

Regulator Advantages

- **Regulators do not require an external power source, resulting in less down time.**
- **Regulators do not require an external packing gland resulting in a lower chance of leakage.**
- **Ease of maintenance.**
- **Lower installation costs.**
- **Instantaneous reaction.**
- **Efficient and durable.**
- **Self-contained. (They do not require external piping.)**

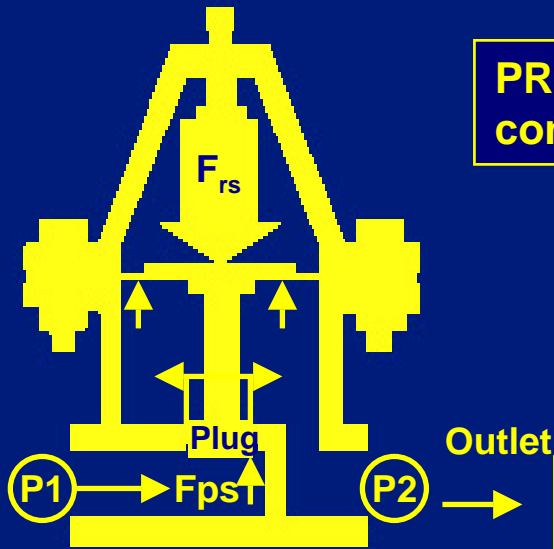
Applying Regulators

KEY: CRV = Control Valve
 REG = Flow-to-close Regulator
 CRV WOP = Control Valve w/out positioner

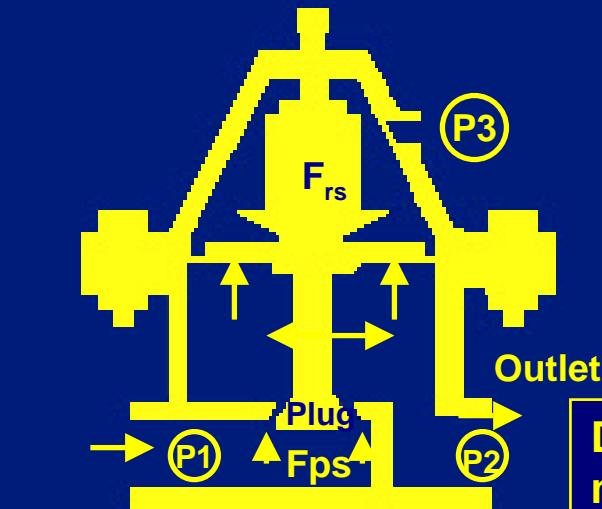
POR = Pilot Operated Regulator
 FTO REG = Flow-to-open Regulator

REG = Self-contained Regulator FTC
 CRV WP = Control Valve w/positioner

FACTORS CONSIDERED	BEST	NEXT	LAST
Line Size Cost – Thru 1-1/2"	REG	POR	CRV
– 2" thru 3"	POR	REG	CRV
– 4" and Up	CRV	POR	REG
Cost/CV – Thru 1-1/2"	POR	REG	CRV
– 2" and Up	CRV	POR	REG
Capacity	CRV	POR	REG
Outlet Pressure Level Capability	CRV	REG	POR
Output Pressure Level Maintenance of Set Point	CRV	POR	REG
Rangeability	FTO REG	CRV/POR	FTC REG
Requirements for External Power – (Air or Electricity)	REG/POR		CRV
Stability	CRV	REG	POR
Speed of Response	REG	POR	CRV WOP CRV WP
Ability to Adapt to System Dynamics	CRV	POR	REG
Fail-Safe Action		CRV	POR/REG
Adaptability (Add accessories, modify action)	CRV	REG	PRO
Remote Set Point Capability	CRV	Regulator, Dome Loaded	POR/REG
Maintenance Cost/Spare Parts	REG	POR	CRV



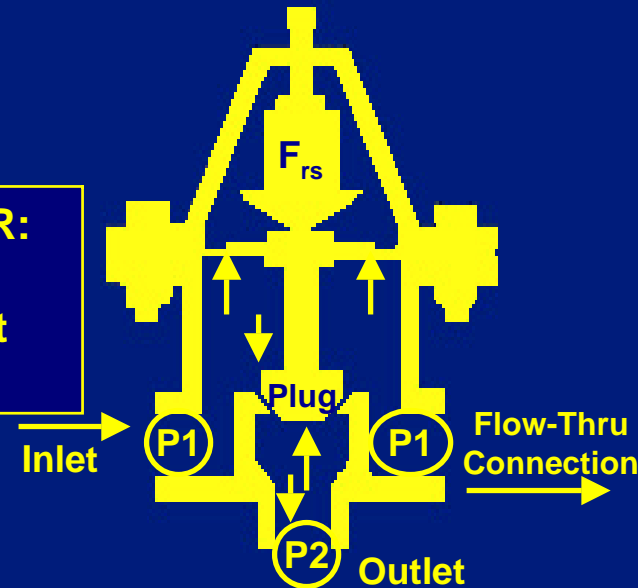
Pressure Reducing Regulator, Globe Design



Differential Pressure Regulator

PRESSURE REDUCING REGULATOR: A device that controls and responds to changes in its outlet pressure.

BACK PRESSURE REGULATOR: A device that controls and responds to changes in its inlet pressure.

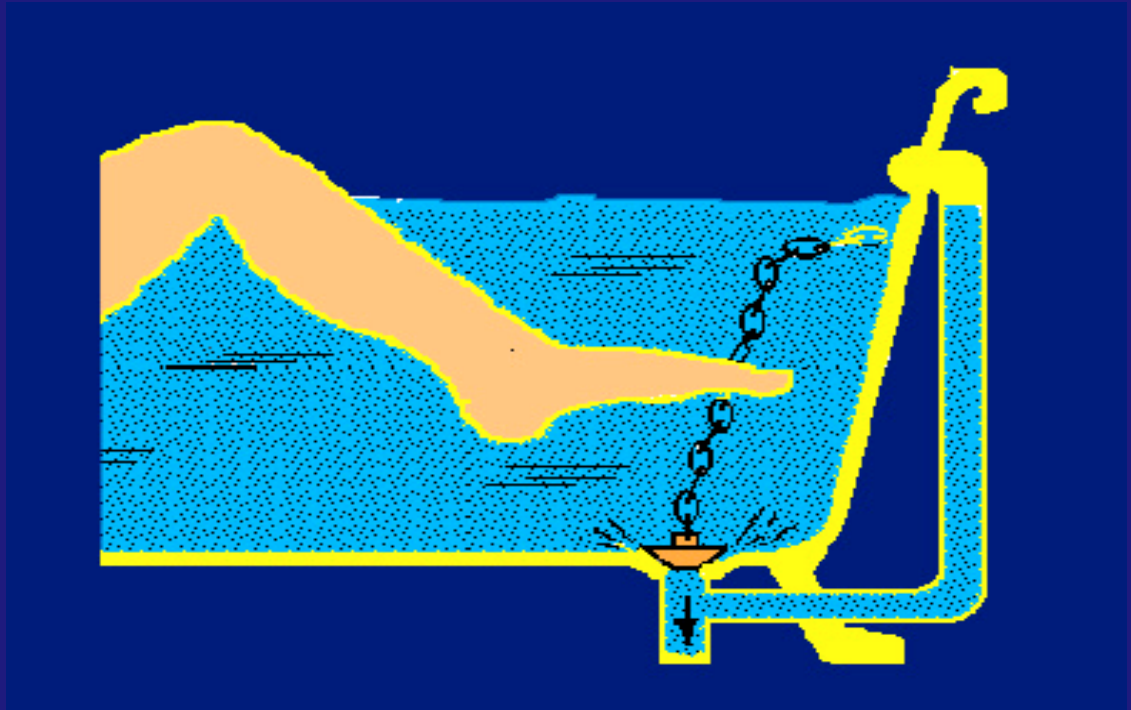


Flow-Thru Angle Design

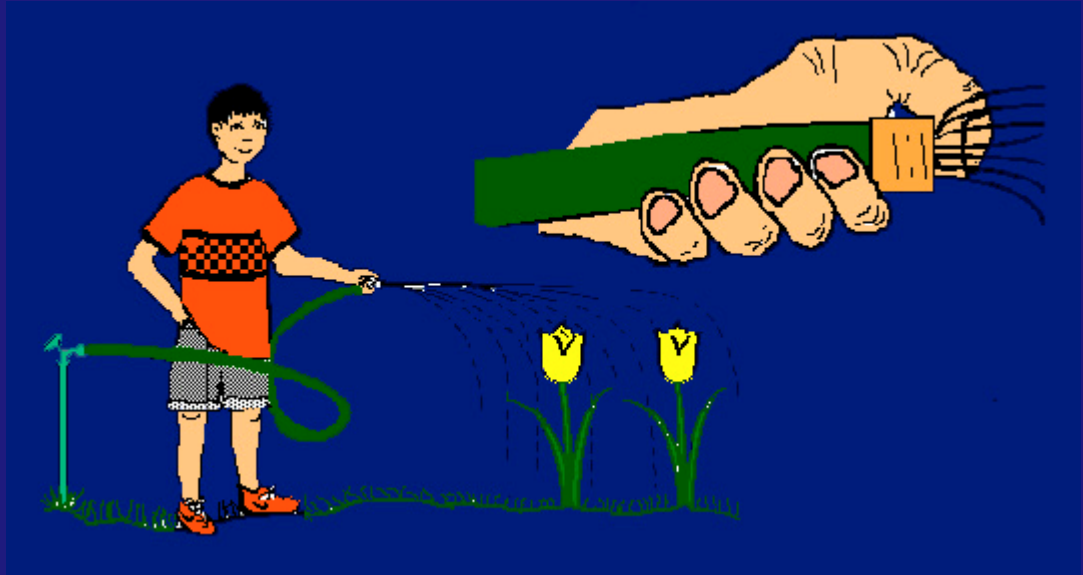
DIFFERENTIAL PRESSURE REGULATOR: A device that maintains a constant differential pressure between a reference pressure and the pressure of the controlled fluid.

FTO vs. FTC

FTC—FLOW TO CLOSE



FTO—FLOW TO OPEN



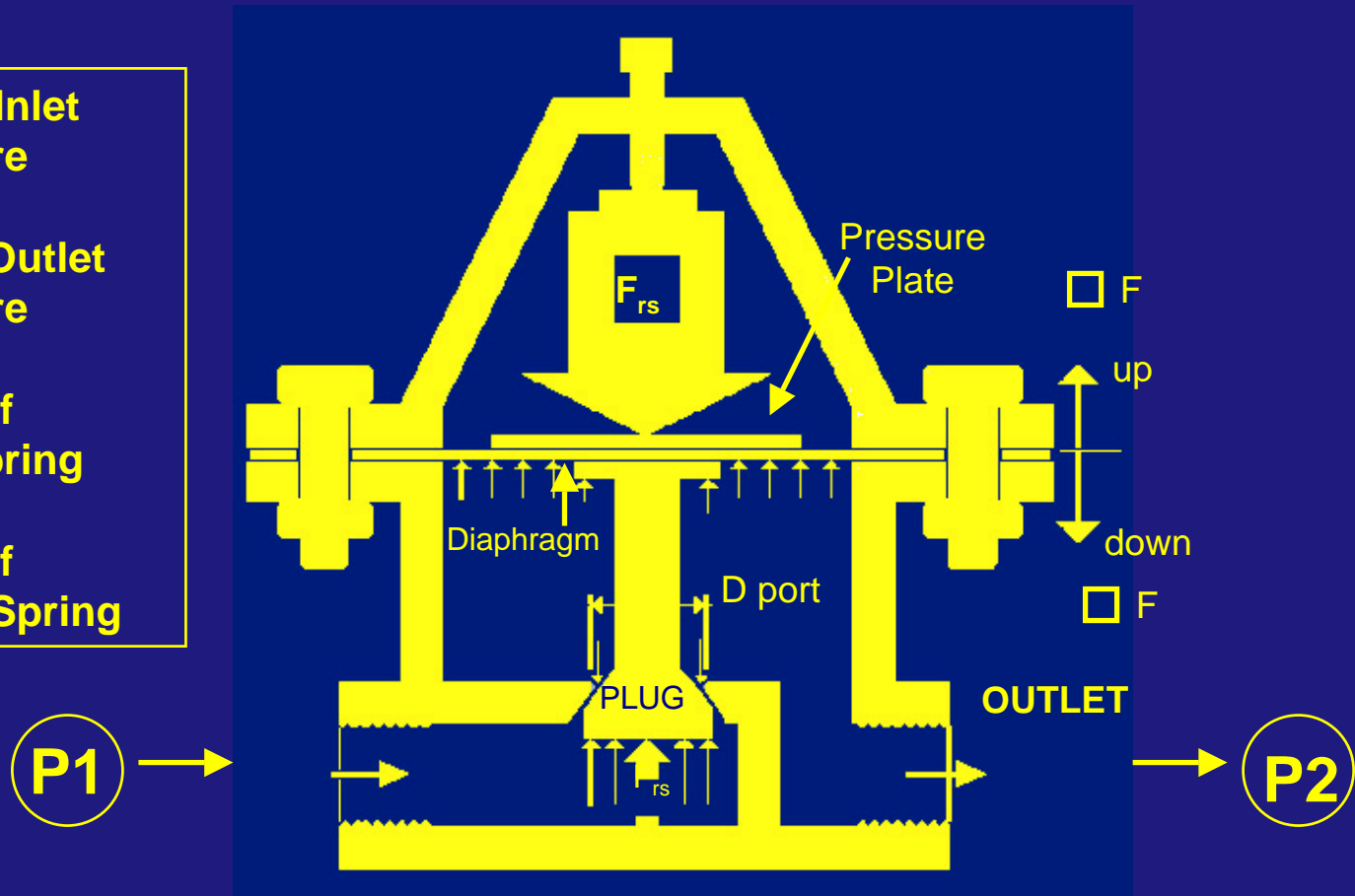
REDUCING REGULATORS

P1 = Higher Inlet Pressure

P2 = Lower Outlet Pressure

F_{rs} = Force of Range Spring

F_{ps} = Force of Piston Spring



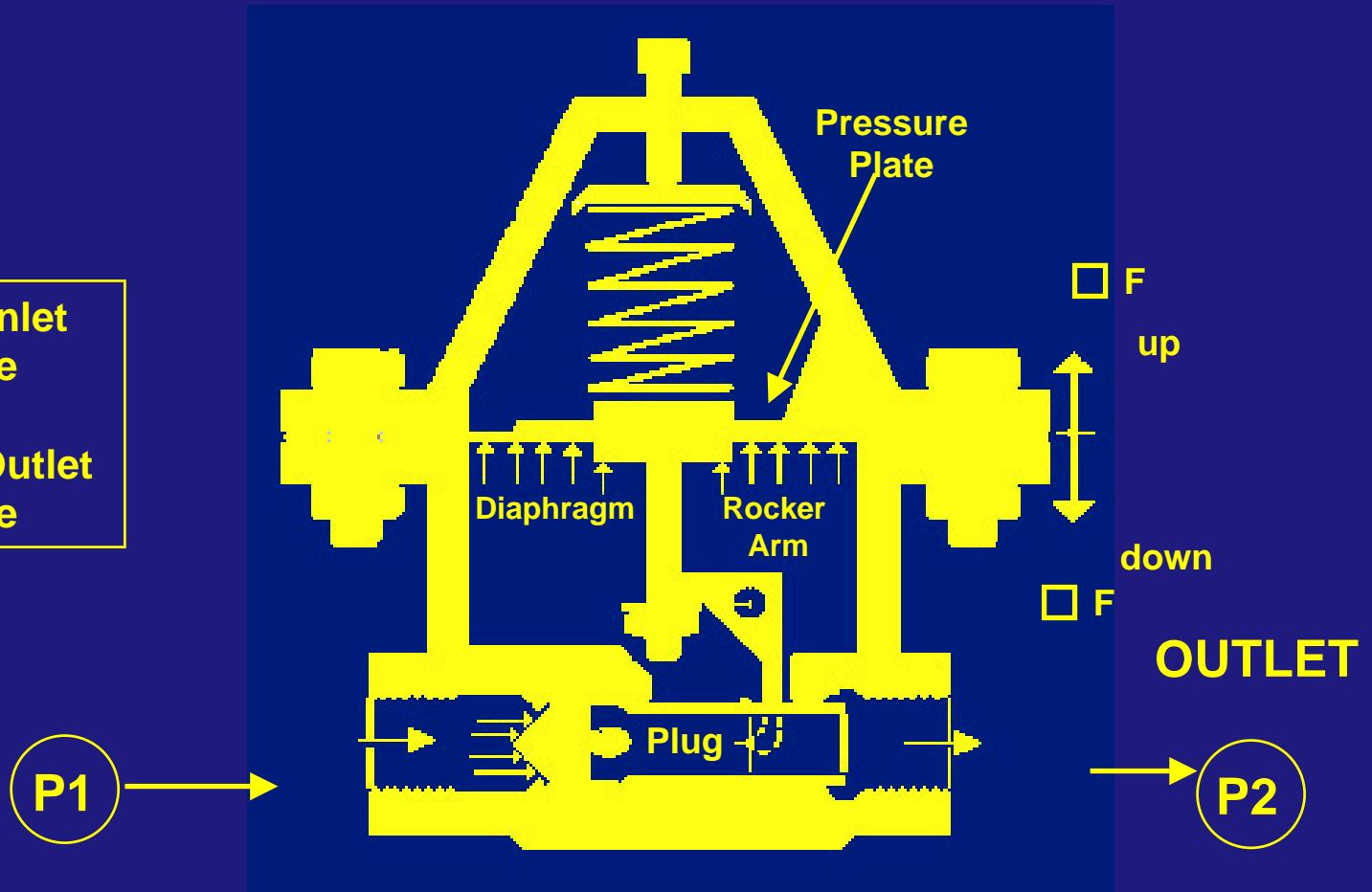
Force-Balance Principle

$$F_{up} = F_{down}$$

$$F_{ps} + (P1 \times A_{piston}) + (P2 \times A_{diaph}) = F_{rs} + (P2 \times A_{port})$$

FTO REDUCING REGULATOR

P1 = Higher Inlet Pressure
P2 = Lower Outlet Pressure



Inlet Pressure Tends to “Push” the Plug Open

TO INCREASE FLOW



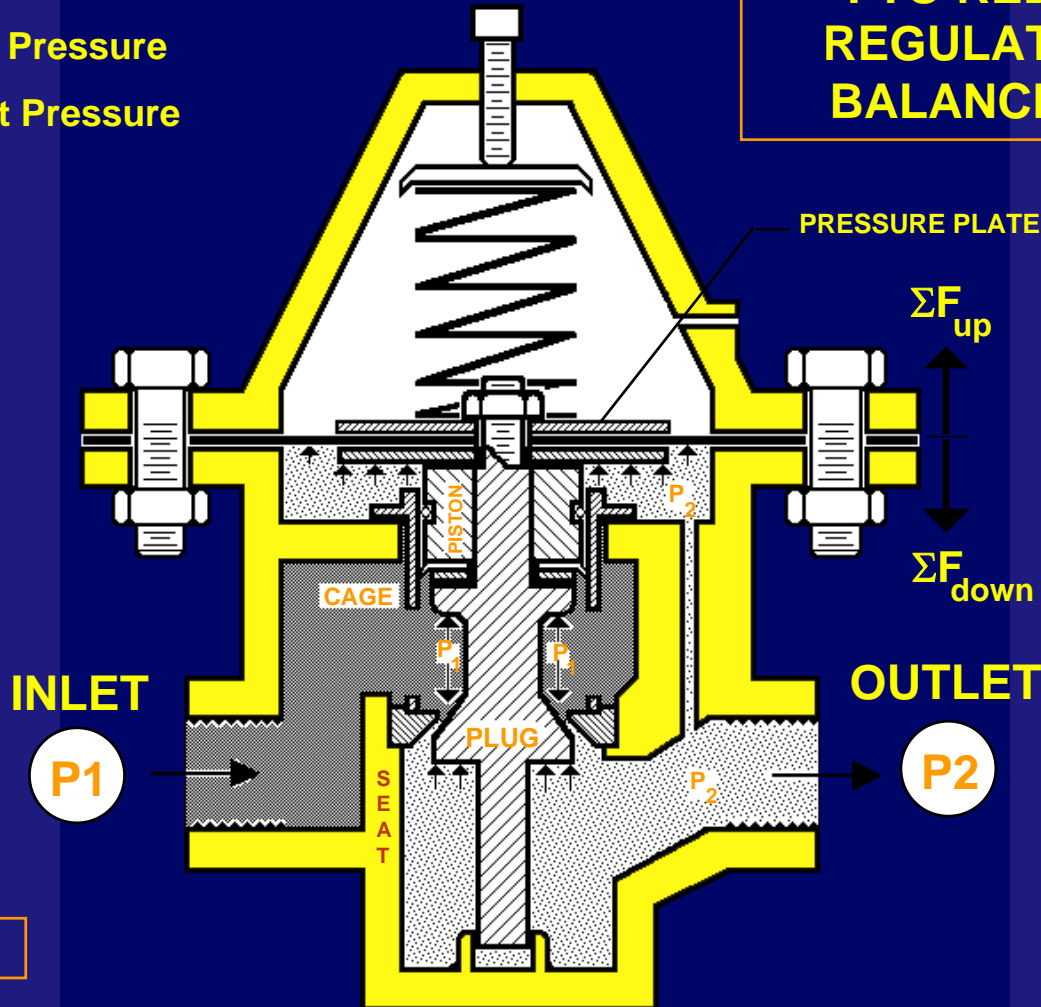
PLUG MOVES RIGHT + DIAPHRAGM MOVES DOWN



RANGE SPRING RELAXES + P2 OUTLET DECREASES

P1 = Higher Inlet Pressure
P2 = Lower Outlet Pressure

**FTO REDUCING
REGULATOR with
BALANCED TRIM**

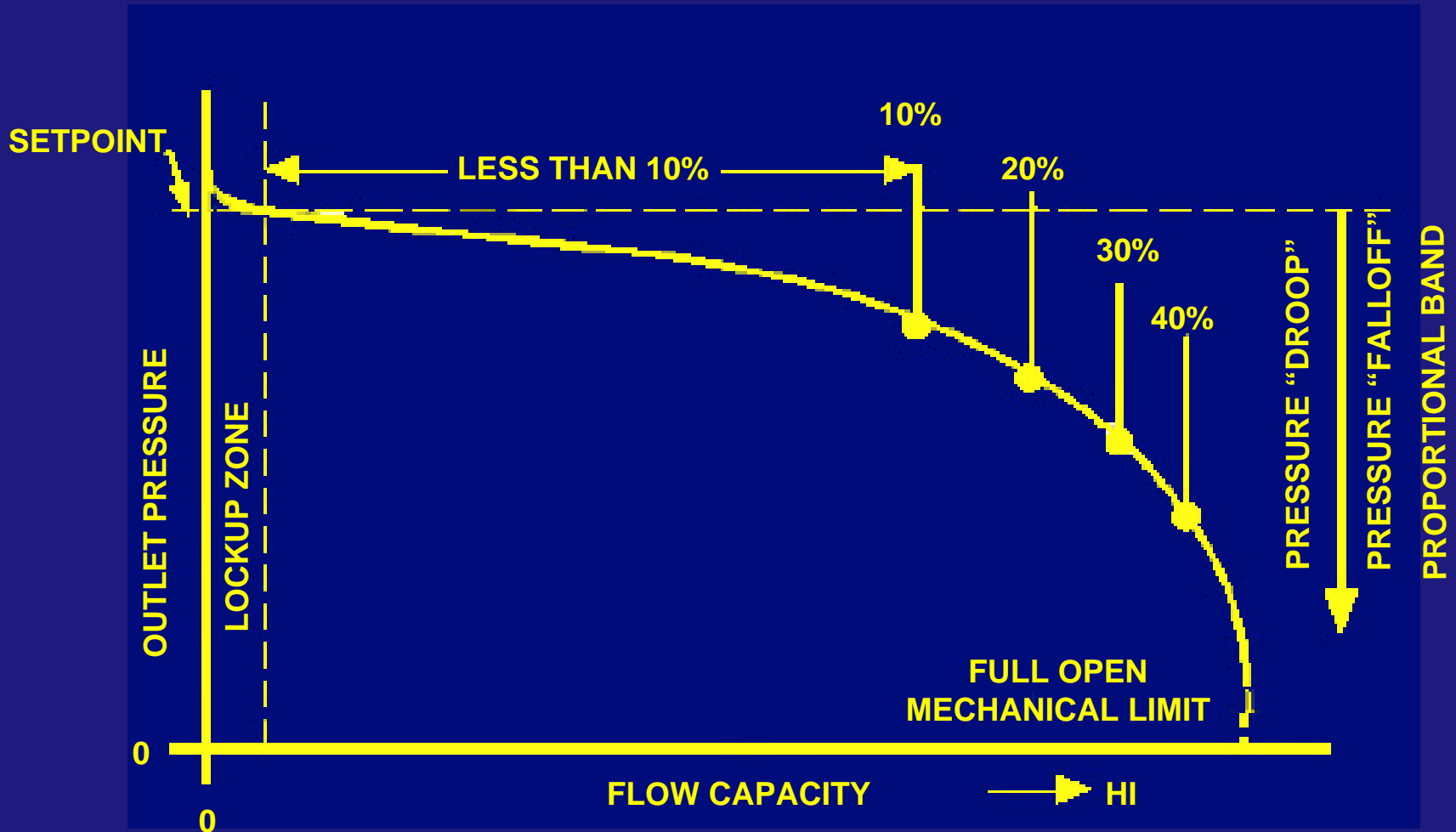


STD Flow Direction

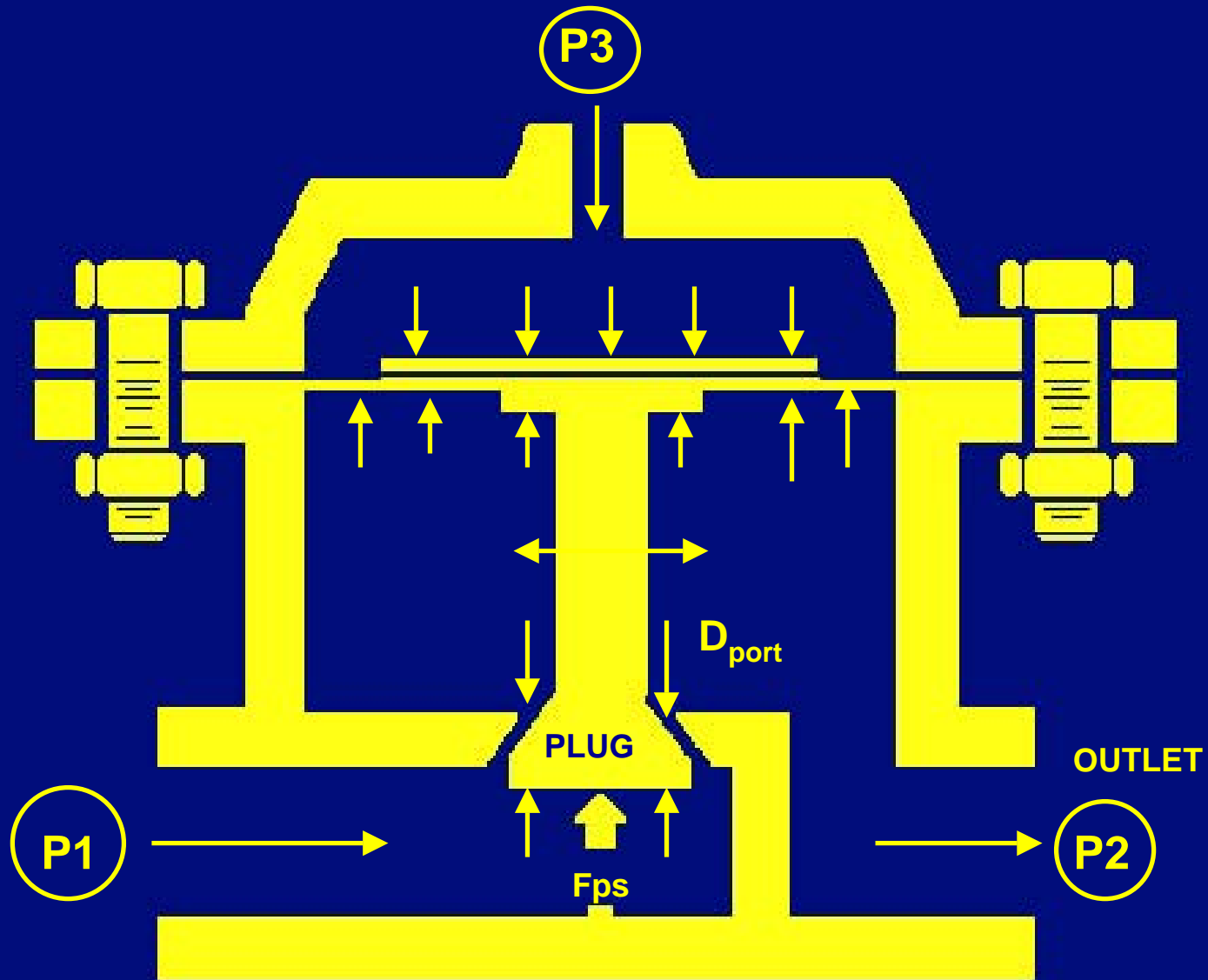
Inlet Pressure Tends To "PUSH" The Plug Open.

TO INCREASE FLOW → PLUG MOVES DOWN + DIAPHRAGM MOVES DOWN → RANGE SPRING RELAXES + P1 OUTLET DECREASES

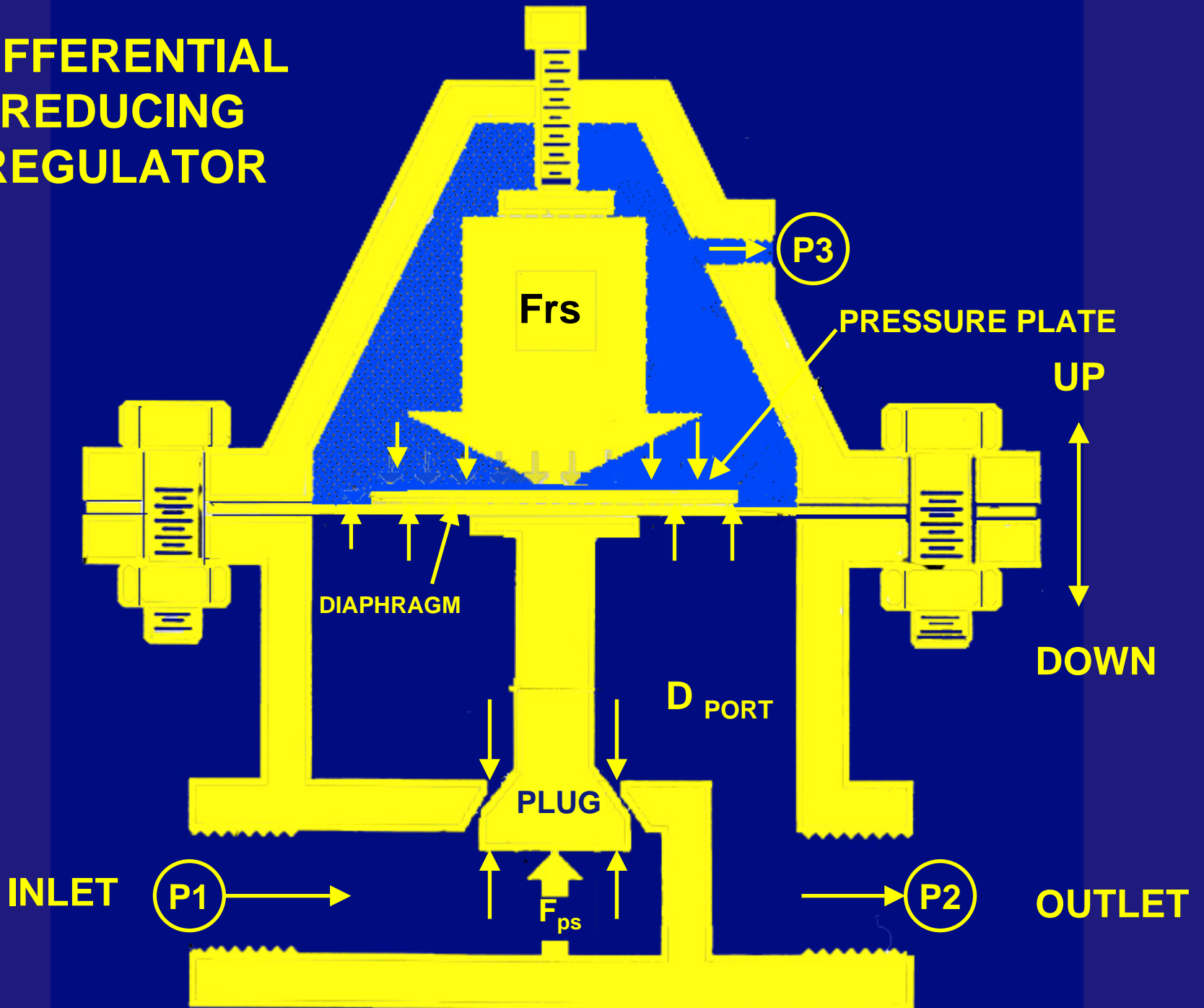
PROPORTIONAL BAND REDUCING REGULATOR



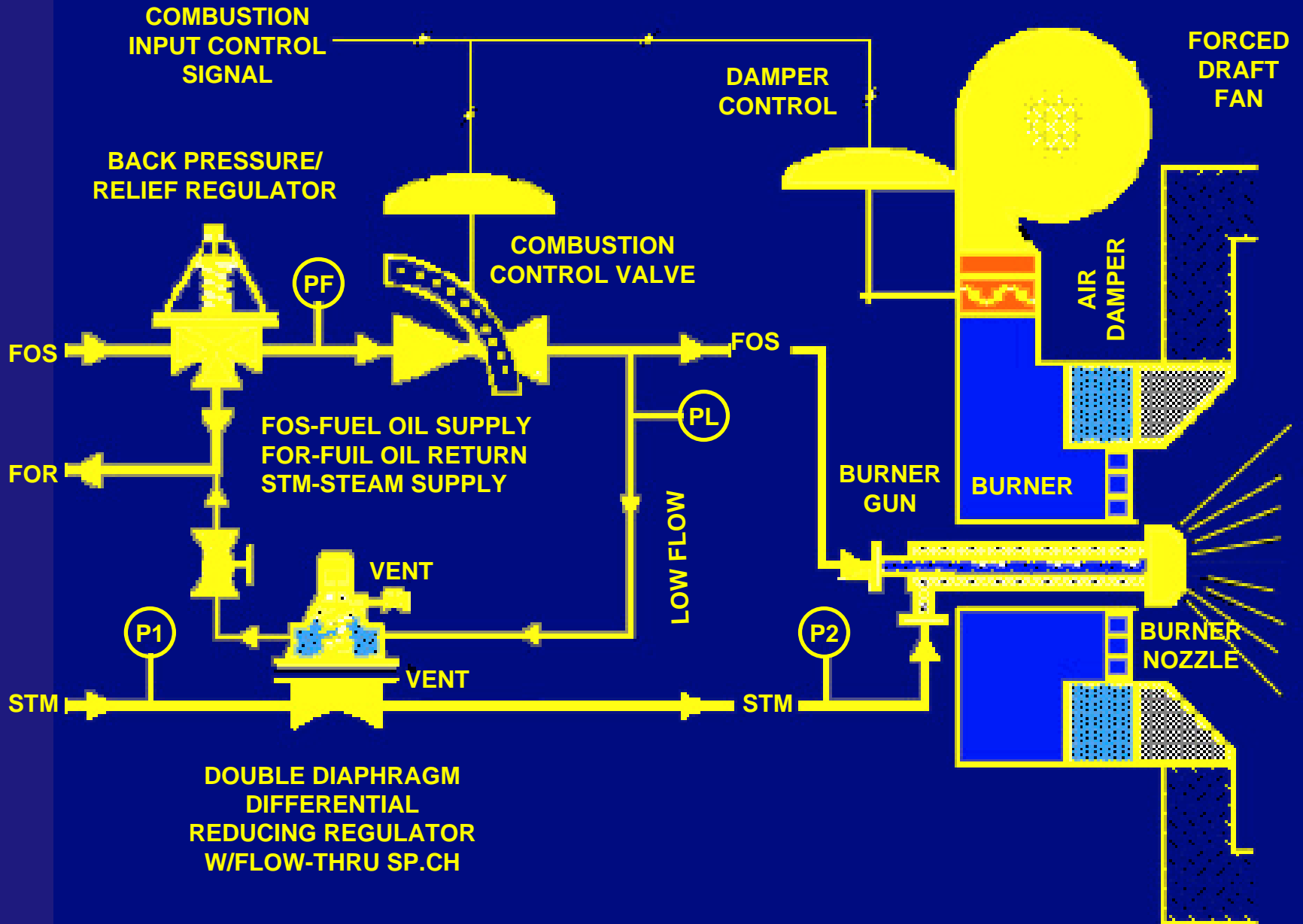
PRESSURE LOADED REDUCING REGULATOR



DIFFERENTIAL REDUCING REGULATOR

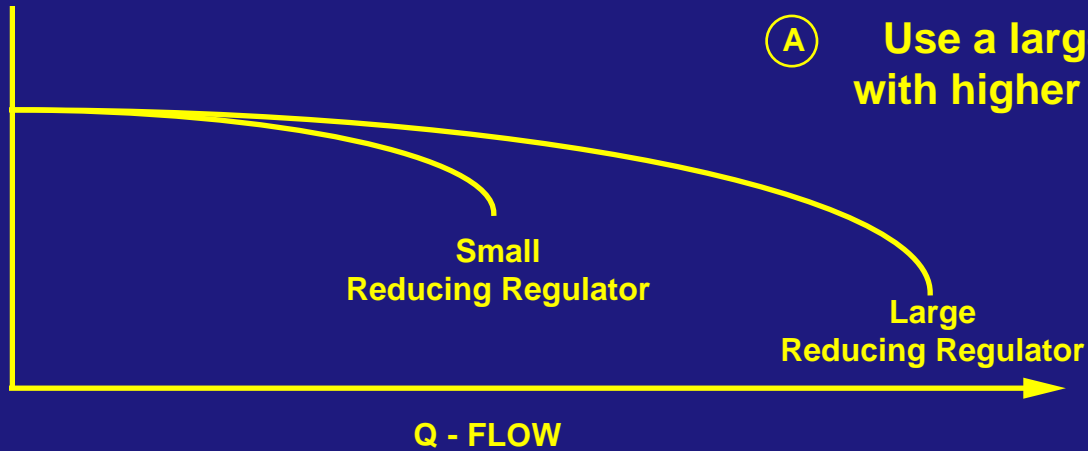


STEAM ATOMIZATION DIFFERENTIAL REDUCING REGULATOR

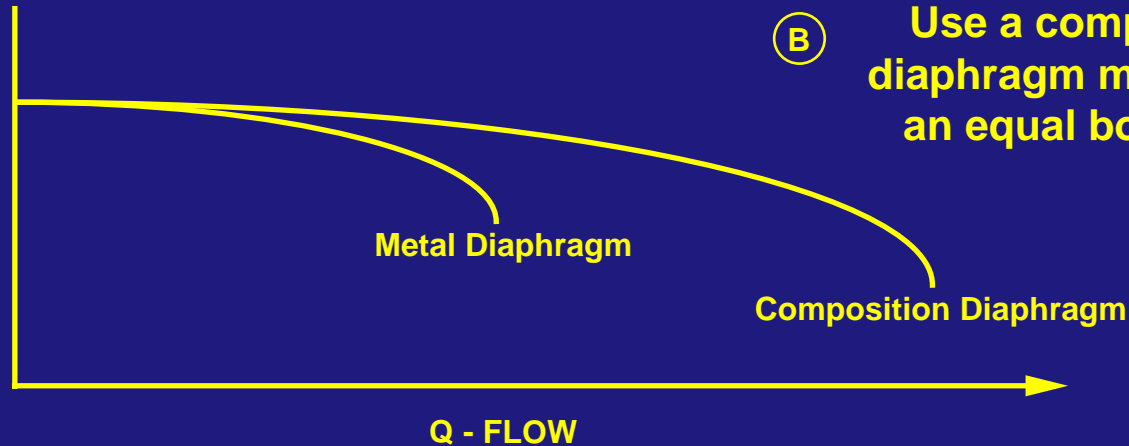


TO MINIMIZE DROOP

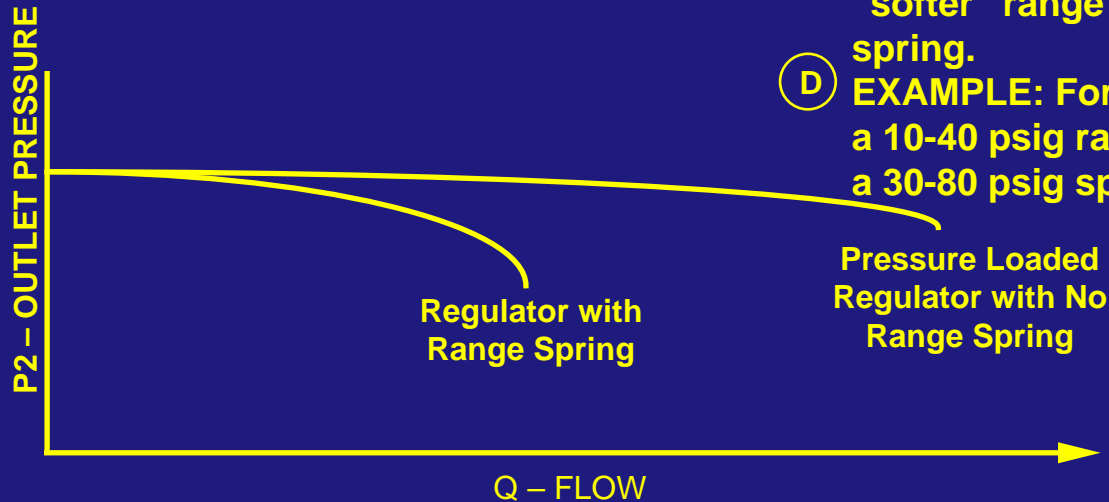
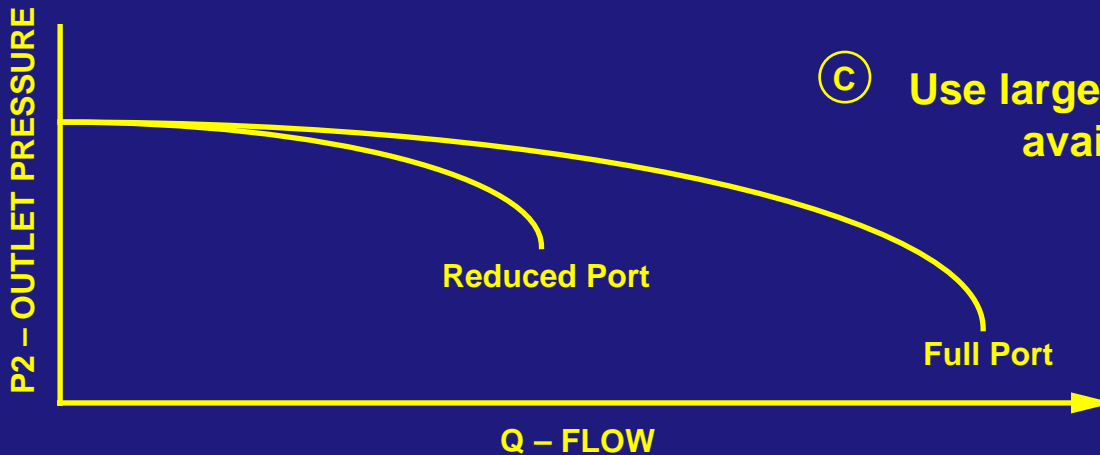
P2 - OUTLET PRESSURE



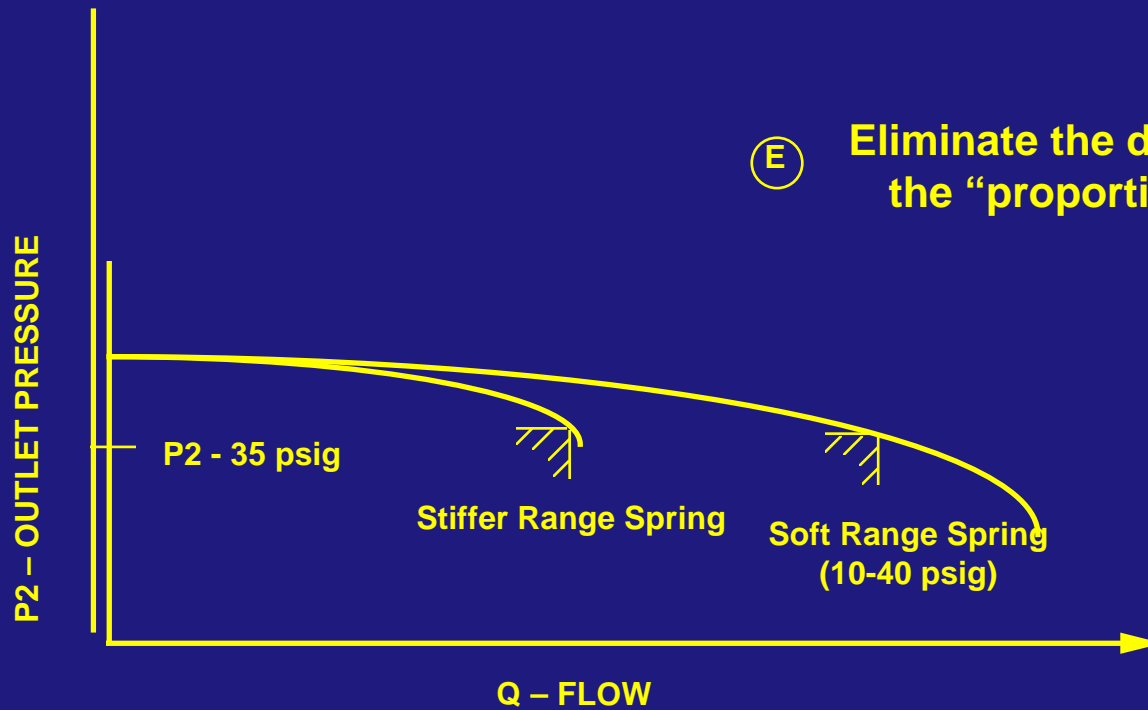
P2 - OUTLET PRESSURE



TO MINIMIZE DROOP

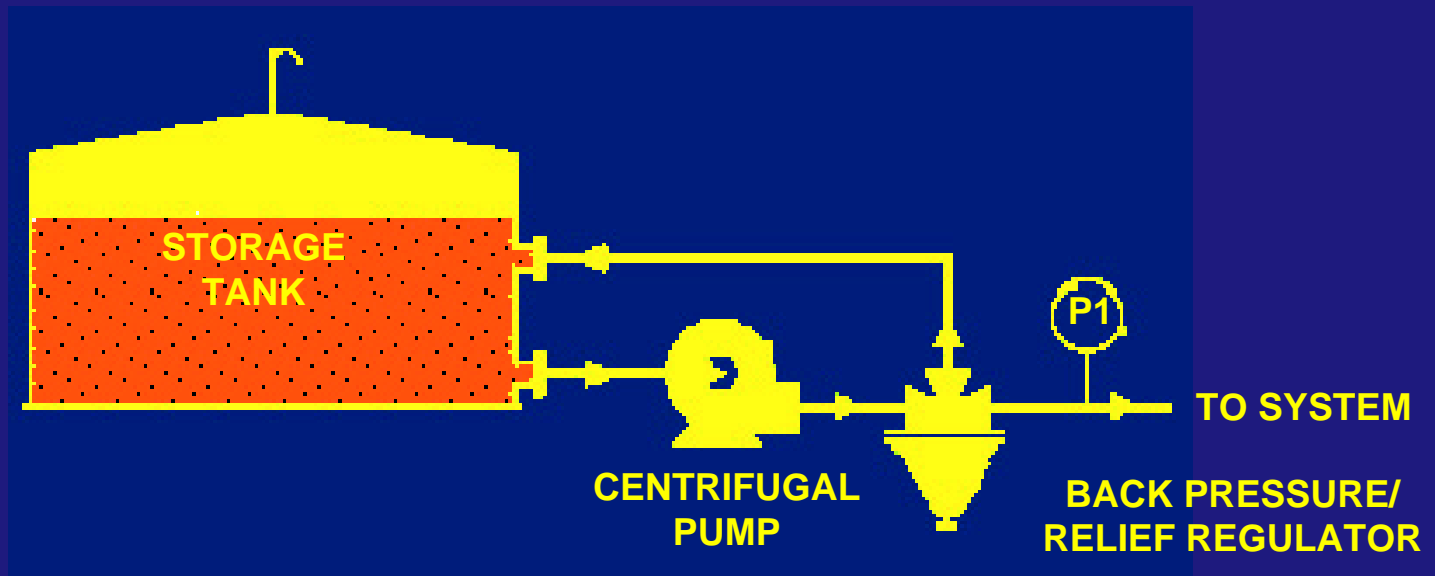


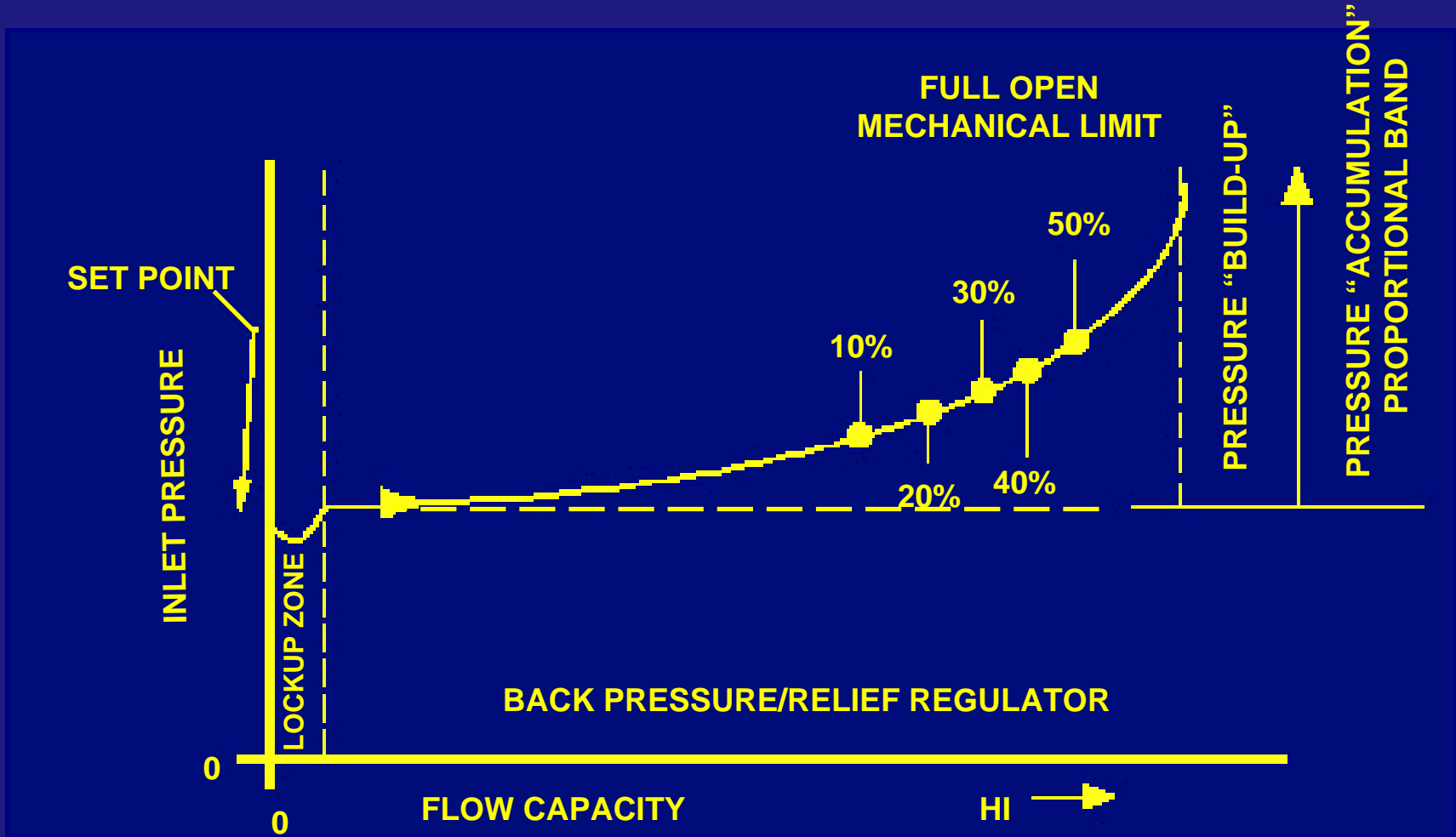
TO MINIMIZE DROOP



Pump Re-circulation Loop Design

Back Pressure Regulator





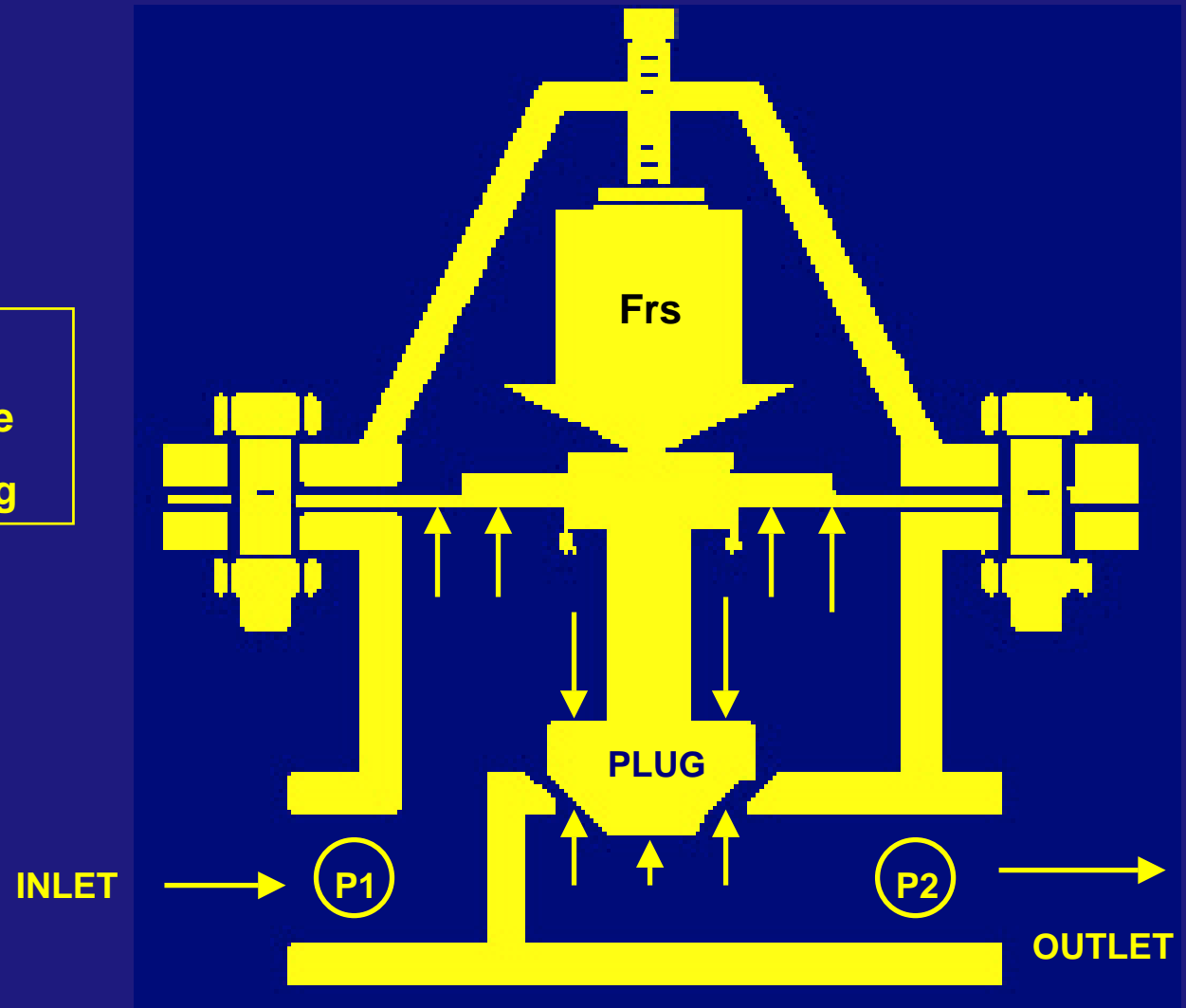
PROPORTIONAL BAND BACK PRESSURE/RELIEF REGULATOR

BACK PRESSURE / RELIEF REGULATOR – GLOBE DESIGN

$P1$ = Higher Inlet Pressure

$P2$ = Lower Outlet Pressure

F_{rs} = Force of Range Spring

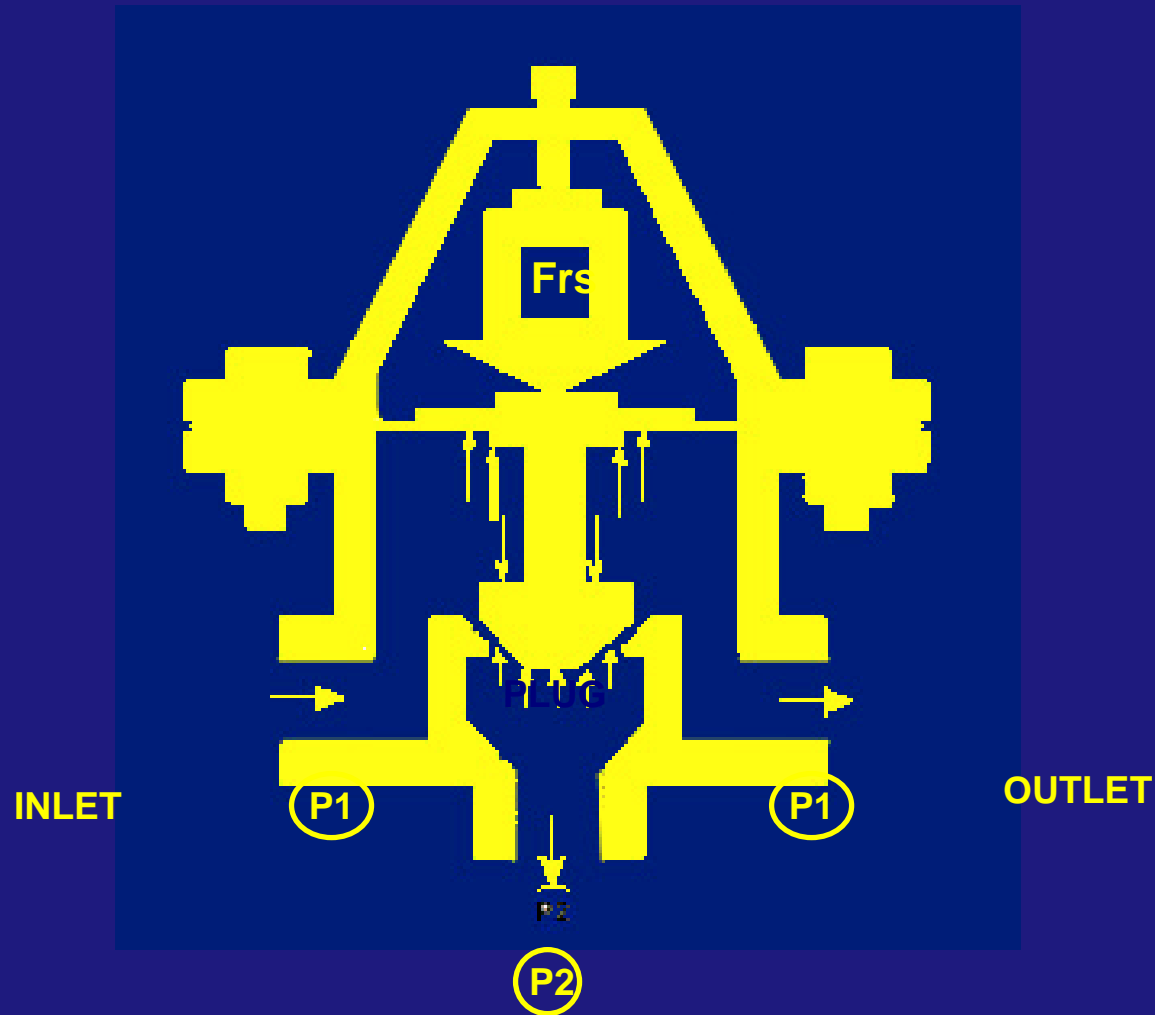


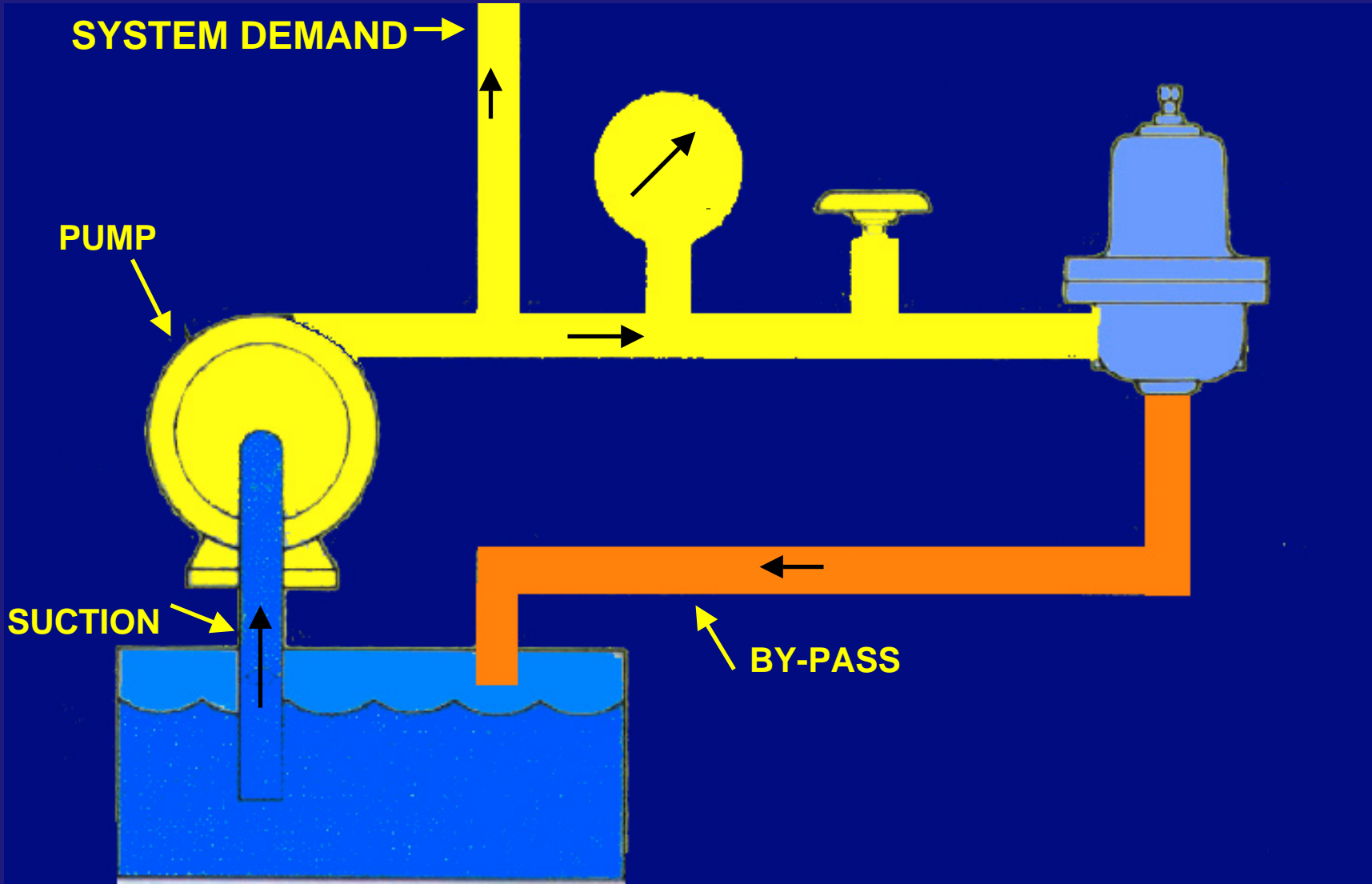
BACK PRESSURE / RELIEF REGULATOR – FLOW-THRU ANGLE DESIGN

P1 = Higher Inlet Pressure

P2 = Lower Outlet Pressure

F_{rs} = Force of Range Spring



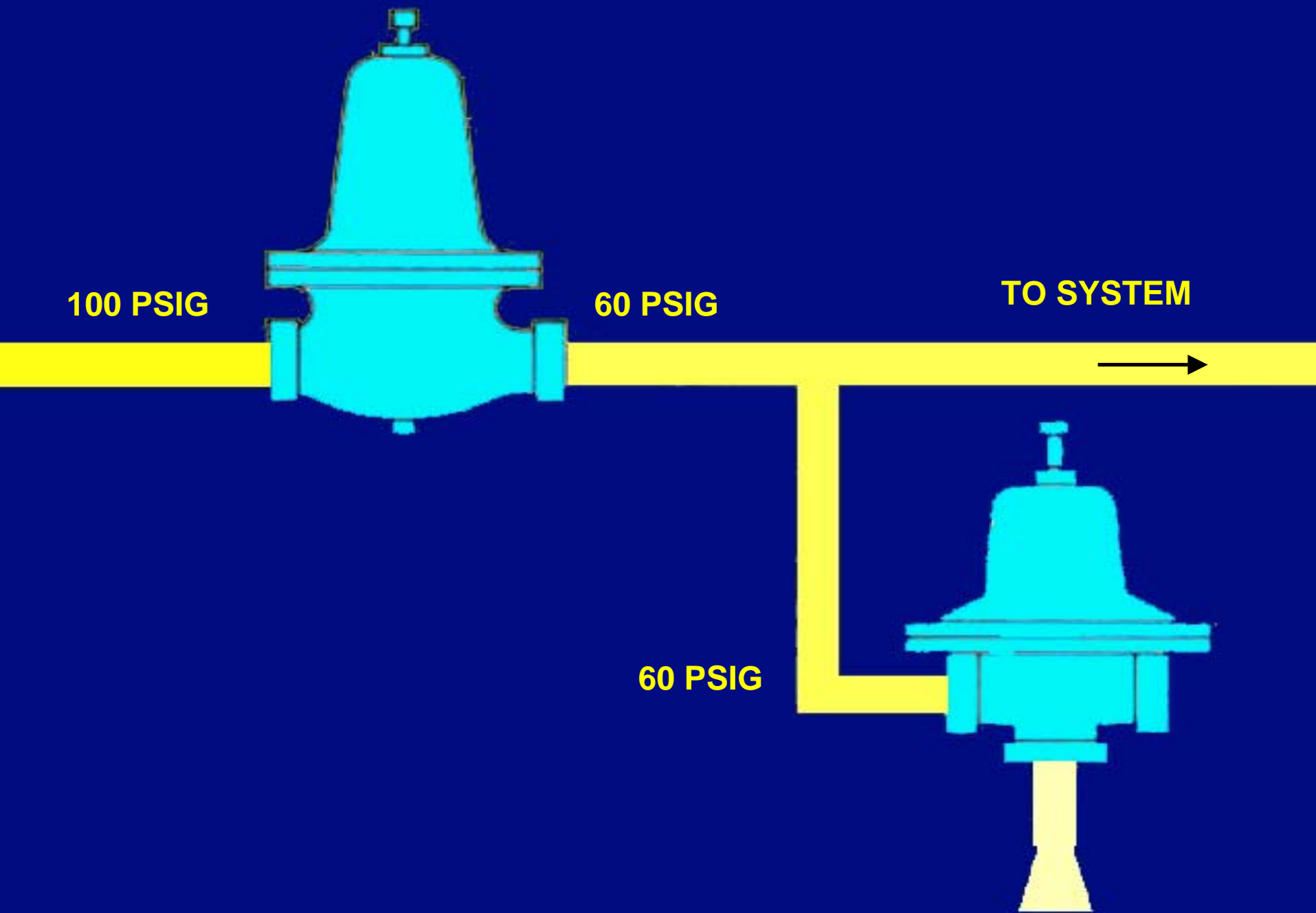


SYSTEM DEMAND →

PUMP

SUCTION

BY-PASS



100 PSIG

60 PSIG

TO SYSTEM

60 PSIG

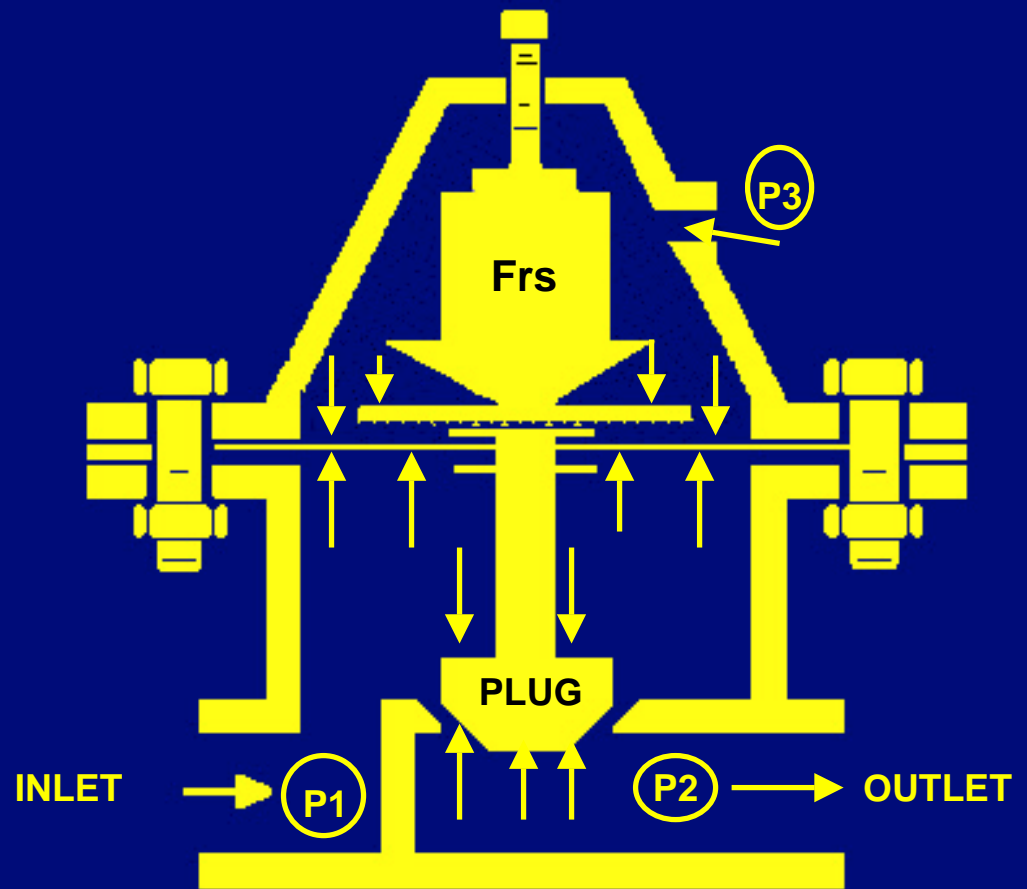
DIFFERENTIAL BACK PRESSURE / RELIEF REGULATOR

P_2 = Lower Outlet Pressure

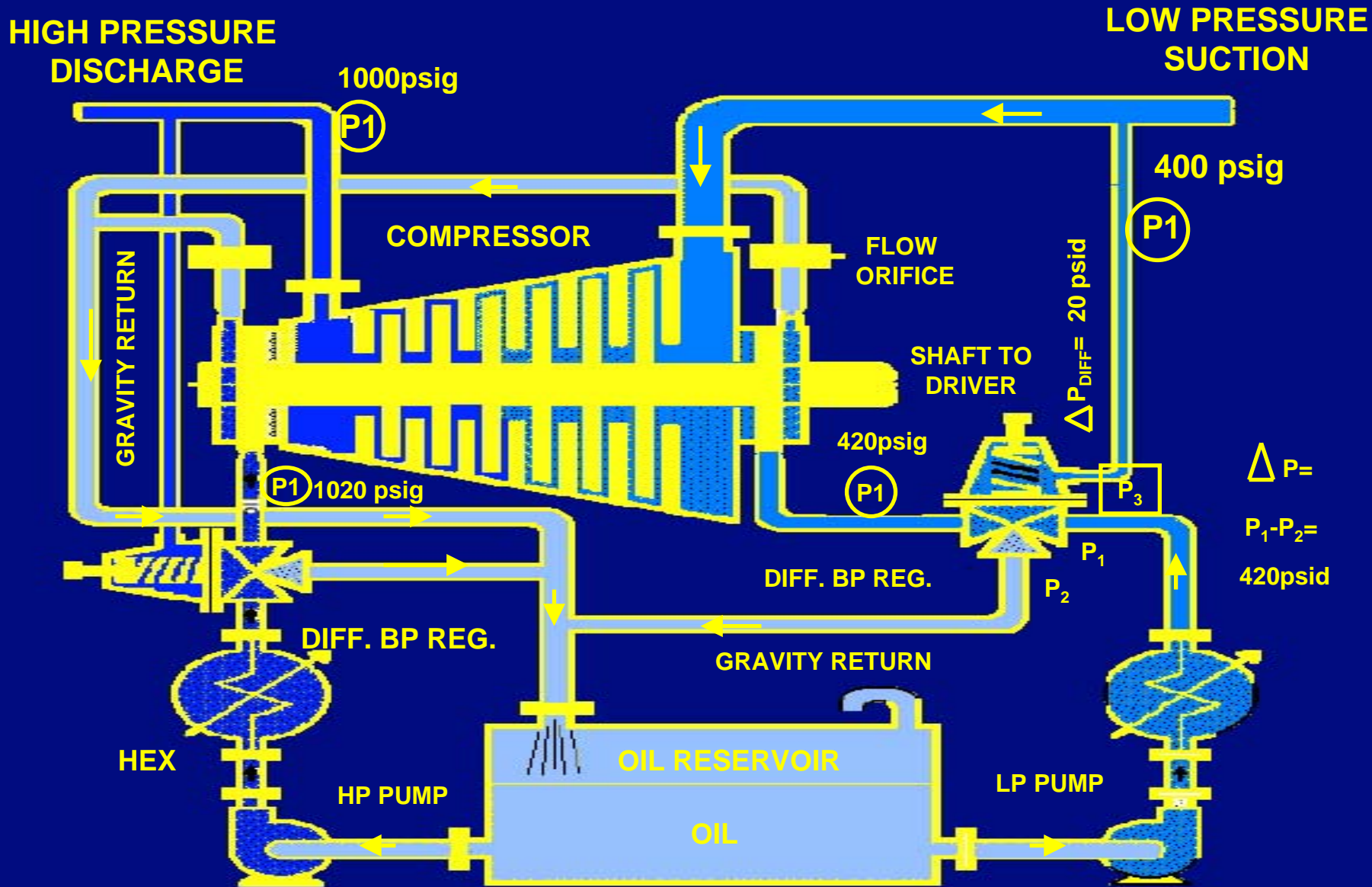
P_3 = Loading Pressure

F_{rs} = Force of Range Spring

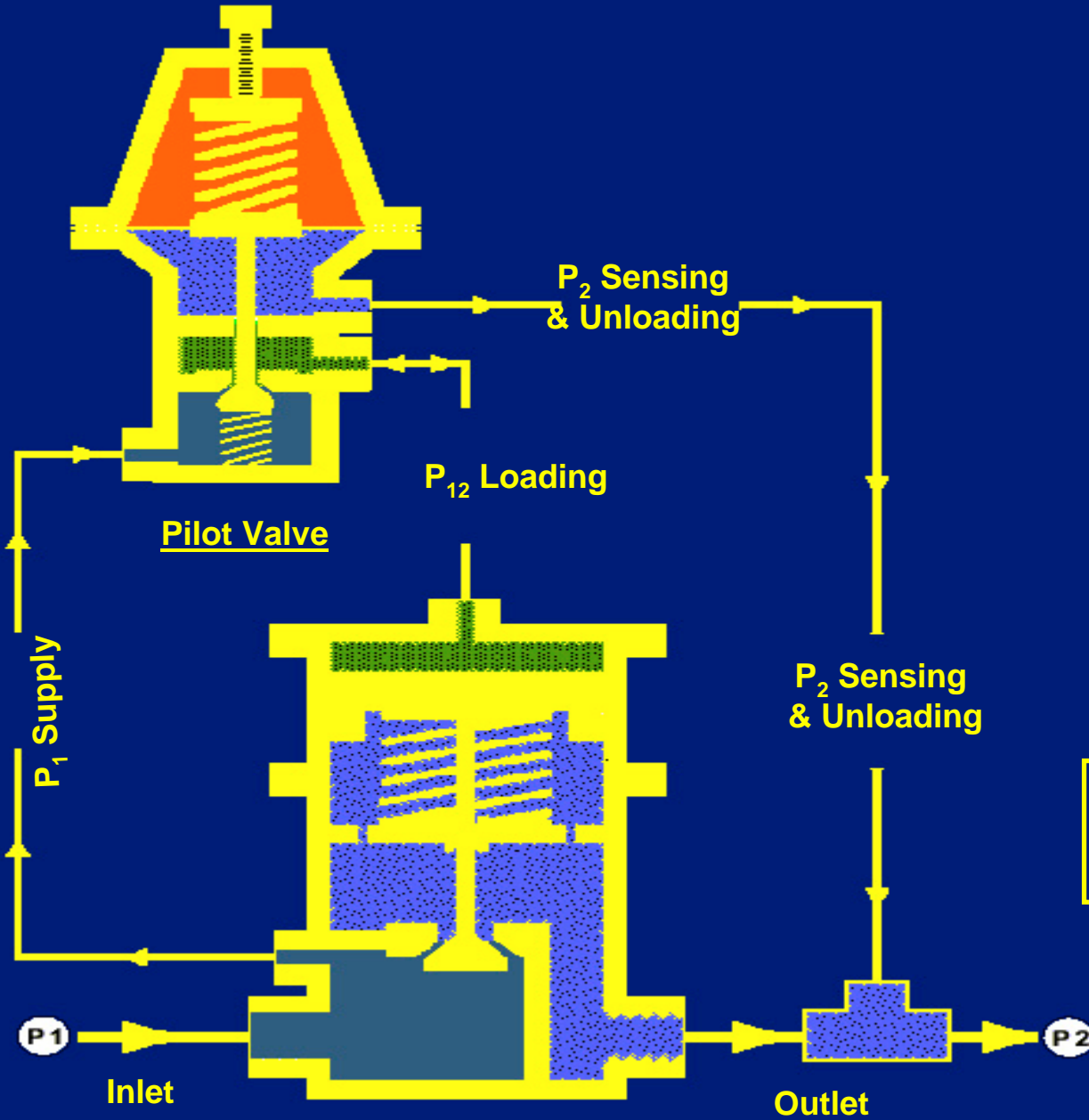
P_1 = Higher Inlet Pressure



ROTARY GAS COMPRESSOR SHAFT SEAL OIL SYSTEMS



**PILOT-OPERATED
REDUCING
REGULATOR
“LOADING”
PILOT**



**P1 HIGH INLET PRESSURE
P12 INTERMEDIATE PRESSURE
P2 LOW OUTLET PRESSURE**

Composition vs Metal Diaphragms

COMPOSITION

- More sensitive.
- Increased efficiency.
- Recommended when compatible with fluids.
- Same price as metal.

METAL

- Less sensitive.
- Recommended for high temperatures.
- Recommended when composition is not compatible with fluid.

Composition vs. Metal Seats

COMPOSITION

- **Tight Shut-off**
- **No Seat Leakage**
- **Extended Seat Life**
- **Recommended when compatible with fluids.**

METAL

- **Does not allow tight shut-off.**
- **Some seat leakage will occur.**
- **Recommended for high temperature applications.**
- **Recommended when composition is not compatible.**
- **Less expensive than composition seats.**

Application and Selection Requirements

- **What is the service fluid?**
- **Inlet Pressure (P_1)**
- **Outlet Pressure (P_2)**
- **Flow Rate / Pipe size**
- **Temperature**

Condensate Sampling System

