



OUR WAY IS YOUR SUCCESS

streparava EASYlift

Enhanced Active SYstem lift



streparava presents **EASYlift**

NEW MODULAR HEAVY DUTY ENGINE VVA SYSTEM

ENABLING ADDITIONAL FEATURES, SAME VALVETRAIN LAYOUT



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HEAVY DUTY APPLICATIONS



Future emissions regulation

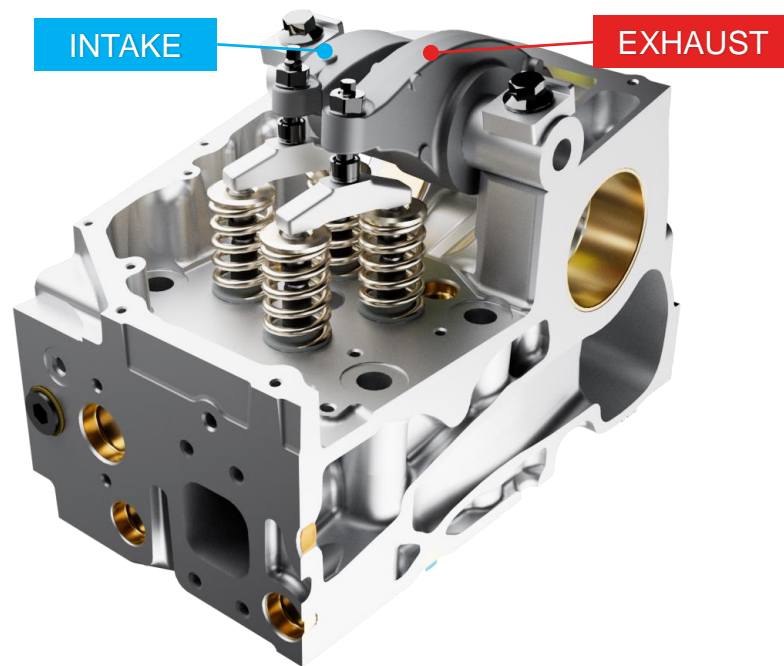
Euro VII regulations will require increasingly efficient heavy-duty transport engines that are more difficult to electrify.

Optimizing engine efficiency requires variable valve opening/closing systems based on engine operating point.

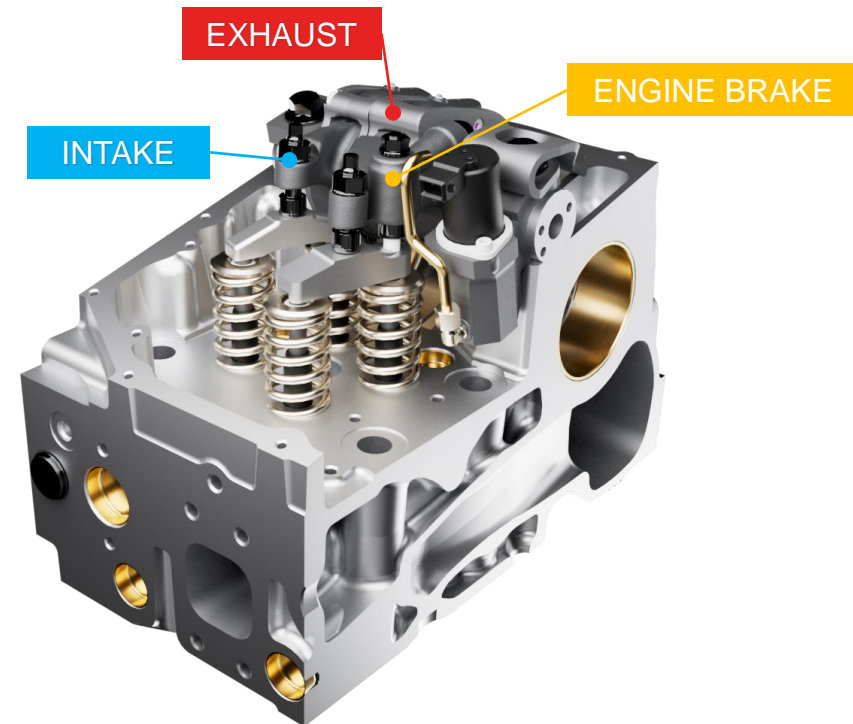
strearava **EASYlift**

A NEW VVA CONCEPT FOR THE NEXT GENERATION HD ENGINES

Conventional system
Fixed Valve Actuation



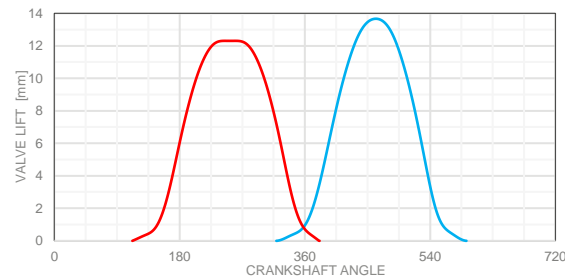
EASYlift
Variable Valve Actuation (VVA)



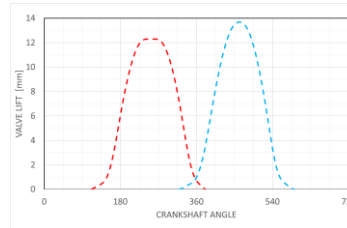
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A NEW VVA CONCEPT FOR THE NEXT GENERATION HD ENGINES

Conventional system Fixed Valve Actuation



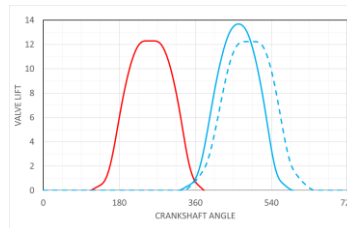
EASYlift Variable Valve Actuation (VVA)



CDA (Cylinder De-Activation)

Switchable rockers

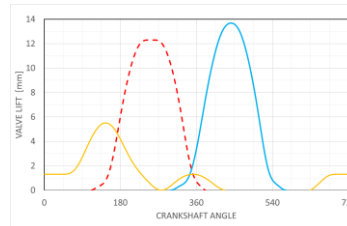
- Engine efficiency -%CO₂
- Thermal management NOx-DPF



MILLER (Late Intake Valve Close)

Switchable LIVC rocker

- Engine efficiency -%CO₂
- Thermal management



ENGINE BRAKE

Compression release brake

- 1.5 **Stroke** (represented) with EXHAUST lift de-activation
+ dedicated rocker
- 1 **Stroke** with dedicated rocker

strearavaEASYlift | CDA

IMEP INCREASE AND EXHAUST THERMAL MANAGEMENT @ LOW LOADS

System specifications

- Two oil control valves for each three cylinders group
- Activation time 30 msec (MIN oil pressure 2.5 bar)
- Crankshaft angle based control strategy
- Skip-fire ready

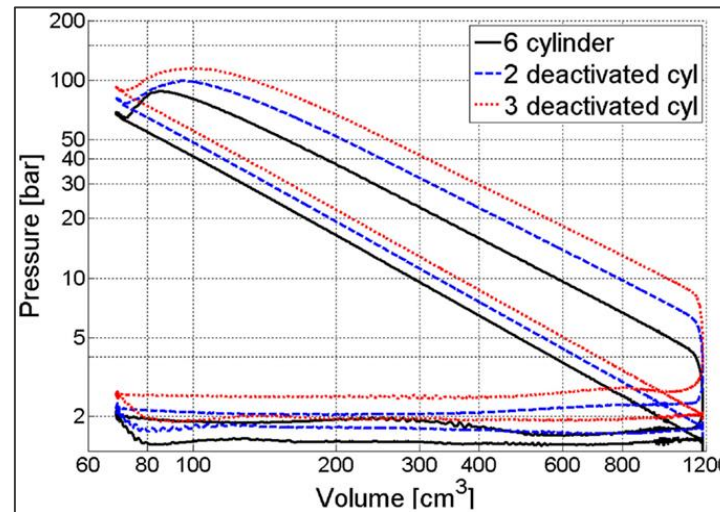


IMEP INCREASE AND EXHAUST THERMAL MANAGEMENT @ LOW LOADS

System advantages

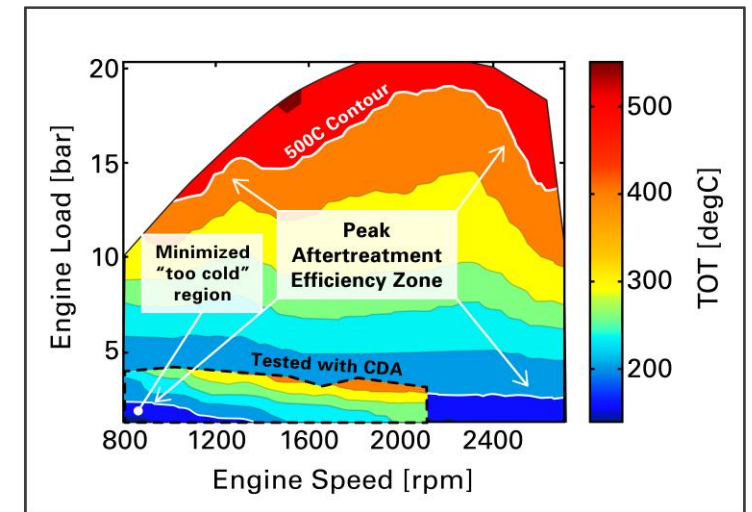
- Improved volumetric efficiency for SI-LNG H2 engines at low/medium load
- Improved engine thermal management at low loads or during engine warm-up phase

Volumetric efficiency improvement for SI-LNG H2



Source: MTZ magazine

Improved SCR/DPF thermal management



Source: MTZ magazine

streparava EASYlift | Miller LIVC

BETTER PERFORMANCES, LESS CONSUMPTION

System specifications

- One oil control valve for six cylinders group
- Activation time 30 msec (MIN oil pressure 2.5 bar)
- On demand IVC delay up to 40°CA (same IVO)



streparava EASYlift | Miller LIVC

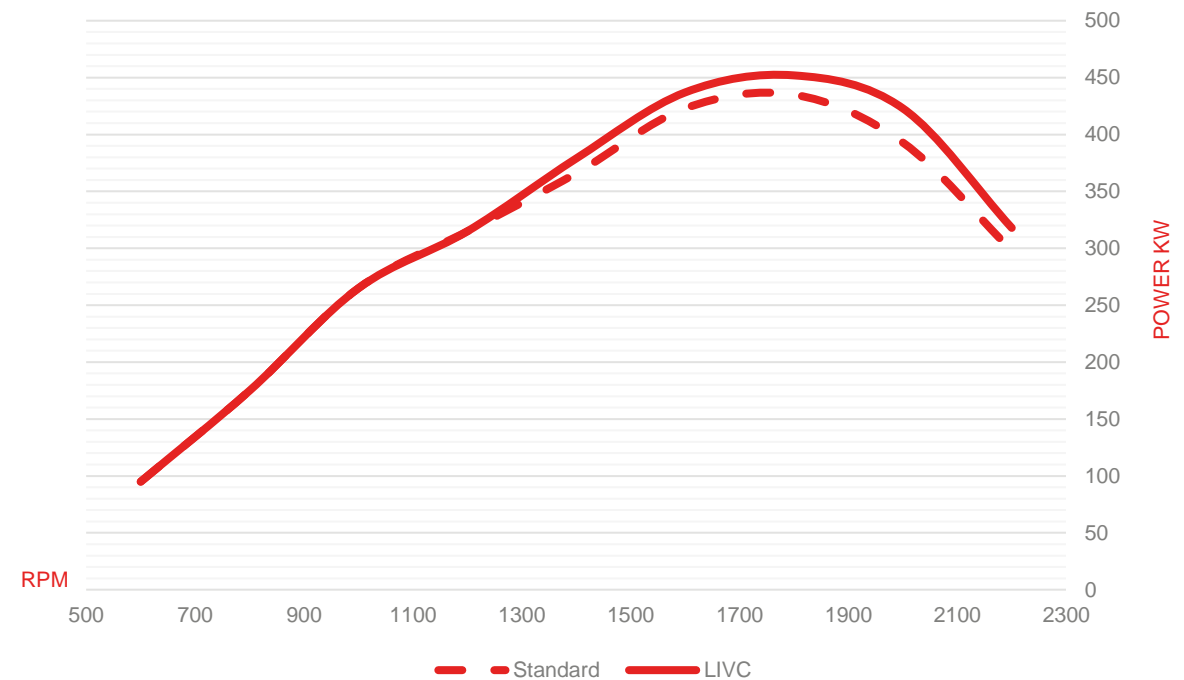
BETTER PERFORMANCES, LESS CONSUMPTION

System advantages

- Miller cycle (LIVC DELAY 40°) advantageous from 1400 to 2200 rpm with Load Factor >50%.
- Increase in maximum power to a peak of +5% (+20kW @ 1800rpm) with the same BSFC (in the ECE simulated cycle)

Increase 5% Power, same BSFC

Engine Power - HD Diesel Engine

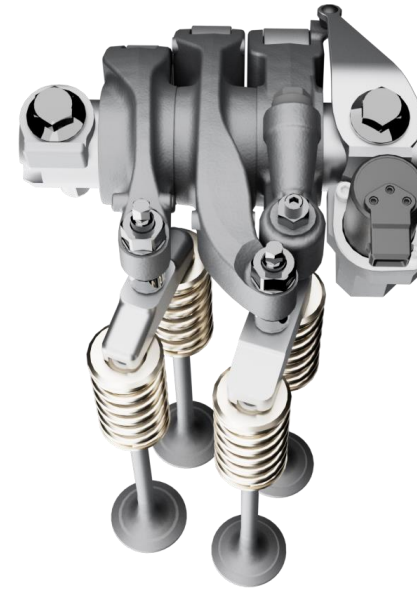


streparavaEASYlift | Engine brake

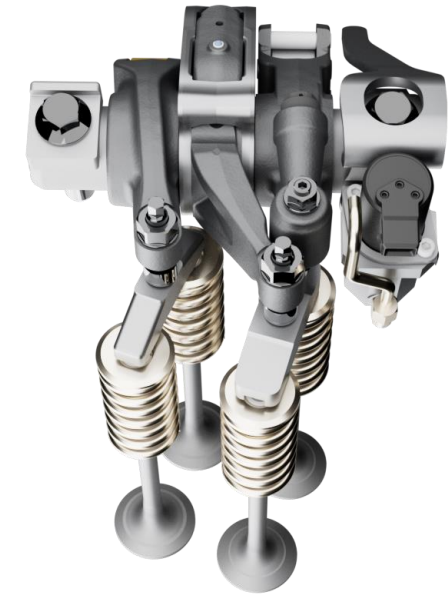
HIGH PERFORMANCE BRAKING POWER

System specification

- Compression release engine brake (1 stroke)
- Compression release engine brake (1.5 stroke)
- MIN oil pressure activation 1.5 bar
- Activation time 30-100 msec



LAYOUT
1-Stroke



LAYOUT
1.5-Stroke

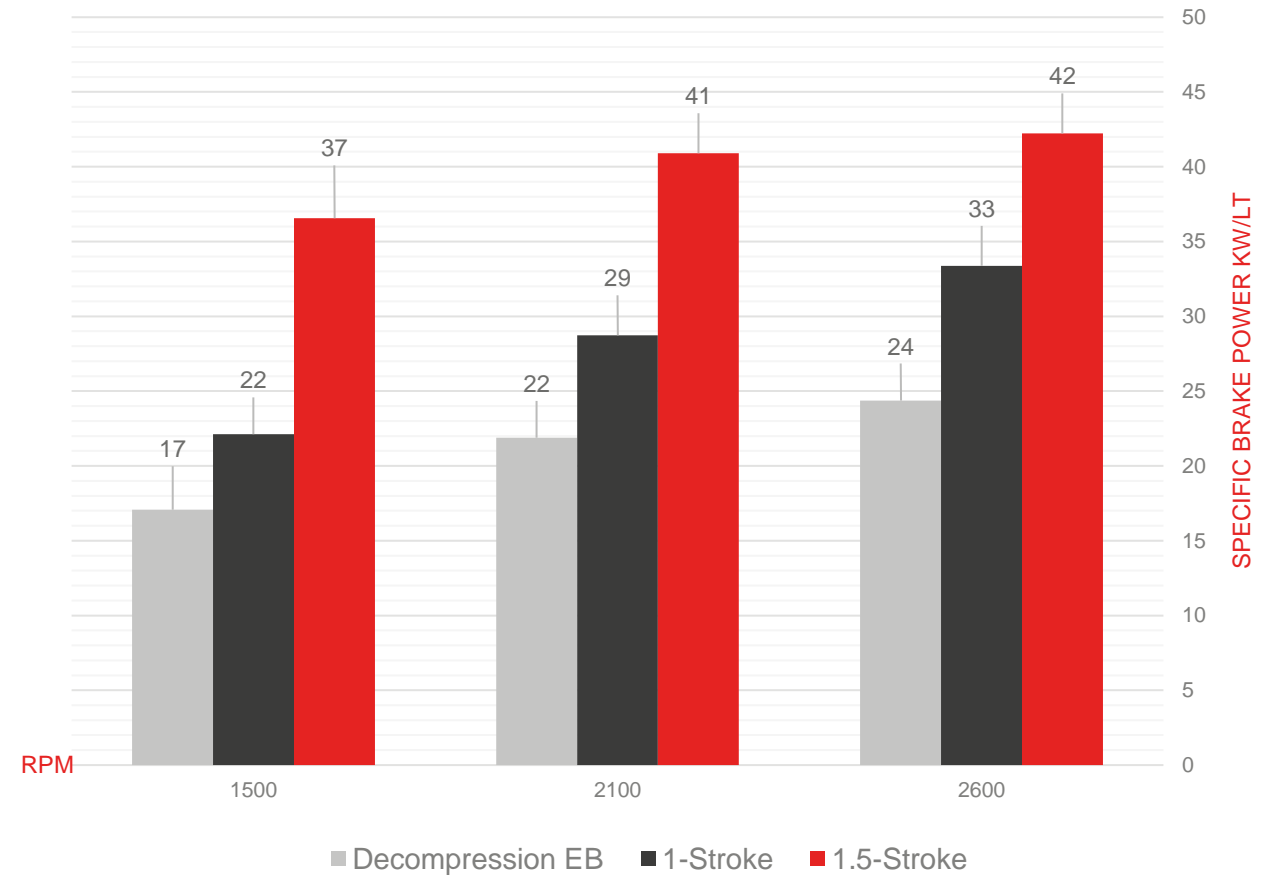
streparava EASYlift | Engine brake

HIGH PERFORMANCE BRAKING POWER

System advantages

- Brake power increase range **30-75%**
- System activation up to one engine cycle (*1 stroke*)
- Proved reliability (limited valve contact wear)

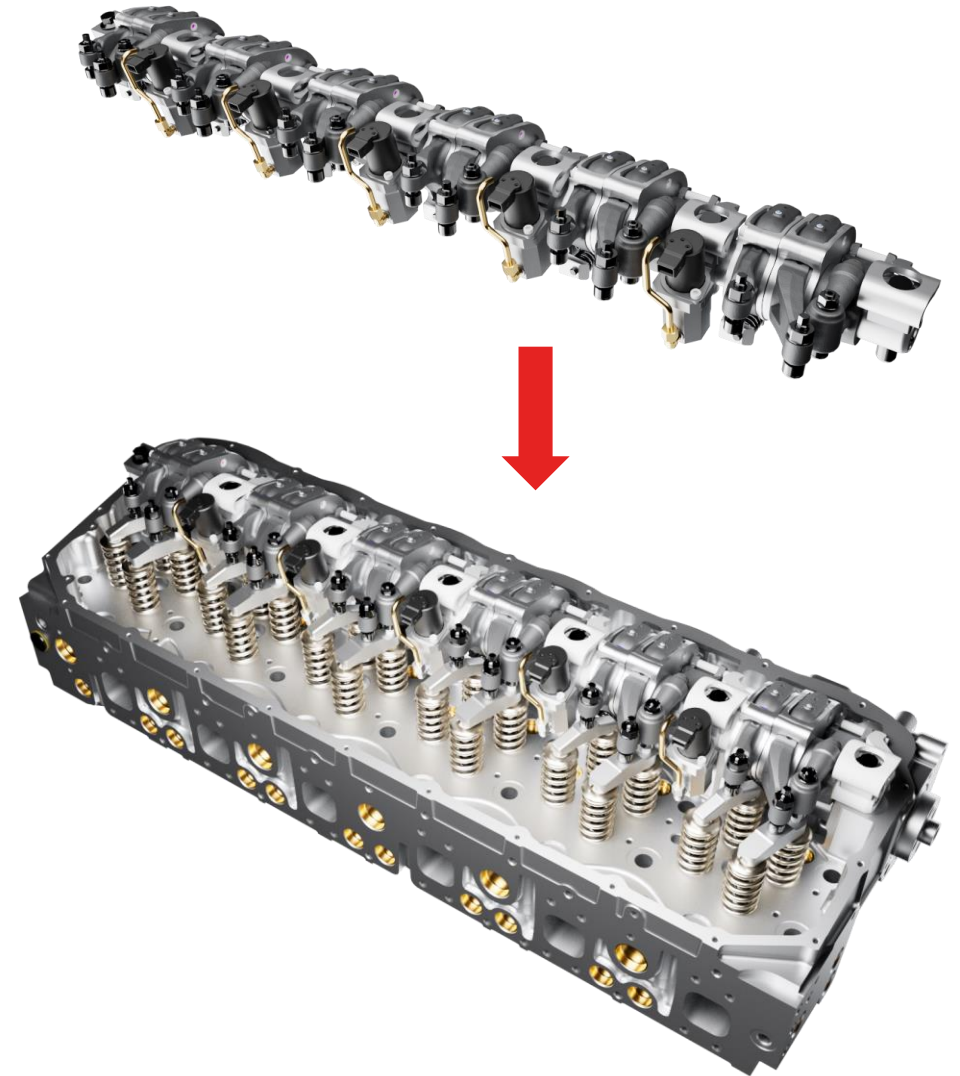
Specific BRAKE Power - HD Diesel Engine



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MAIN ADVANTAGES

- **EASY to integrate**
Modularity of the System according to the features required by the customer (CDA, Engine Brake)
- **EASY to install**
No or minimal requirements for modification of existing engine layout, no additional oil boost for system drive
- **EASY to handle**
Shipping and workshop line assembly with no difference from standard valvetrain assembly
- **EASY to maintain**
No additional service and inspection activities compared with conventional systems, simple and quick replacement of electrical control components



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SYSTEM MODULARITY

Multiple solutions tailored to the customer's needs

Three rockers designs combined for any system configuration



FIXED



SWITCHABLE

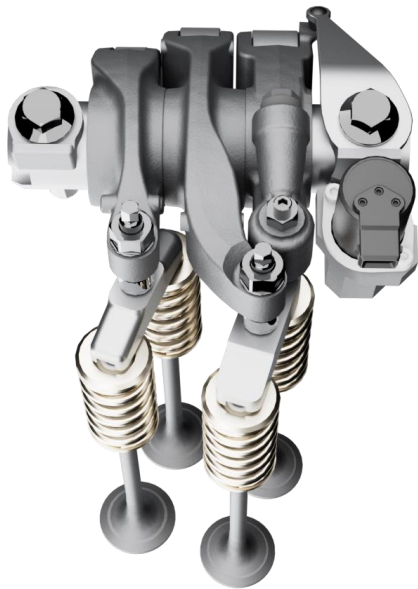


EXTENDABLE

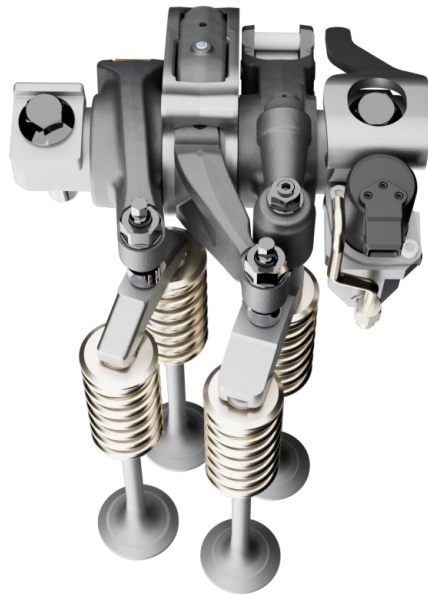
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SYSTEM MODULARITY

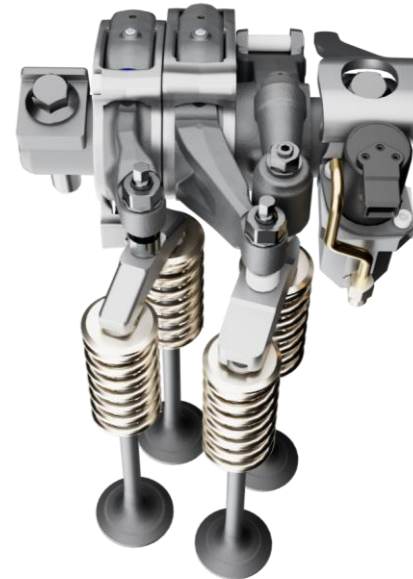
Multiple solutions tailored to the customer's needs



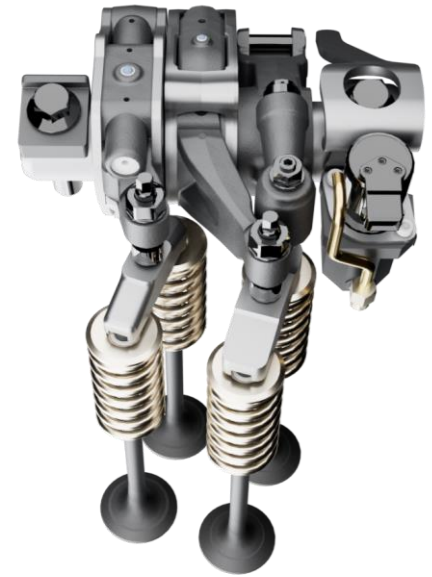
LAYOUT
1-Stroke



LAYOUT
1.5-Stroke



LAYOUT
1.5-Stroke + CDA
















LAYOUT
1.5-Stroke + LIVC

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SYSTEM MODULARITY

Multiple solutions tailored to the customer's needs

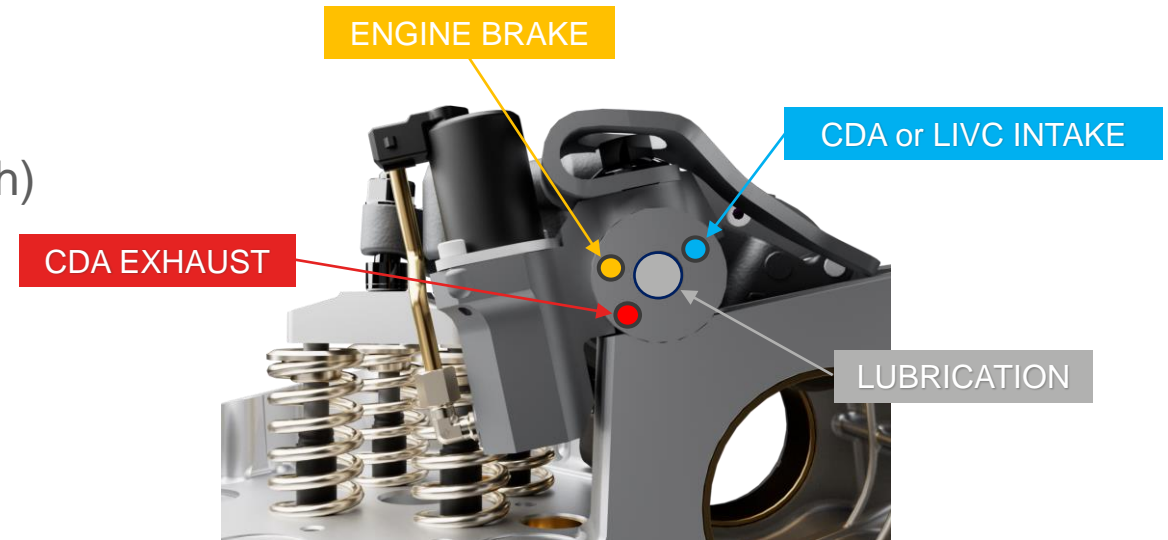
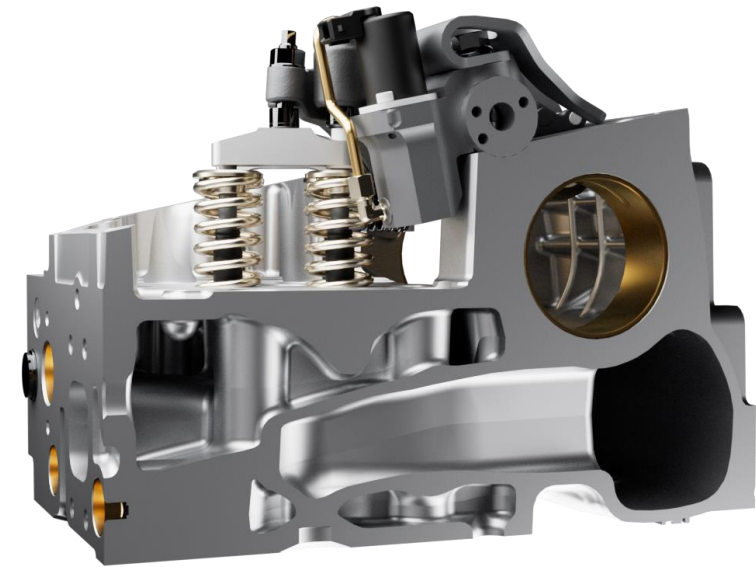
INTAKE ROCKER ARM	EXHAUST ROCKER ARM	ENGINE BRAKE ROCKER ARM	FUNCTIONS COMBINATION
			1 STROKE ENGINE BRAKE
			1.5 STROKE ENGINE BRAKE
			CYLINDER DEACTIVATION + ENGINE BRAKE (1 or 1,5 stroke)
	 or 		MILLER CYCLE LIVC + ENGINE BRAKE (1 or 1,5 stroke)

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HYDRAULIC ACTUATION CIRCUIT LAYOUT

System specification

- Use existing rockers lubrication holes in cylinder heads
- Additional dedicated control holes in the rocker shaft
- Minimizing oil circuit leakage
- Oil control solenoid proved reliability (>10 mln. switch)
- Max oil pressure 10 bar
- Oil temperature range -40°+135°C



strearava EASYlift | Simulation tools and RIG test equipment

DEDICATED DEVELOPMENT TOOLS AND EQUIPMENT FOR EFFECTIVE CUSTOMER SUPPORT

Design and simulation tools

1 BRAKE PERFORMANCES THERMODYNAMIC SIMULATIONS

Left Chart: Brake Power (kW) vs RPM (1500, 2250, 3000). Configurations: 6 bar P_31, 60 bar, 60 bar PCP. Right Chart: Brake Power (kW) vs RPM (1500, 2250, 3000). Configurations: 6 bar P_31, 60 bar PCP, 60 bar PCP.

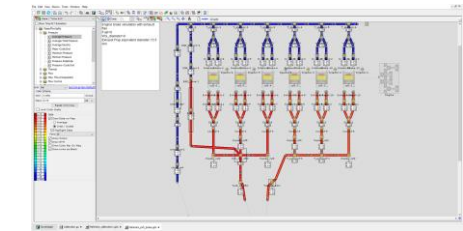
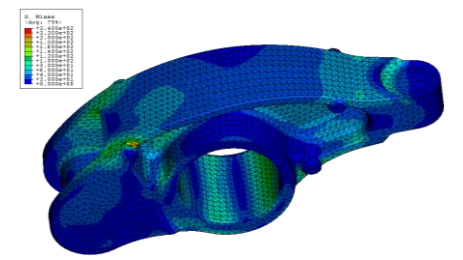
Performance – CFD – Multibody – Stress Simulations

2 OCV DEFINITION & INSTALLATION

3 SYSTEM ACTIVATION CFD SIMULATIONS

4 SWITCHING TIME MBS SIMULATIONS

5 CONTACT STRESS, UNIT LOADS, EFF. VALVE LIFT, MBS SIMULATIONS



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DEDICATED DEVELOPMENT TOOLS AND EQUIPMENT FOR EFFECTIVE CUSTOMER SUPPORT

Prototypes workshop



Prototypes workshop



Valvetrain prototype assembled

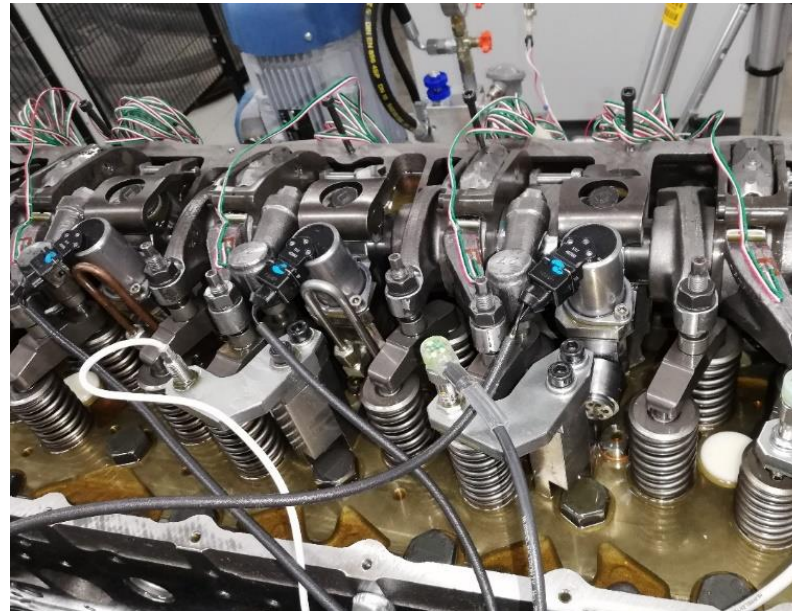
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DEDICATED DEVELOPMENT TOOLS AND EQUIPMENT FOR EFFECTIVE CUSTOMER SUPPORT

RIG test measurement equipment



Motored RIG test bench



Real time valve lift measurement system



High speed camera for event detection



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