

Hydraulic Cylinder Unit

(HCU)

PrimeServ Academy Copenhagen

MAN PrimeServ



Learning objectives

Upon completion of this module you ...

- will be able to recognize the various parts in the HCU system.
- will be able to explain the HCU system.



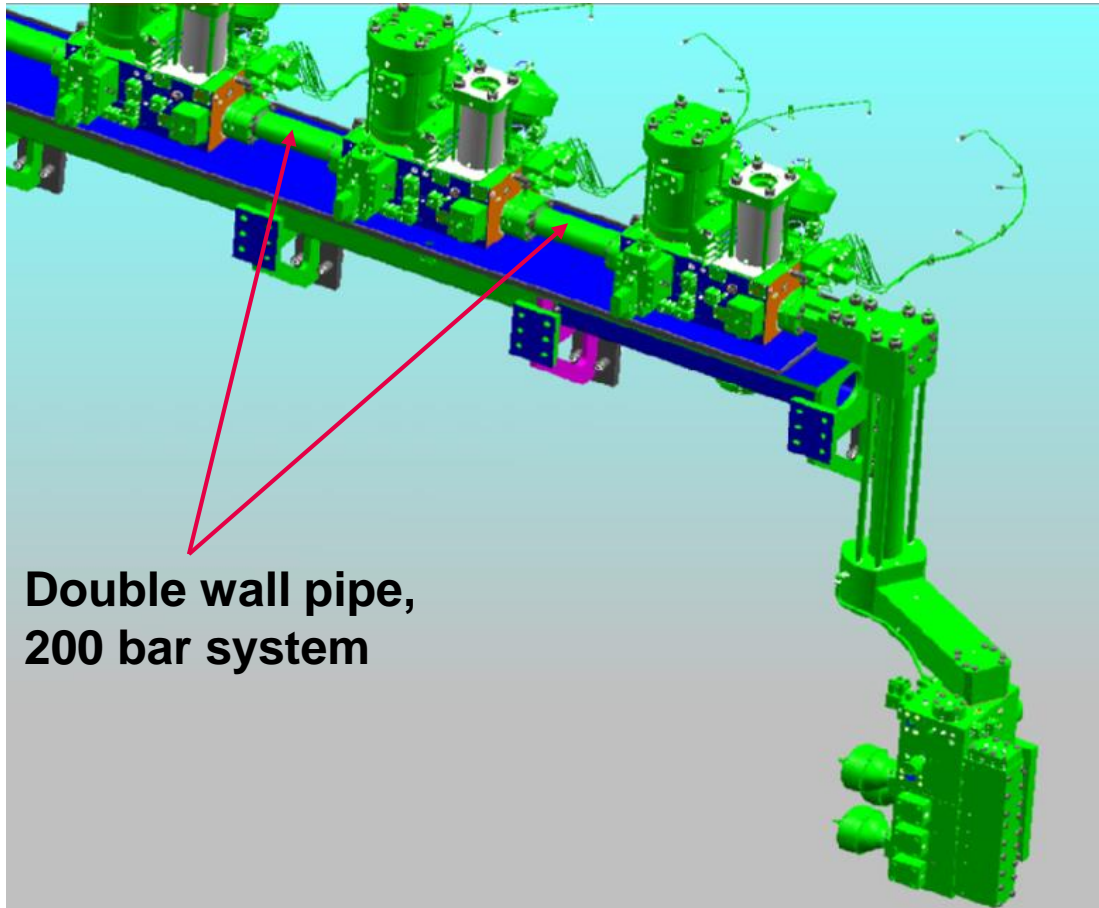
Agenda

Hydraulic Cylinder Unit (HCU)

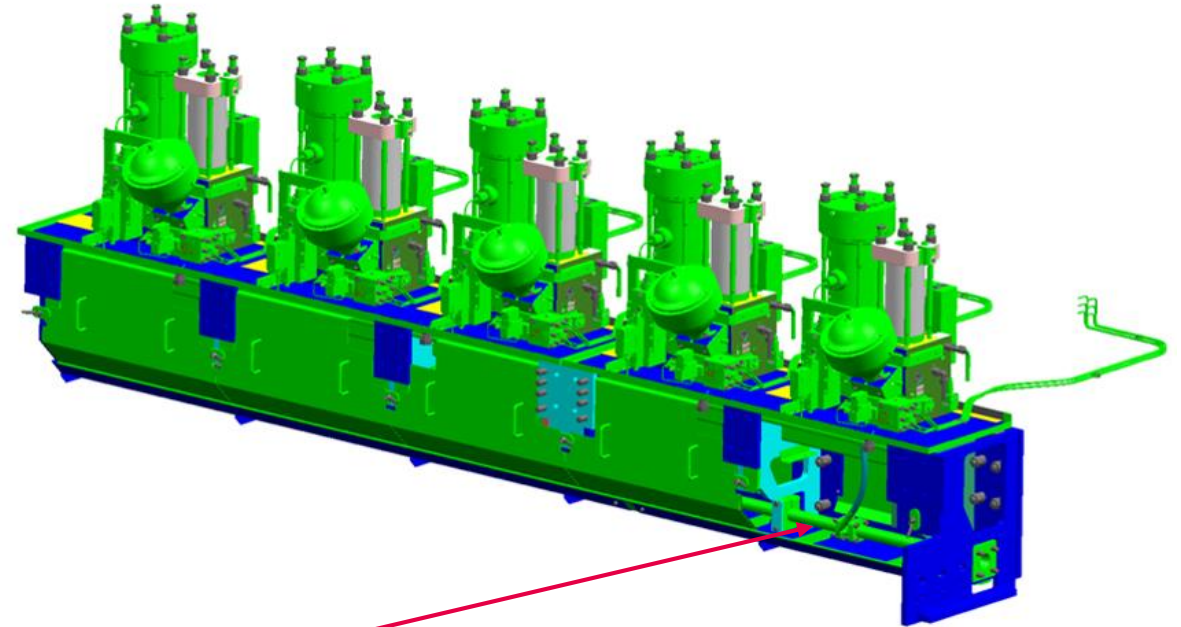
- 1 High pressure pipes**
- 2 Distribution block**
- 3 Components:**
 - Accumulators
 - Lubricator
- 4 Lubrication**

Hydraulic Cylinder Unit (HCU)

High pressure pipes – 200 or 300 bars system



Double wall pipe,
200 bar system



Single pipe in casing
300 bar system

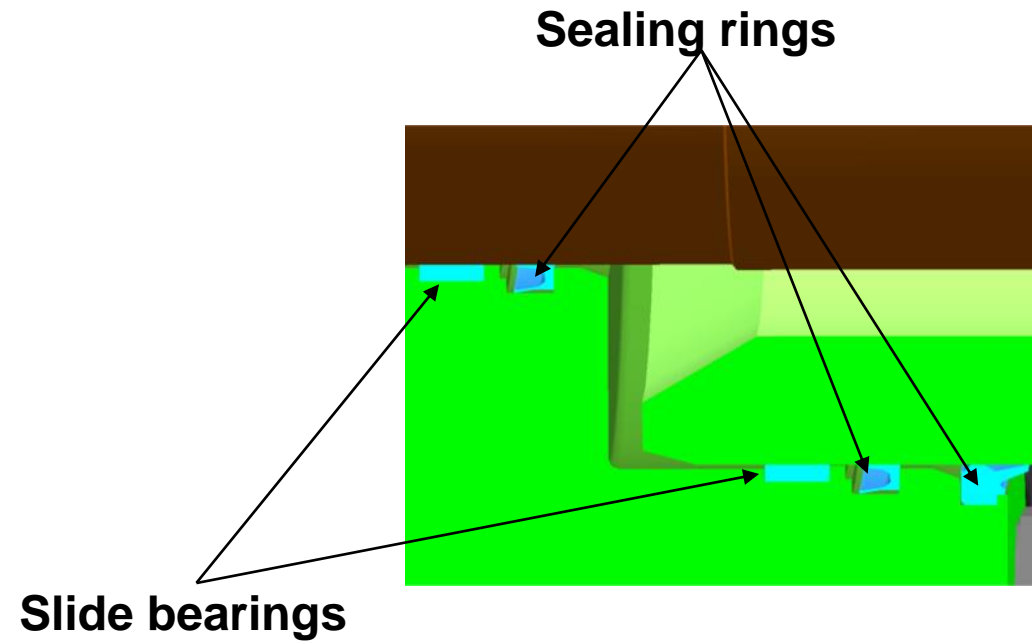
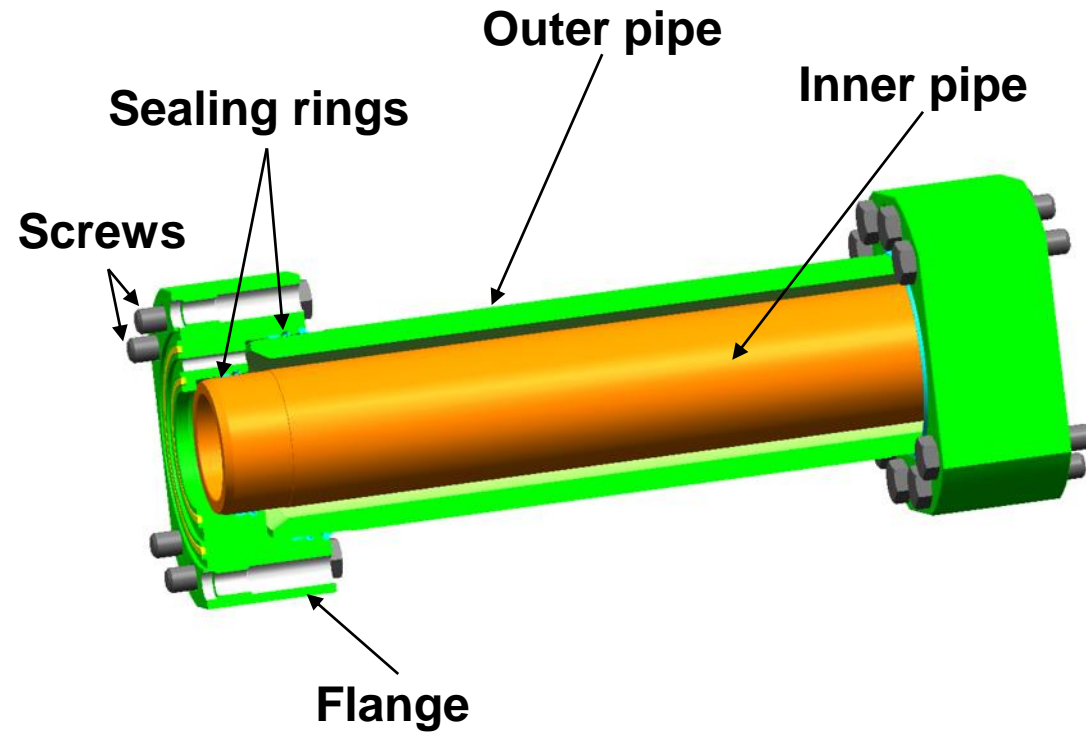
Hydraulic Cylinder Unit (HCU)

High pressure pipes – 200 or 300 bars system



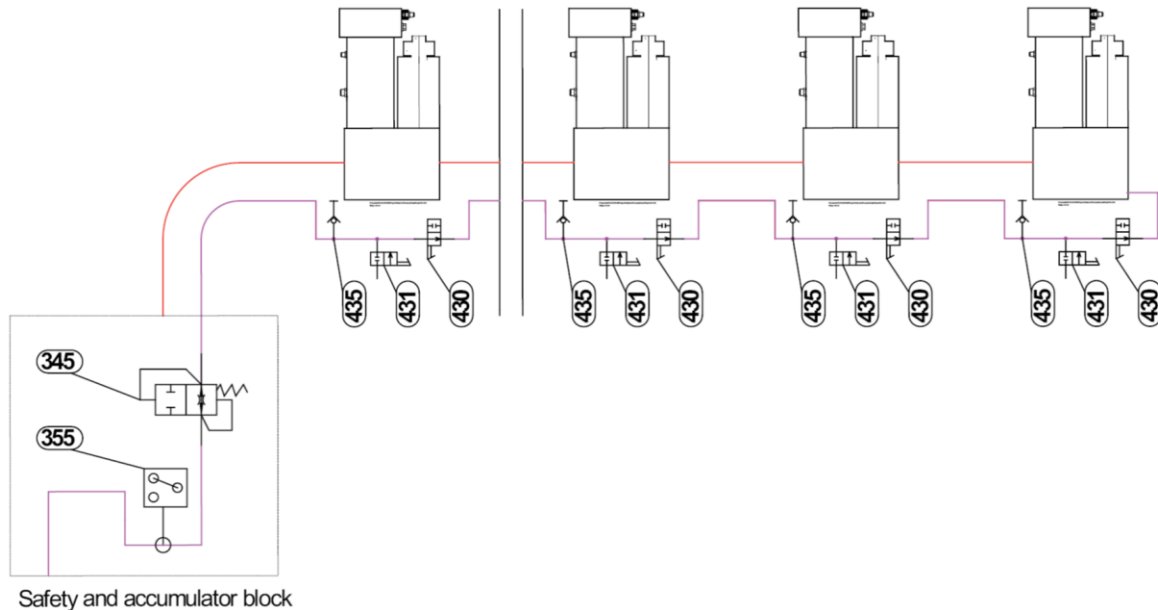
Hydraulic Cylinder Unit (HCU)

High pressure pipes – 200 bars pipe



Hydraulic Cylinder Unit (HCU)

High pressure pipes – Leak detection 200 bars system



1. CLOSE the valve 430 at the last, but one Hydraulic Cylinder Unit (HCU).
2. OPEN the valve 431 at the last HCU to decrease the pressure in the space between the inner and outer pipe.
3. CLOSE the valve 431 at the last HCU again.
4. Check the pressure increase in the space between at position 435, at the last HCU.
5. If the pressure increases to system pressure level, the leakage has been found.
6. When the leakage has been eliminated, bring all the valves to their normal position.

Agenda

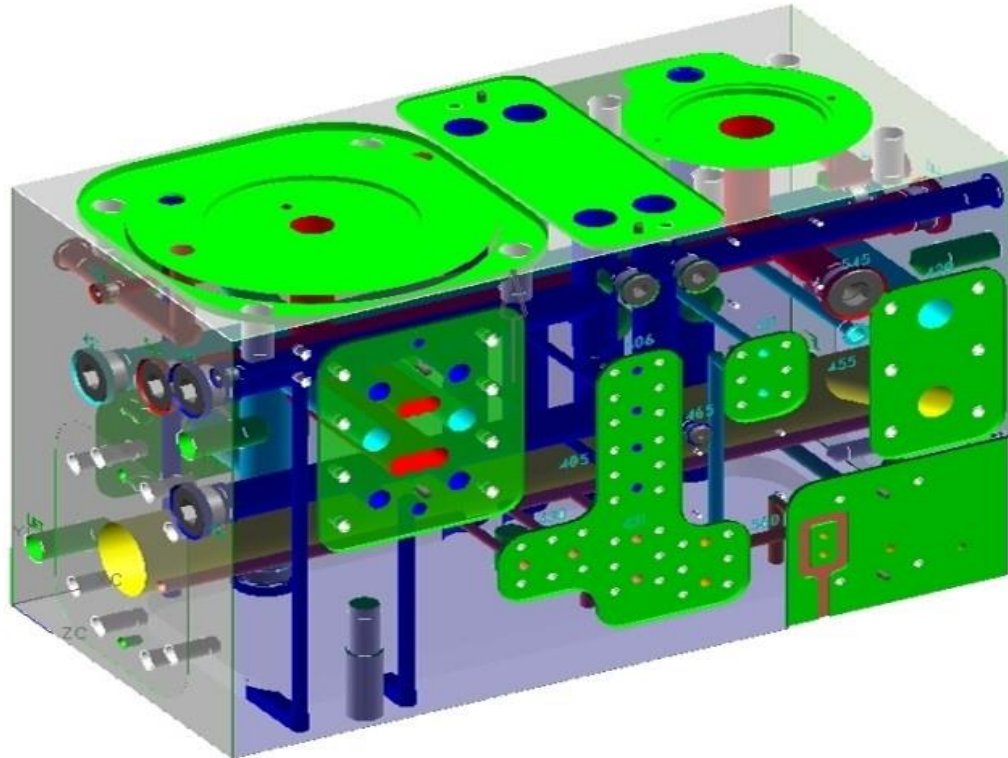
Hydraulic Cylinder Unit (HCU)

- 1 High pressure pipes**
- 2 Distribution block**
- 3 Components:**
 - Accumulators
 - Lubricator
- 4 Lubrication**

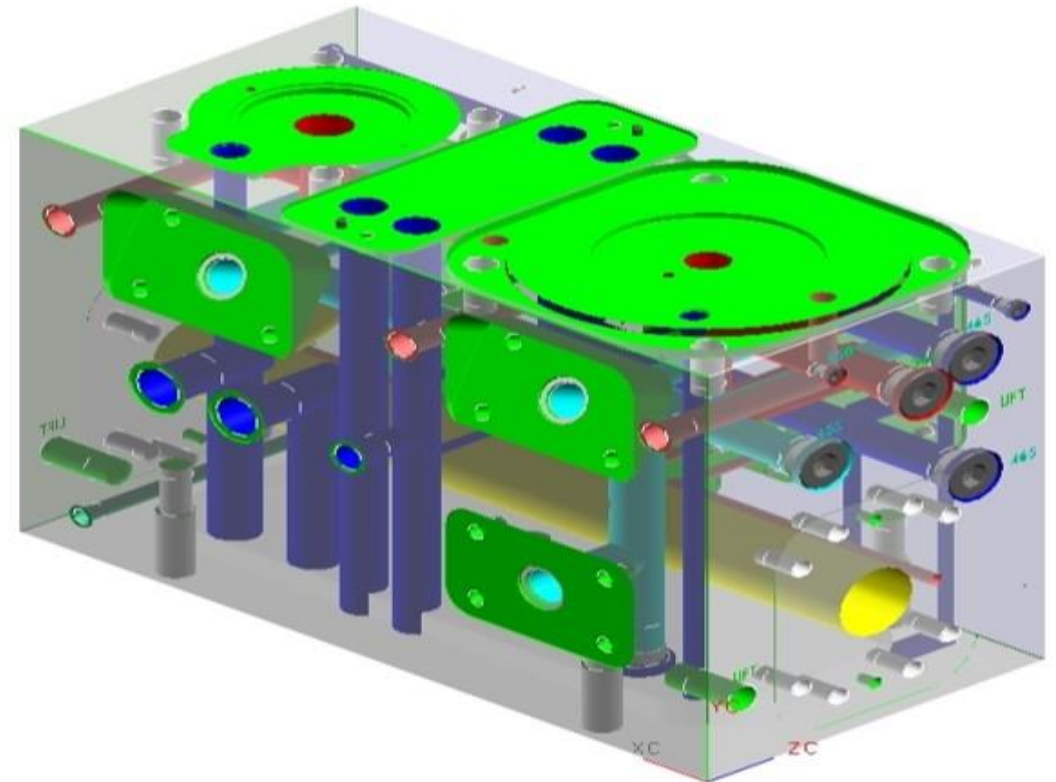
Hydraulic Cylinder Unit (HCU)

Distribution block

Front side



Back side



Hydraulic Cylinder Unit (HCU)

Distribution block

Fuel oil pressure booster

Overflow pipe (de - air rating)

Distribution block

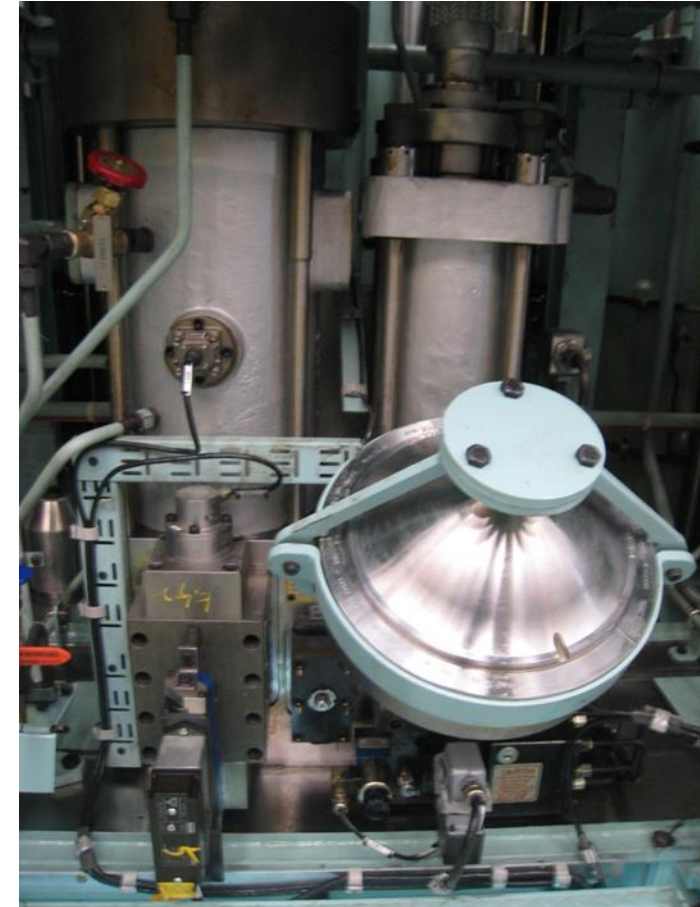
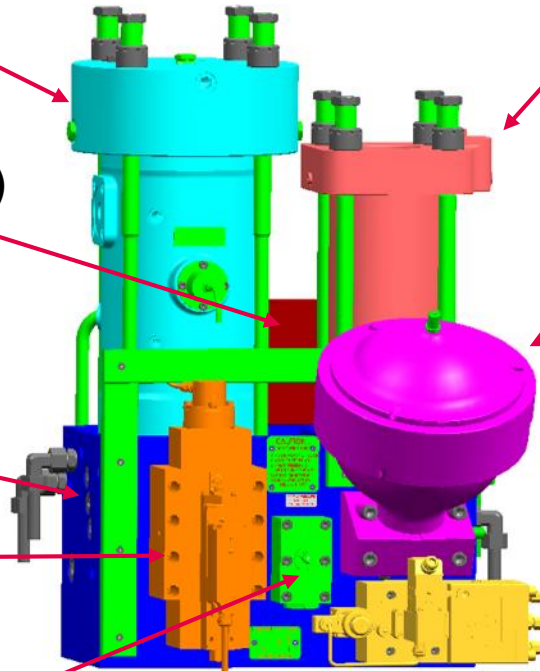
FIVA valve

Ball valve

Exhaust valve actuator

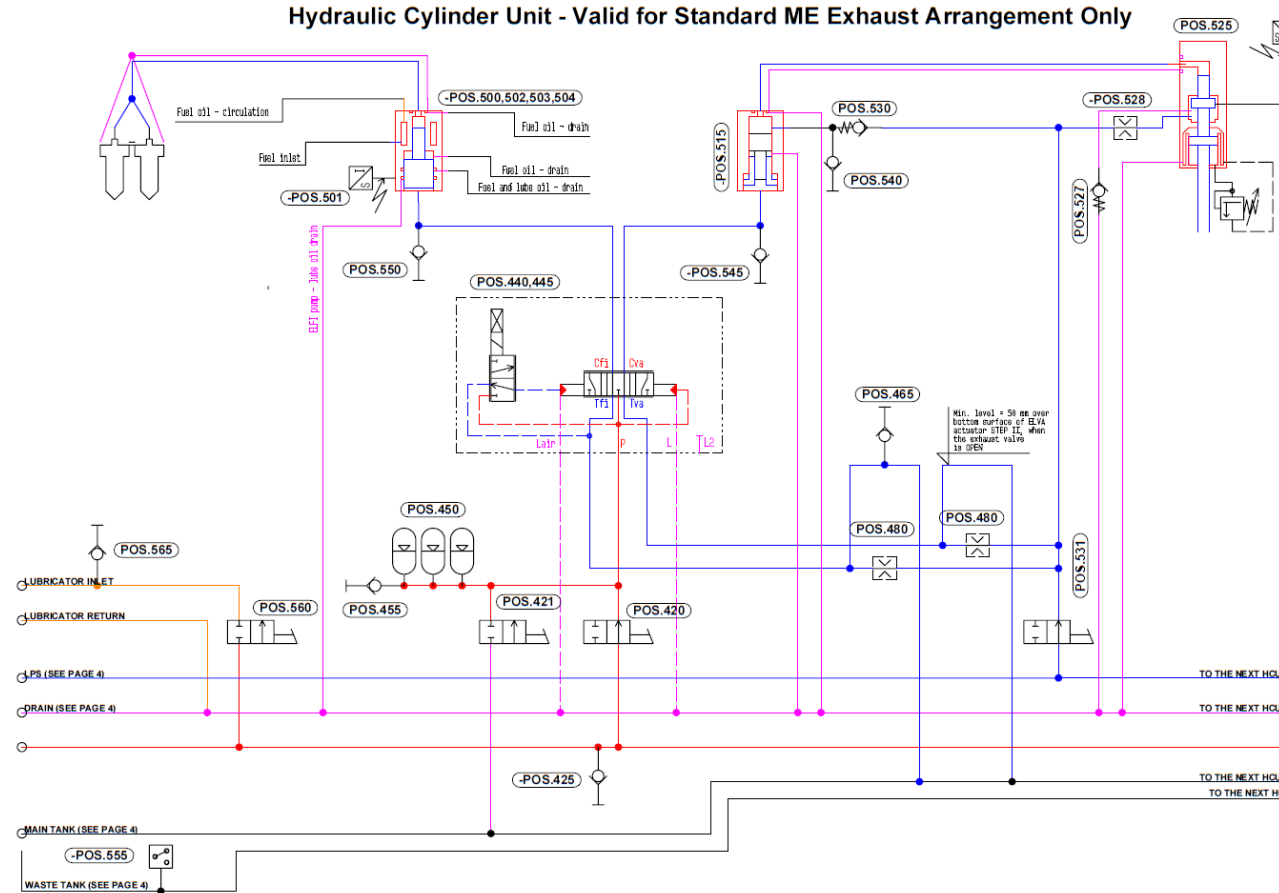
Accumulator

ME lubricator



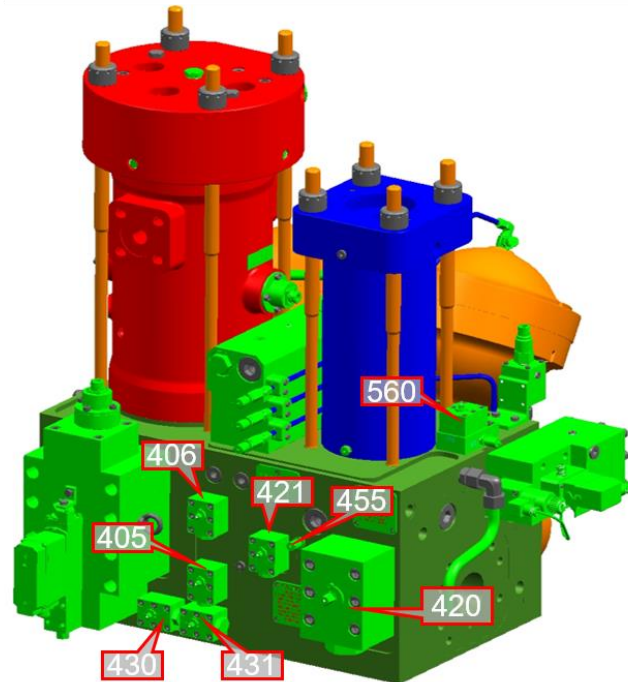
Hydraulic Cylinder Unit (HCU)

Distribution block – 300 bars system diagram



Hydraulic Cylinder Unit (HCU)

Distribution block – 200 bars system valves

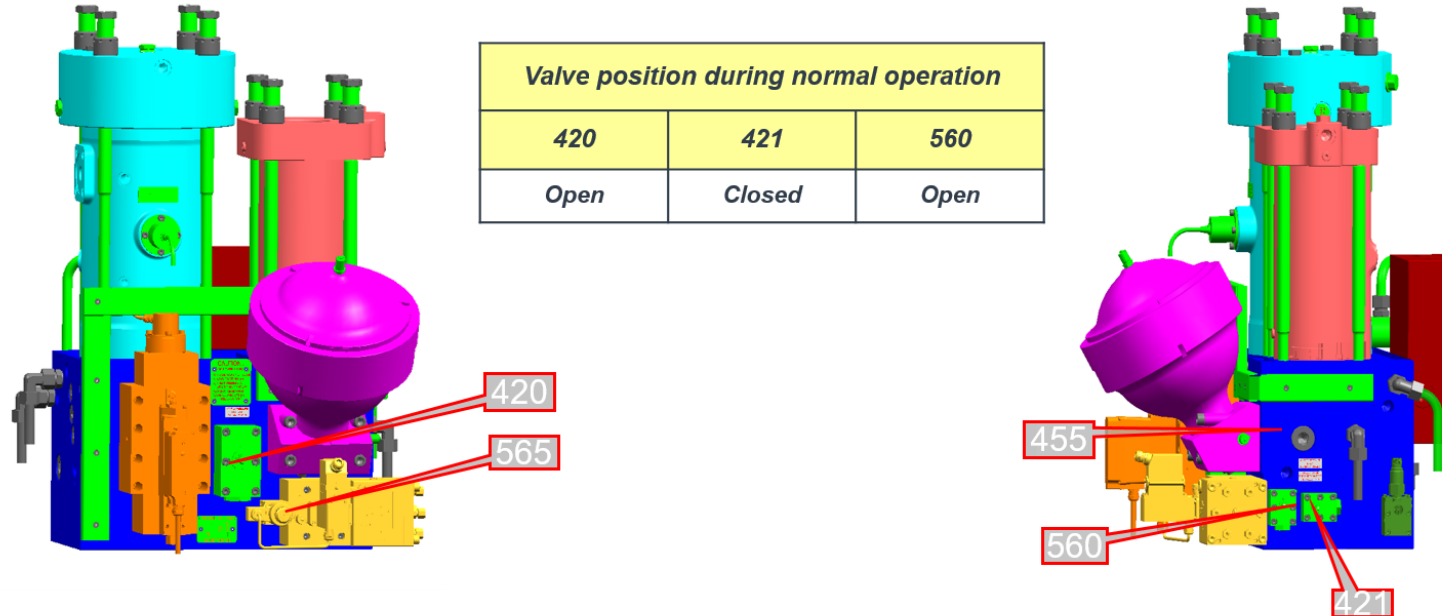


- 405 : Drain valve for FIVA valve
- 406 : Drain valve for FIVA valve
- 420 : Main supply valve of high pressure oil to FIVA valve
- 421 : Drain valve for distribution block
- 430 : Valve for double wall pipe leakage detection
- 431 : Drain valve for outer pipe oil
- 455 : Mini-mess coupling for measurement of the oil pressure (high pressure side)
- 560 : Supply valve of high pressure oil to ME lubricator

Valve position during normal operation						
405	406	420	421	430	431	560
Closed	Closed	Open	Closed	Open	Closed	Open

Hydraulic Cylinder Unit (HCU)

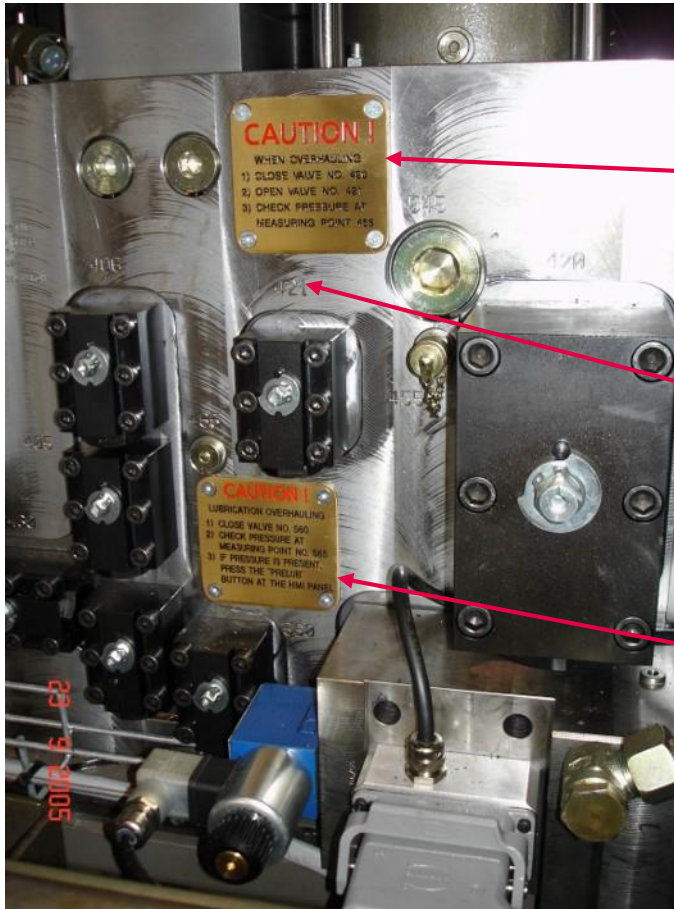
Distribution block – 300 bars system valves



- 420 : Main supply valve of high pressure oil to FIVA valve
- 421 : Drain valve for distribution block
- 455 : Mini-mess coupling for measurement of the oil pressure (high pressure side)
- 560 : Supply valve of high pressure oil to ME lubricator
- 565 : Mini-mess coupling for measurement of the oil pressure (high pressure side)

Hydraulic Cylinder Unit (HCU)

Distribution block – Preparation for maintenance



Valve No.

CAUTION!

HCU OVERHAULING

0. CHECK GAUGE WORKS!

1. CLOSE VALVE NO. 420, 531
2. OPEN VALVE NO. 421, 405, 406
3. CHECK PRESSURE AT MEASURING POINT 455.

WARNING – NEVER 'OPEN' VALVE 420 WHEN SYSTEM PRESSURE IS 'ON'

CAUTION!

LUBRICATION OVERHAULING

0. CHECK GAUGE WORKS!

1. CLOSE VALVE NO. 560
2. CHECK PRESSURE AT MEASURING POINT 565
3. IF PRESSURE IS PRESENT, PRESS THE 'PRE-LUB' BUTTON AT THE HMI PANEL.

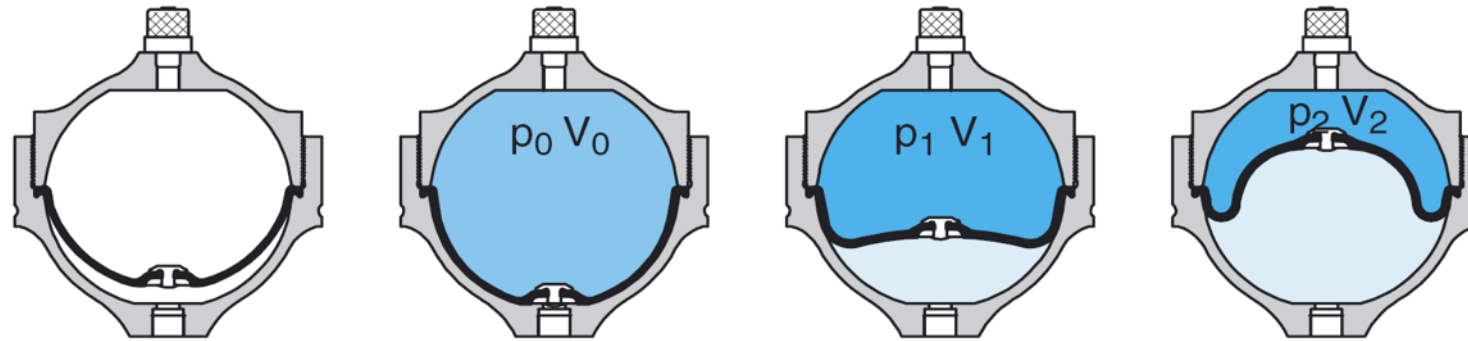
Agenda

Hydraulic Cylinder Unit (HCU)

- 1. High pressure pipes**
- 2. Distribution block**
- 3. Components:**
 - Accumulators
 - Lubricator
- 4. Lubrication**

Hydraulic Cylinder Unit (HCU)

Accumulators



WARNING

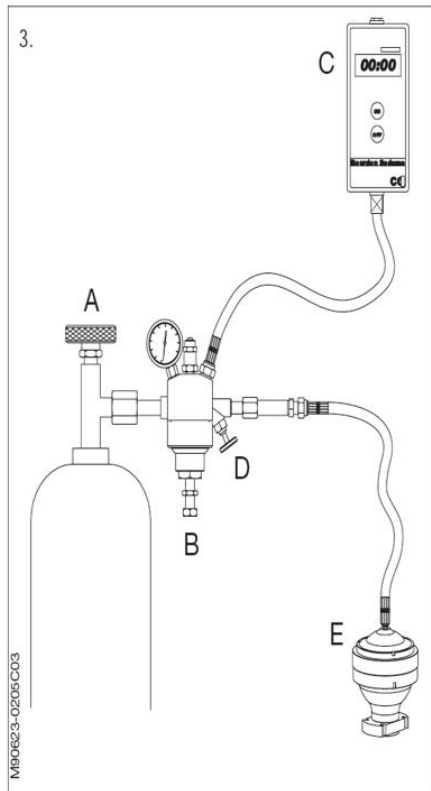
To protect the accumulator from unnecessary stresses (fast acceleration of the membrane) and oil jets, the valve Pos. 420 must not be opened at pressurised oil system.

After check/overhaul or whatever situation where the valve Pos. 420 has been closed the opening procedure is:

- 1) The engine must be stopped (no oil pressure)
- 2) Open/Close all valves into normal running position.
- 3) Pressurise the system by starting the Start-up pumps.

Hydraulic Cylinder Unit (HCU)

Accumulators – Nitrogen check, SL2019 - 673



The accumulator charge pressure should be checked within the first week of service. Next check should be made minimum every month.

A minor leakage from the accumulators is unavoidable and service experience shows that a pressure drop in the range of 2 - 5 bar / month is to be expected. The charge pressure is dependent on working servo oil pressure as well as the accumulator temperature.

For the 300 bar HPS accumulator charging pressures are:

Ref.	Description	Value	Unit
T45-42	Accumulator	25	kg
T45-43	N2 charging pressure	136	bar at 20°
T45-45	Pressure adjustment table		
	Accumulator temperature	°C	bar
	0	124	bar
	10	130	bar
	20	136	bar
	30	142	bar
	40	148	bar
	50	154	bar
	60	160	bar
	70	166	bar
	80	172	bar
	90	178	bar
	100	185	bar
	Filling pressure must be as stated above		
	Check pressure within ± 5 bar		
T45-46	Assembly off-set 4-liter accumulator	9	mm
T45-48	Screw, flange to accumulator	80	Nm
T45-49	Screw, flange to hydraulic cylinder unit	50	Nm

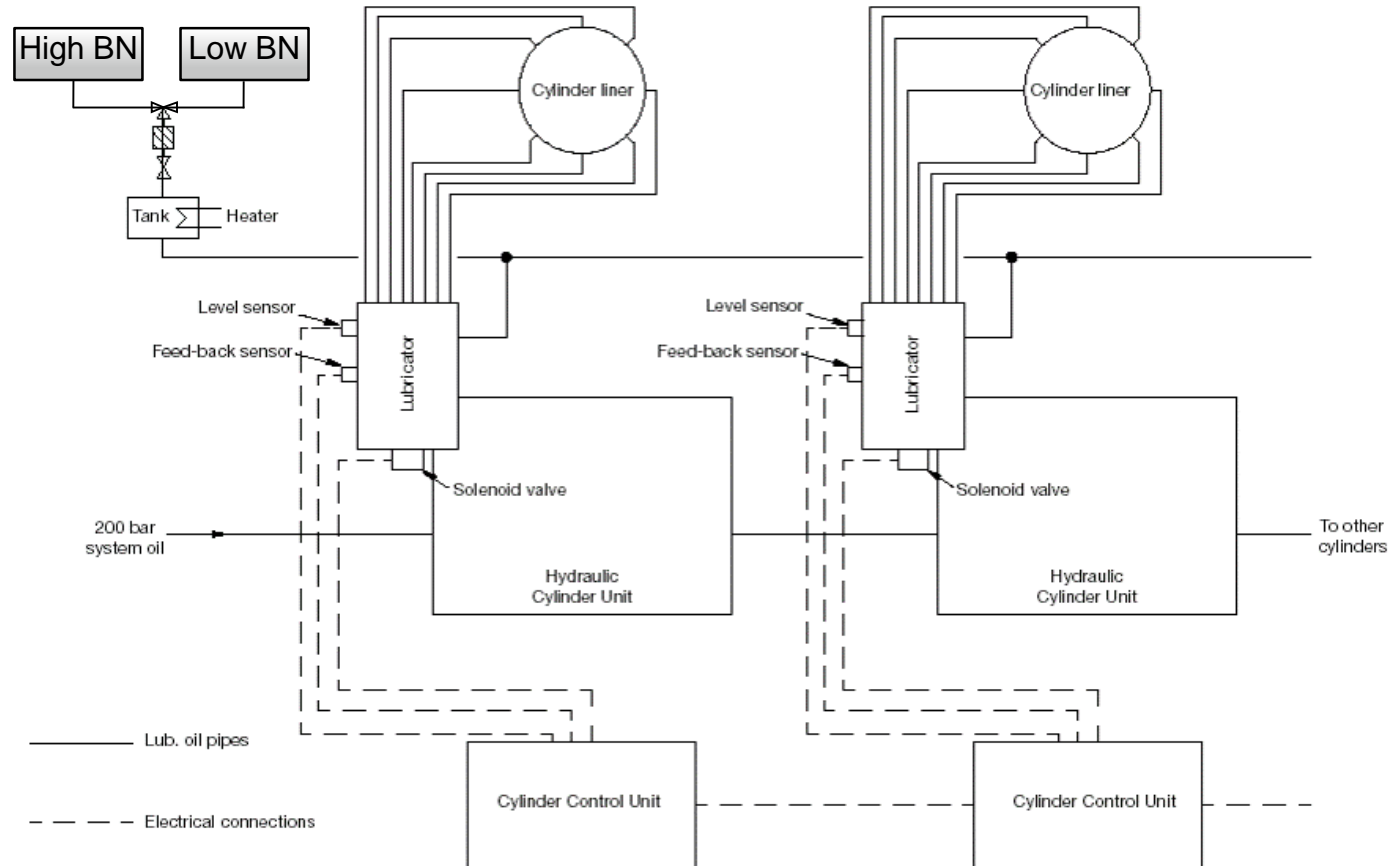
Agenda

Hydraulic Cylinder Unit (HCU)

- 1. High pressure pipes**
- 2. Distribution block**
- 3. Components:**
 - Accumulators
 - Lubricator
- 4. Lubrication**

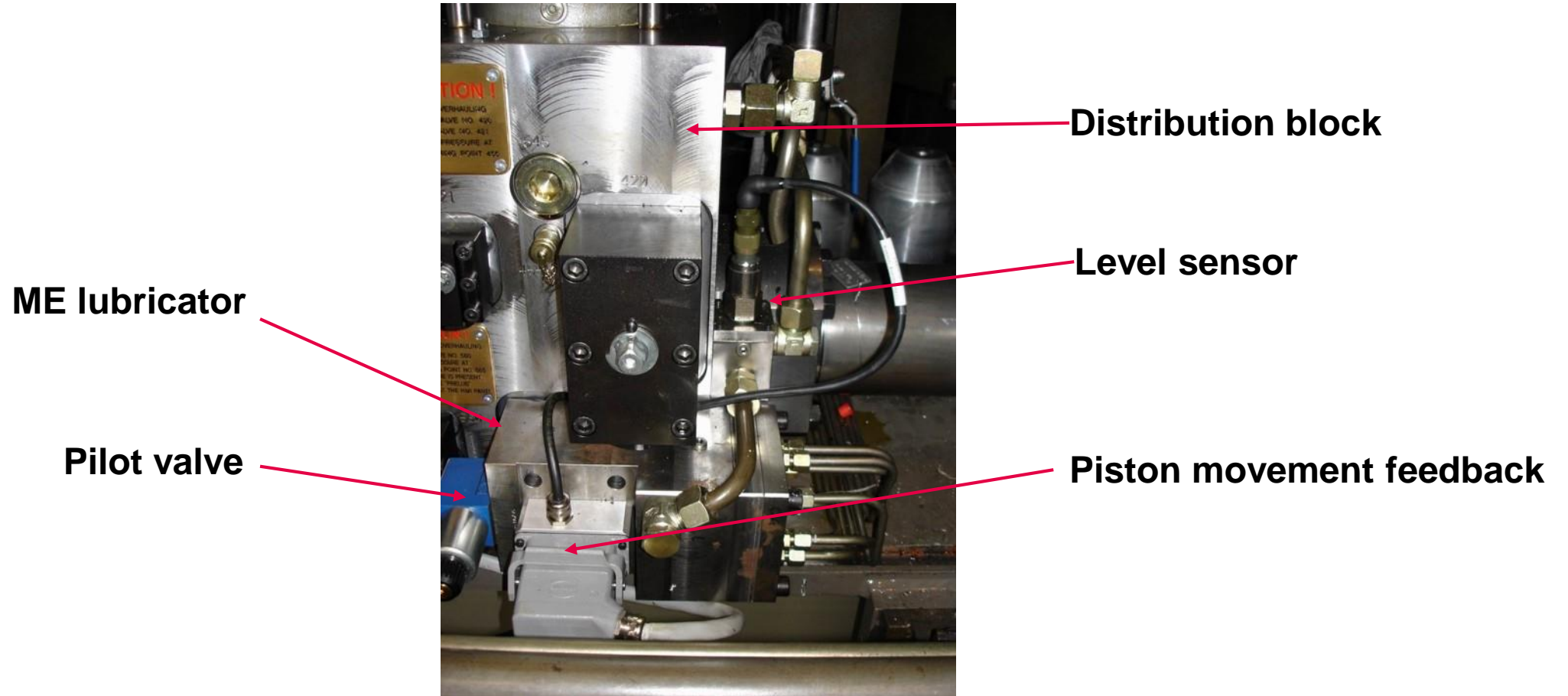
Hydraulic Cylinder Unit (HCU)

Lubricator - Diagram



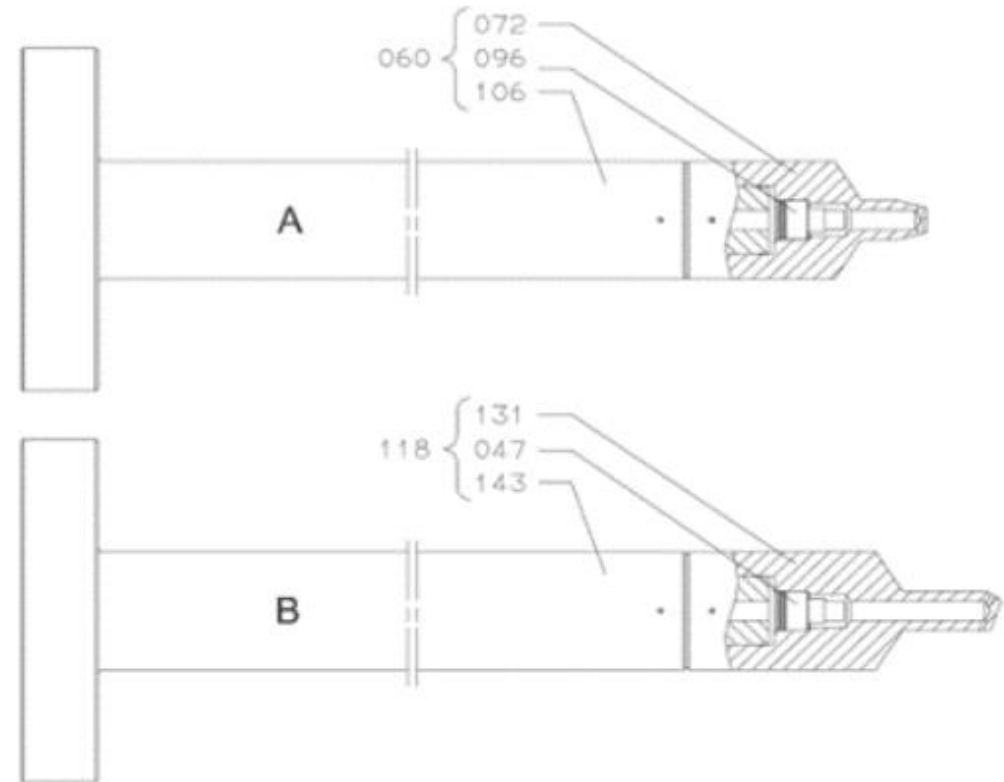
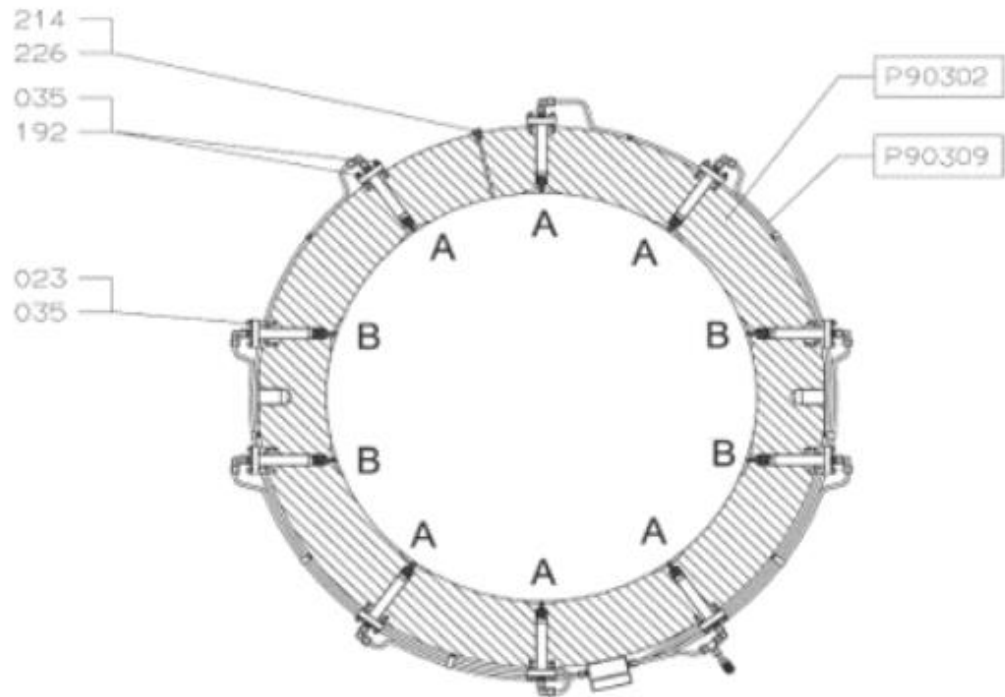
Hydraulic Cylinder Unit (HCU)

Lubricator - Components



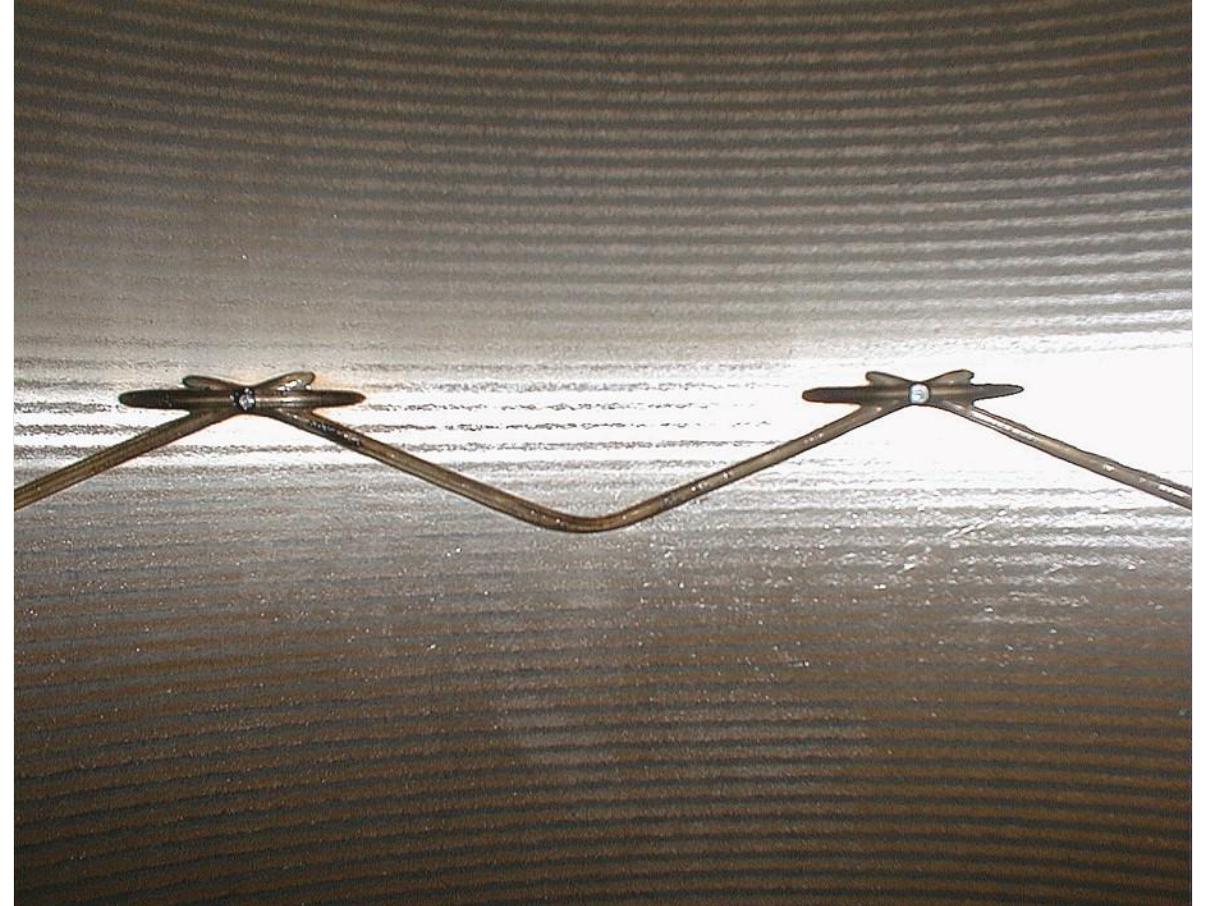
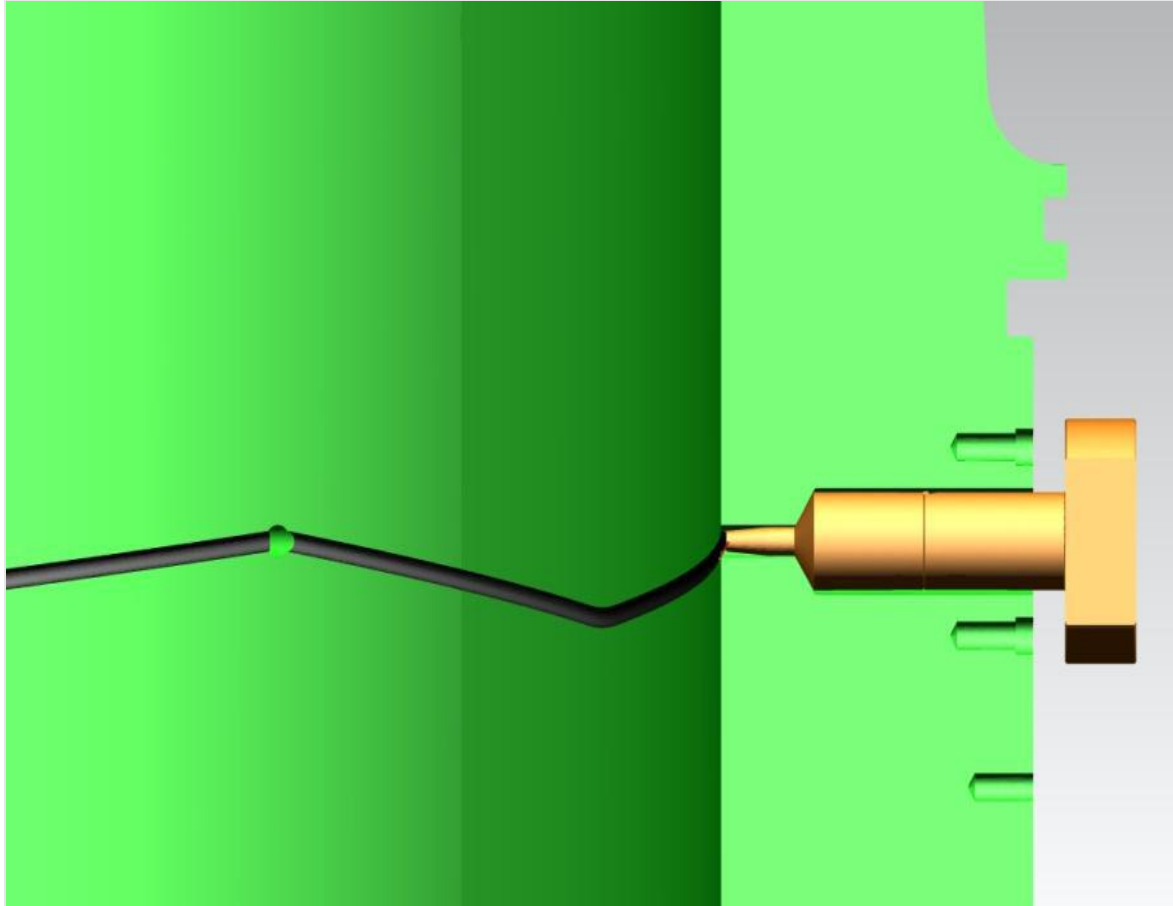
Hydraulic Cylinder Unit (HCU)

Lubricator – Injection nozzles



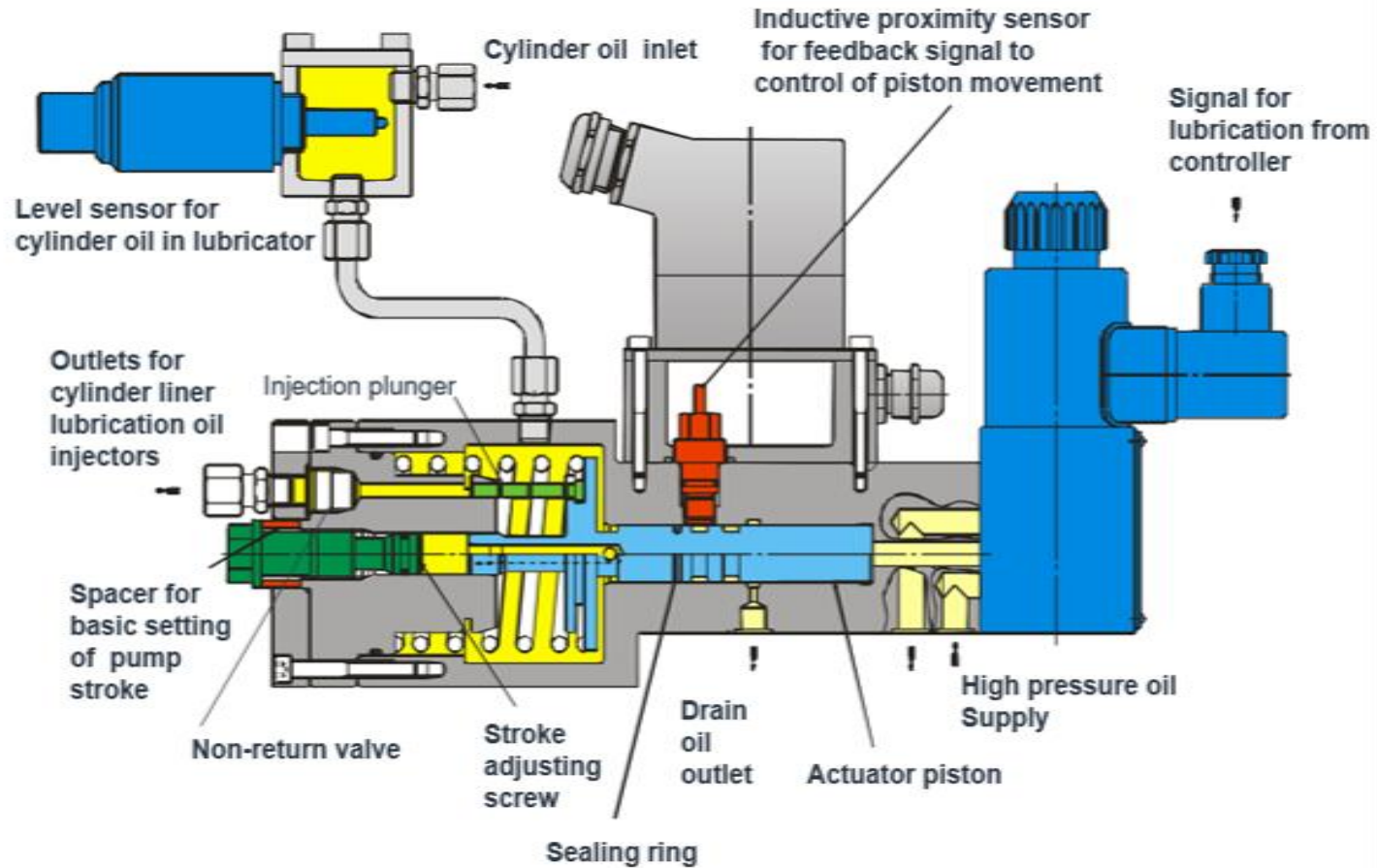
Hydraulic Cylinder Unit (HCU)

Lubricator – Liner Groves



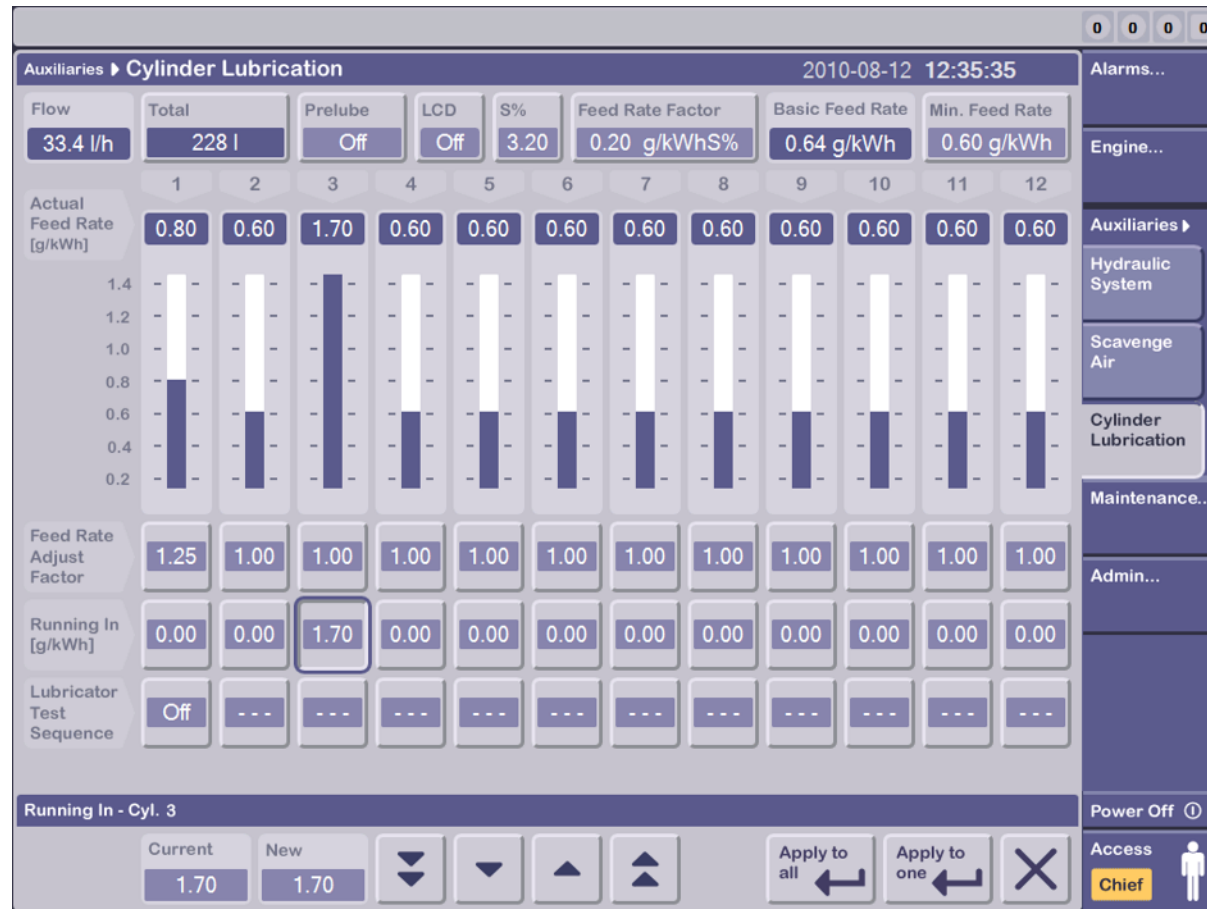
Hydraulic Cylinder Unit (HCU)

Lubricator – ME lubricator design



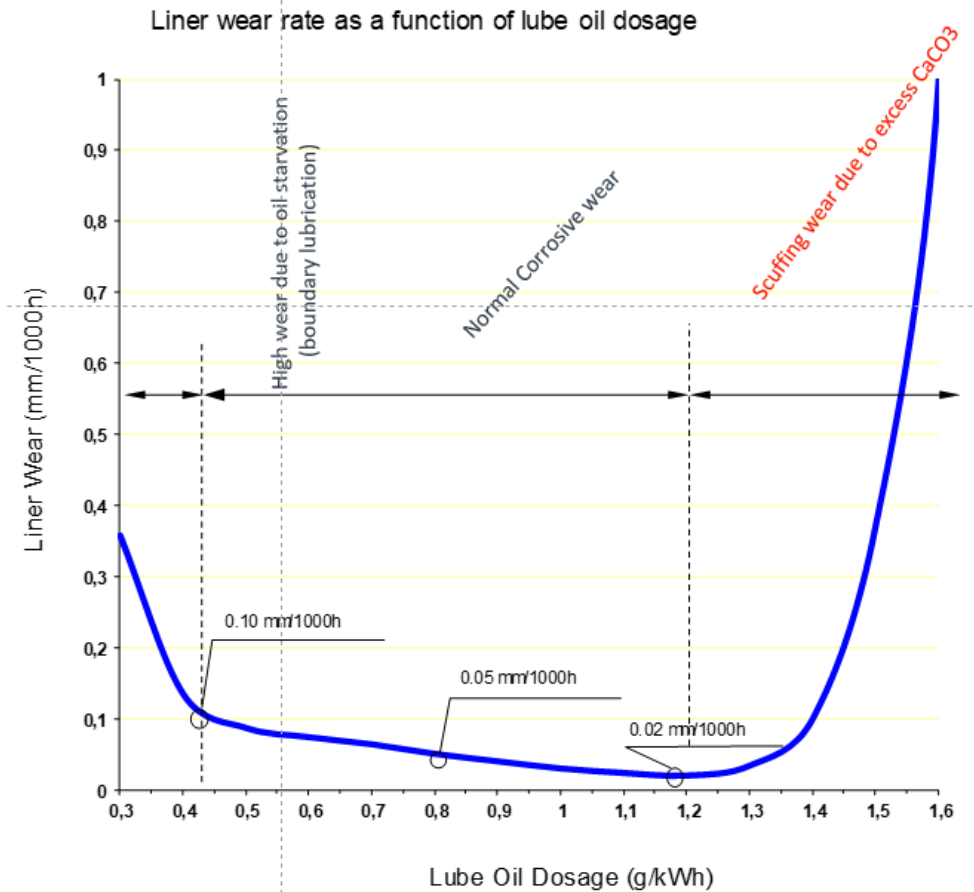
Hydraulic Cylinder Unit (HCU)

Lubricator – Cylinder lubrication screen



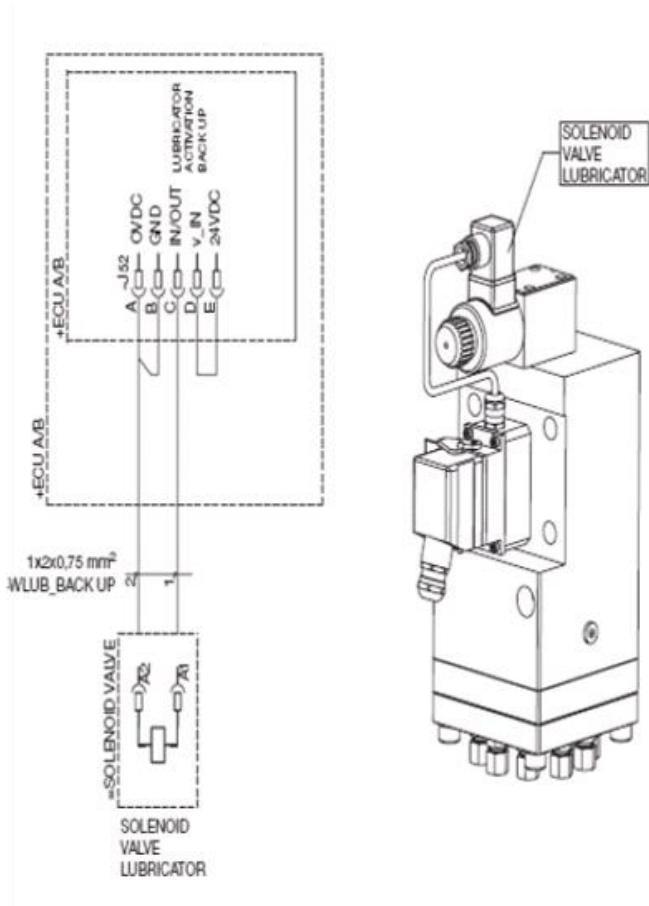
Hydraulic Cylinder Unit (HCU)

Lubricator – Wear rate / Oil dosage



Hydraulic Cylinder Unit (HCU)

Lubricator - Backup



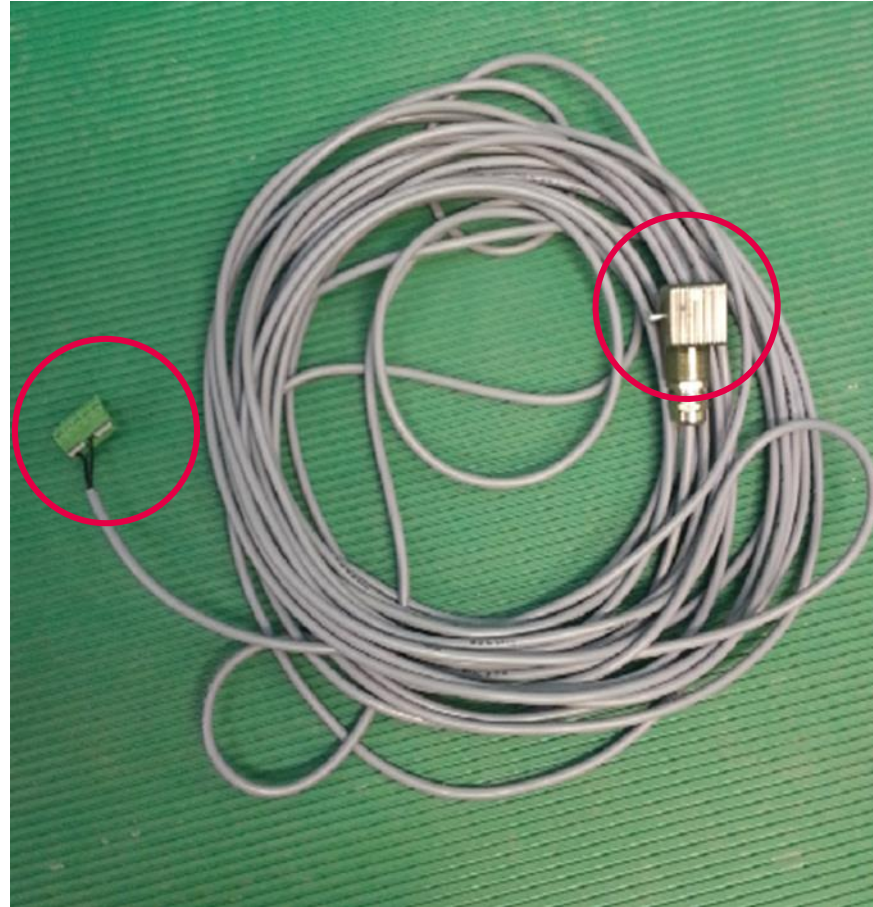
In case of CCU failure where the CCU cannot be changed immediately, the cylinder lubrication can be achieved by a temporary cable from one of the ECU units, plug 52, to the solenoid valve on the lubricator on the unit in question.

The lubrication will be with random timing:

Hydraulic Cylinder Unit (HCU)

Lubricator - Backup

**Cylinder lubrication
backup cable**



Hydraulic Cylinder Unit (HCU)

Lubricator - Backup

Suprv. Ch35,8601-A,Scavenge Air Pre Alarm ECUA_8601-A04 09:04:07 3 4 0 0

Maintenance ▶ System View - I/O Test 2010-08-13 09:04:59

ECU-A

MPC Mode: Normal

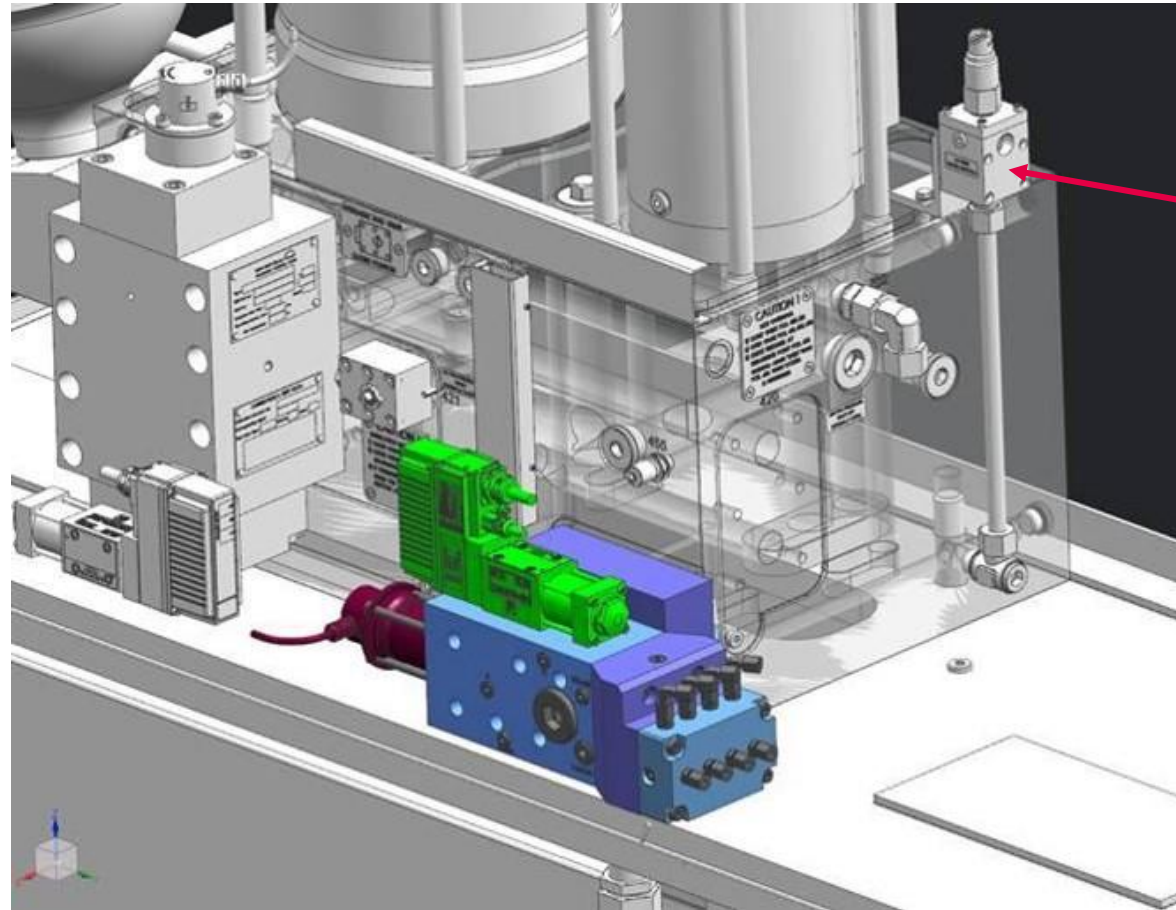
Legend: A Analog Input, D Digital Input, A Analog Output, D Digital Output, / Invalidated, / Not used, ! Alarm, N/A Not available

#	Info	ID	Description	Process Value	#	Info	ID	Description	Process Value
20	/				44	D	4001-B	marker master	False
21	D	2152-A	Local: Increase Limiter	OFF	45	D	4002-B	marker slave	False
22	D	2151-A	Local: Stop	ON	46	D	4003-B	quadrature master	False
23	D	2114-A	Local: Air Run	OFF	47	D	4004-B	quadrature slave	False
24	D	2115-A	Local: Slow Turn	OFF	48	/			
25	D	2153-A	Local: Take CMD	OFF	49	/			
26	A	1006	Local: Speed Set	0.7 RPM	50	/			
27	/				51	/			
30	/				52	D	011501	Lubricator Backup Signa	N/A
31	/				53	/			
32	D	1117-A	Blocked Start Air Distr	OFF	61	D	2005-A	Reset Shut Down	ON
33	/				70	A	2184	Governor Index	0.0 %
34	D	2001-A	Shut Down	OFF	71	A	8501	Start Air Pressure	28.5 -
35	A	8601-A	Scavenge Air Pressure (0.00 -	80	D	1114	Slow Turn Valve	OFF
36	/				81	/			
37	/				82	D	1121-A	Main Start Air Valve	OFF
40	D	4001-A	marker master	False	83	D	2206-A	Slow Down Local Indicati	OFF
41	D	4002-A	marker slave	False	84	D	2154-A	Local Take Command	OFF
42	D	4003-A	quadrature master	False	85	D	2159-A	Increase Limit Indicati	OFF
43	D	4004-A	quadrature slave	False					

Alarms... Engine... Auxiliaries... Maintenance ▶ System View I/O Test Invalidated Inputs Network Status Function Test Troubleshooting Admin... Power Off ⓘ Access Chief

Hydraulic Cylinder Unit (HCU)

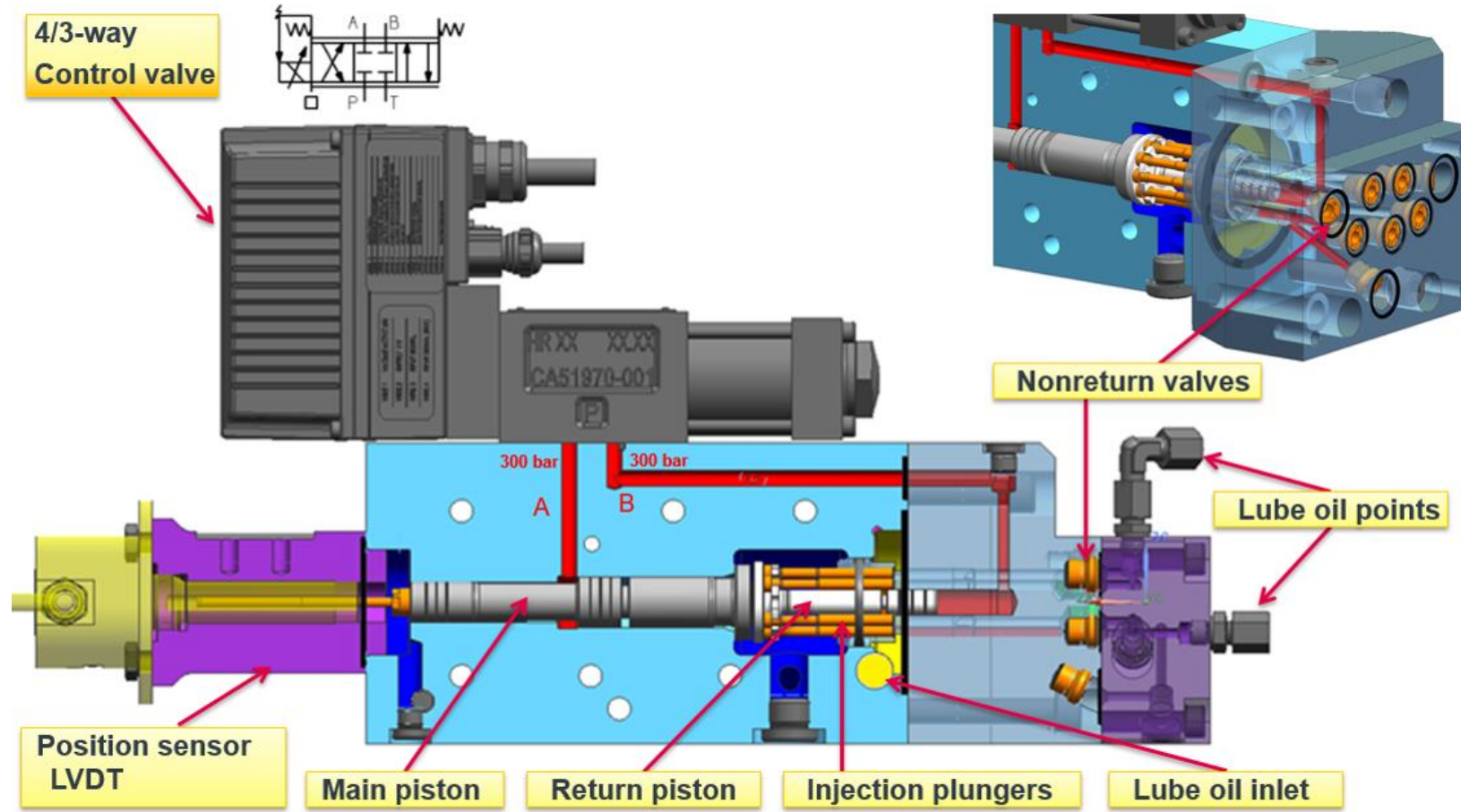
Lubricator – Alpha lubricator Mk. II



Level sensor

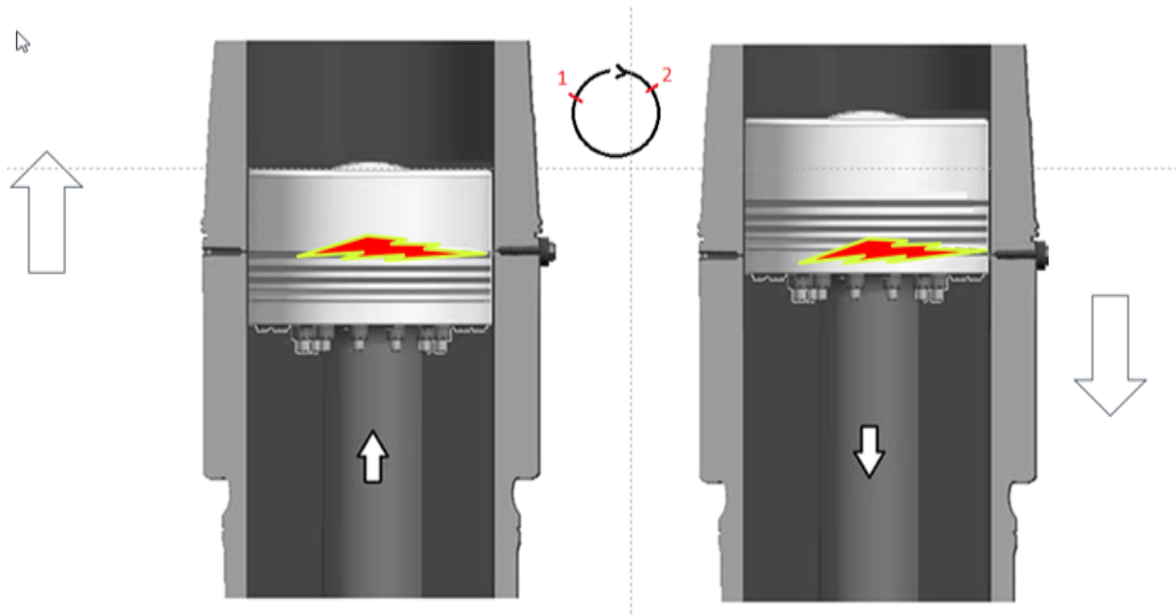
Hydraulic Cylinder Unit (HCU)

Lubricator – Alpha Lubricator Mk. II



Hydraulic Cylinder Unit (HCU)

Lubricator – Alpha lubricator Mk. II; Working principle



The possibility for up to two injections per revolution with different timing / amount

Every injection timing is decided according to Top Dead Center (TDC) for the actual cylinder.

Agenda

Hydraulic Cylinder Unit (HCU)

- 1. High pressure pipes**
- 2. Distribution block**
- 3. Components:**
 - Accumulators
 - Lubricator
- 4. Lubrication**

Hydraulic Cylinder Unit (HCU)

Lubrication – How to...

Service letter SL2019-671/JAP



Action code: WHEN CONVENIENT

Cylinder lubrication update for 0 to 0.50% sulphur fuels

SL2019-671/JAP
April 2019

Concerns

Owners and operators of MAN B&W two-stroke marine diesel engines.
Type: All MAN B&W engines

Summary

Check the cylinder condition frequently and ensure that the piston ring pack is clean and moving freely.

In case of deposits, use oil with higher detergency to clean.

General guidance for operation on:

- Max. 0.10% S fuel: 15–25 BN CLO
- 0.10%–0.50% S fuel: 40–70 BN CLO

Guidelines on lubrication when operating on fuel with a sulphur content above 0.50% are found in SL2014-587.

Other relevant Service Letters are: SL2016-659, SL2019-670, SL2017-638, SL2016-663, SL2014-587



Dear Sir or Madam

This service letter provides operational guidelines on how to lubricate the cylinder and piston when operating on max 0.50% sulphur fuel.

It is expected that the vast majority of all vessels with MAN B&W engines will experience a trouble-free transition to max. 0.50% S fuels. We recommend beginning with 40 BN cylinder oil and evaluating the condition continuously.

In case of deposit build-up, a cylinder oil with higher detergency properties should be considered. For some engines, a lower BN oil will be acceptable whereas others will need to change to a higher BN oil.

For questions or inquiries regarding the content in this letter, contact our Operation department at: OperationCS@man-es.com

Yours faithfully

Mikael C. Jensen
Vice President
Engineering

Stig B. Jakobsen
Senior Manager
Operation

Head office (A po. address) PrimaServ
MAN Energy Solutions Taghtrapside 41
2450 Copenhagen SV
Denmark Phone: +45 33 85 11 00
Fax: +45 33 85 10 30
88-qd@man-es.com
www.man-es.com

Production Taghtrapside 35
2450 Copenhagen SV
Denmark Phone: +45 33 85 11 00
Fax: +45 33 85 10 17
manufacturing-dk@man-es.com

Forwarding & Receiving Taghtrapside 35
2450 Copenhagen SV
Denmark Phone: +45 33 85 11 00
Fax: +45 33 85 10 16
shipping-qd@man-es.com

MAN Energy Solutions Branch of MAN Energy Solutions SE, Germany
C/O No. 31051702
Head office Taghtrapside 41
2450 Copenhagen SV, Denmark
German Reg.No.: HRB 22056
Amtgericht Augsburg

1 MAN Energy Solutions
MUN2019-06-11

Market Update Note



11 September 2019

0.50% S fuel operation 2020

Important service letters and papers on MAN B&W two-stroke engines

Do you have questions about 0.50% sulphur (S) operation? Or do you consider retrofitting a scrubber? MAN Energy Solutions has issued information and recommendations relevant to 0.50% S operation and how to prepare for IMO's global 0.50% sulphur limit. Click on the links below and check it out!

Main 2020-information on 0.50% S fuel operation

The service letter and paper listed below provide information and guidance on 0.50% S fuel operation and how to prepare for the change from operation on high-sulphur fuel to 0.50% S fuel. Attention is drawn to specific fuels properties that should be in focus and how 0.50% S fuels affect the equipment on board. Expectations for the new types of fuels are given, and information on fuel testing, biofuels, and fuels that are not fit for purpose is also included.

- [SL2019-670 – Operation on fuels with max 0.50% S](#)
- [Paper: 0.50% S fuel operation 2020 – detailed information on fuels, with less than 0.50% sulphur – preparation and operation](#)

Cylinder lubrication

The cylinder lubrication recommendation has undergone extensive revision. The three most important factors are: 1. cleanliness in the piston ring pack; 2. feed rate and 3. close monitoring of the cylinder condition and appropriate action.

- [SL2019-671 – Cylinder lubrication update for 0 to 0.50% sulphur fuels](#)
- [SL2014-587 – Cylinder lubrication update](#) (for vessels with scrubbers and for running-in)

Piston rings

Cermet-coated rings are recommended for VLSFO operation. Cermet coating increases the margin against damage to rings and liners and increases the reliability of the main engine.

- [SL2016-659 – Cermet coated piston rings for operation on low-sulphur fuels \(0.50% S or lower\)](#)

Fuel cleaning

Fuel cleaning and removing cat fines (A+S) are and will still be very important.

- [SL2019-674 – Fuel tank cleaning](#)
- [SL2017-638 – Cleaning of heavy fuel oil and maximum 0.10% S fuels – How to remove cat fines](#)
- [Paper: Cat fines – impact on engine wear and how to reduce wear](#)

Scrubbers

MAN PrimeServ offers a SO₂ scrubber retrofit package with recommendations on the turbocharger re-matching parts.

- [SL2016-665 – SO₂ scrubber retrofit on two-stroke engines in service](#)

Link to Service Letters (SL):

- <https://marine.man-es.com/two-stroke/service-letters>

Link to Technical Papers:

- <https://marine.man-es.com/two-stroke/technical-papers>



MAN Energy Solutions

Disclaimer

All data provided in this document is non-binding.

This data serves informational purposes only and is especially not guaranteed in any way.

Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project. This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.

Intellectual property rights

The intellectual property rights of this work are owned and managed by MAN Energy Solutions and are protected both nationally and internationally according to related laws such as copyright law.

This content is for personal learning and non-commercial use only.

You may not modify or reproduce it except for your personal use.

This content is for training purposes only.

This work is the proprietary intellectual property of MAN Energy Solutions.

MAN Energy Solutions owns all rights to this work and the lecture, and this work is only offered by the instructor or via the MAN eAcademy through the MAN Energy Solutions.

Any use of this work at will, without the consent of MAN Energy Solutions, may cause legal problems.

This work is provided for the convenience of course participant, and it does not give intellectual property rights to user.

MAN Energy Solutions
Future in the making



PrimeServ Academy Copenhagen

MAN PrimeServ

