**MAN Energy Solutions**
Future in the making

# HCU components

## Hydraulic Cylinder Unit

PrimeServ Academy Copenhagen

MAN PrimeServ

# Learning objectives

**Upon completion of this module you …**

– will be able to recognize the various components in the HCU system.

– will be able to explain the HCU components.

# Agenda

Components

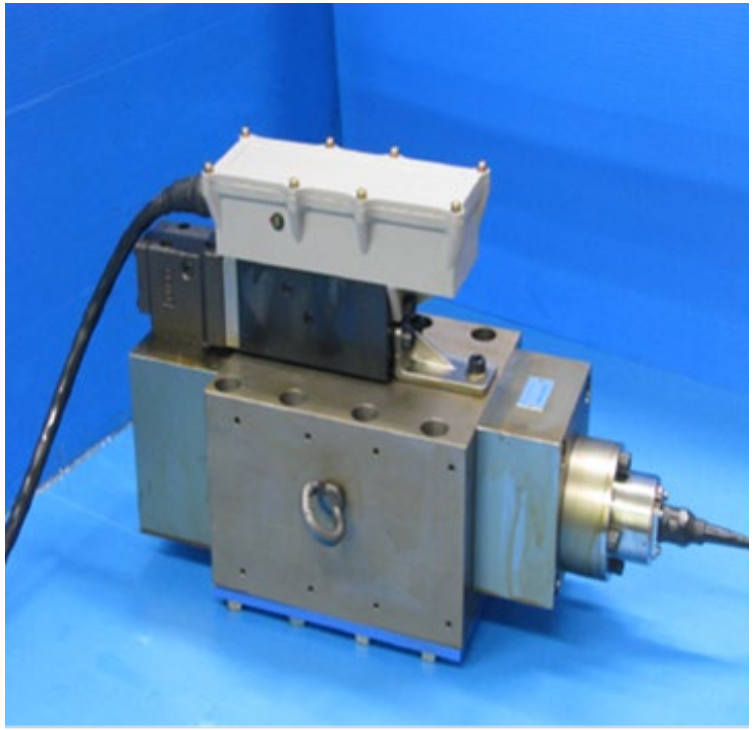
1. **FIVA**
2. **Fuel oil pressure booster**
3. **Exhaust valve**
   - Actuator
   - Designs

# Components

Fuel Injection Valve Actuation (FIVA)

**MAN FIVA**

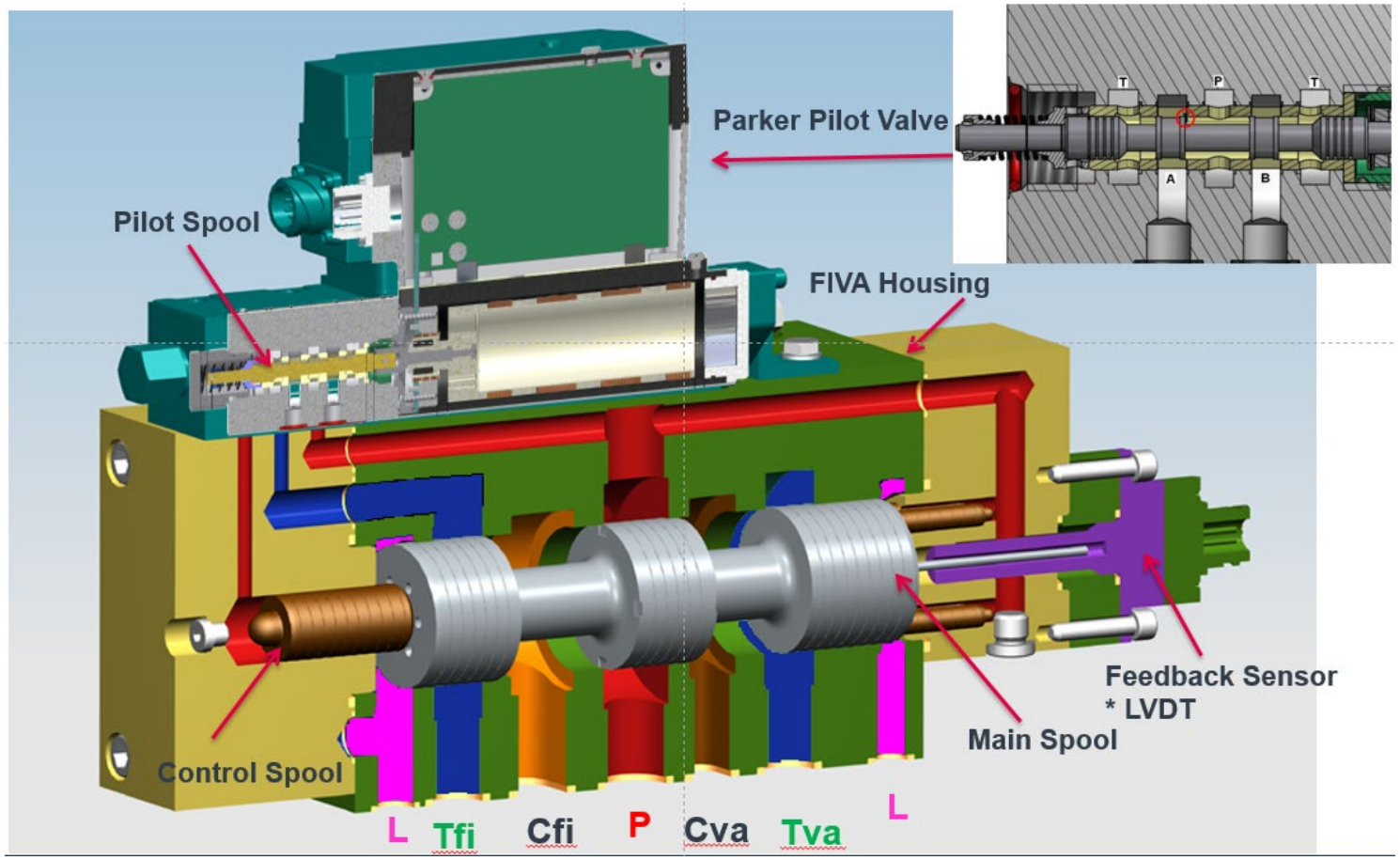
**Bosch Rexroth**



**Nabtesco**

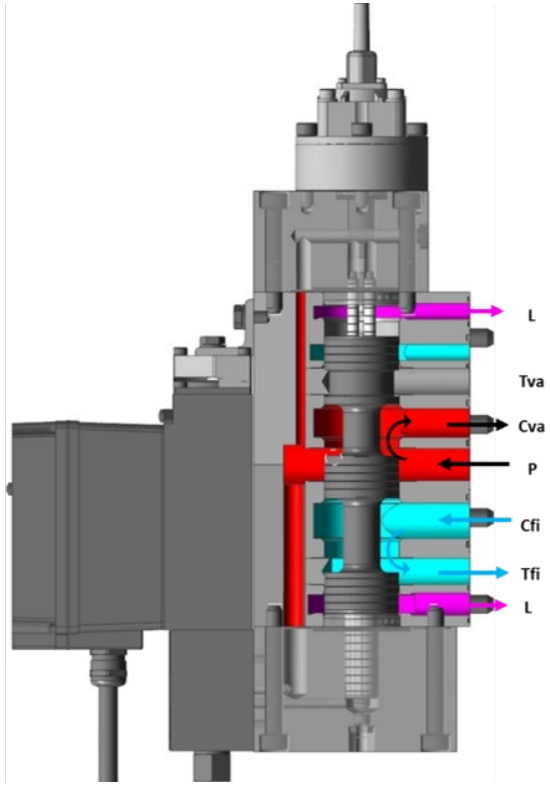
# Components

FIVA – MAN - ES FIVA

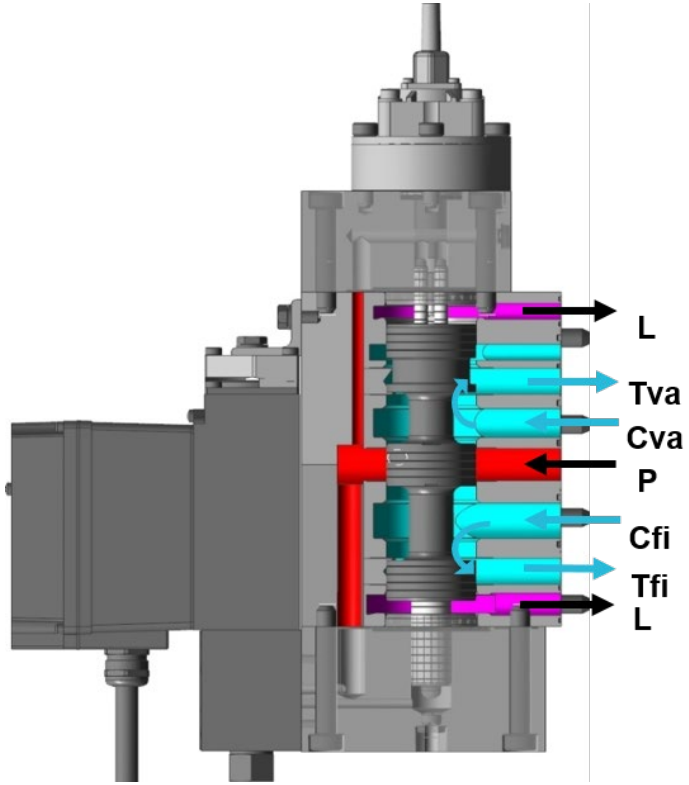


# Components

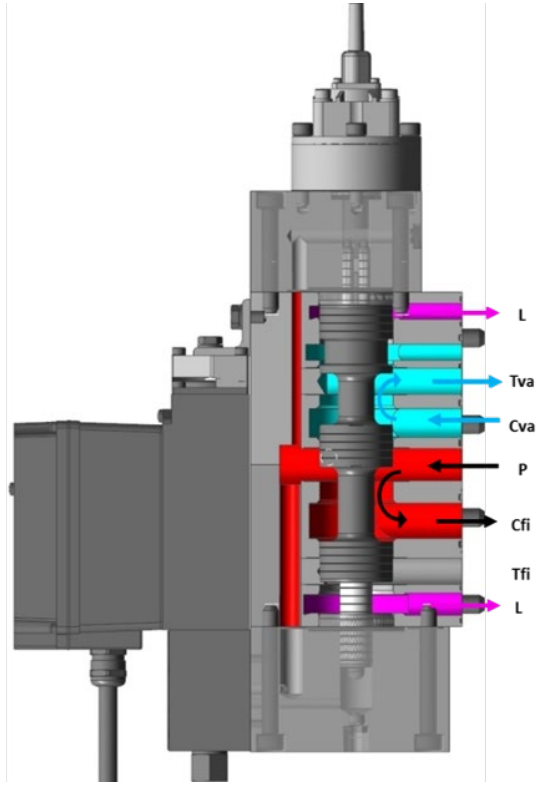
FIVA - Operation




**Exhaust valve operation**



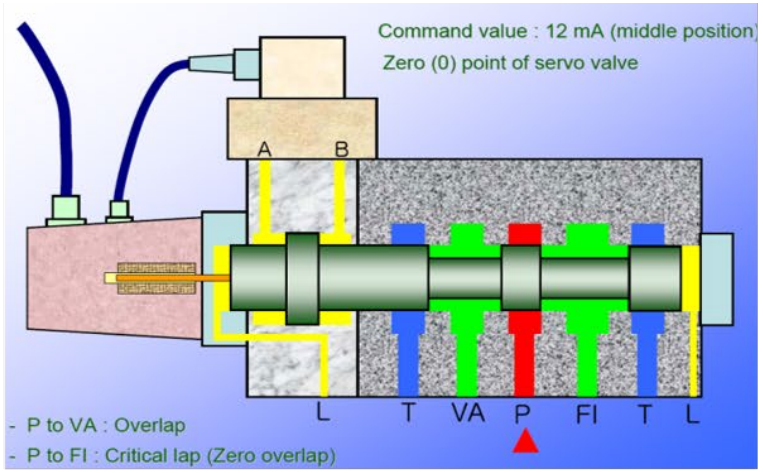

**Neutral**

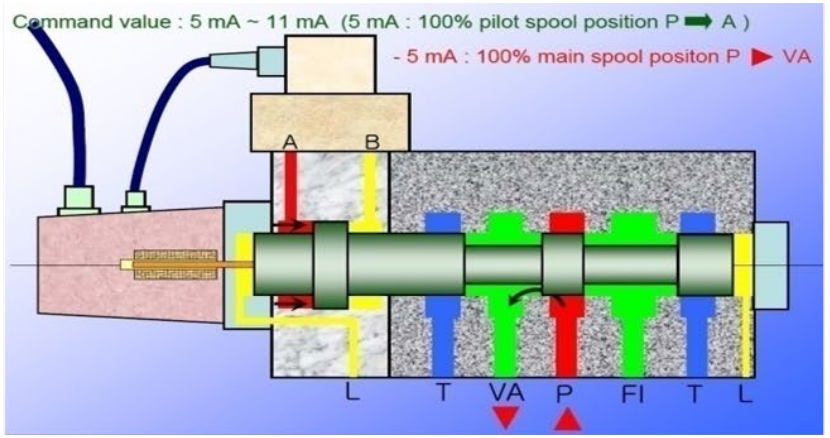



**Fuel injection**

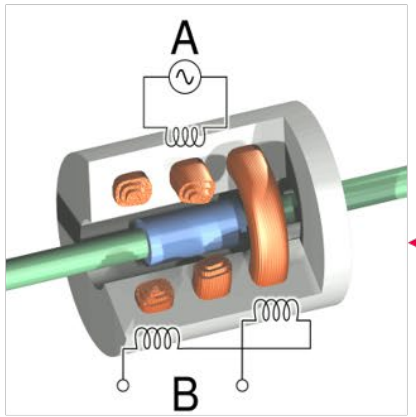
# Components

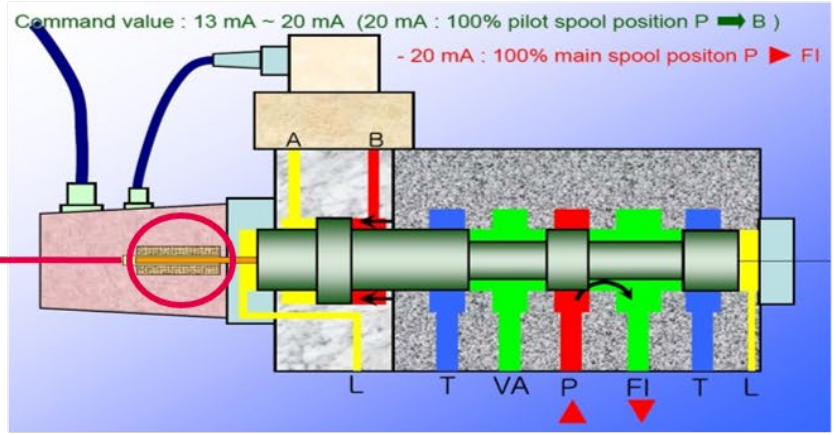
FIVA – Bosch Rexroth



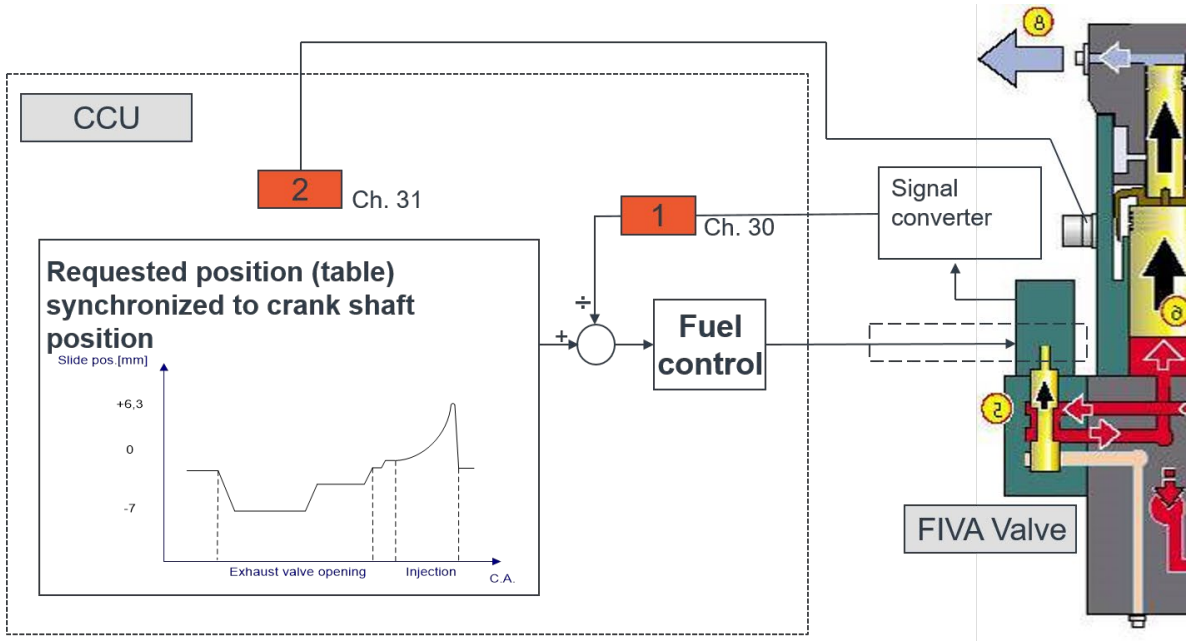

Main spool position
Feedback from LVDT sensor.
Linear variable differential transformer



# Components

FIVA – Feedback signals




**The FIVA is immediately set to exhaust valve open position: (Safe position) if:**

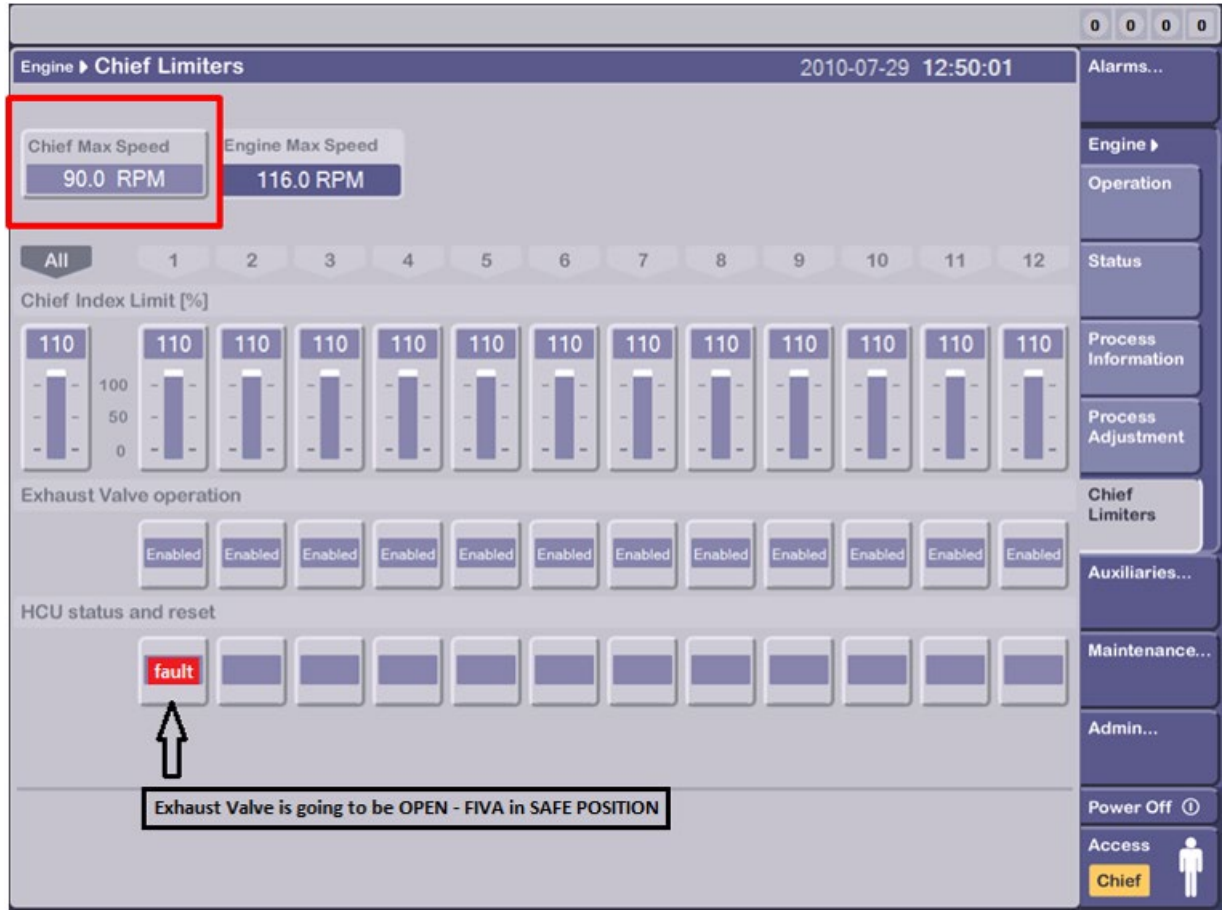
1

- The FIVA valve feed back signal is not valid, i.e. outside 4-20 mA
- The FIVA valve feed back signal indicates a too high (not physical possible) speed
- The FIVA valve feed back signal indicates a position not allowed outside a window around TDC

2 ***Are only used for index calculations and alarms.***

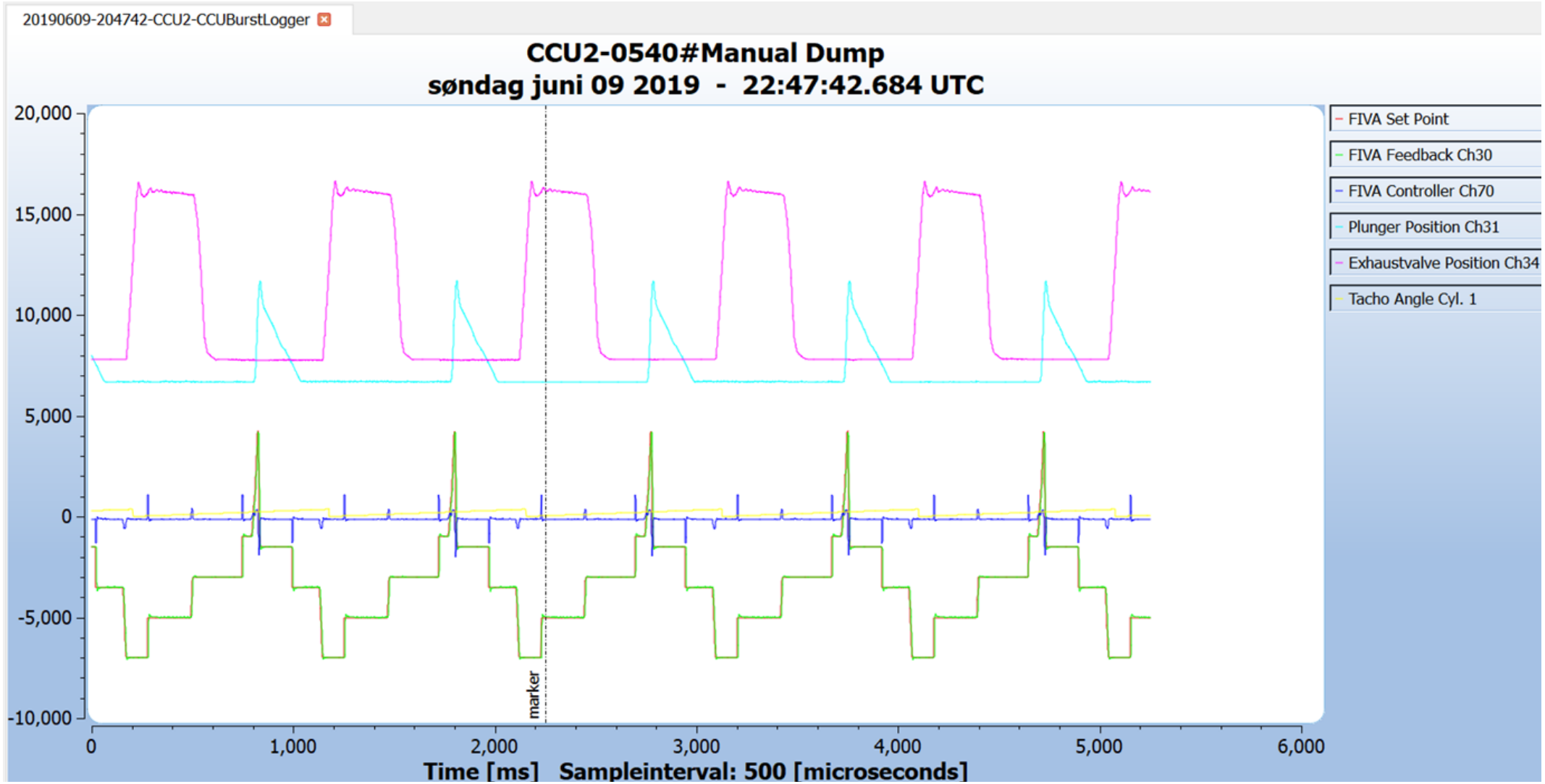
# Components

FIVA – Safe position identified



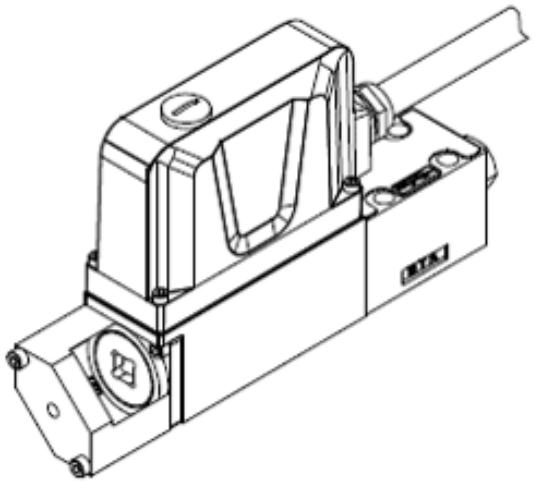
# Components

FIVA – HCU events

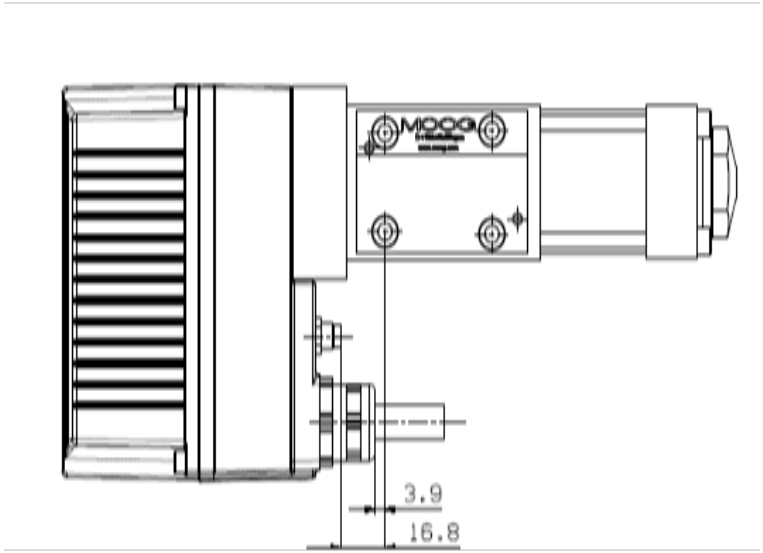


# Components

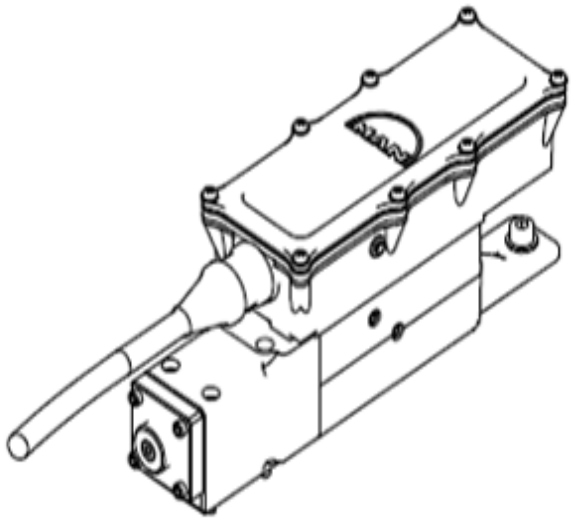
FIVA – Pilot valves



**Parker**



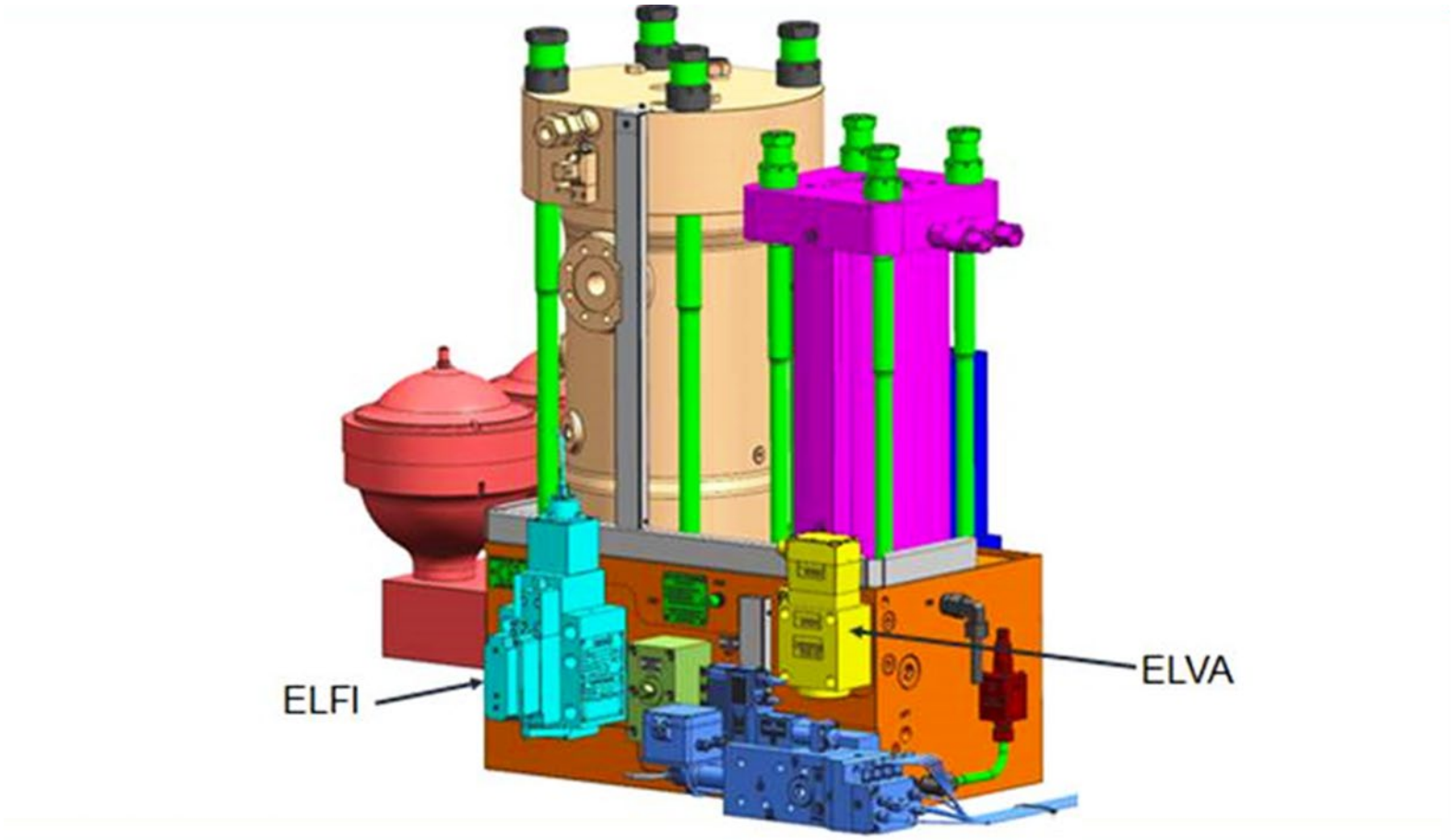

**MOOG**



**Nabtesco**

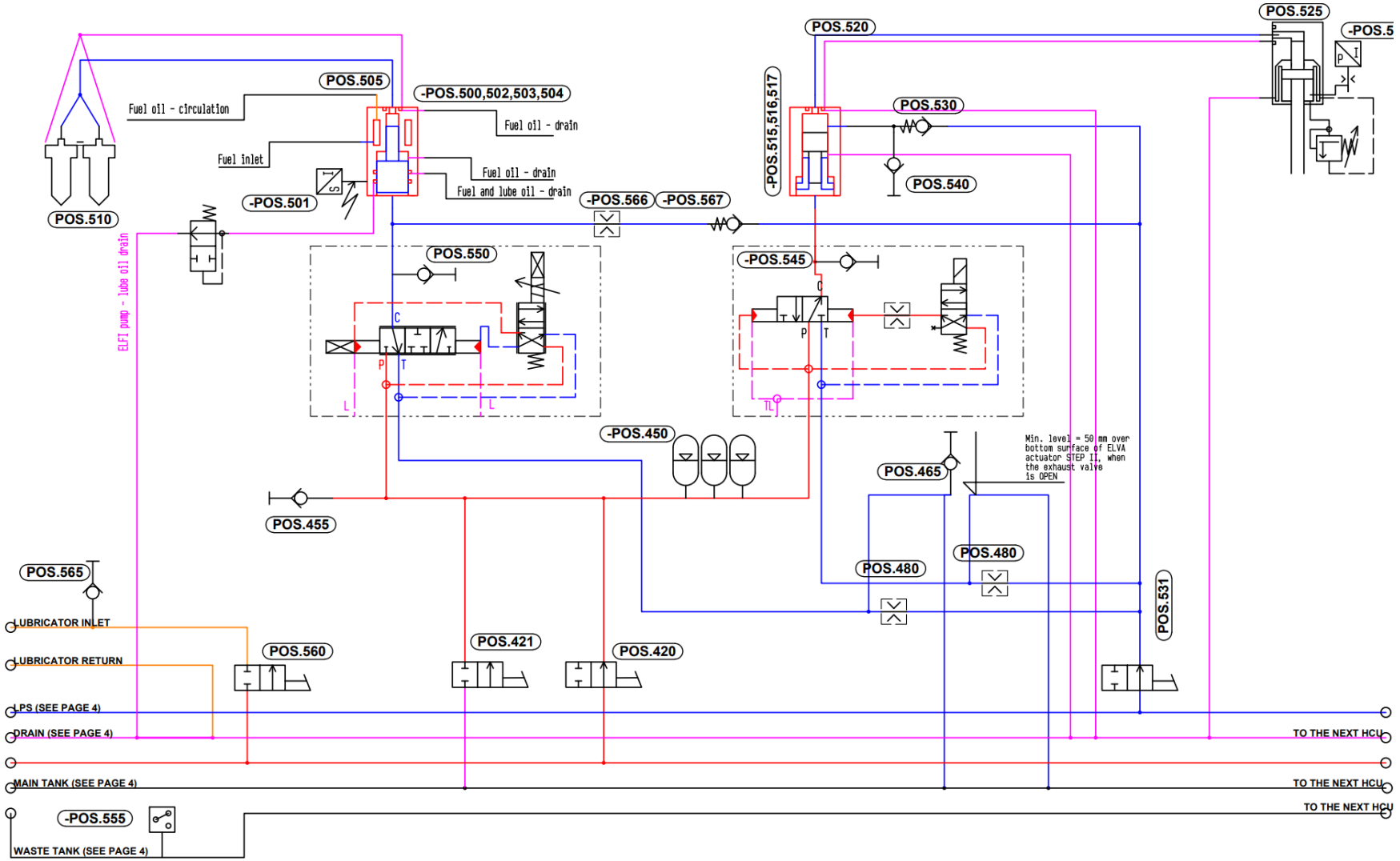
# Components

FIVA – ELFI & ELVA



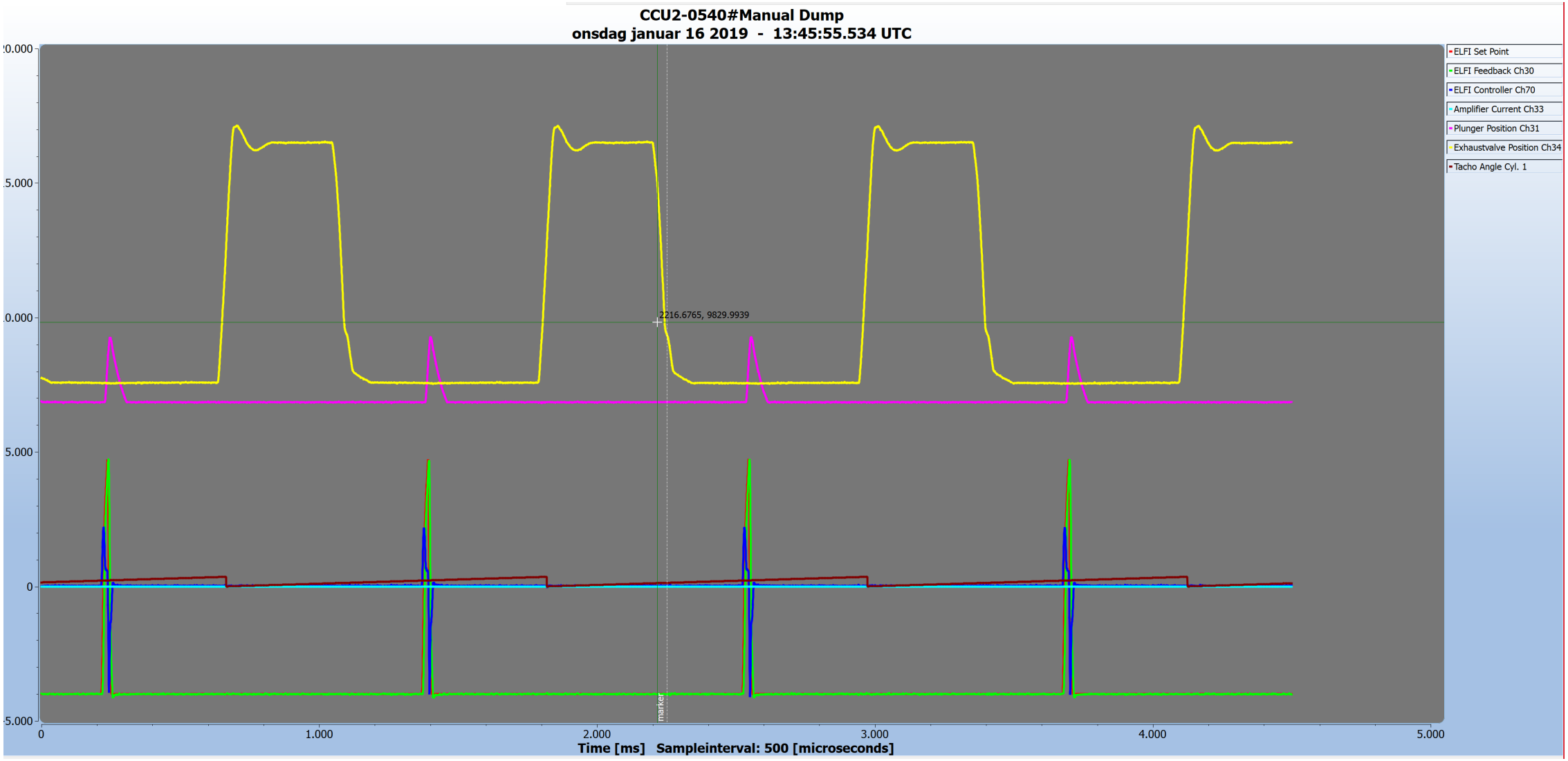
# Components

## FIVA – ELFI & ELVA - 300 bars system diagram



# Components

FIVA – HCU events with ELFI and ELFA



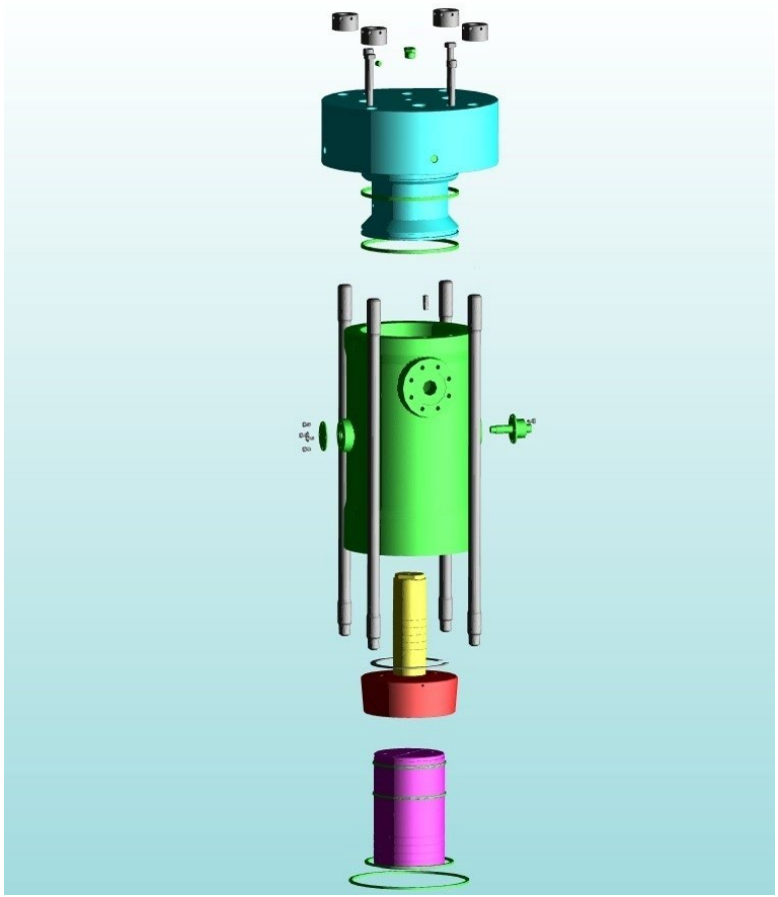
# Agenda

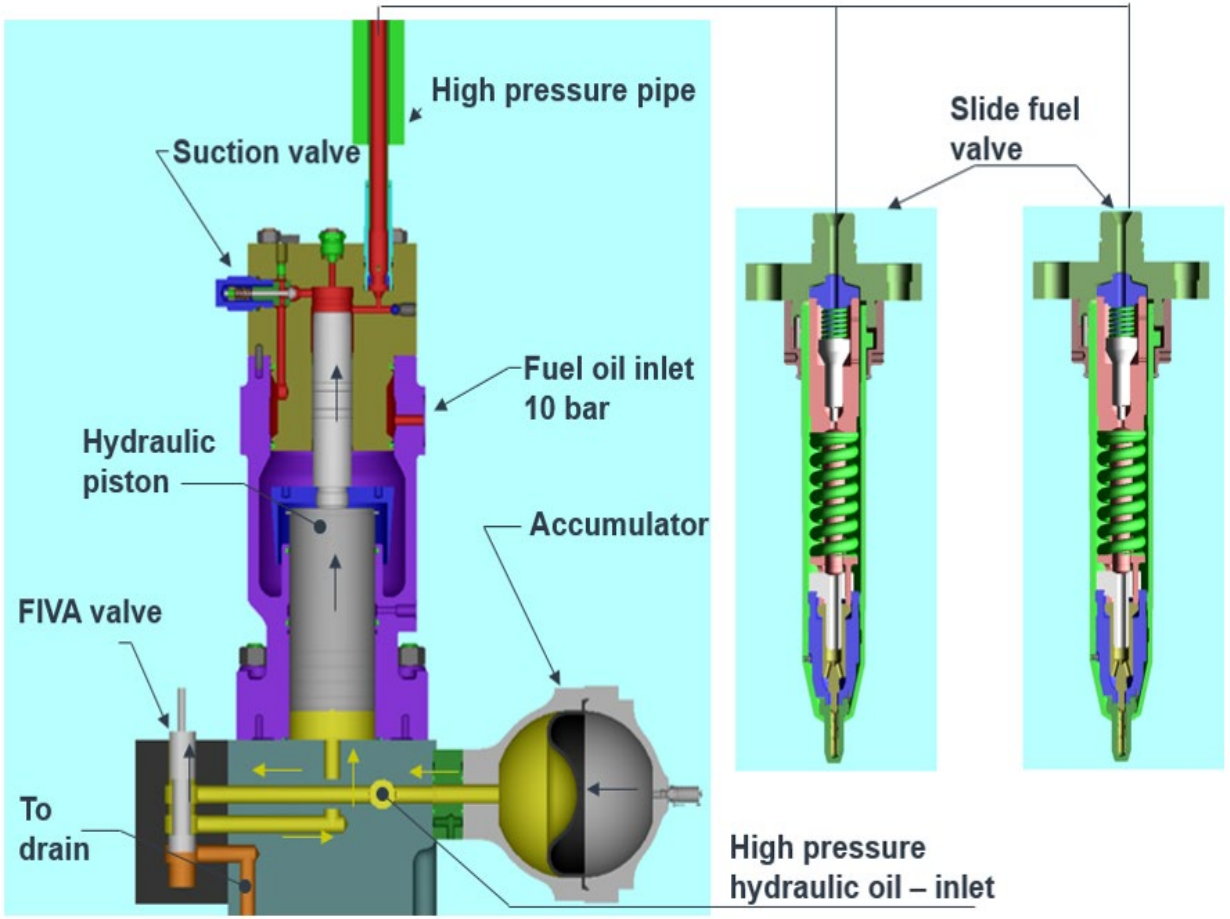
Components

1. **FIVA**
2. **Fuel oil pressure booster**
3. **Exhaust valve**
   - Actuator
   - Designs

# Components

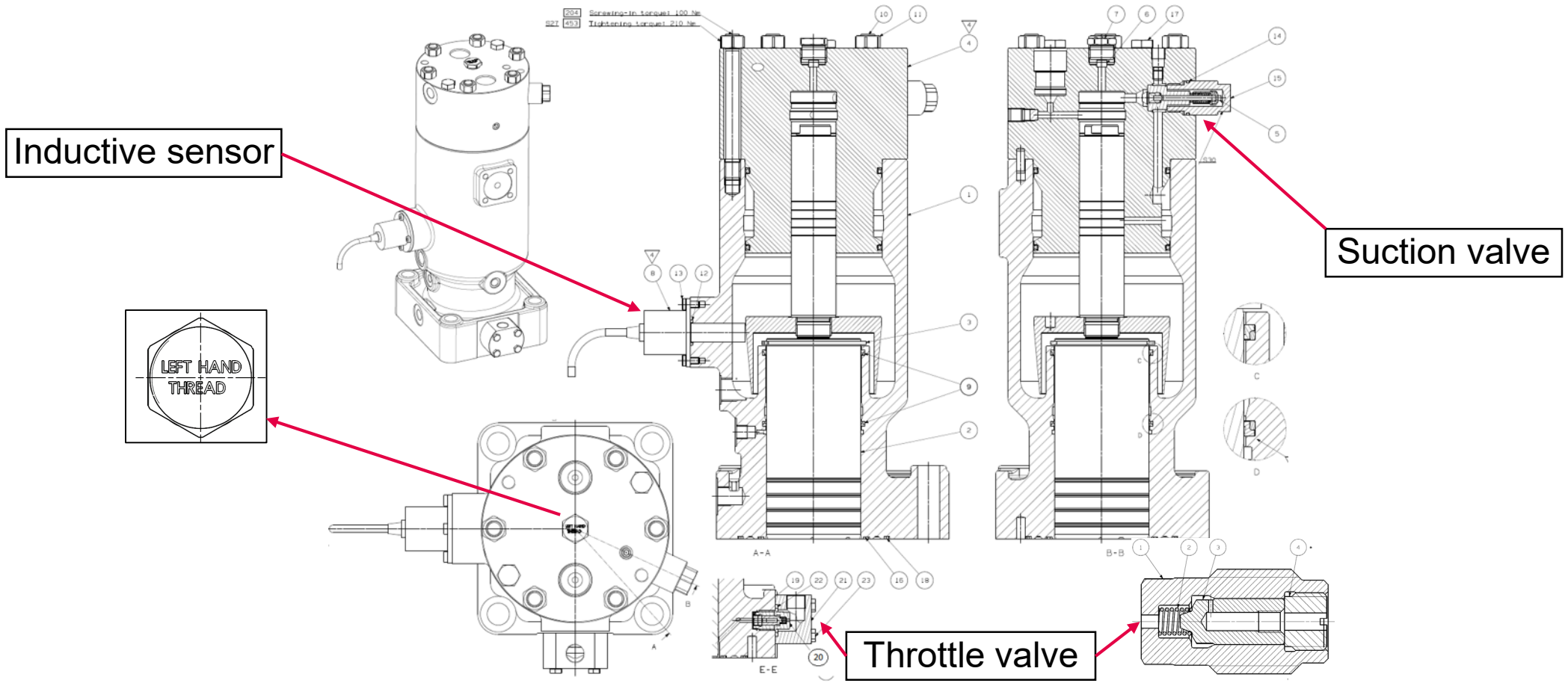
Principle





# Components

Cross section



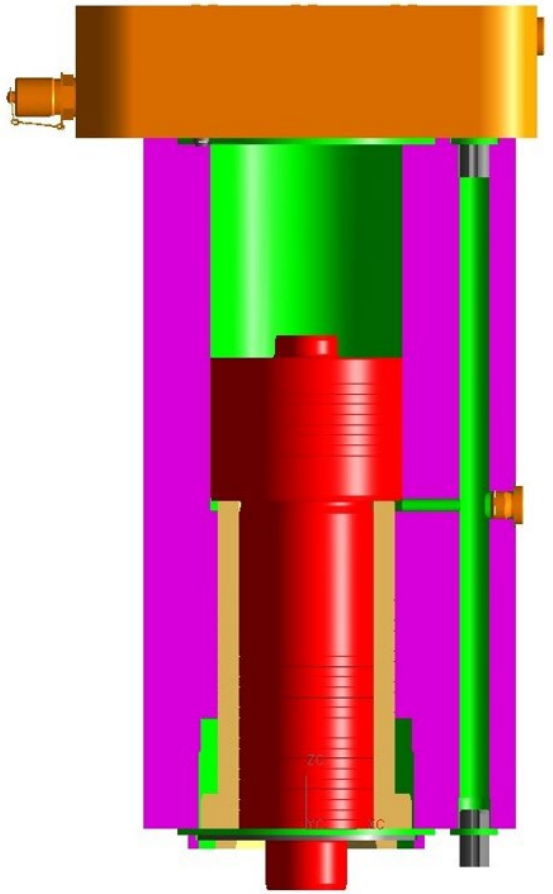
# Agenda

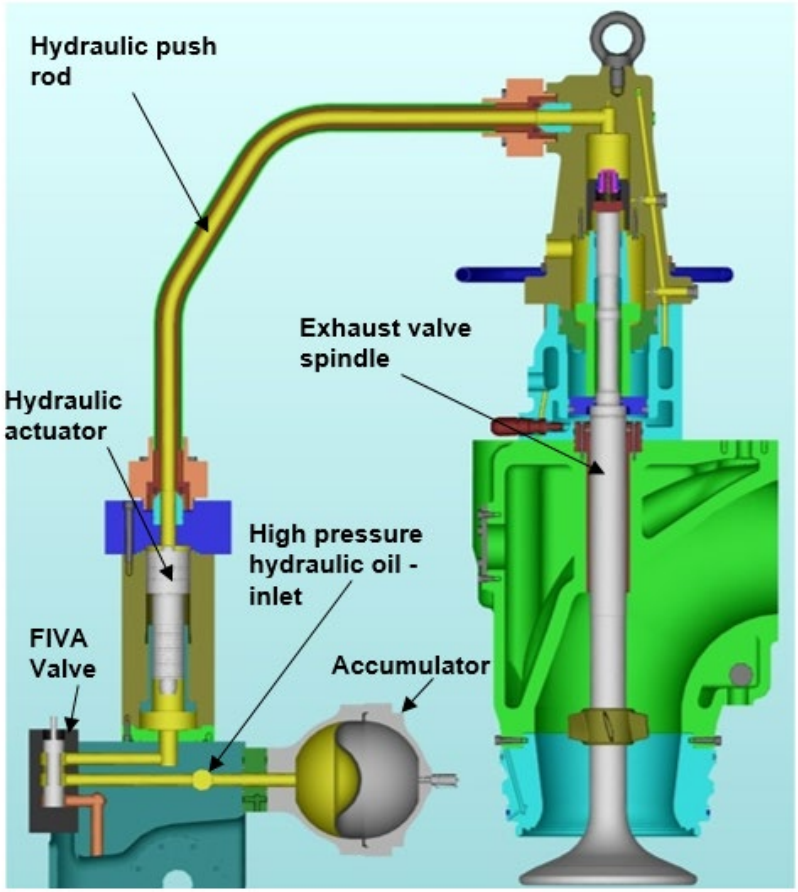
Components

1. **FIVA**
2. **Fuel oil pressure booster**
3. **Exhaust valve**
   - Actuator
   - Designs

# Components

Exhaust valve and actuator

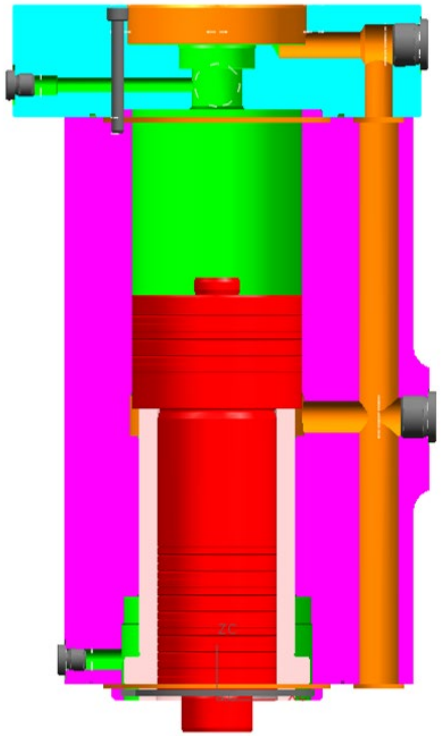




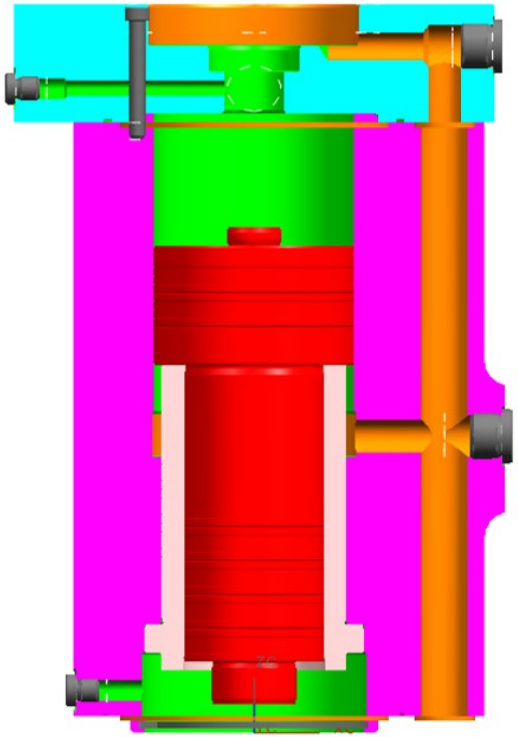
# Components

Actuators

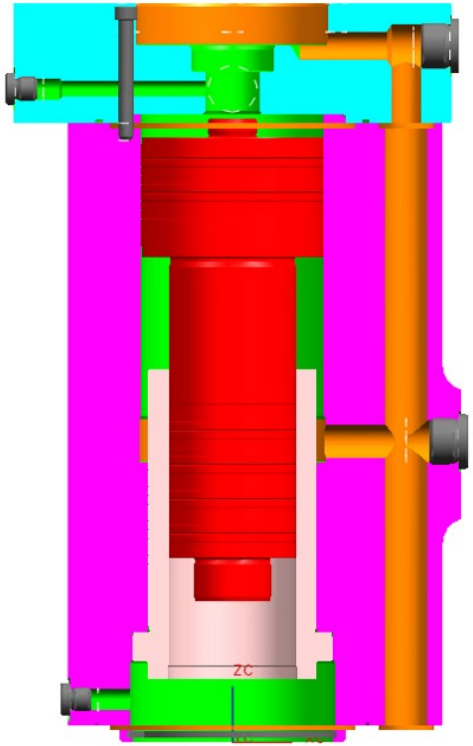
**Initial position**



**Step 1**



**Step 2**



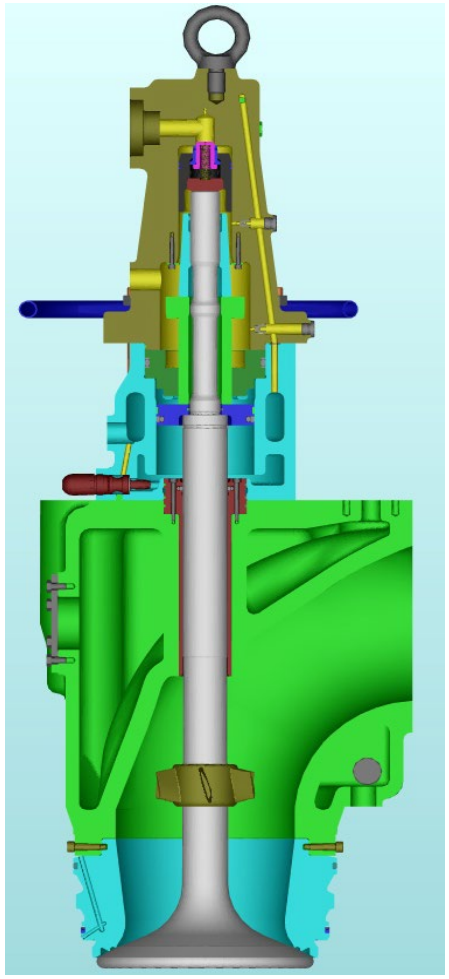
# Agenda

Components

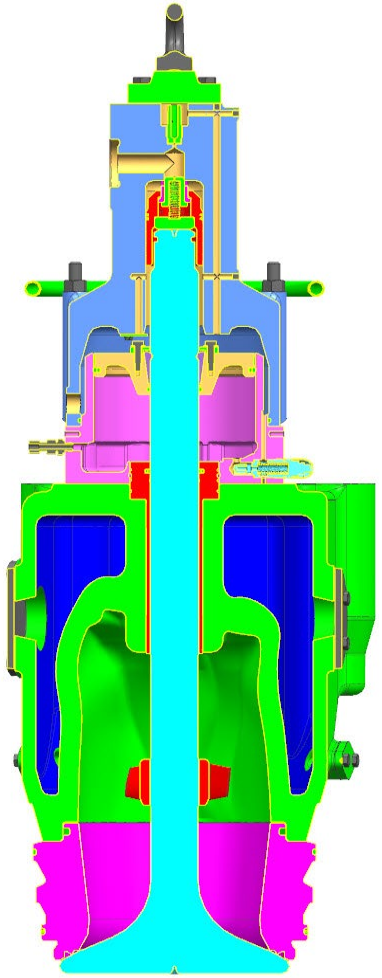
1. **FIVA**
2. **Fuel oil pressure booster**
3. **Exhaust valve**
   - Actuator
   - Designs

# Exhaust valve types

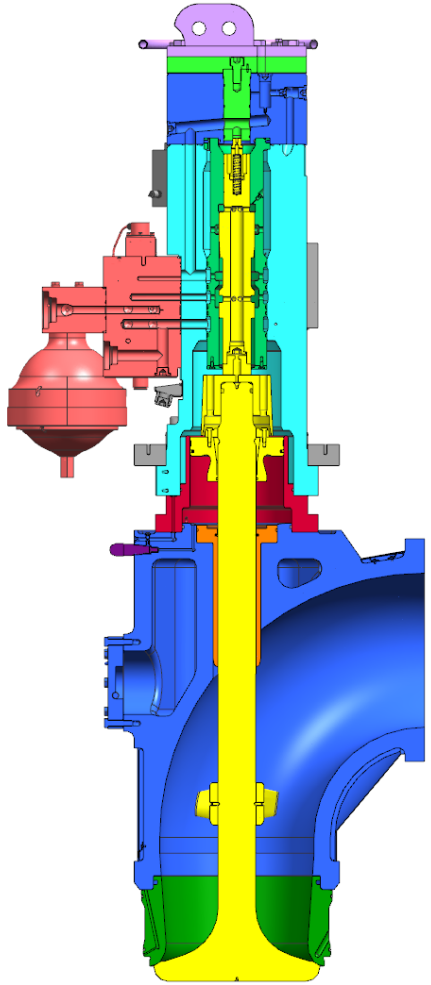
## High Force



## Low Force

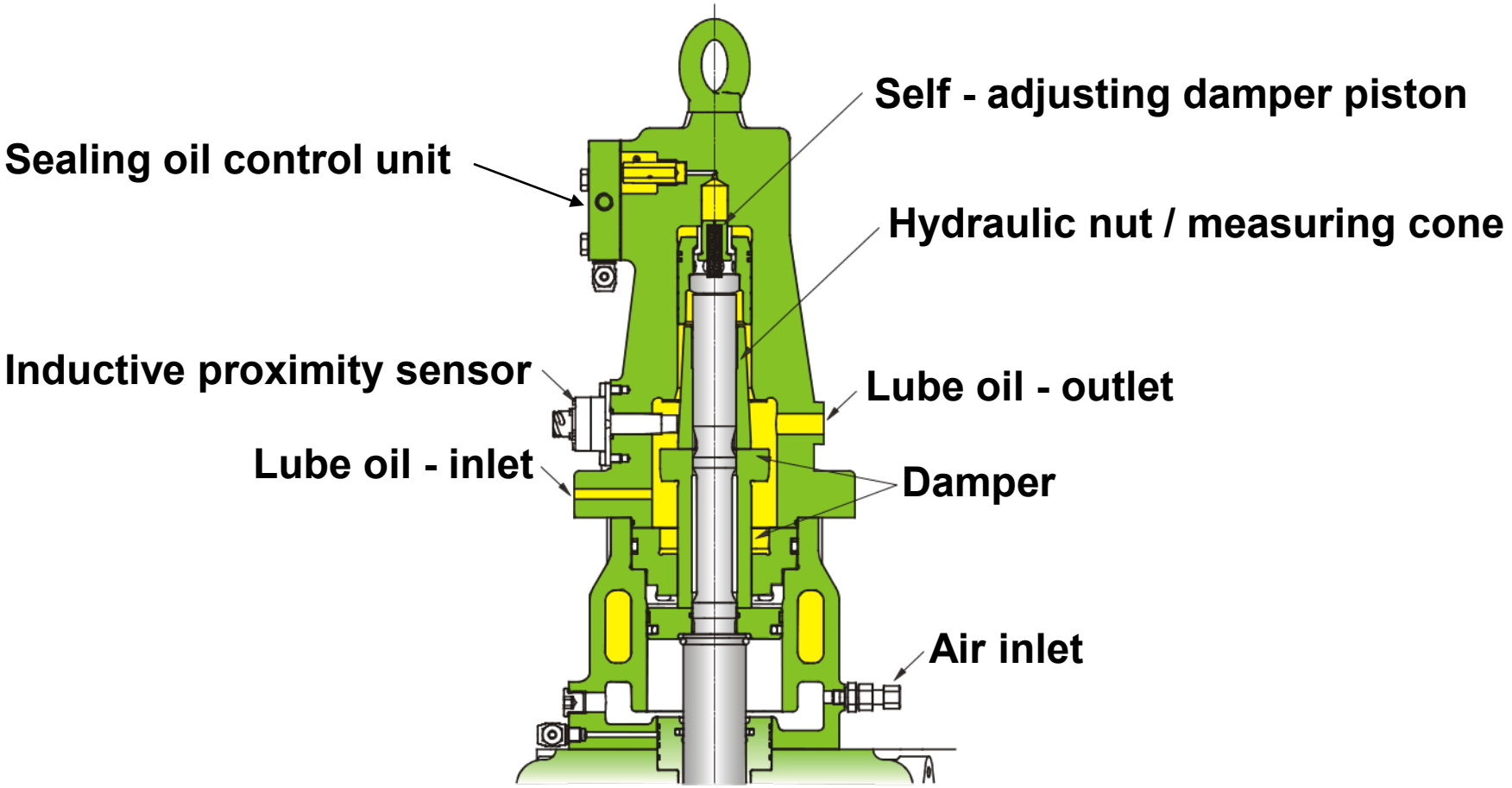


## TCEV



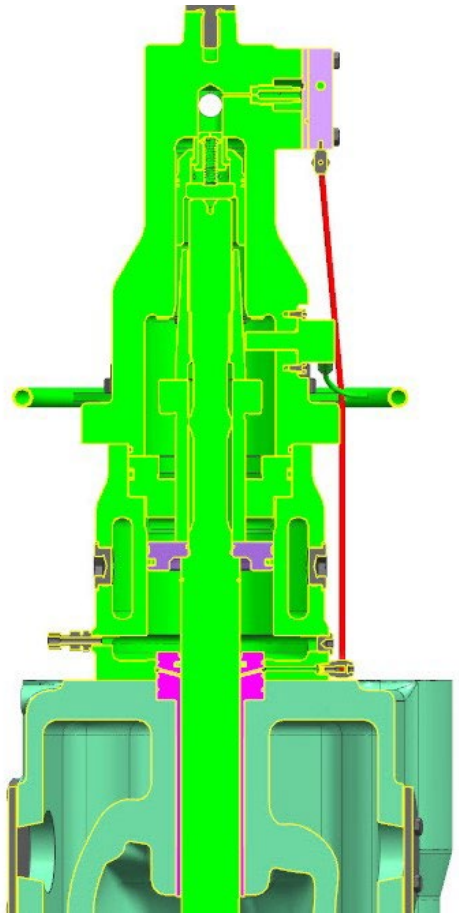
# Components

High force exhaust valve



# Components

High force exhaust valve – Sealing oil control unit



Sealing oil control unit

Applied to all high force valves

Lubrication of spindle stem

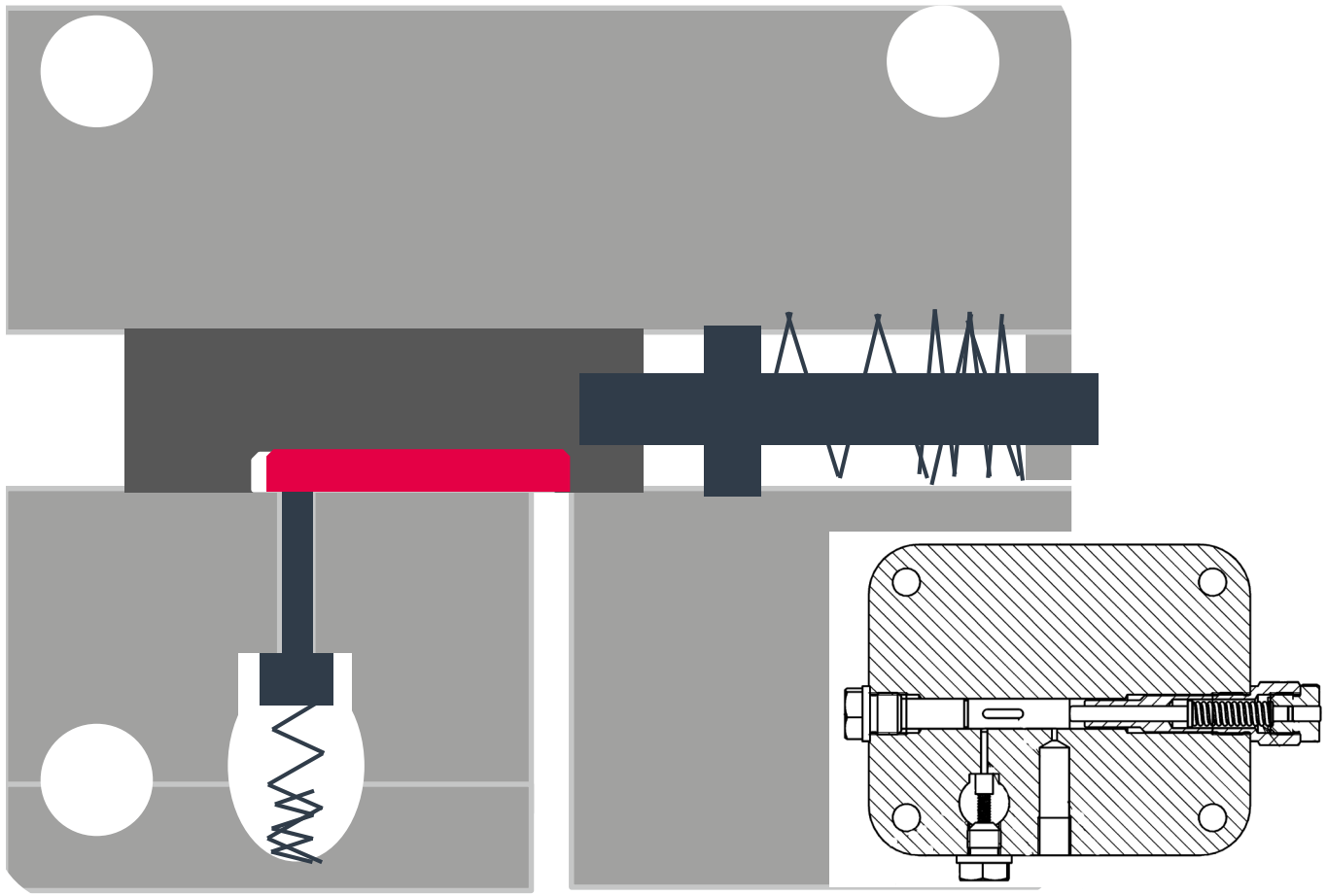
Consumption one liter / day per cylinder

Complex design

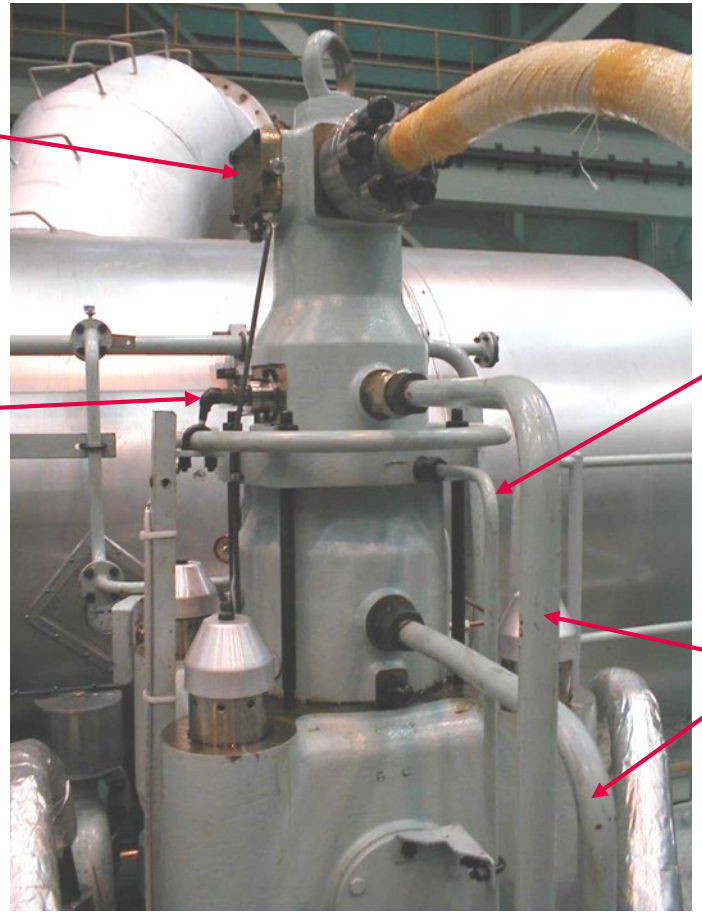
Indicator pin for activation

# Components

High force exhaust valve – Sealing oil control unit



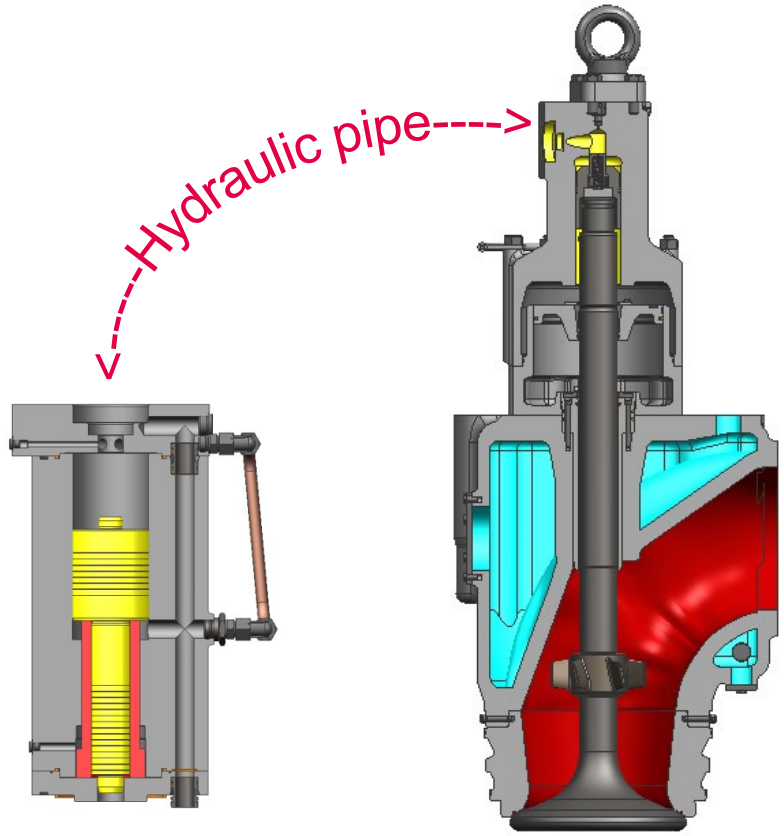
# Components


Sealing oil control unit
Feedback sensor
Damper oil - inlet
Drain pipes

# Components

Low force exhaust valve

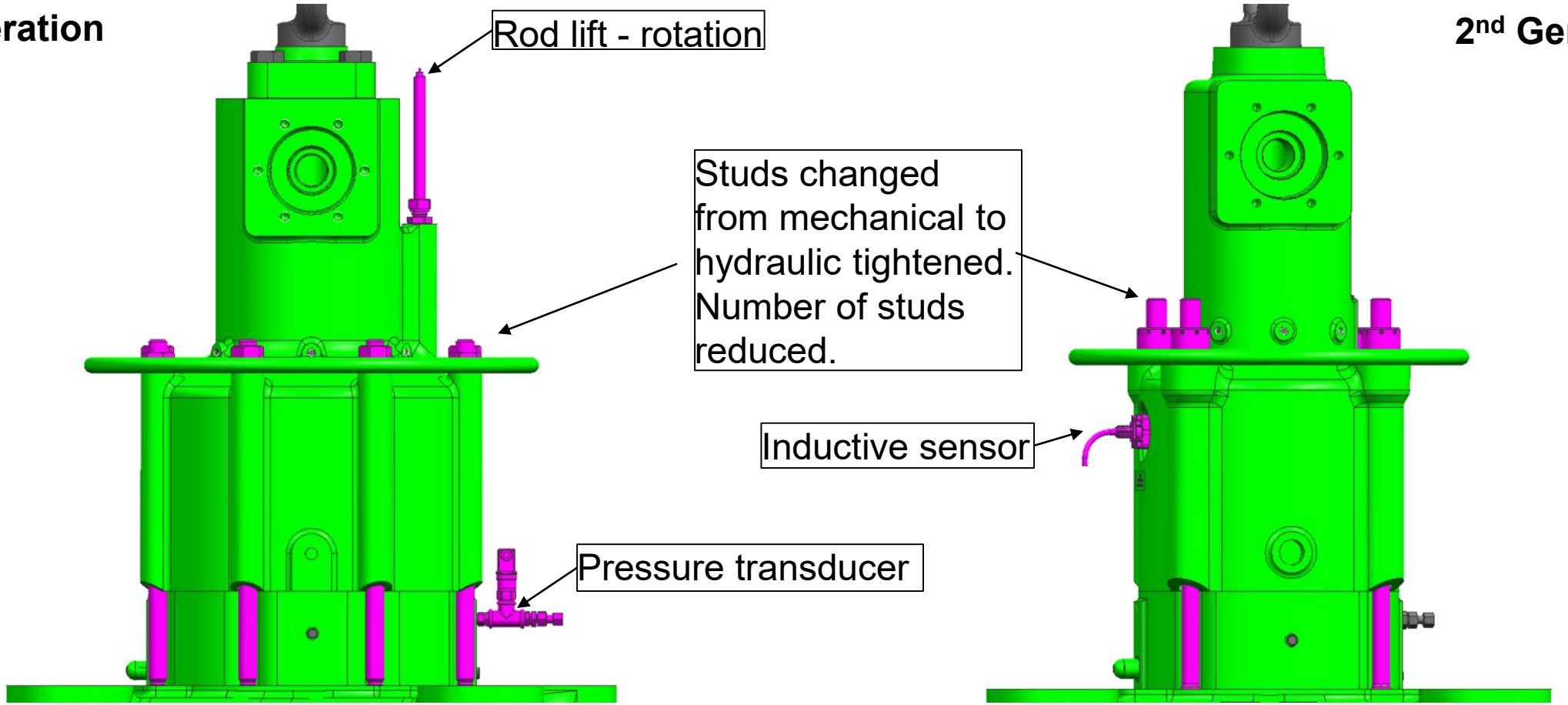
– Cost reduction
– Less force and cavitation in hydraulic pipe and actuator
– Dura spindle design applied
– Longer Time Between Overhaul (TBO)
– Controlled Oil Level (COL)
– In some cases down sizing of HPS can also be possible
– Step one stroke and step two diameter reduced in actuator



# Components

1st and 2nd generation low force

**1st Generation**




**2nd Generation**

# Components

1st and 2nd generation

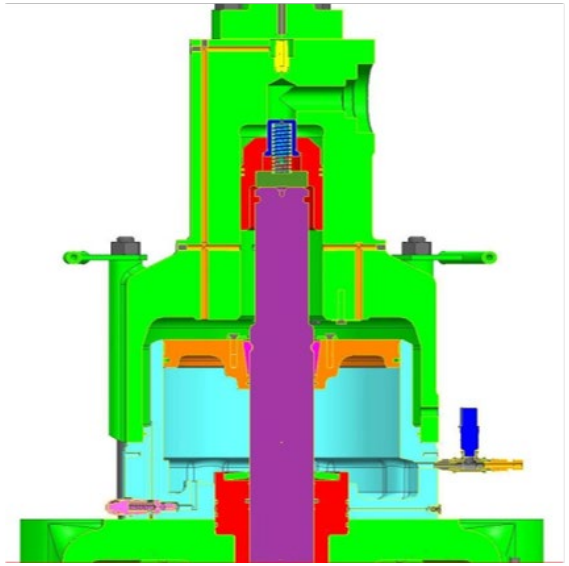
Reduced diameter on oil cylinder, air cylinder and air piston (reducing weight)

Added cone on exhaust valve spindle (for direct measurement of valve stroke)

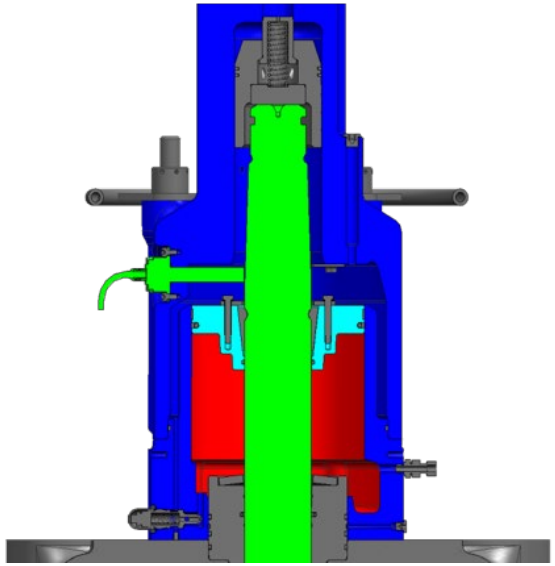
Added inductive sensor for direct measurement of valve stroke

Simplifying air spring by increasing air pressure from three bar to seven bar (removing reduction station)

**1st generation**

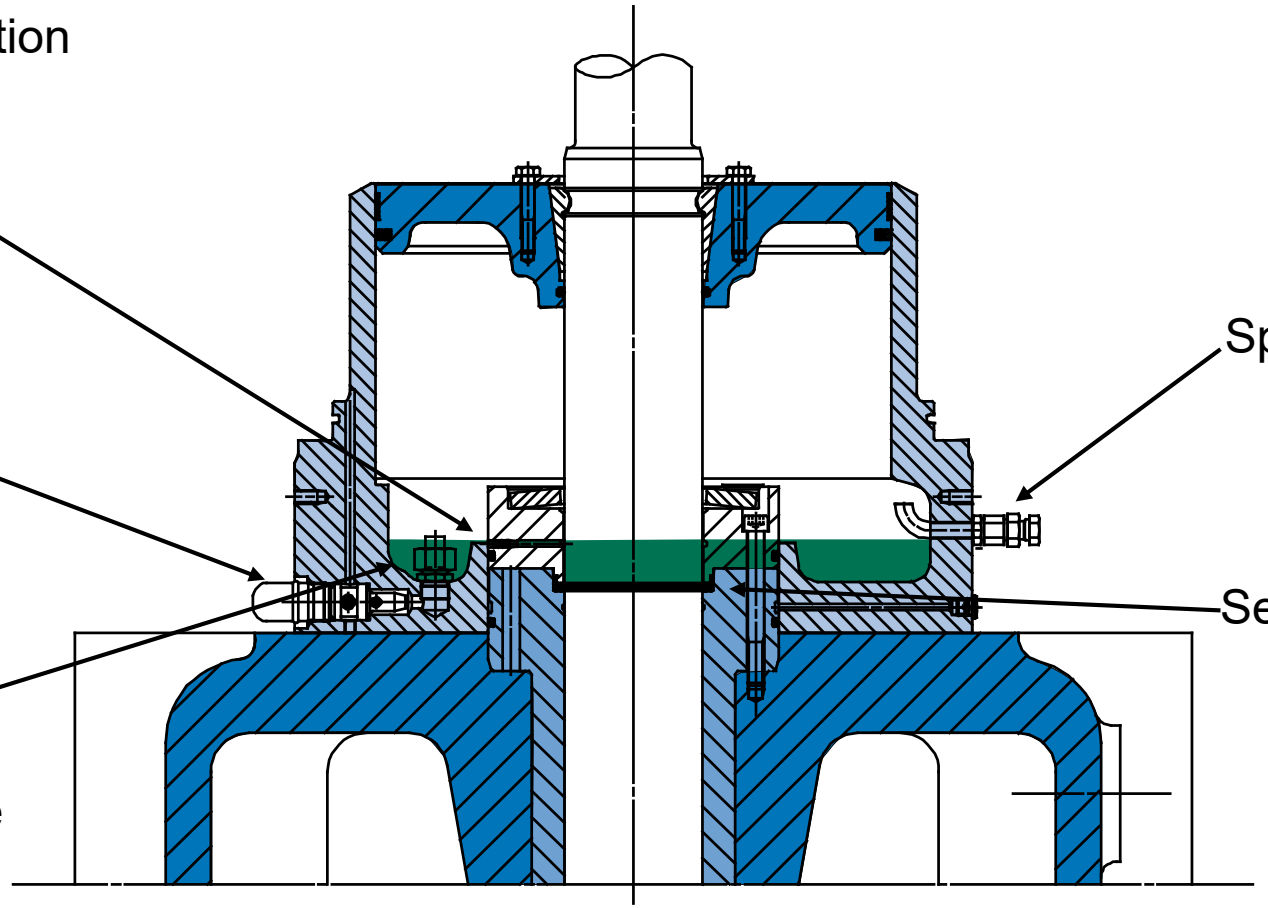


**2nd generation**

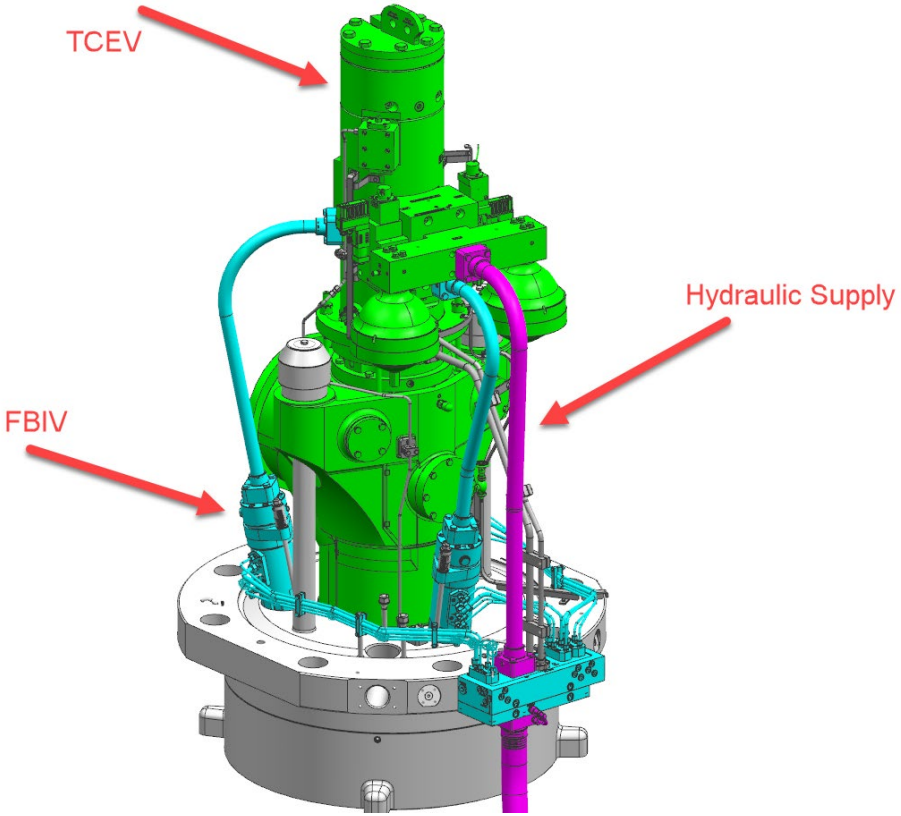


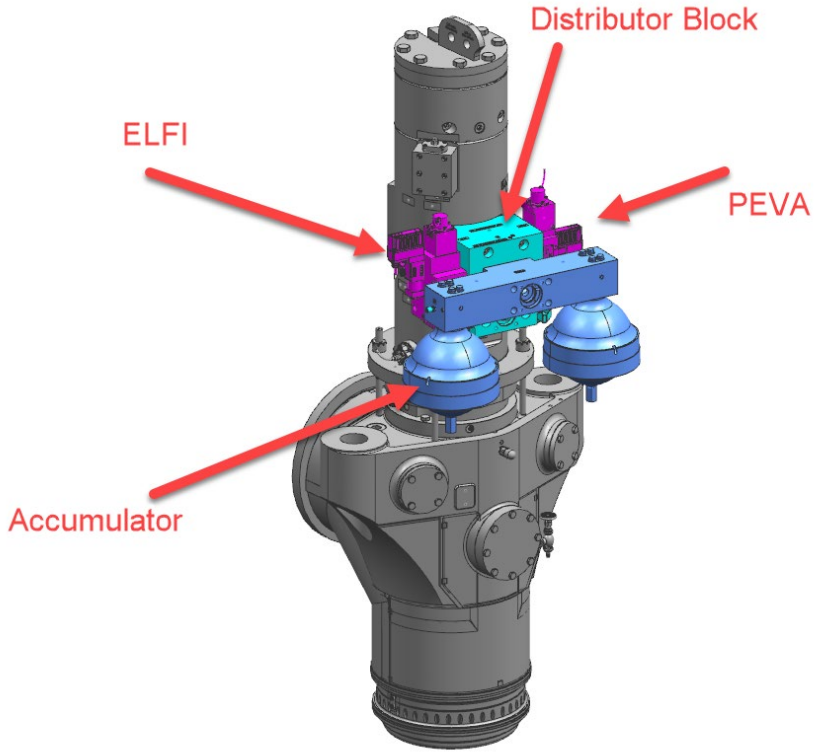
# Components

Controlled Oil Level (COL)

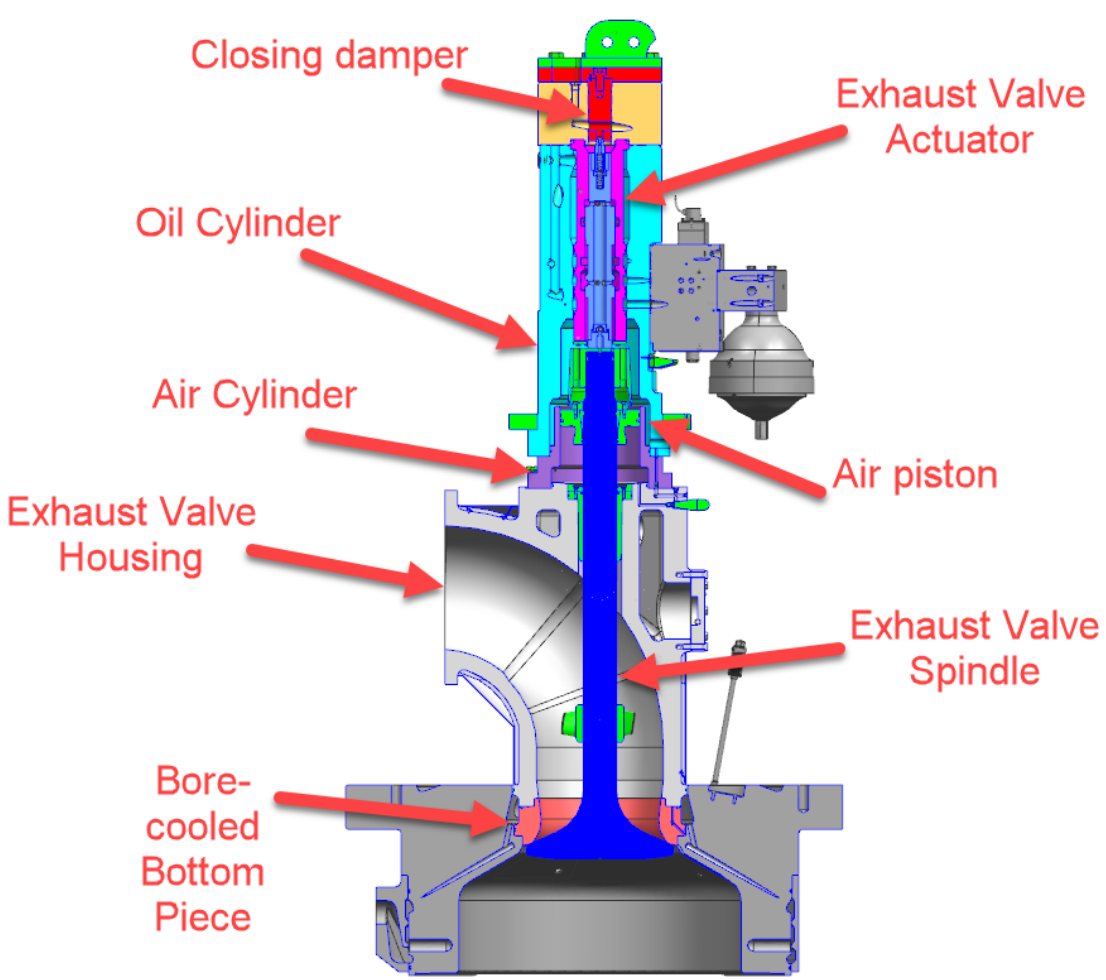


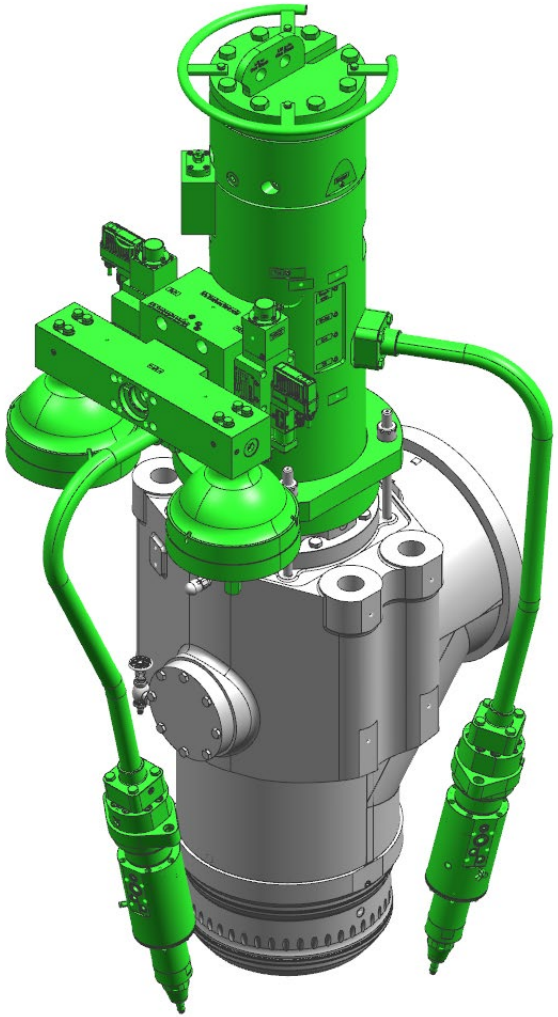
# Top controlled exhaust valve - TCEV
# Components



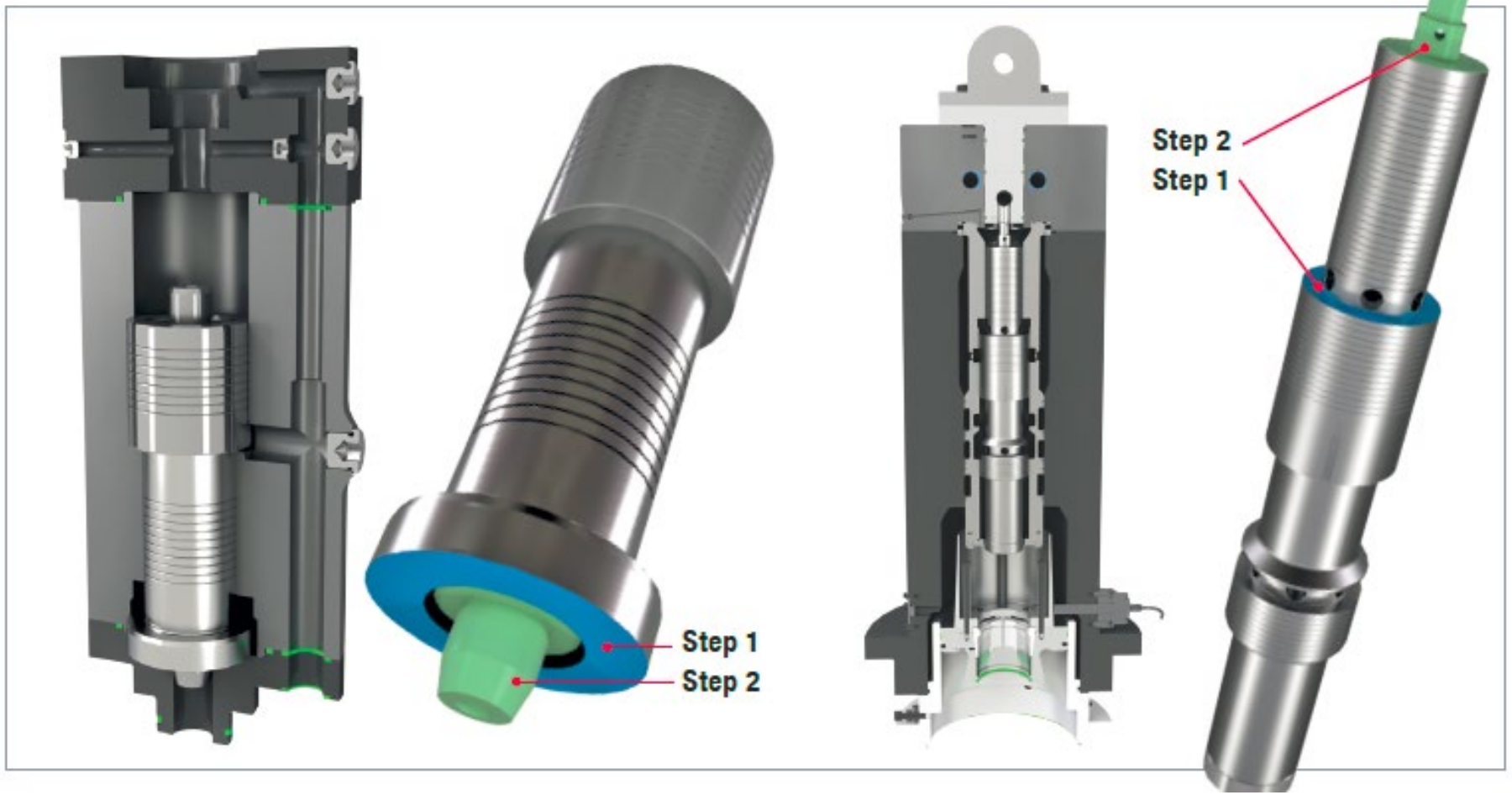
# TCEV component overview



# Top Controlled Exhaust Valve - TCEV

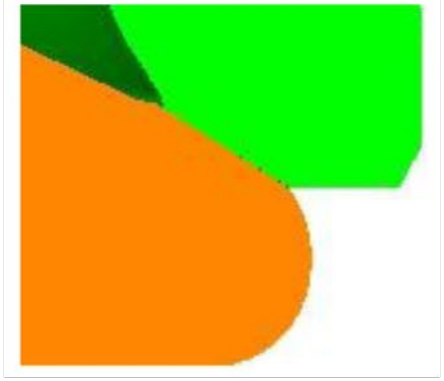
- Standard
- TCEV



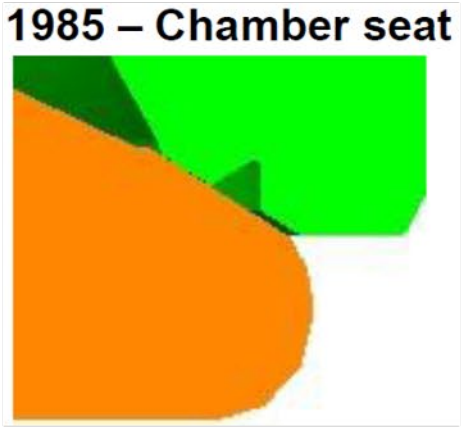
# Components

Seat geometry and development

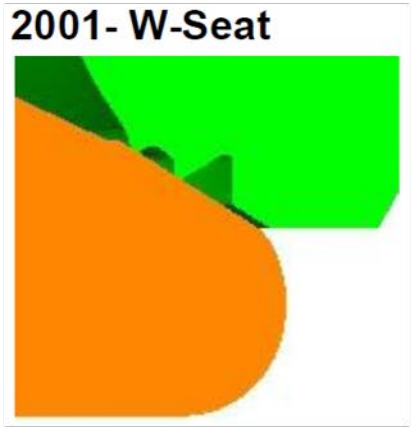
1983 – Wide Seat

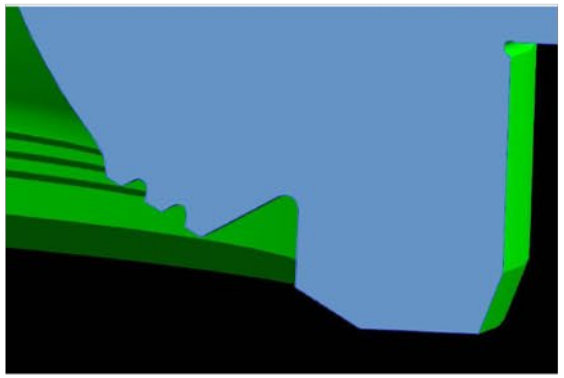


1985 – Chamber seat



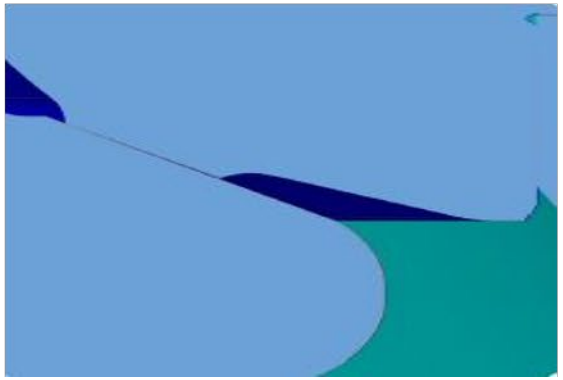
2001- W-Seat





2013 – triple V

2014 – Wide seat



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Future in the making

# Thank you very much!

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Technical instructor
PrimeServ Academy [Your Location]

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