Optimization of Fuel Consumption
M 43 C – IMO I

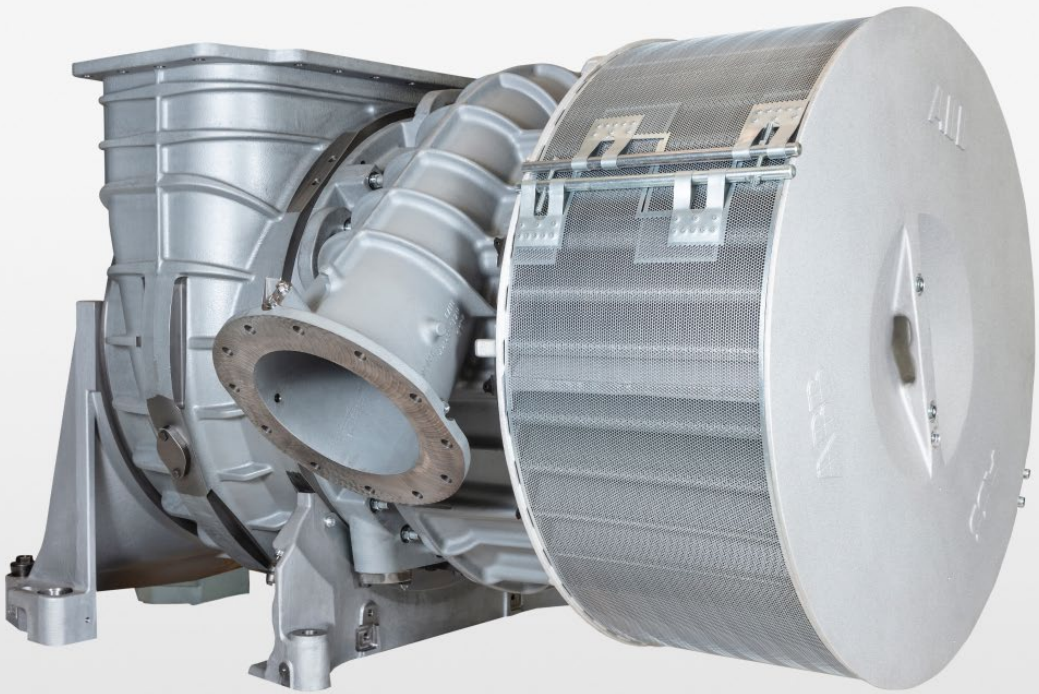
Parts Product Solution

MaK

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 same emission limits and maintaining the rated power.

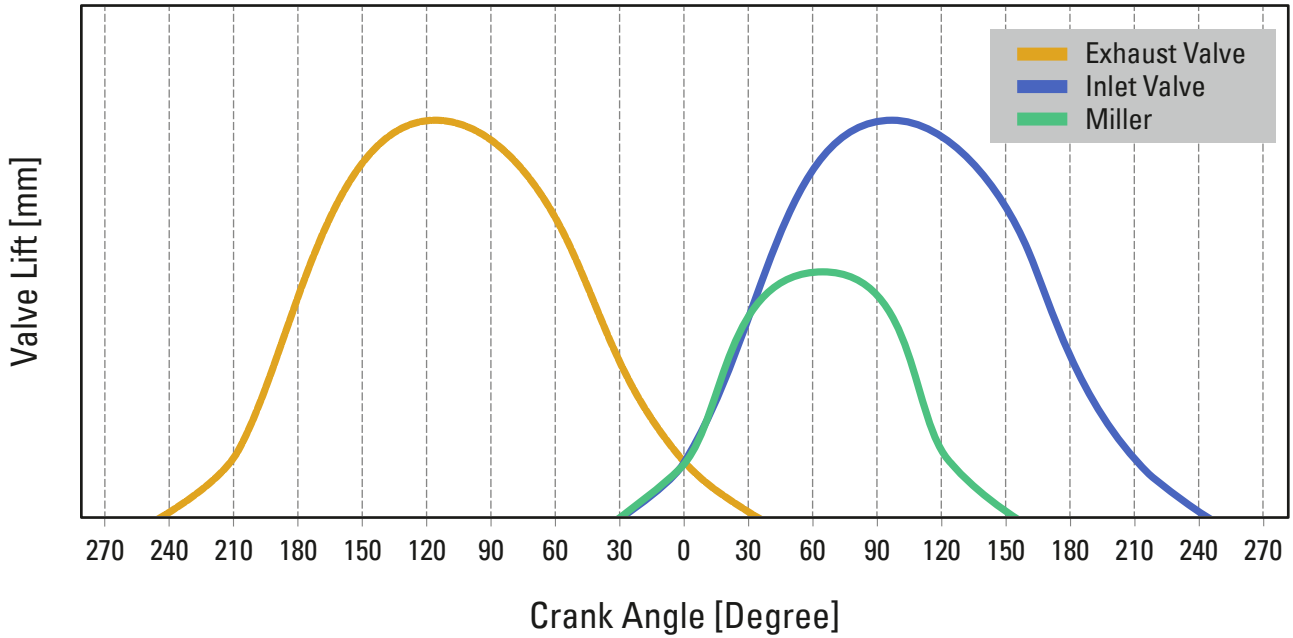
Caterpillar Motoren offers conversions for M 43 C engines equipped with ABB TPL76 or TPL71 with optimized valve timing and an adjusted turbocharger. The conversion changes a few core components in the engine so that the efficiency of the engine, which is already favorable, will be considerably improved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



The Impact and Proposed Solution

Efficiency and low fuel consumption are achieved by a combustion in the cylinder. IMO requirements often limit the optimization opportunities, but by using the Miller process, fuel consumption can be decreased without increasing NO_x emissions.

Valve lift curves:



Changing the geometry of a new camshaft enables an earlier closure of the inlet valve; leading to expansion and cooling down of the cylinder's charge air. The increased charge air pressure by the adjusted turbocharger ensures a constant air mass in the combustion chamber compared to the OEM engine set up.

As the initial temperature at the start of compression is lower, the combustion chamber temperature and thus also NO_x emission is 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, 16 cylinder with turbocharger TPL76

Downrated engines can also be retrofitted within the IMO certificate.
For more detailed specifications and information, contact your authorized Cat and MaK dealer.

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 approved 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
- Fuel consumption of the engine reduced significantly in the entire load range
- No reduction of certificate power after retrofit
- EEXI improvement of up to 5 %
- Lower CO_2 emissions enable CII improvement

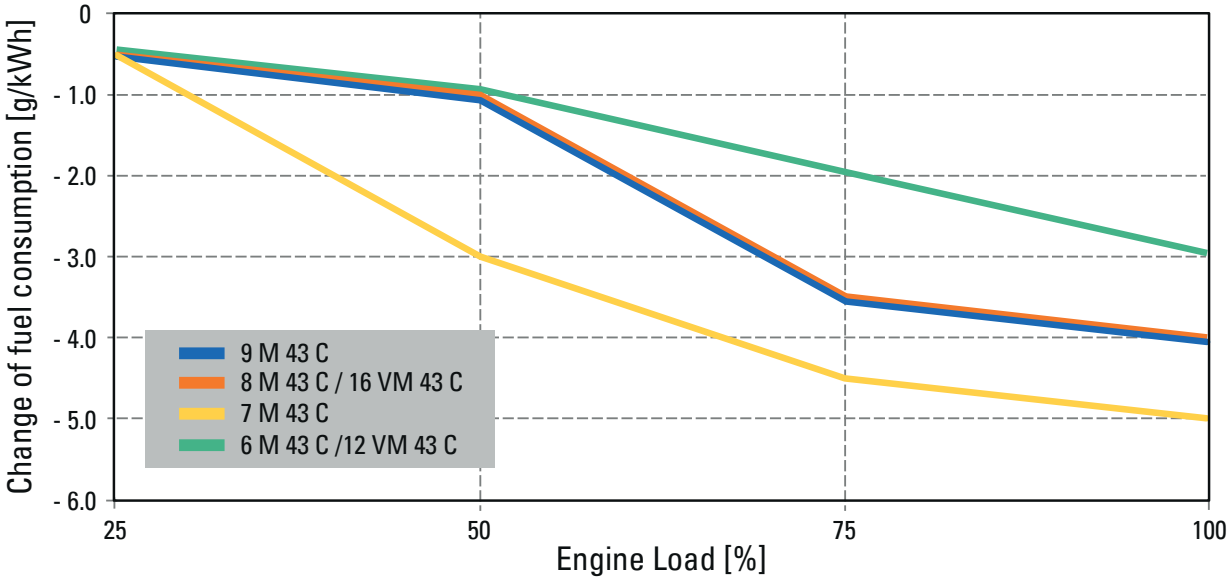
Expected fuel savings:

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 CO_2 emission:

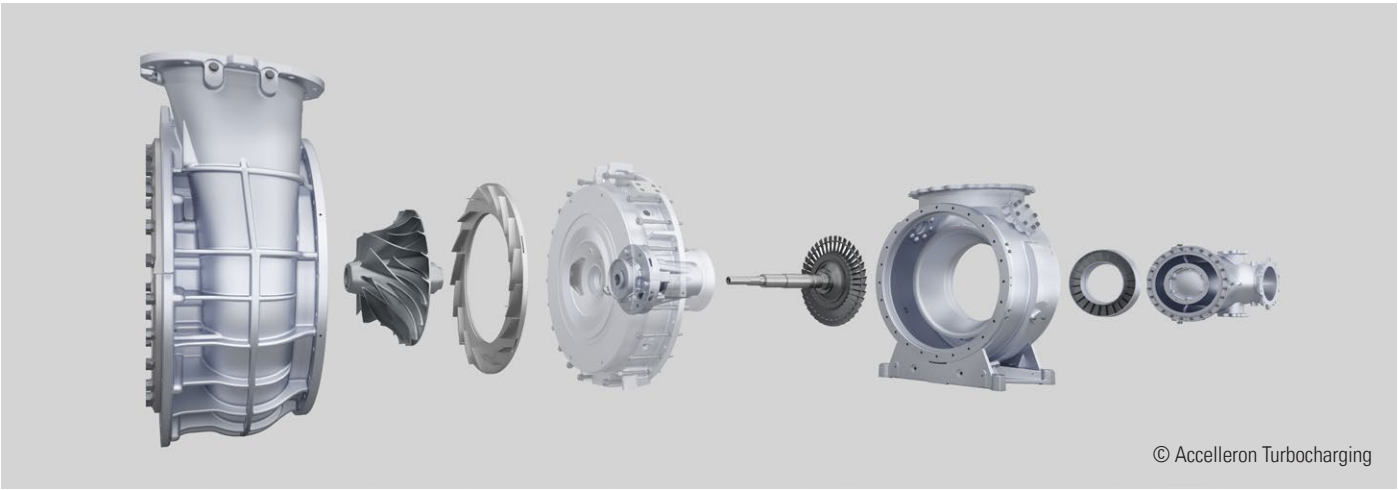
Power % MCR (maximum continuous rating)	Expected decrease in CO_2 emission [g/kWh]			
	6 / 12 M 43 C	7 M 43 C	8 / 16 M 43 C	9 M 43 C
25	1.6	1.6	1.6	1.6
50	3.2	9.6	3.2	3.2
75	6.4	14.4	11.2	11.2
100	9.6	16	12.8	12.8

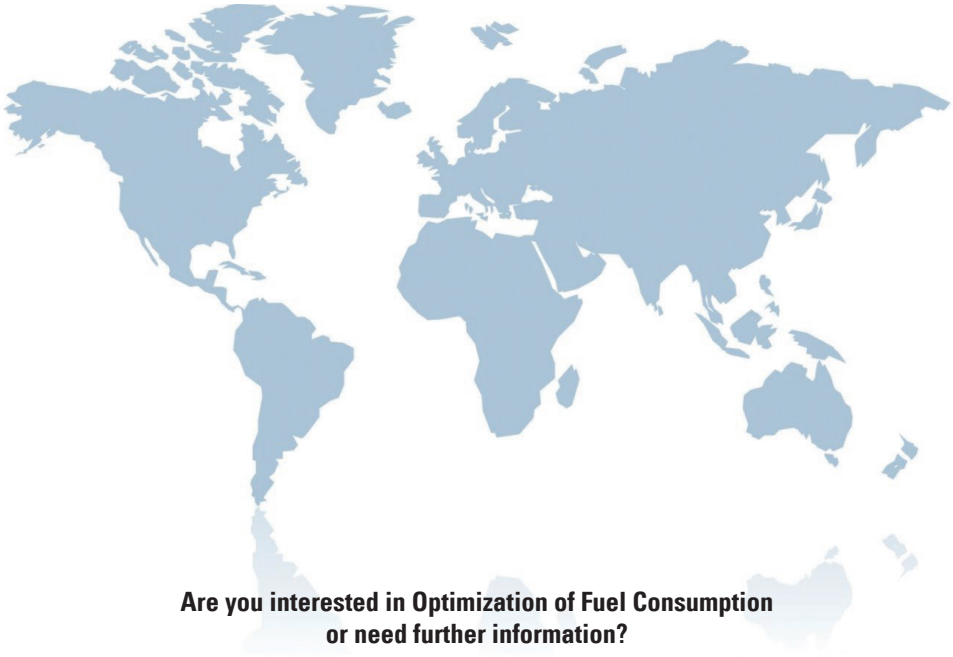
Fuel consumption curves:



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.
Return on Investment (ROI) can be 1.5 – 2 years, depending on the application and mode of operation.





Are you interested in Optimization of Fuel Consumption or need further information?

Please contact your dealer or the Parts Product Solutions Team directly at:
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