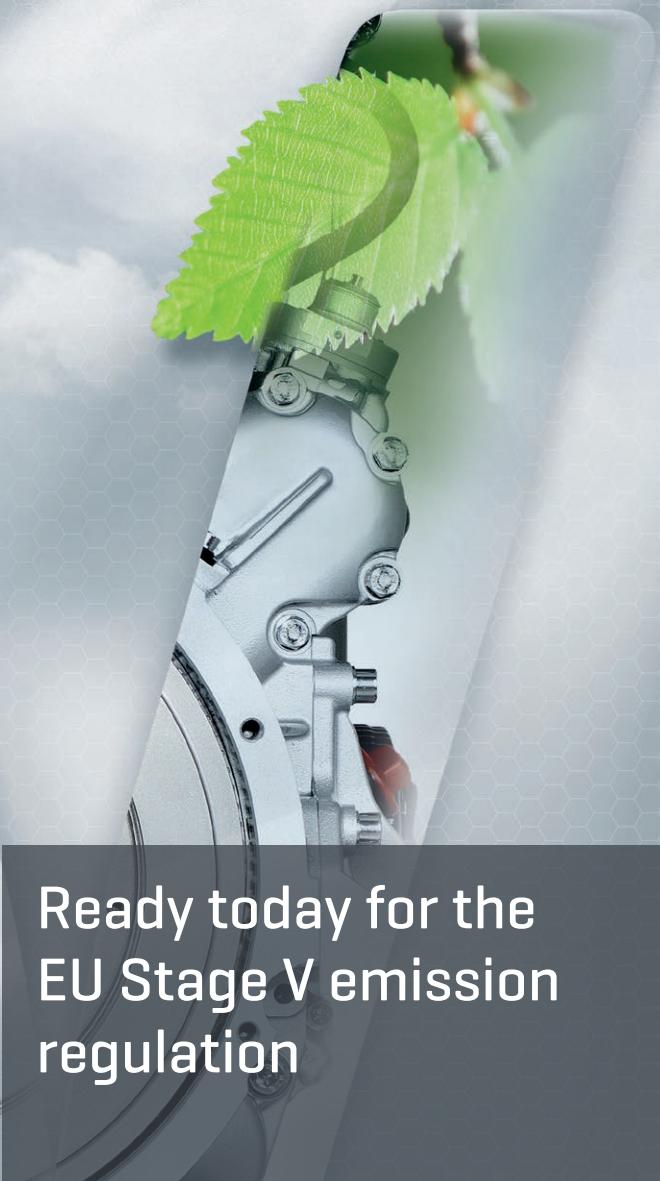
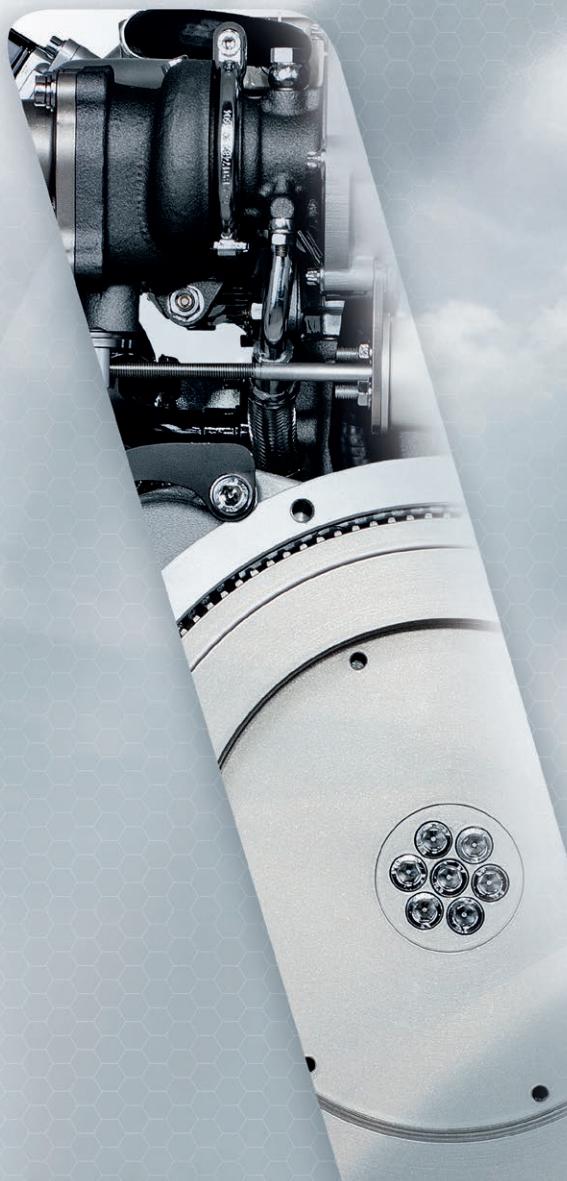


CREATING POWER SOLUTIONS.



Ready today for the  
EU Stage V emission  
regulation

Hatz industrial diesel engines



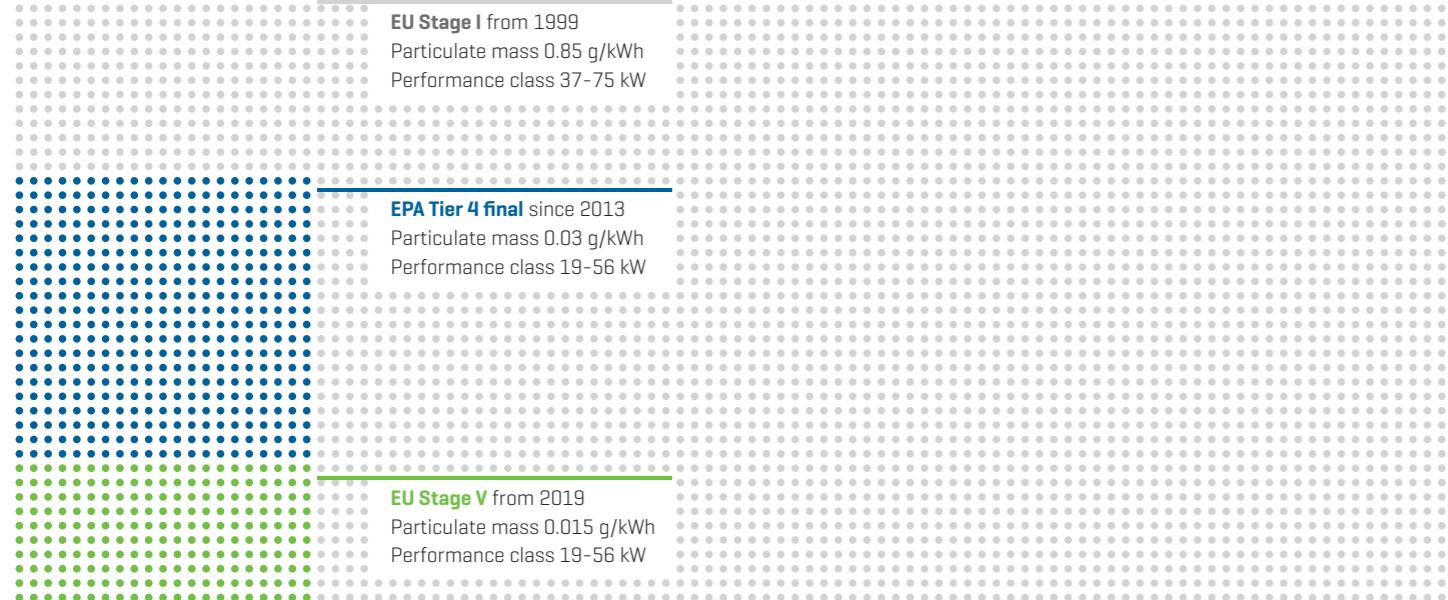
# Challenge for engines. On the way towards zero emissions.

The demands on engine design are becoming ever greater due to stricter exhaust gas regulations. With the introduction of EU Stage V, the permissible emission values are being driven to even lower levels. With its engines in the power range up to 56 kilowatts, Hatz already chose the right technology at an early stage in order to meet these challenges successfully.

**EU Stage I from 1999**  
Particulate mass 0.85 g/kWh  
Performance class 37-75 kW

**EPA Tier 4 final since 2013**  
Particulate mass 0.03 g/kWh  
Performance class 19-56 kW

**EU Stage V from 2019**  
Particulate mass 0.015 g/kWh  
Performance class 19-56 kW



EU Emission Directive		EPA Emission Directive	
Performance class	2013	2019	2013
0 < P < 8 kW	-	Stage V [PM 0.4/0.6 / NOx+HC 7.5]	Tier 4 final [PM 0.4/0.6 / NOx+HC 7.5]
8 ≤ P < 19 kW	-	Stage V [PM 0.4 / NOx+HC 7.5]	Tier 4 final [PM 0.4 / NOx+HC 7.5]
19 ≤ P < 37 kW	Stage IIIA [PM 0.3 / NOx+HC 7.5]	Stage V [PM 0.015 / NOx+HC 4.7 / PN 1x10 <sup>12</sup> ]	Tier 4 final [PM 0.03 / NOx+HC 4.7]
37 ≤ P < 56 kW	Constant: Stage IIIA [PM 0.3 / NOx+HC 4.7] Variable: Stage IIIB [PM 0.025 / NOx+HC 4.7]	Stage V [PM 0.015 / NOx+HC 4.7 / PN 1x10 <sup>12</sup> ]	Tier 4 final [PM 0.03 / NOx+HC 4.7]

Since 1999, the more stringent exhaust gas standards for mobile machinery have resulted in the reduction of the emission of particulates and nitrogen oxides by more than 95 percent, especially in the USA and Europe – two of the largest sales markets. Regarded globally as the most important regulations, the standards in the USA with EPA Tier 4 final and the EU with the latest version of Stage IIIB have become established in the industrial engine sector.

## New exhaust gas standard EU Stage V in Europe

Based on the recommendation of the EU Commission dated September 25, 2014, EU Stage V can be expected from January 2019 in Europe with the introduction of the exhaust gas standard for mobile machinery. It is expected that within 2016 the regulation will be presented in the definitive final version.

Industrial diesel engines with a power output of less than 19 kilowatts will then also be affected for the first time by EU Stage V. Unlike the markets regulated according to EPA standards, this performance class has so far been without regulation in the EU. The EU Stage V now specifies the particulate mass limit [PM] at maximum 0.6 g/kWh, the emission limits for nitrogen oxides and hydrocarbons [NOx+HC] at 7.5 g/kWh and is thus comparable with EPA Tier 4 final.

For diesel engines between 19 and 560 kilowatts, a limit for the particulate numbers of  $1 \times 10^{12}$ /kWh has been introduced. According to the current state of the art, this makes the use of a diesel particulate filter (DPF) unavoidable. In comparison to EU Stage IIIB, the particulate mass limit will be reduced by 40 percent to 0.015 g/kWh and will thus be 50 percent lower than EPA Tier 4 final.

## High demands on the technology

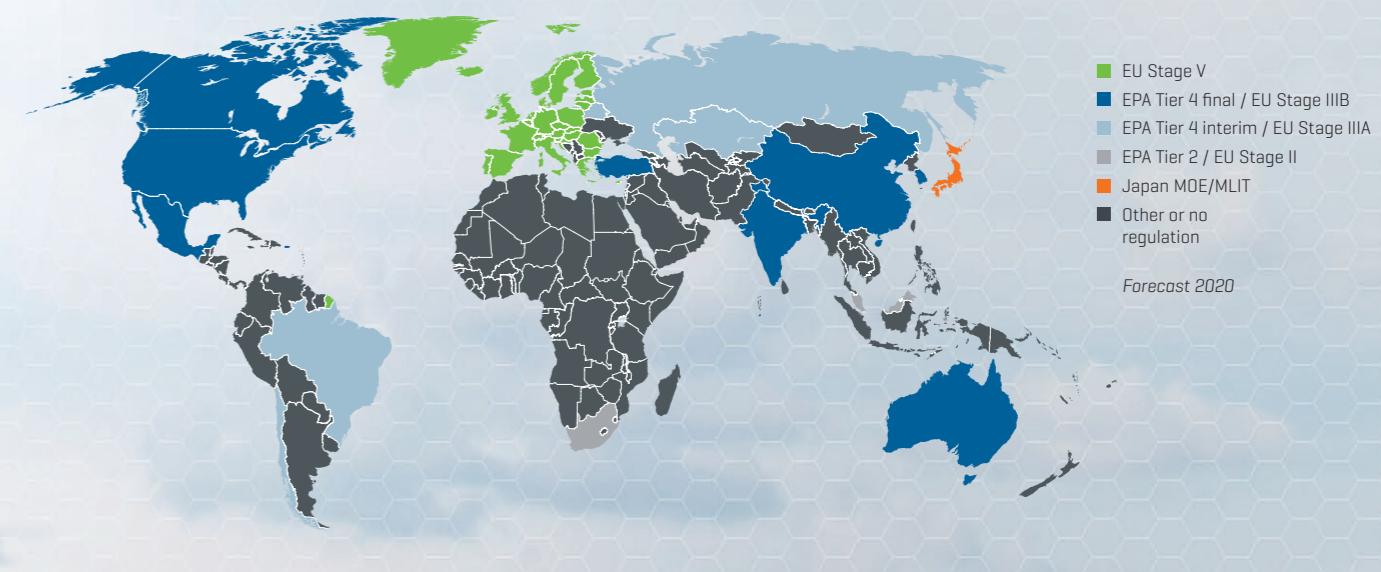
Ever lower emission values are good for the environment, but a growing technical challenge for all engine and machinery manufacturers at the same time. The advances in the emissions relevant areas of engine development (injection, combustion, turbocharging and exhaust after-treatment) have made it possible for today's Hatz diesel engines to be among the cleanest on the market and are moving towards zero emissions.

## No real challenge for Hatz

Hatz industrial engines up to 19 kilowatts are already certified today to Tier 4 and also fulfil the Stage V requirements without any modification. In the power range 19 to 56 kilowatts, the new H-series fulfils the specifications of Tier 4 final and – equipped with a diesel particulate filter – also EU Stage V in the future. This allows Hatz customers to safely plan for the future.

## Global exhaust gas standards

Throughout the world, there are different exhaust gas regulations that apply to industrial engines. The bandwidth ranges from no regulations to very strictly regulated. In addition to the standards of the US environmental protection authorities EPA (Tier X) and the EU (Stage X), other countries have their own regulations that move however approximately at the level of the EU/US specifications: Switzerland, Japan, South Korea, China and India.



# Always one step ahead. Hatz engines up to 19 kilowatts.

Since 2010, Hatz has been the only manufacturer whose entire engine range below 19 kilowatts has qualified to EPA Tier 4. As the requirements of the new EU Stage V emission level in this engine class correspond with the previous US standards, the Hatz engines already fulfil the future EU exhaust gas regulations today.

## Stage V from the market leader

In the range of single-cylinder and two-cylinder engines up to 19 kilowatts, Hatz has been one of the market leaders for decades. Hatz diesel engines have always proven to be reliable and durable under the most difficult of conditions all over the world. This is due not least to the quality of the individual components, such as the injection equipment that is produced completely in-house and signifies a considerable technology advantage.

The introduction of the EU Stage V emission level will not cause any changes to our engines and our customers can also rely on the proverbial Hatz reliability in the future.

## No changes with Stage V for Hatz customers

With the introduction of EU Stage V, diesel engines with a power output of less than 19 kilowatts will also be subject to exhaust gas regulation in the European Union for the first time. In EPA-regulated markets, the Tier 4 specifications have applied to these engines since 2010. Since then, all Hatz engines in this performance class have been delivered around the world subject to these EPA specifications.

EU Stage V corresponds in emission values and test specifications to EPA Tier 4 of model year 2012. Thus, Hatz engines up to 19 kilowatts already meet the requirements of EU Stage V today and Hatz customers can – without having to fear modifications – continue to use the established and tested engines.

The characteristics and output power of today's engines remain unchanged, only the crankcase breather is converted into a closed circuit which guides the ventilation from the crankcase back to the intake manifold. This results in no changes however to the installation on the customer side.

Unlike Tier 4 final, EU Stage V does not require an NRTC [Non-road Transient Cycle] certification run, which means there are no limitations on the usable speed range. No exhaust gas treatment is required with Stage V.



Hatz engine series  
up to 19 kW



**B-series**

The B-series is the industrial diesel engine that will meet all expectations. With a power range from 1.5 to 8 kW, the engine can be used for numerous applications. In regard to robustness and lifetime, the single-cylinder series sets standards in the market.

**D-series**

The Hatz D series is best suited for challenging tasks. It is characterized by high power and the unique design in particular. Thus, with 11.2 kW, the 1D90 engine is the highest performance single-cylinder diesel engine in the world.



**G-series**

The engines of the G-series are universally usable industrial diesel engines. They score highly with low weight due to the lightweight metal design, low fuel consumption and high reliability as no V-belt is used.



**2M41**

The M-series is the long running success among the industrial diesel engines. The robust basic drive train, notably the sturdiest crankshaft of all engines on the market, has remained unchanged since its market introduction 30 years ago. Running times of several tens of thousands of hours are no problem for these engines.



**2L41**

Economic, reliable, quiet: These are the properties that distinguish the engines of the L-series. Their extremely long service life is attributed to the robust design. Their high operating reliability allows L-series engines to be operated dependably even in remote areas or in applications without constant monitoring.

Speed range rpm

1,500-3,600

1,500-3,600

1,500-3,600

1,500-2,000

1,500-2,000

Power range kW

3.4-7.6

5.2-11.2

15.6

13.5-18.4

13.5-18.4

Current certification EPA / EU

Tier 4 final / not necessary

Tier 4 final / not necessary

Tier 4 final / not necessary

Tier 4 final / not necessary \*\*

Tier 4 final / not necessary \*\*

Fulfils EU Stage V\*

Yes

Yes

Yes

Yes

Yes



# Fit for the future. Hatz engines above 19 kilowatts.

The anticipated requirements of the new EU Stage V emission level cannot be fulfilled by diesel engines with a power output of more than 19 kilowatts without diesel particulate filters. Hatz already took this path at an early stage in the development of the new H-series engine generation and is thus well prepared for the future.

## Based on a perfectly designed basic engine

In the development of the H-series, Hatz had already placed the emphasis on future stricter exhaust gas regulations. The specifications for the H-engines included low fuel and oil consumption, friction losses as low as possible and downsizing for optimum load profile. In addition, the combustion is perfected with iHACS (intelligent Hatz Advanced Combustion Strategy). All of this results in fewer particulates being emitted, hence making the exhaust gas treatment more efficient. Engines of the H-family are therefore designed to be extremely compact and provide maximum flexibility during installation in the machine.

## The right exhaust gas treatment for every purpose

optiHEAT – optimised Hatz Exhaust Aftertreatment Technology – provides our customers with the optimum exhaust gas treatment for the target market with an ideal match with the machine and the customer requirement. In order to fulfil the EPA Tier 4 final, CARB and EU Stage IIIB exhaust gas regulations, the basic H50TIC model is only equipped with a combination of exhaust gas recirculation [EGR] and diesel oxidation catalyst [DOC].

## Ideally prepared for Stage V

Thanks to the high product maturity and the best preconditions of the basic model for a proven exhaust aftertreatment process, the step to a Stage-V-compliant engine is not far. To meet the specifications of EU Stage V and LRV in Switzerland, the TIC basic model is equipped with a splittable – and hence maintenance-friendly – DOC/DPF combined filter, thus becoming the H50TICD.

The basis for a long service life of the diesel particulate filter are the lowest possible raw emissions of the engine that are best achieved with a turbocharger and charge air cooler. In addition, the operating time within the optimum system temperature range must also be as high as possible. Engines of the Hatz H-series provide a profound basis for fulfilling this.

## Customized DPF system for Stage V models

With optiHEAT and intensive research and development work, the Hatz engineers have been successful in the design of the matching DPF. Here, reasonable dimensioning of the DPF substrate (high storage capacity vs. long heating time) plays a role – as does a reasonable temperature range or the technical execution as an active or passive system. The regeneration strategy is also crucial for the conception of the DPF system. It must be brought into compliance with the operation time per machine use and service life of the machine.

In addition, not only does "optimised" mean the ideal model size design of the DPF system for the requirements of the machine in this context, but also optimum adaptation to the load/temperature profile under real conditions as well as a regeneration strategy matched to requirements. The expandable modular system also allows flexible installation and simple maintenance.

**Summary:** With one basic model and the correct variation in the exhaust gas treatment, all major markets can be served with an ideal engine/machine combination.



Hatz engines  
above 19 kW



4H50TICD

A groundbreaking downsizing approach was adopted in the development of the H-series engines. The water-cooled three-cylinder engines are the ideal solution for today's compact machine class of less than 37 kilowatts.



← H50TIC basic model

The H50TIC basic model fulfils the currently applicable EPA Tier 4 final and EU Stage IIIB emission standards with only a combination of exhaust gas recirculation [EGR] and diesel oxidation catalyst [DOC]. In combination with the individual Hatz diesel particulate filter system, the H-series engines as TICD models are ideally prepared for future emission standards such as EU Stage V.



Speed range rpm	1,500-2,800	1,500-2,800
Max. power kW	42	55
Current certification EPA / EU	Tier 4 final / Stage IIIB	Tier 4 final / Stage IIIB
Fulfils EU Stage V*	Yes	Yes

\* according to the proposal of the EU Commission from September 25<sup>th</sup>, 2014

**iHACS**

intelligent HATZ ADVANCED  
COMBUSTION STRATEGY

**optiHEAT**

optimised HATZ EXHAUST  
AFTERTREATMENT TECHNOLOGY

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