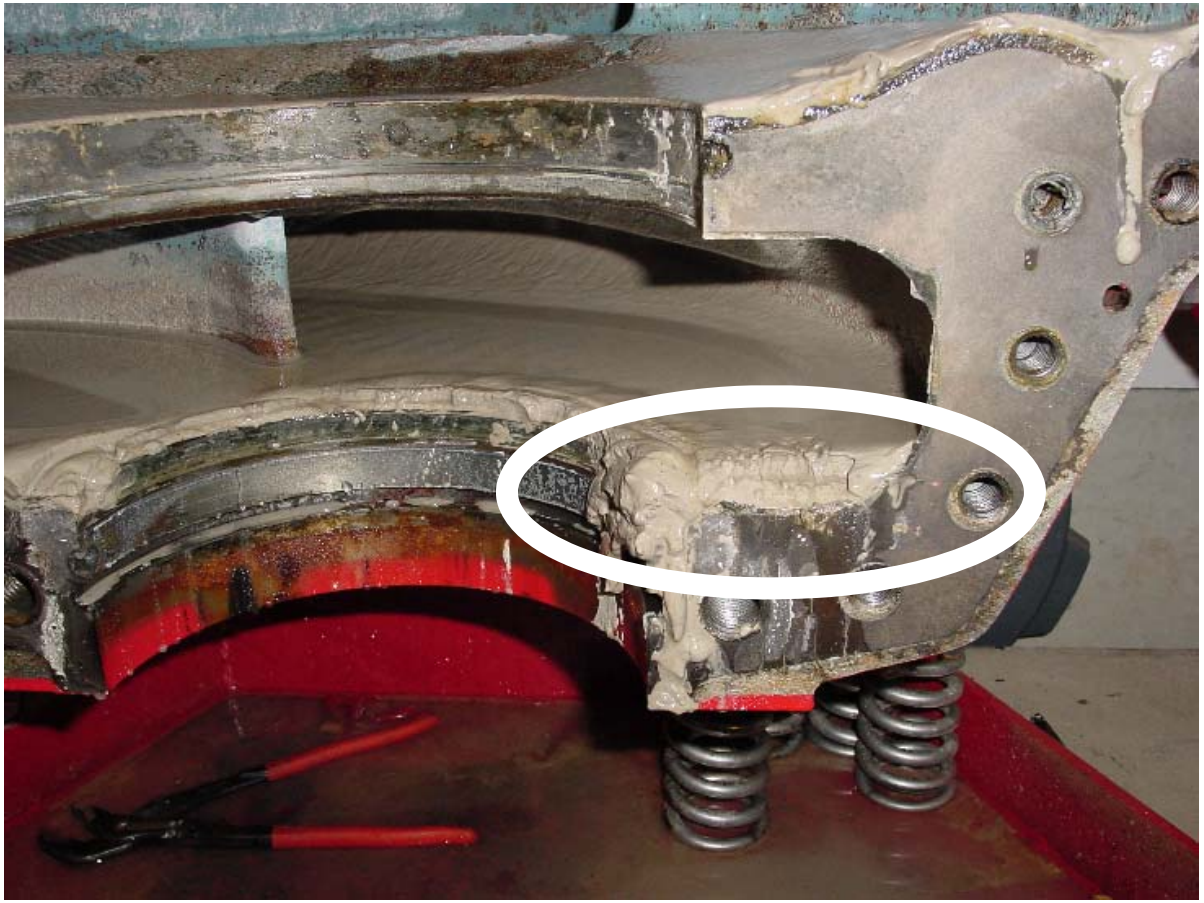
System Problem?



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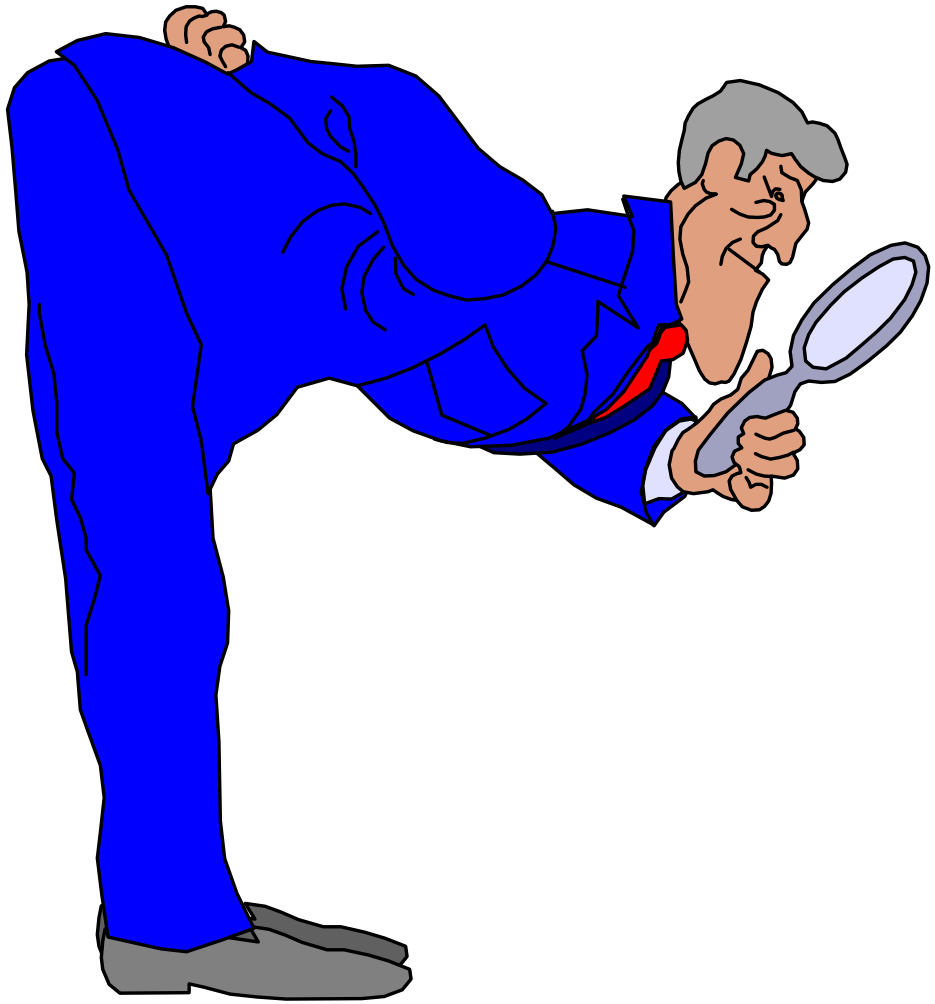
Key Performance Factors



- Face Wear
- Types of Failure
- Seal Application Limits
- Leakage
- Seal Environment

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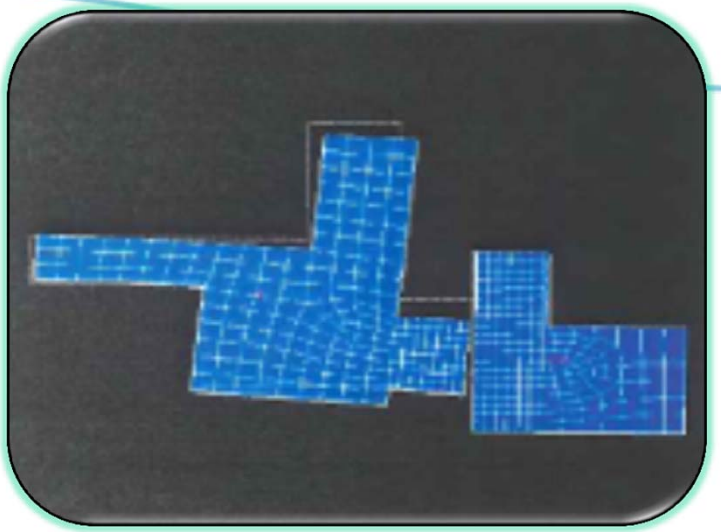
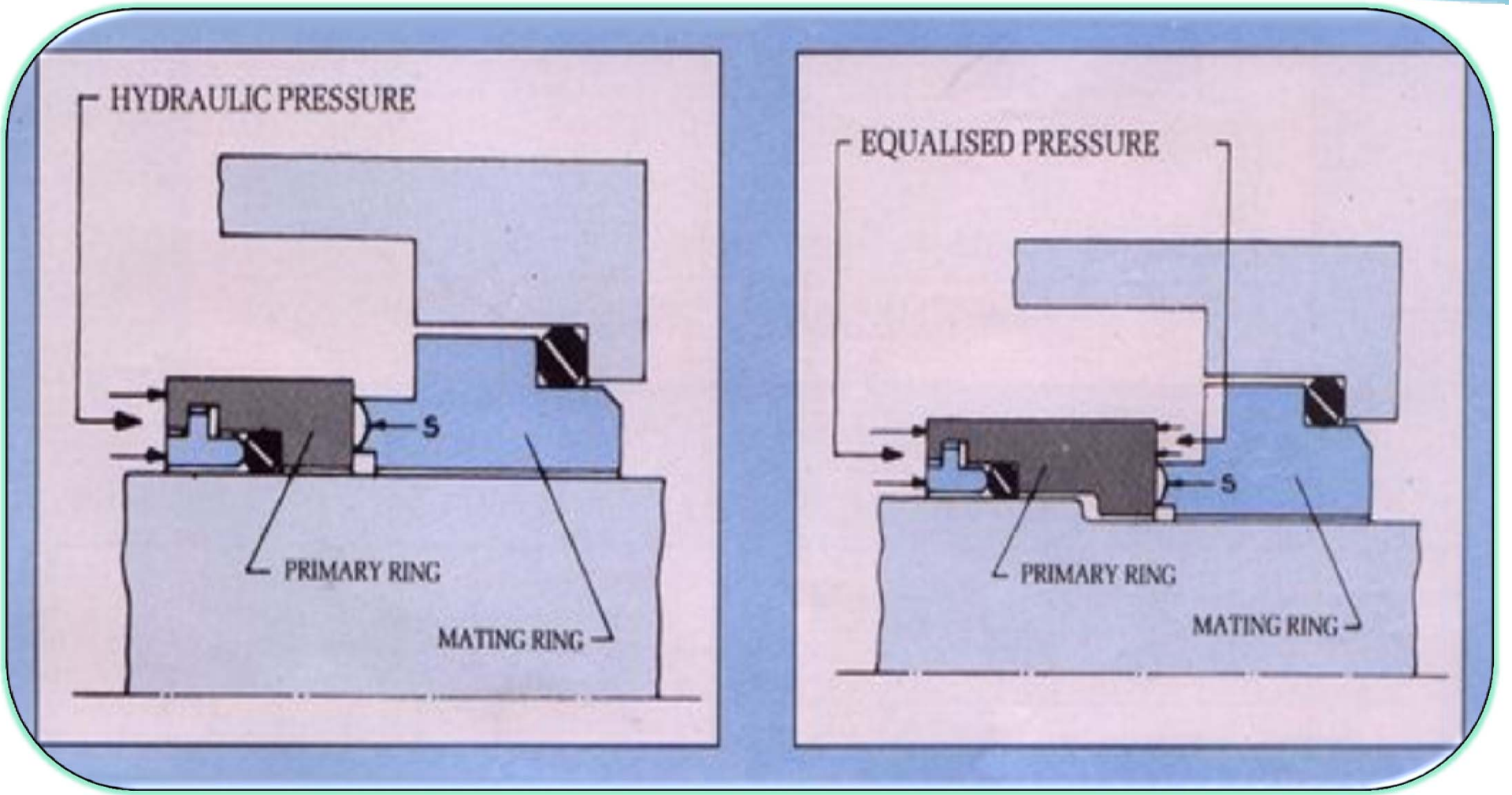
Face Wear

- Completely Worn (Rare)
- High Pressure
- High Abrasive Fluids



Balanced Mechanical Seal



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Iron Oxide Deposits

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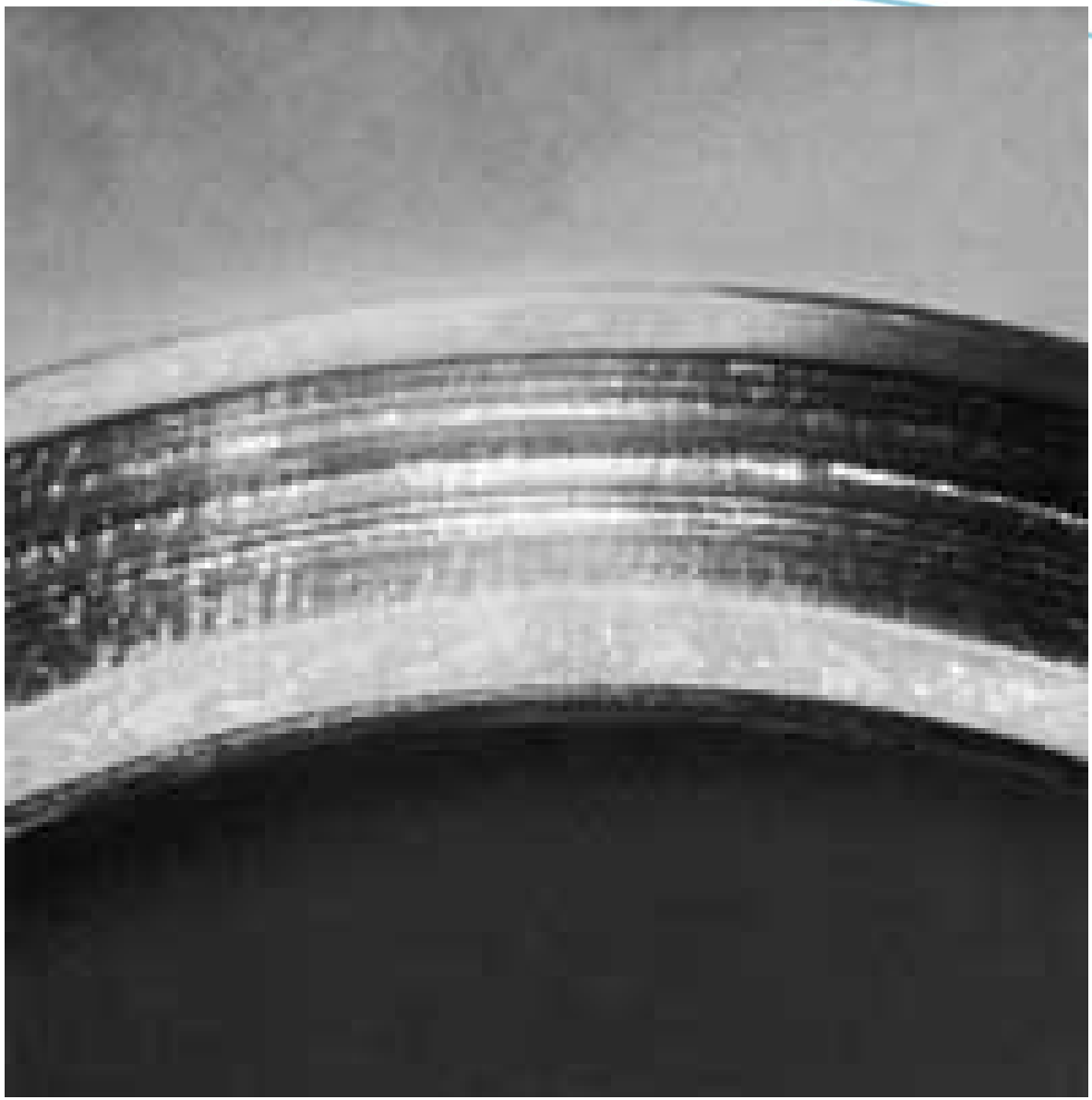
Record Grooved Seal Faces



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Embedded Material

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Types of Failure

- Premature
- Random
  - Difficult to Predict
  - Application
- Wear-Out

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Inner Diameter Chipped

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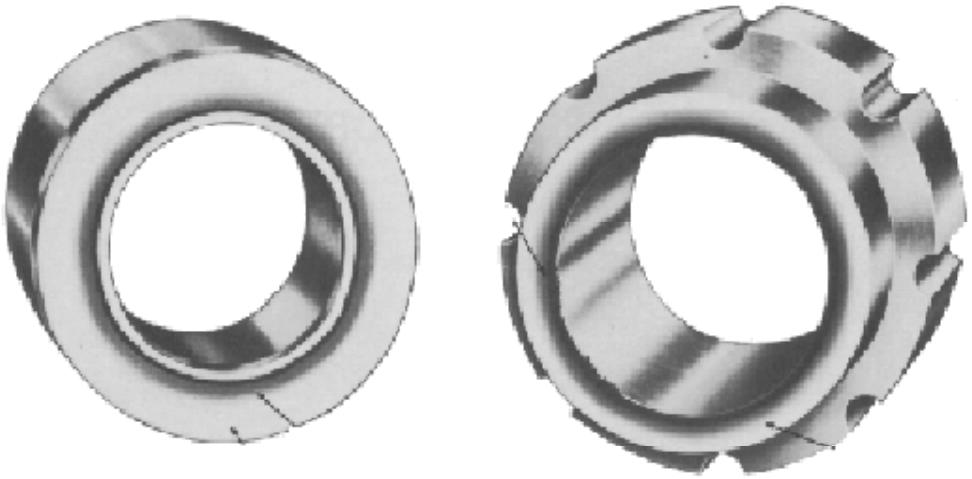
Seal Application Limits



Rotation Due to High Temperature

- Pressure
- Temperature
- PH
- Fluid
- Dissolved Solids
- Undissolved Solids

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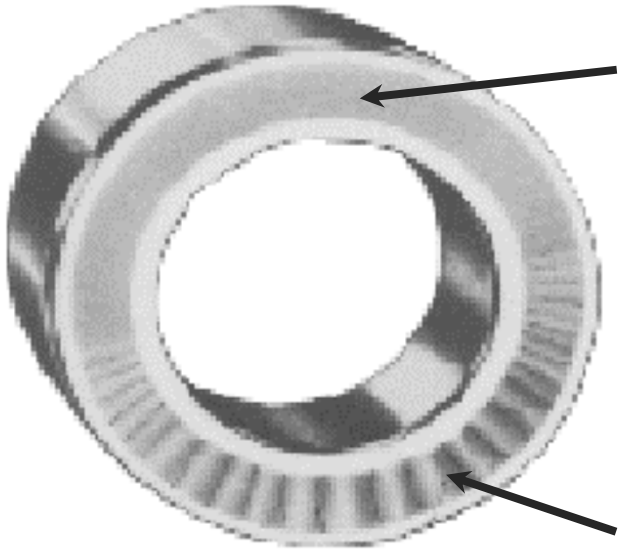
Seal Face Deflection

- Improves or Starves Lubrication
- Faces Sensitivity to Changes In
  - Temperature
  - Pressure
  - Chemicals



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Carbon Face Blistering

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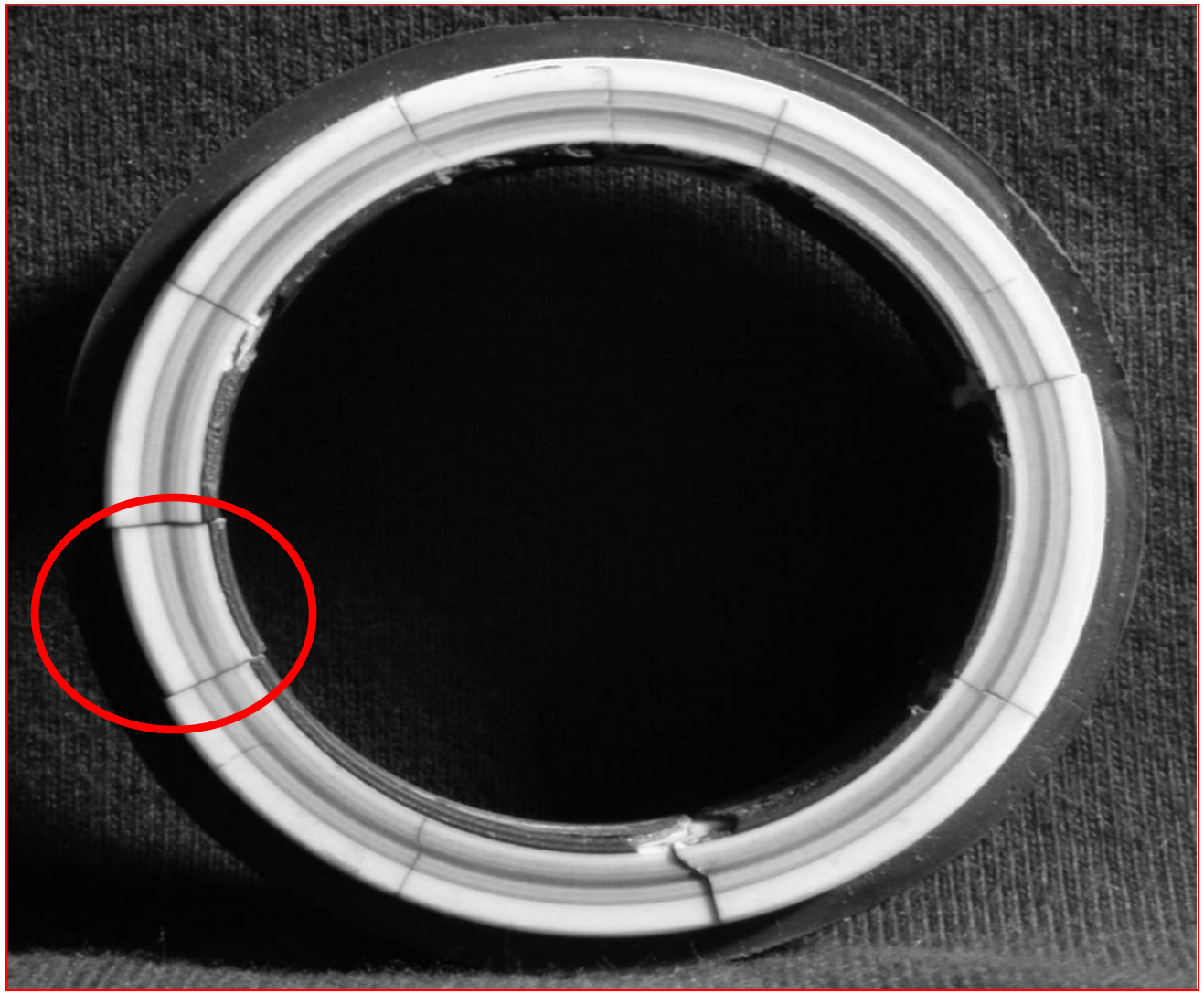
Cracked or Fractured Seat Inserts



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Chemical Attacks

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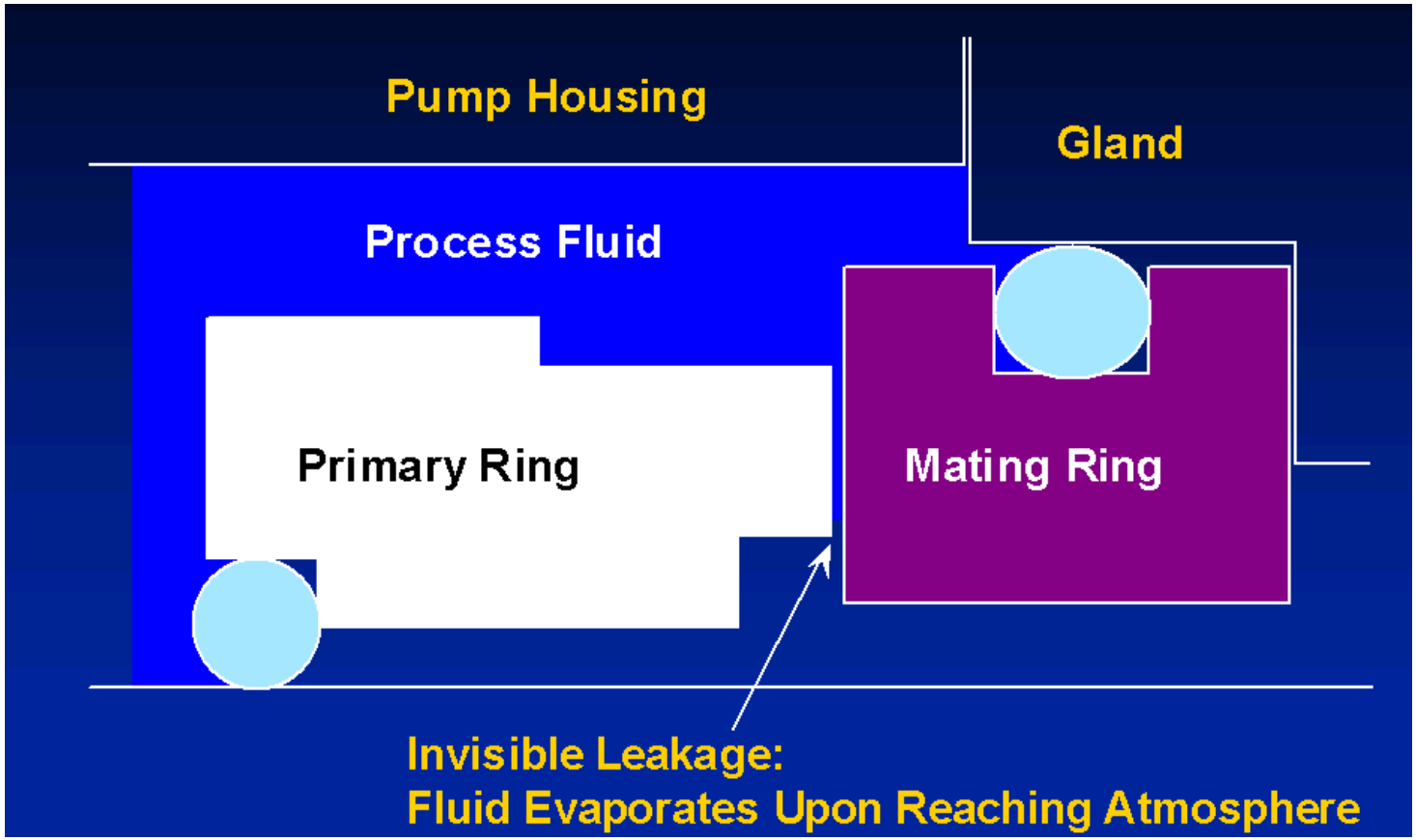
Leakage

- Lubricates
- Cools
- Rate



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Seal Environment

Seal is Only as Reliable as the Environment in which it Operates

Week 1

Week 8

Provided by Dan Slater, Fernox & Charlie Meier, Hydro-Flo Products, Inc.

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Factors Affecting Corrosion

- Materials of Construction
- Oxygen Content
- pH
- Temperature
- Water Conductivity
- Pressure
- Fluid Velocity
- Fouling

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Corrosion Inhibition

- Acceptable Corrosion Rate
- Leak Free System
- Minimize Make Up Water
- Maintain System Log
  - Pressure
  - Temperature
  - Consumption
  - Quality Testing

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Questions

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