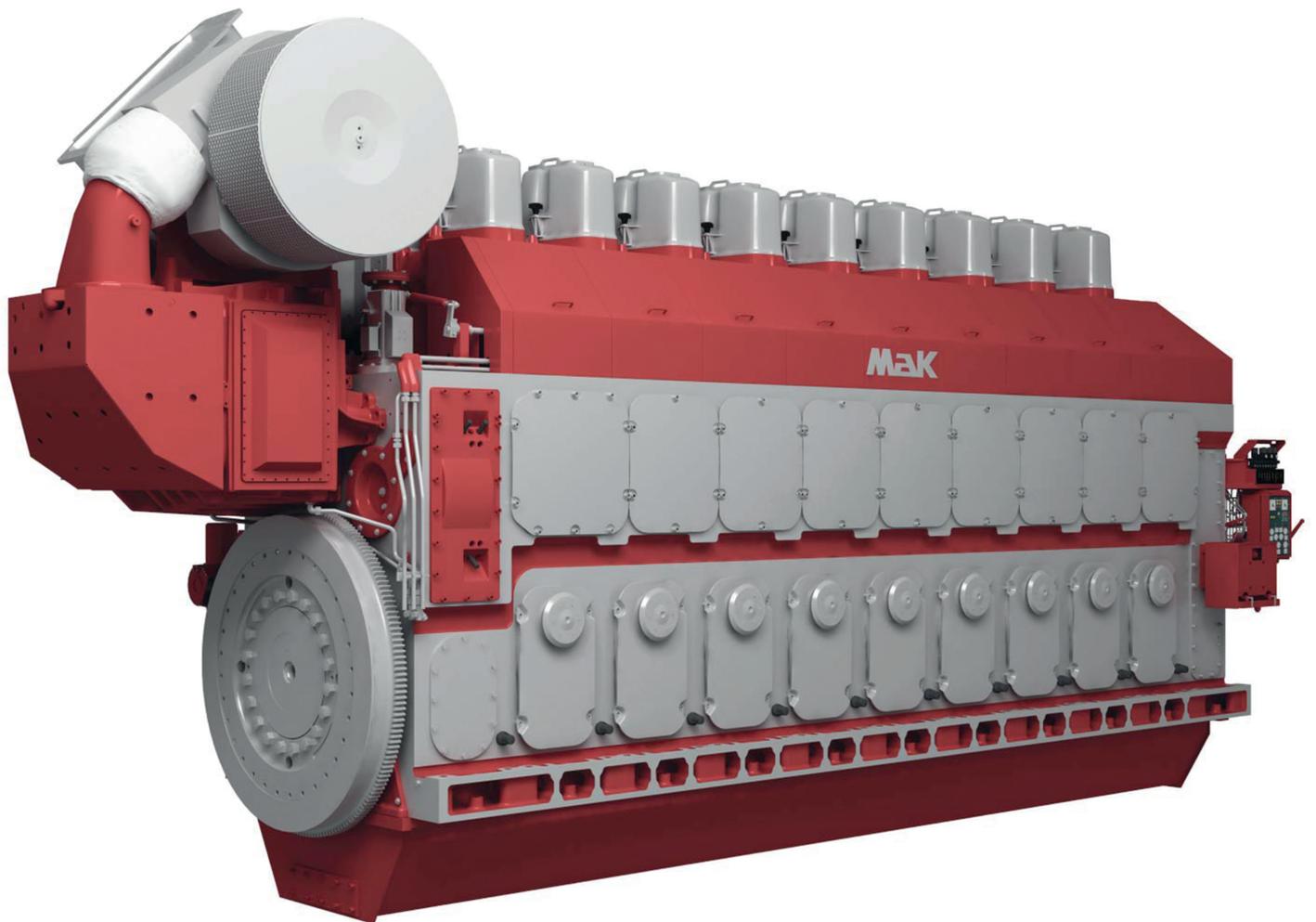


Efficiency Upgrade M 43 C – IMO I



Introduction

For turbocharged, medium-speed four-stroke engines, the interaction of engine set-up, e.g., valve timing and turbochargers plays a critical role. Continued development of the engine and its components leads to new possibilities for modifying the engine set-up. This offers the opportunity to reduce fuel consumption and thus improved engine efficiency while at the same time complying with the NO_x emission limits and maintaining the rated power.

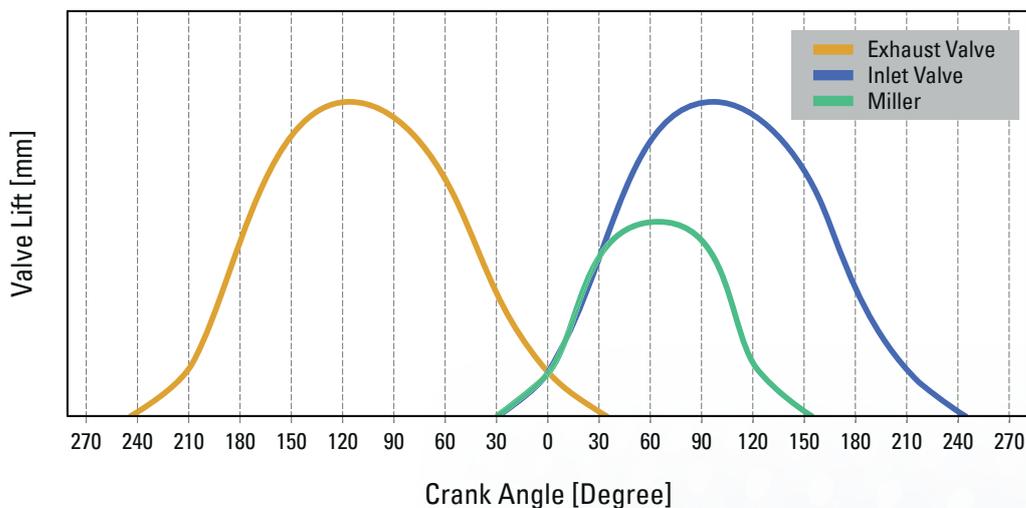
Caterpillar Motoren offers conversions for M 43 C engines equipped with ABB TPL76 or TPL71 with optimized valve timing and an adjusted turbocharger. The conversion changes a few core components in the engine so that the efficiency of the engine, which is already favorable, will be considerably improved even further. This results in an economically appealing reduction in fuel consumption.



The Impact and Proposed Solution

Reducing the fuel consumption and increasing the efficiency often results in increased NO_x emissions. IMO requirements, on the other hand, often limit the optimization opportunities, but by using the Miller cycle, fuel consumption can be decreased without increasing NO_x emissions.

Valve lift curves:



Changing the geometry of the camshaft enables an earlier closure of the inlet valve, leading to expansion and cooling down of the cylinders' charge air. The increased boost pressure from the optimized turbocharger ensures the same air mass in the combustion chamber as with the standard engine tuning, but at a lower temperature.

As the initial temperature at the start of compression is lower, the combustion chamber temperature and thus also NO_x emissions are lower. This NO_x benefit can be „converted“ into an improvement in fuel consumption by advancing the start of fuel delivery.

Availability

The conversion is available for the following IMO I M 43 C engine types:

- 6, 7 and 12 cylinder with turbocharger TPL71
- 8, 9 and 16 cylinder with turbocharger TPL76

Upgrade to Existing Turbochargers

The conversion includes camshaft sections with Miller timing combined with TPL76-C8X/TPL76-C32 or TPL71-C8X turbocharger, which both require replacement. The new turbocharger configuration ensures safe operation in the entire operating range thanks to the changed turbocharger characteristics. Our Caterpillar Motoren REParts program may apply. Please check with us for your options.



Fuel consumption upgrades can be requested from Cat® and MaK™ authorized dealers who are OEM trained and equipped to carry out maintenance on specific turbocharger types.

Your Benefits

- Low scope of exchanged components: camshaft sections and turbocharger
- Longer maintenance intervals for rotating components in the TPL76-C8X and TPL71-C8X lead to lower maintenance costs
- Fuel consumption is particularly reduced in the ranges above 75 % load
- No reduction of certificate power after retrofit
- Lower CO₂ emissions enable CII (Carbon Intensity Indicator) improvement

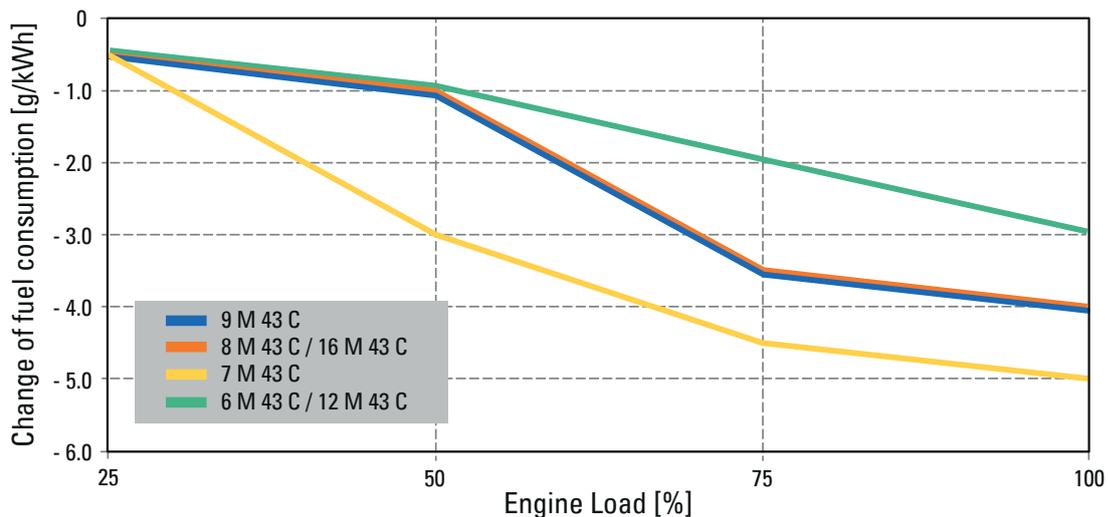
Expected fuel savings:

Power % MCR (maximum continuous rating)	Expected fuel savings [g/kWh] (ISO 3046/1)			
	6 / 12 M 43 C	7 M 43 C	8 / 16 M 43 C	9 M 43 C
25	0.5	0.5	0.5	0.5
50	1	3	1	1
75	2	4.5	3.5	3.5
100	3	5	4	4

Expected decrease in CO₂ emissions:

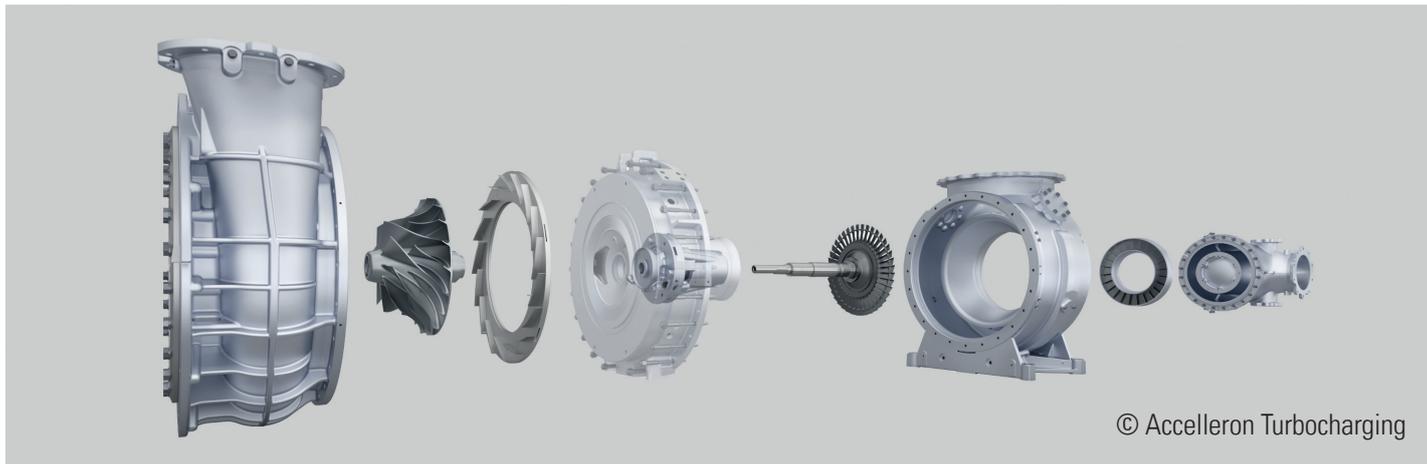
Power % MCR (maximum continuous rating)	Expected decrease in CO ₂ emissions [g/kWh]			
	6 / 12 M 43 C	7 M 43 C	8 / 16 M 43 C	9 M 43 C
25	1.6	1.6	1.6	1.6
50	3.2	9.6	3.2	3.2
75	6.4	14.4	11.2	11.2
100	9.6	16	12.8	12.8

Fuel consumption curves:



After the Retrofit

The emission certification must be extended by means of an integration measurement, an amendment will be issued afterwards. The engine will continue to be classified in the IMO I group.



**Are you interested in an efficiency upgrade
or need further information?**

Please contact your dealer or your responsible Solution Sales Manager.

Caterpillar Motoren GmbH & Co. KG
Falckensteiner Str. 2
24159 Kiel/Germany

Phone: +49 431 3995 01
Telefax: +49 431 3995 2193

For more information please visit our website:
cat.com/marine

Subject to change without notice.
03.25 - e - COGMD
LEHM20697-D4

© 2025 Caterpillar. All Rights Reserved. CAT, CATERPILLAR, LET'S DO THE WORK, their respective logos, „Caterpillar Corporate Yellow“, the „Power Edge“ and Cat „Modern Hex“ trade dress as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.

Contact your local dealer:
<https://www.cat.com/marine>

Visit us on ShipServ:
<https://www.shipserv.com/brand/mak>

Check out our MaK LinkedIn page to stay up to date:
<https://www.linkedin.com/showcase/caterpillar-mak/>



MaK