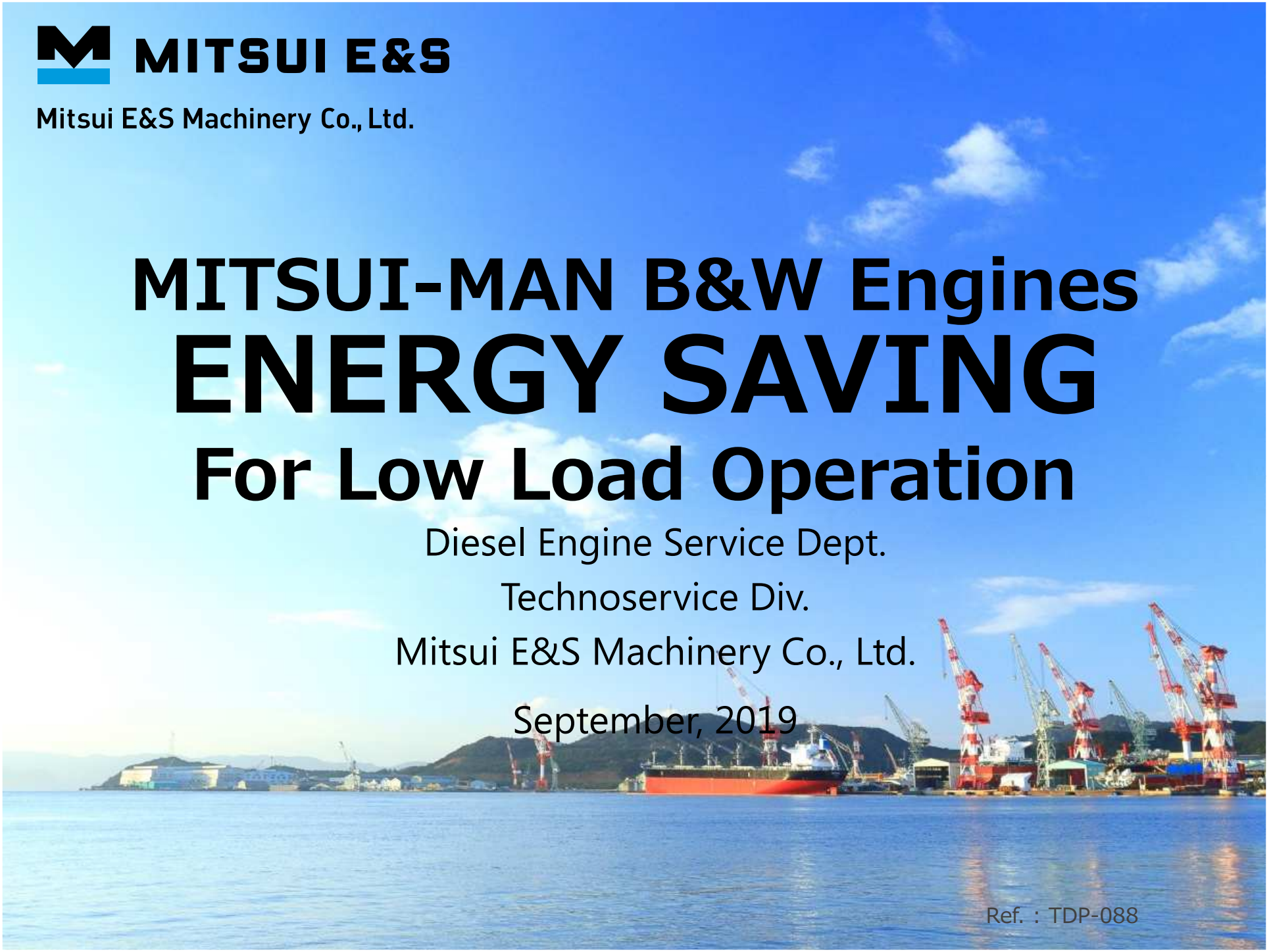
MITSUI E&S

Mitsui E&S Machinery Co., Ltd.

MITSUI-MAN B&W Engines
ENERGY SAVING
For Low Load Operation

Diesel Engine Service Dept.
Technoservice Div.
Mitsui E&S Machinery Co., Ltd.

September, 2019



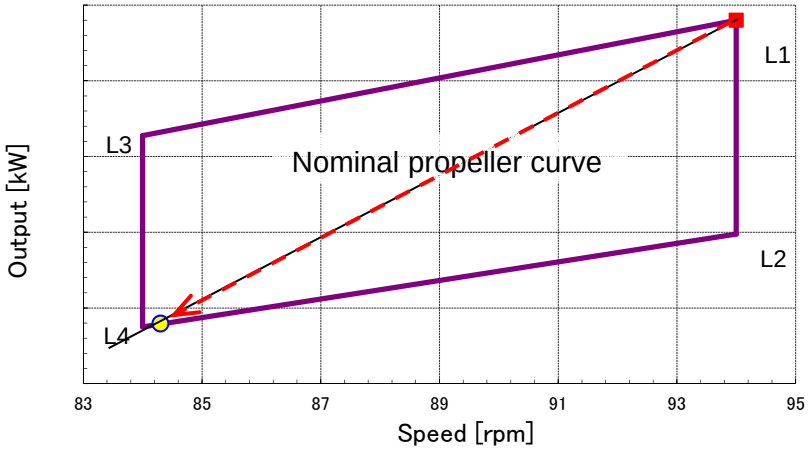
Ref. : TDP-088

Energy Saving

1. Engine Derating
2. EcoCam system
3. Electronic control VIT (e-VIT)
4. EcoNozzle
5. UpGrade to Mark 8

1. Engine Derating

Re-match the engine & T/C by changing the MCO to any point on the propeller curve in the layout diagram without changing the nominal Pmax. (Propeller is not changed)
With derated MCO, Pmax at the same output of part load can be increased compared to the original.
This improves thermal-efficiency and improves SFOC.



New-set MCO pint to low load, low speed

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Engine・T/C Re-matching

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Pmax increase

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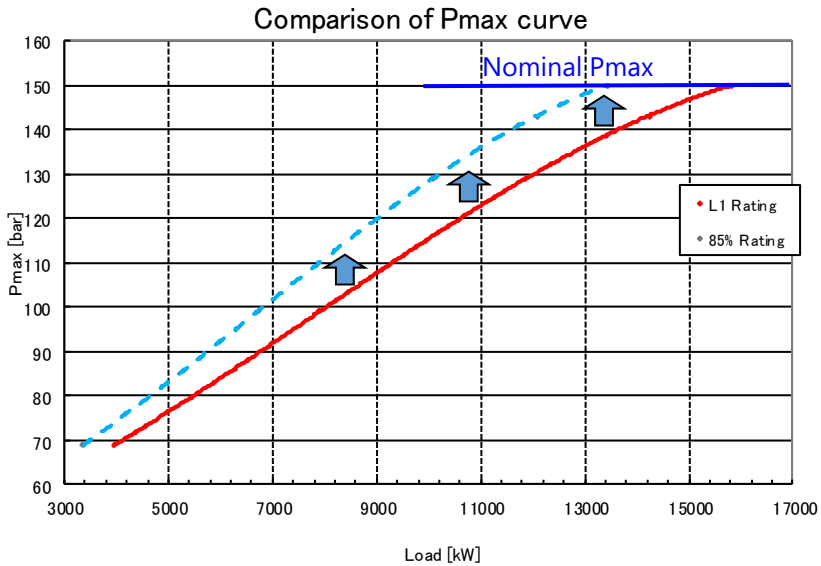
SFOC improve

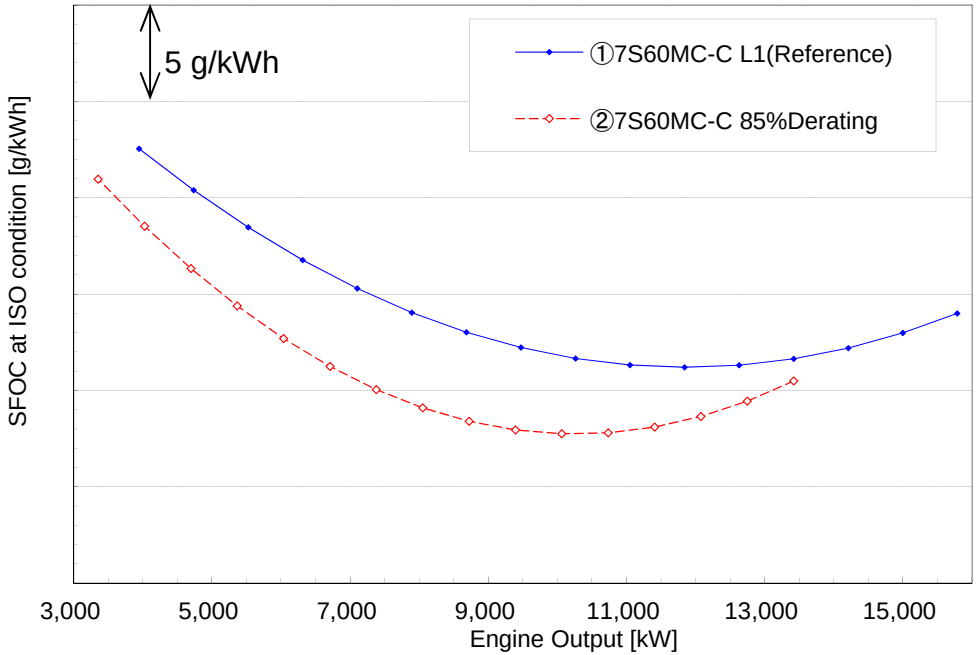
<Example>

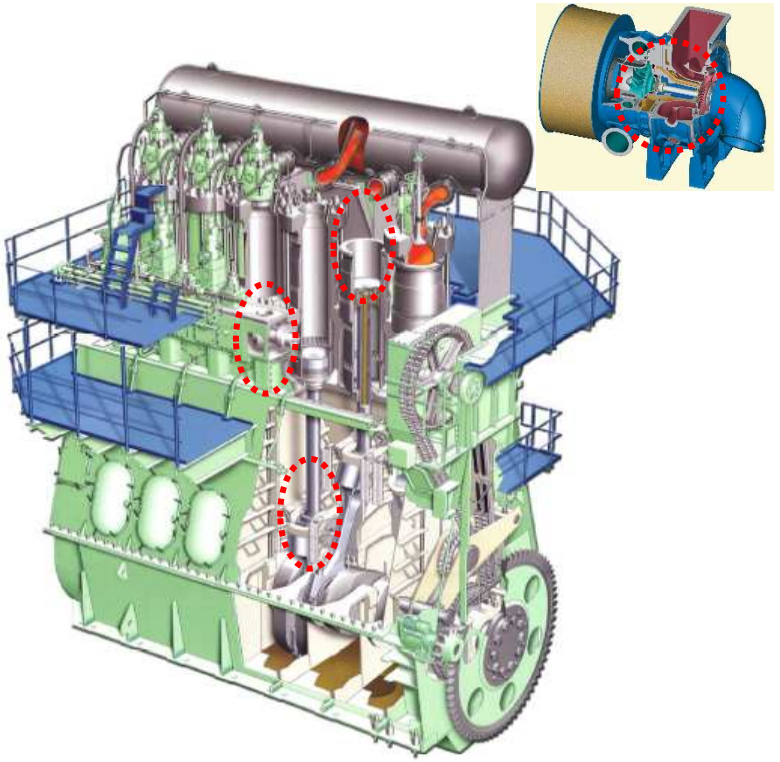


1. Engine Derating

Case study

Case-①: Normal (MCO=15,785kW x 105rpm)
Case-②:85% Derating (MCO=13,417kW x 99.5rpm)





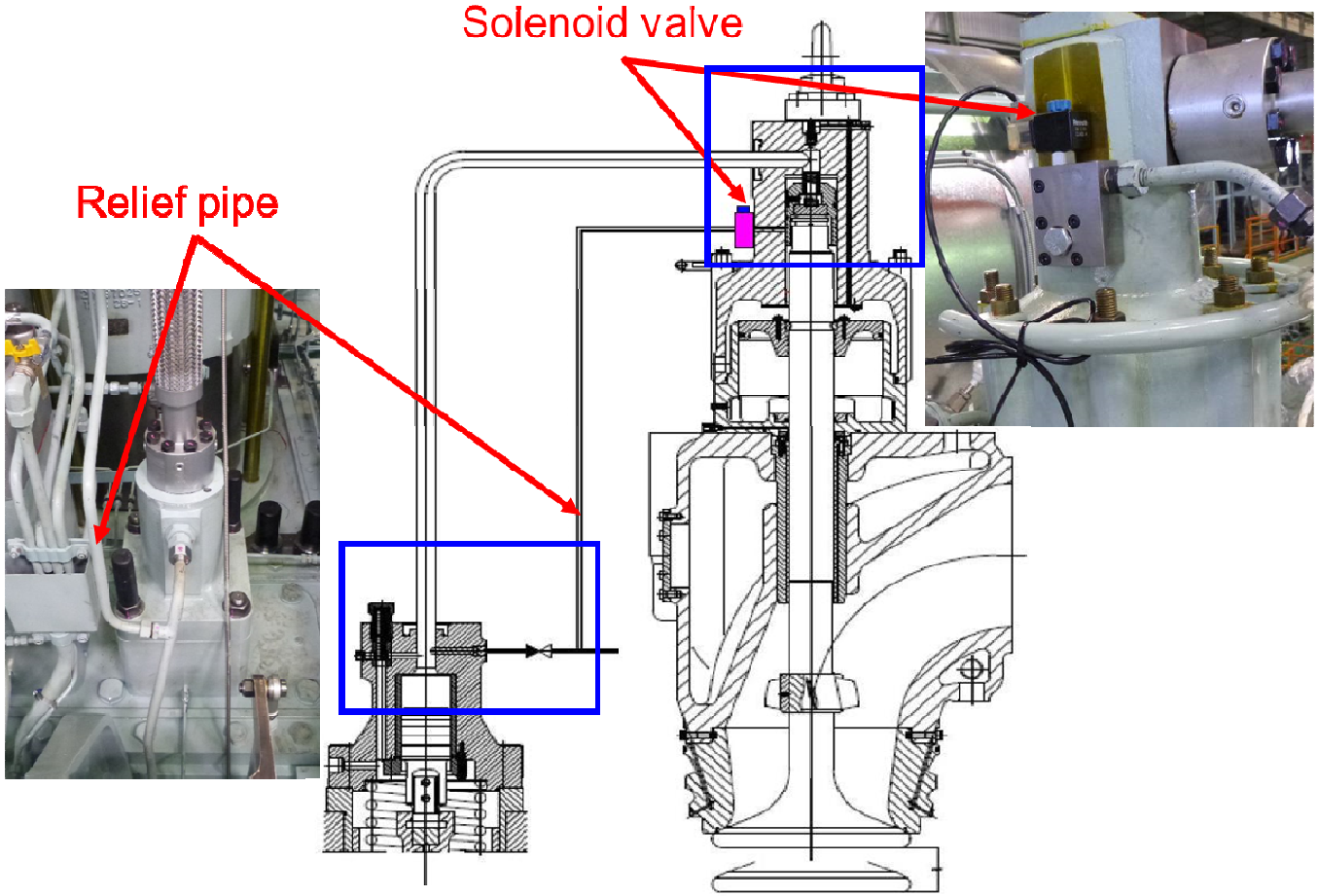
Target engine
+Mechanical control
or electronical control engine
(Depend on rating)

Modification item
+Change of T/C spec
+Adjustment of cam timing
+Change of compression shim
+Removal of step wear at liner top

2. EcoCam system

What is EcoCam? :

Exhaust valve driven oil is controlled by solenoid valve and hydraulic pressure relief piping, and the exhaust valve closing timing can be controlled even in mechanical engine.



2. EcoCam system

At Low load operation

Oil press in hyd. cylinder is reduced

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Exh. Valve “Close” timing is advanced.

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Pcomp, Pmax increase

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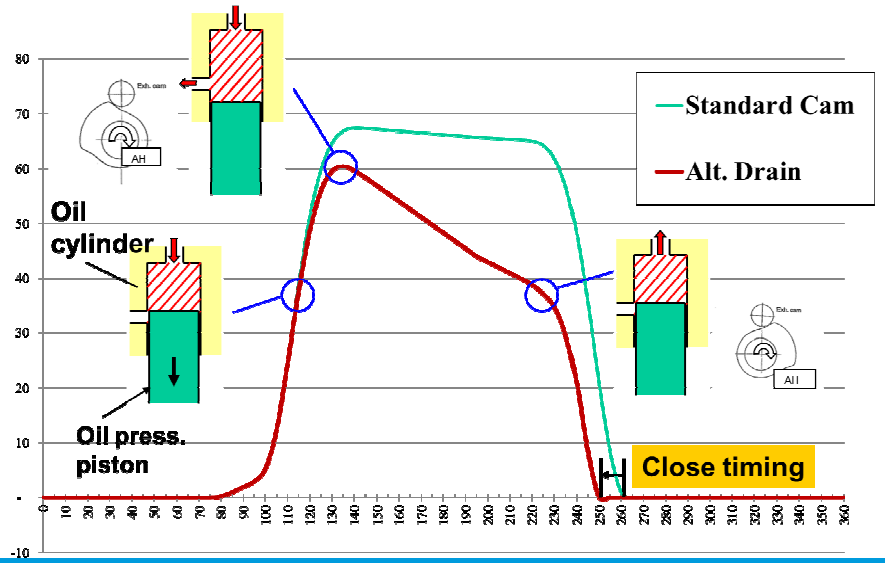
SFOC improve



Without EcoCam
With EcoCam

Operation range by EcoCam system

(EcoCam is not used at high load due to no merit.)

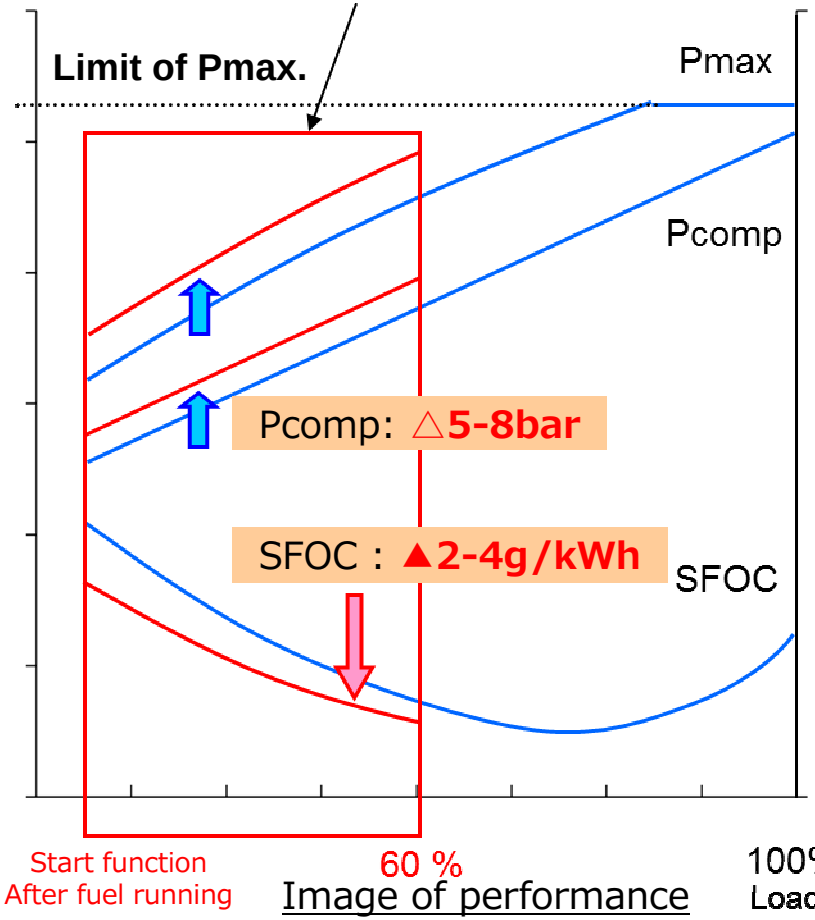
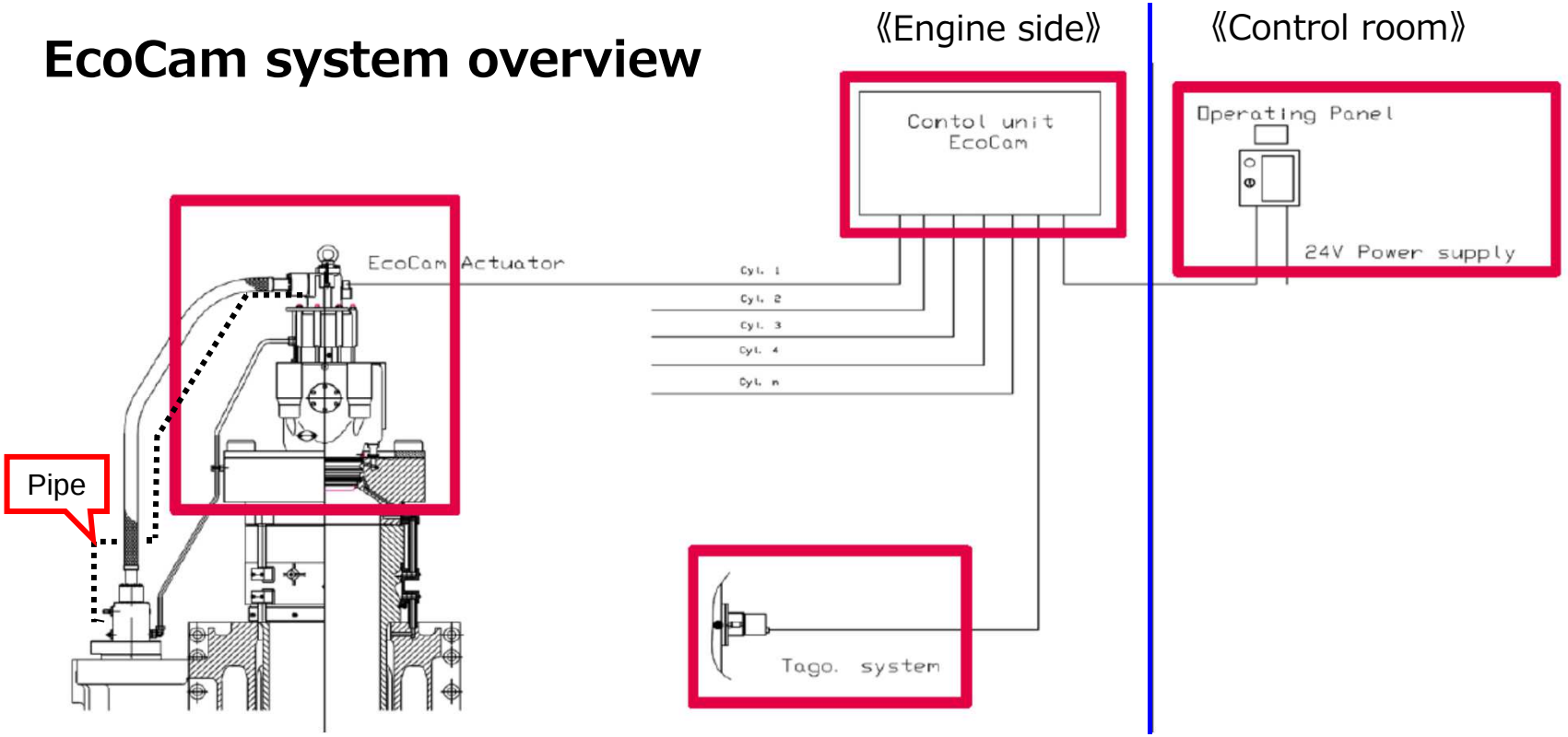


Image of performance

2. EcoCam system

EcoCam system overview



Target engine
+ S50MC-C or S60MC-C

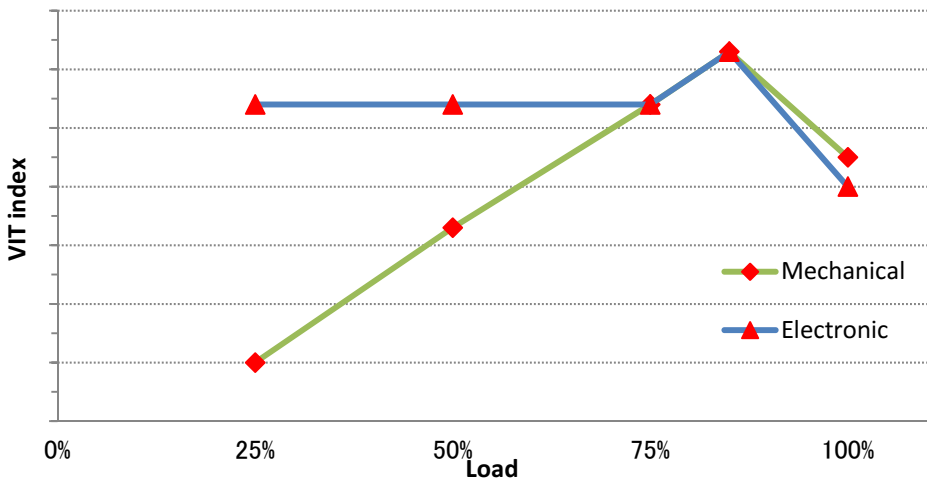
Modification item
+Hydraulic cylinder for Eco Cam
+Pipe for oil press. relief
+Wiring for control system
+Control unit

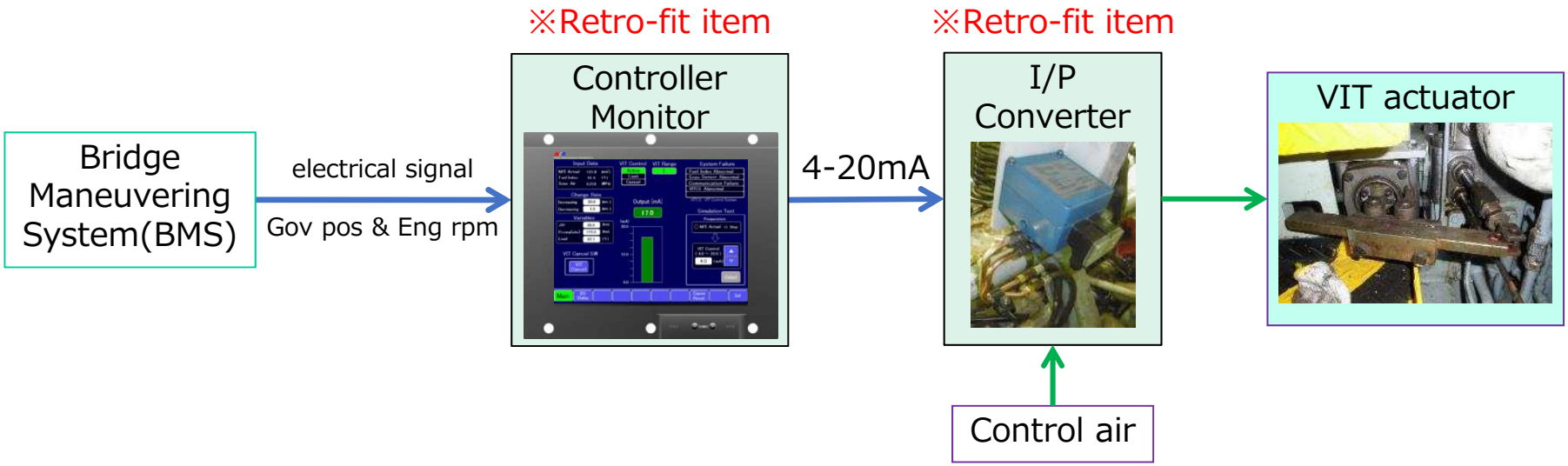
3. Electronic control VIT (e-VIT)

The VIT index can be increased below 75% MCR by applying e-VIT instead of mechanical one.
The fuel oil injection timing is advanced and then Cylinder Pressure Maximum “Pmax” is increased.

The retrofit of **controller, I/P converter and monitor** are necessary for e-VIT.

It converts 4-20mA signal output from the controller into air pressure through the I/P converter and the VIT Actuator is moved by air pressure at any position.





3. Electronic control VIT (e-VIT)

Low load (below 75%)

e-VIT control

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VIT Index increase

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FO injection timing advanced

↓

Pmax increase

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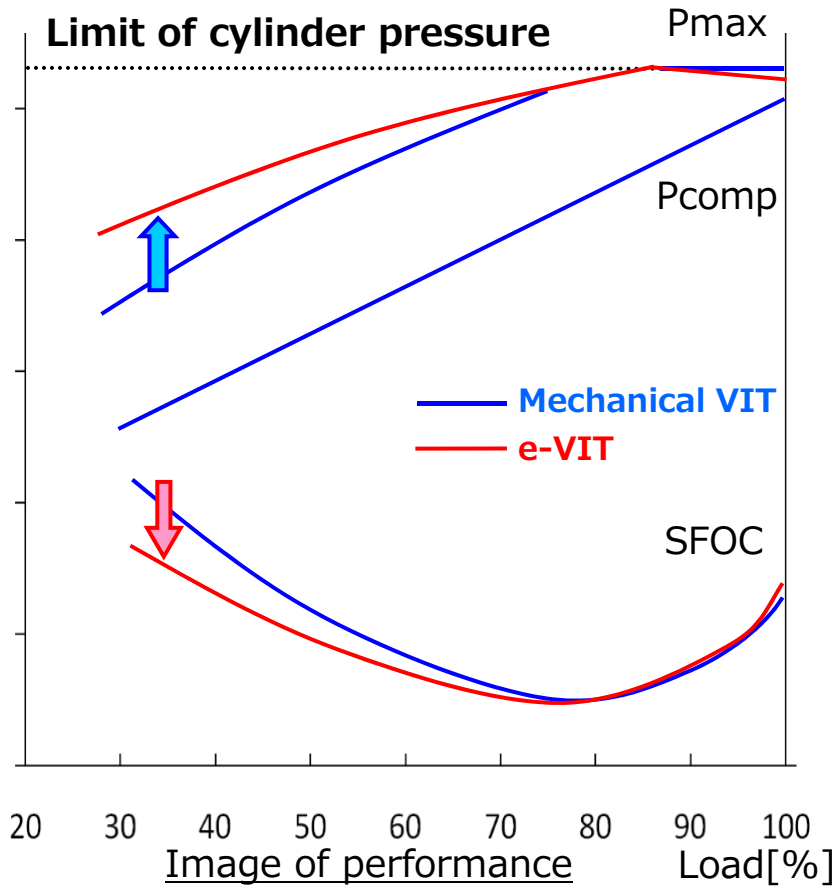
SFOC improve

High load (above 75%)

Unchanged*

* Pmax at 100% load is need to be decreased accordingly in order to maintain the same NOx emission values in E3 cycle.

Pmax **5-10bar** up
⇒ SFOC **1-2%** improve



Target engine
+ Installed Mech VIT(with VIT actuator) and NOx Tier I applied

Modification item
+I/P Converter
+Controller and Monitor
+Wiring for control system

4. EcoNozzle

EcoNozzle

Optimized combustion

Optimized spray pattern

- SFOC improve　2-7 g/kWh
- Fuel savings in entire load range
- Replace Atomizer and spindle guide

Target engine
+S50MC-C Mk 7/8
and NOx Tier II applied

Modification item
+Atomizer & spindle guide

5. UpGrade to Mark 8

Change engine specifications and re-match engine & T/C, so that Nominal Pmax can be increased to Mk8 specification (160bar)

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Pcomp, Pmax increase

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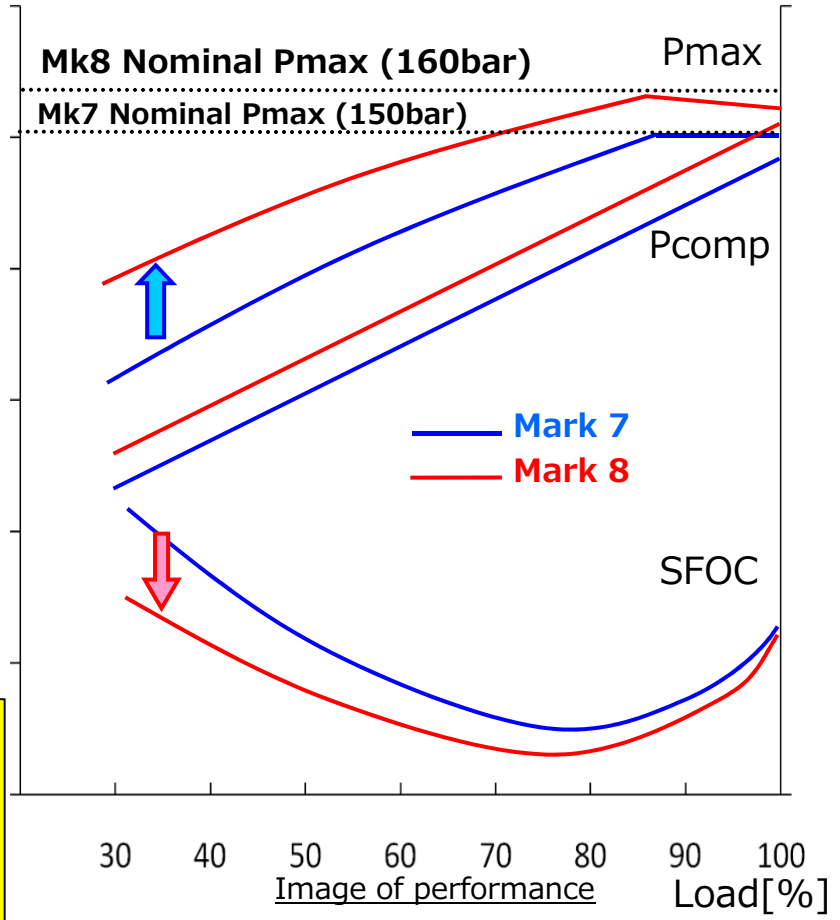
SFOC improve

Pmax **5-15bar** increase
⇒ SFOC **1-3%** improve



Target engine
+ Mark7 engine

Modification item
+Change of T/C spec
+Adjustment of cam timing
+Change of compression shim
+Removal of step wear at liner top
+Change FV Atomizer
+Retrofit e-VIT

Conclusion

Summary of each saving methods

	1. Engine Derating	2.EcoCam	3. e-VIT	4. EcoNozzle	5. Mark 8
Summary	Change MCO, Re-match engine	Control Exh valve by EcoCam	Control VIT index by I/P Converter	Change Atomizer Optimized combustion	Increase Pmax, Re-match engine
Benefit range	Below 85%Load	Below 60%Load	Below 75%Load	All range	All range
Target engine	Mechanical or Electronical control engine (Depend on rating)	S50MC-C S60MC-C	Installed Mech VIT with VIT actuator and NOx Tier I applied	S50MC-C Mk 7/8 and NOx Tier II applied	Mark7 engine
Estimated Work period	7-10 days	3 days	3 days	1 day	7-10 day

※ As the applicability, improvement effects and modification details are different depending on the engine specifications, Please contact us when considering.

Conclusion

Estimated fuel consumption reduction effect of each saving method under 50% load operation based on 6S50MC-C

	1. Engine Derating	2.EcoCam	3. e-VIT	4. EcoNozzle	5. Mark 8
SFOC improve (⊿SFOC@50%load) [g/kWh]	4.5	2.5	2	3	3.5
Reduction gain [Ton/Year]	127.98	71.10	56.88	85.32	99.54
Reduction gain [US$/Year]	70,389	39,105	31,284	46,926	54,747
Reduction gain [thousand JPY/Year]	**7,743**	**4,302**	**3,441**	**5,162**	**6,022**
Pay back year	Abt 5 year	Abt 1.8 year	Abt 1.9 year	Abt 0.7 year	Abt 6.4 year

※ As the applicability, improvement effects and modification details are different depending on the engine specifications, Please contact us when considering.

Calc condition
4740 kW@50%load
6000 hrs/year
550 US$/ton
110 JPY/$


Thank you for your attention !
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