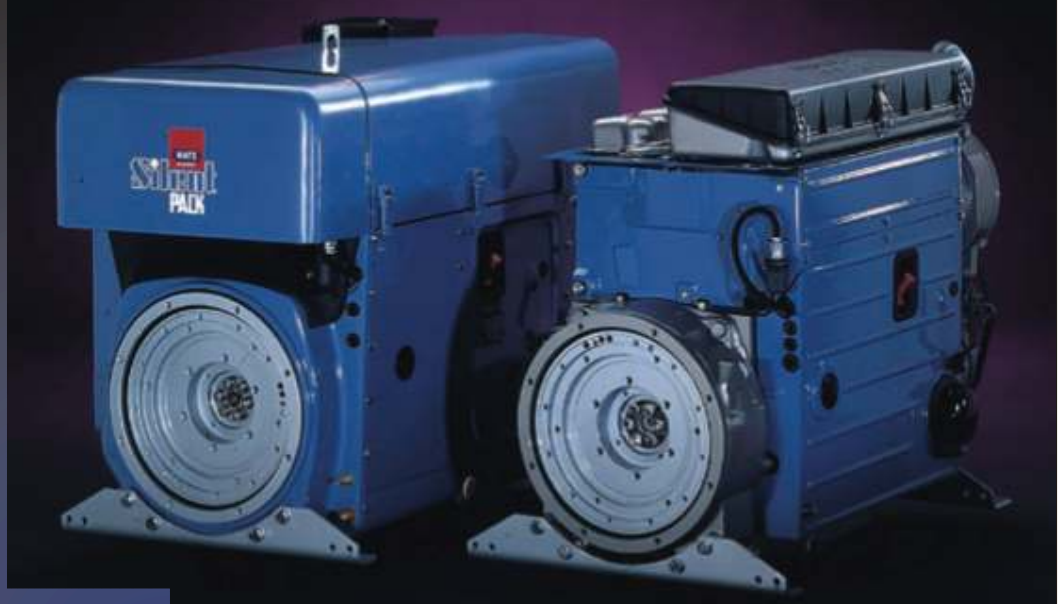
HATZ DIESEL

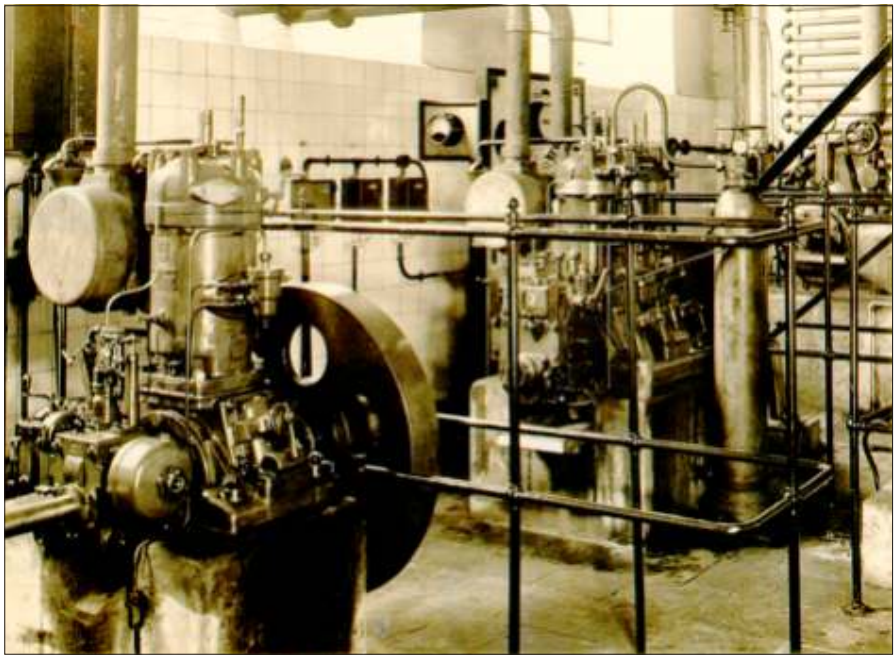


& M

Ready for installation
Concentrated power,
compact dimensions

INDEX

HATZ multi-cylinder engines
a living tradition



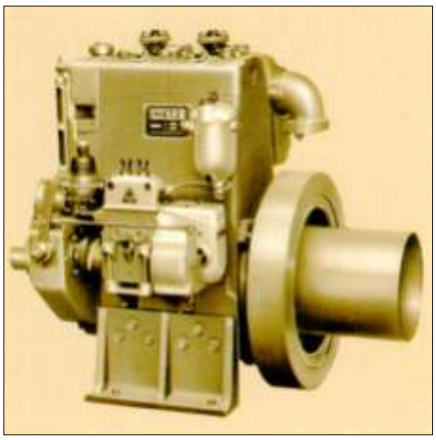
Multi-cylinder engines made by HATZ have become a living tradition.
The 2-cylinder engines of the legendary H Series designed and manufactured in about 1925. They were the first HATZ diesel engines.

The Serie A multi-cylinder engines, followed in the thirties. In the fifties there were special F 2 S and B 2 S 2-for farm tractors. Until that time HATZ manufactured watercooled, 2-stroke medium-speed engines only.

In 1958 a completely new multi-cylinder Series 90/105 engine was introduced, now as a fourstroke Diesel, aircooled and of high speed type. The Series 95 and 108 were the result of continued development.

Finally, in 1978, HATZ introduced the new multi-cylinder Series L, of modular design. The results of over 10 years' research work on noise abatement, optimizing of fuel consumption and problem-free maintenance were incorporat into the design; the 2-, 3- and 4-cylinder engines of this series were available as encapsulated engines for the first time: the "HATZ-DIESEL Silent Pack".

80 years of experience in engine manufacturing therefore = to apply HATZ multi-cylinder diesel engines just as they do to the company's single-cylinder engines.



L and M Series
multi-cylinder engines
from 1716 cc
to 3432 cc
from 13.5 kW to 57 kW
2 - 3 - 4 cylinder

Economical

Two essential characteristics illustrate the economy: the minimum fuel consumption and the incomparably long engine life, due among other things to the low piston speed.

Friendly to the environment

HATZ has achieved significant success in the reduction of noise and exhaust gas emissions .

Robust and reliable

HATZ engines are designed for durability and robustness. This is guaranteed by excellent quality control during production. HATZ engines are noted for their reliable starting even at extremely low temperatures.

Operational safety

HATZ engines are produced to give the highest standards of operational safety under the most severe climatic conditions. Air cooling contributes to this considerably. Air is everywhere - contrary to water, air does not freeze or evaporate.

Easy to service

Operation and maintenance are problem-free, for experts and non-experts alike.
Essential features:

- Automatic hydraulic belt tensioner
- Automatic injection pump bleeding
- Maintenance indicator for air filter
- Automatic extra fuel device for cold start

Indestructible

An “intelligent” auto-protection device protects the engine from destruction. It stops the engine before any damage occurs:

- if the blower drive breaks down
- if oilshortage occurs
- if the permissible tilting positions are exceeded.

The auto-protection device is integrated into the lubrication system of the engine. It is unique in the industrial diesel engine sector, and

- not only protects the engine from total destruction
- but also avoids its owner suffering financial loss

The technology - always one step ahead

- Injection timer for favourable exhaust emission values
- Auto-protection device (additional equipment)
- Automatic belt control with stop
- Additional balancing of free mass forces (models Z and K)
- Suppression of start-up smoke (additional equipment)
- Governor quality
- Electronic governors on request

Universally applicable

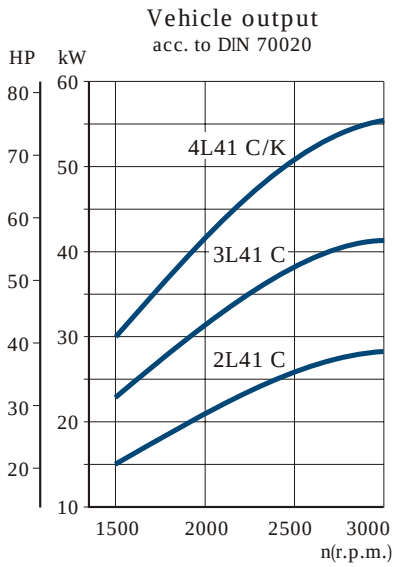
- Torque control
- Flywheel-side adaptations
- Governor-side adaptations
- Remote control
- Inlet and outlet ducts for cooling and combustion air.

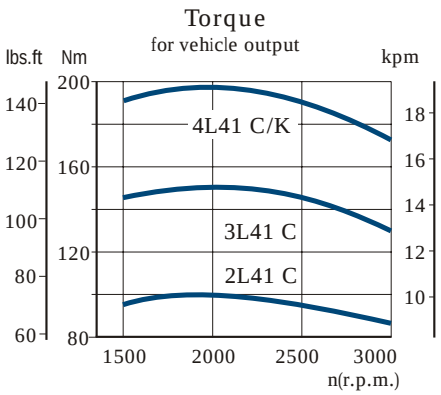
Performance table, torque, technical data, installation data

Type code:

2 L 41 C
3 L 41 C
4 L 41 C

- C — Model
- 41 — Size
- L — Family
- 2 / 3 / 4 — Number of cylinders





Performance data refer to standard reference conditions of DIN ISO 3046:
+25 °C (77 °F), 100 m above sea level, relative humidity 30 %
During running-in period the output increases by approx. 5 %, which is taken into consideration at delivery. Power reduction acc. to DIN ISO 3046.
Standard values:
Above 100 m above sea level approx. 1 % per 100 m.
Above 25 °C (77 °F) approx. 4 % per 10 °C (50 °F)

Technical data		2L41C	3L41C	4L41C/K
Number of cylinders		2	3	4
Bore x stroke	mm	102 x 105	102 x 105	102 x 105
	inches	4.02 x 4.13	4.02 x 4.13	4.02 x 4.13
Displacement	l	1.716	2.574	3.432
	cu.in.	104.7	157.0	209.4
Mean piston speed at 3000 r.p.m.	m/s	10.5	10.5	10.5
	ft/s	2067	2067	2067
Compression ratio		18.7	18.7	18.7
Lub. oil consumption		approx. 0.2% of fuel consumption, related to full load		
Lub. oil capacity max. / min.	l	4.7 / 2.8	7.8 / 4.7	15.0 / 11.3
	US qts	5.0 / 3.0	8.2 / 5.0	15.9 / 11.9
Speed control	Lowest idle speed	approx. 800 r.p.m.		
	Stat. speed droop	approx. 5% at 3000 r.p.m.		

Installation data

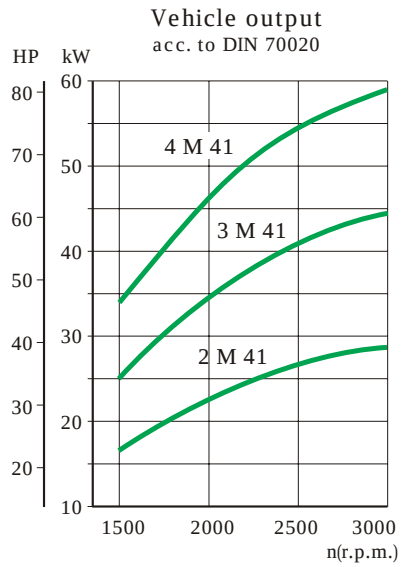
Combustion air required at 3000 r.p.m. approx.[1]	m^3 / min	2.6	3.9	5.2
	cu.ft./min	92	138	184
Cooling air requred at 3000 r.p.m. approx.[1]	m^3 / min	29	39	49
	cu.ft./min	1024	1377	1730
Permanent tilting	max. degrees	30 [2) 3) 4) 5)]	25 [2) 3) 4)] 30 [5)]	25 [4)] 30 [5)] 15 [2)] 18 [3)]
Moment of inertia	SAE flywheel 8“	0.64 kgm² (15.2 lb.ft²)	0.65 kgm² (15.4 lb.ft²)	0.67 kgm² (15.9 lb.ft²)
	Flywheel for F+S clutch	0.49 kgm² (11.6 lb.ft²)	0.50 kgm² (11.9 lb.ft²)	0.51 kgm² (12.1 lb.ft²)
Starter motor		12 V - 2.7 kW (3.7 HP)	24 V - 4.0 kW (5.4 HP)	
Alternator charging current at 3000 / 1500 r.p.m.		14 V - 50 / 42 A	28 V - 40 / 28 A	
Battery capacity	min/max Ah	12 V - 88 / 143 Ah	24 V - 55 / 110 Ah	

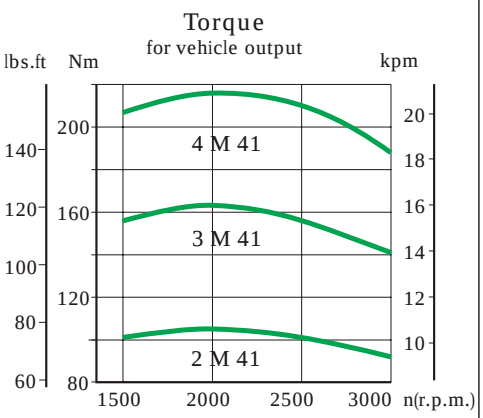
1) For other r.p.m. there is a linear reduction in the air requirement
2) Applicable for flywheel up
3) Applicable for flywheel low
4) Applicable for oil filter low
5) Applicable for oil filter up

Type code:

2 M 41 Z
3 M 41 Z
4 M 41 Z

- Model
- Size
- Family
- Number of cylinders





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Standard values:
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Technical data		2M41	3M41	4M41
Number of cylinders		2	3	4
Bore x stroke	mm	102 x 105	102 x 105	102 x 105
	inches	4.02 x 4.13	4.02 x 4.13	4.02 x 4.13
Displacement	l	1.716	2.574	3.432
	cu.in.	104.7	157.0	209.4
Mean piston speed at 3000 r.p.m.	m/s	10.5	10.5	10.5
	ft/s	2067	2067	2067
Compression ratio		18.7	18.7	18.7
Lub. oil consumption		approx. 0.2% of fuel consumption, related to full load		
Lub. oil capacity max. / min.	l	5.5 / 3.0	8.6 / 5.1	14.0 / 5.0
	US qts	5.8 / 3.2	9.1 / 5.4	14.8 / 5.3
Speed control	Lowest idle speed	approx. 800 r.p.m.		
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Installation data

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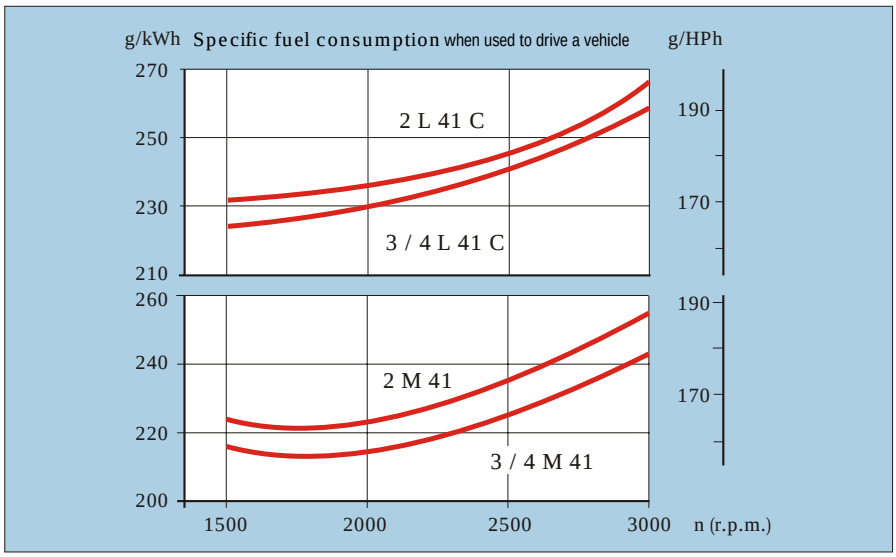
Starter motor		12 V - 2.7 kW (3.7 HP)		24 V - 4.0 kW (5.4 HP)
Alternator charging current at 3000 / 1500 r.p.m.		14 V - 50 / 42 A		28 V - 40 / 28 A
Battery capacity	min / max Ah	12 V - 88 / 143 Ah		24 V - 55 / 110 Ah

1) For other r.p.m. there is a linear reduction in the air requirement
2) Applicable for flywheel up
3) Applicable for flywheel low
4) Applicable for oil filter low
5) Applicable for oil filter up

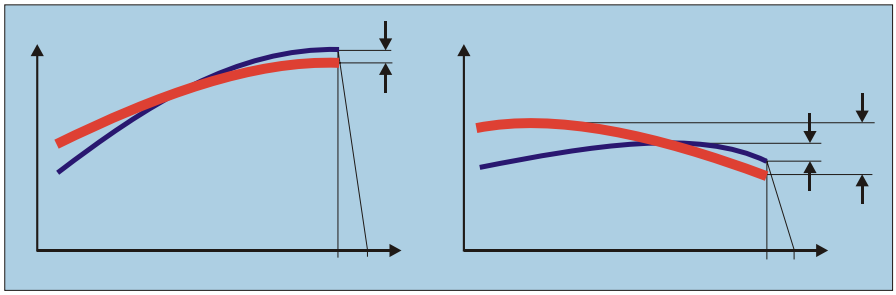
Fuel and oil consumption:

The trend towards lower exhaust emission levels has been combined with a reduction in consumption. The specific consumption of lubricating oil for broken-in engines, for example, has been lowered by 25% to approx. 0.5 g/kWh.
The optimized fuel consumption for a 4 L 41 C, for instance, lies significantly below 225 g/kWh. This value is exceptionally good, considering the fact that fuel-consumption levels normally tend to rise for engines that have been optimized for exhaust emissions. In addition, the four-cylinder engine drives not just one, but two balancer shafts.



Torque characteristic:

HATZ Diesel engines are not designed only for a single application; they must be able to drive a large variety of equipment.
The torque characteristic can be adjusted within practical limits. This is because HATZ does not obtain the speed governor from an outside supplier but builds its own. For this reason, the control-rod travel that is required for fuel supply adjustment during torque increases can be matched to a control lever specially designed for this purpose.



Engine noise

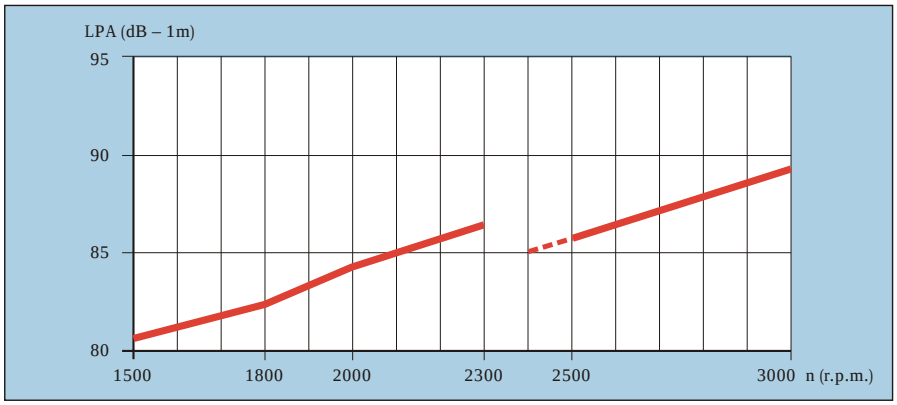
HATZ Silent Packs are the quietest ready-to-install engines in their class.

The average sound-pressure values shown here, measured at a distance of one meter, include unrestricted intake and exhaust noise at full load, as required by DIN-ISO 3046/ IFN.

These low values speak for themselves and require no further comment.

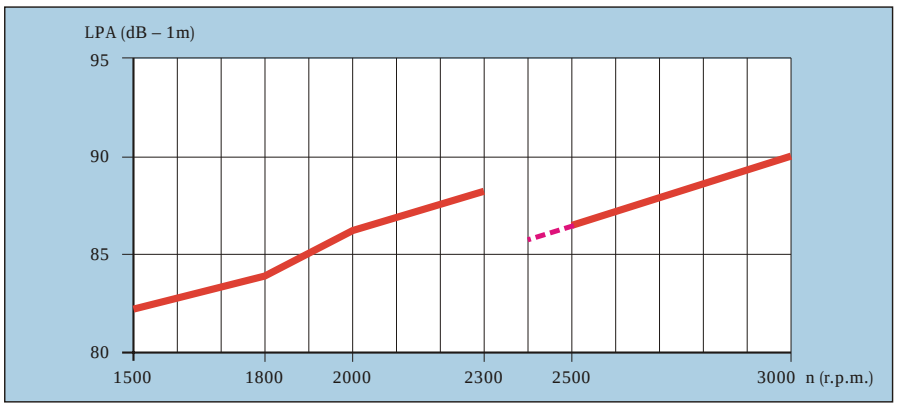
SilentPACK 2L41C

15.0 kW / 1500 r.p.m.
23.5 kW / 2300 r.p.m.
24.4 kW / 3000 r.p.m.



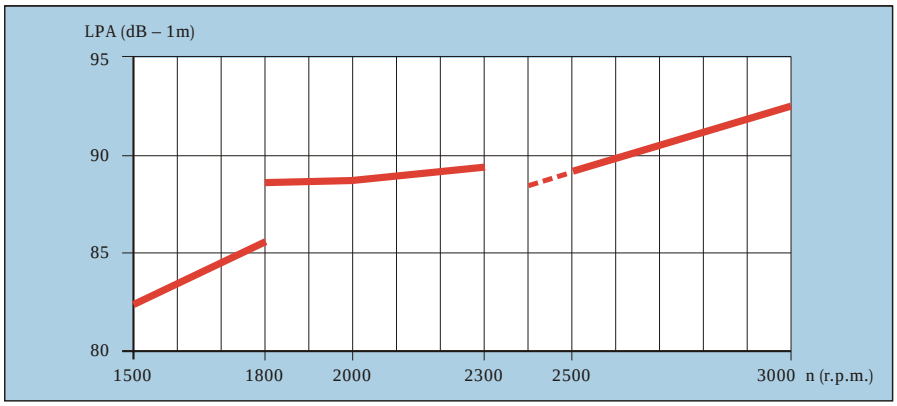
SilentPACK 3L41C

22.9 kW / 1500 r.p.m.
35.9 kW / 2300 r.p.m.
36.7 kW / 3000 r.p.m.



SilentPACK 4L41C

30.0 kW / 1500 r.p.m.
47.0 kW / 2300 r.p.m.
48.8 kW / 3000 r.p.m.



The mixture formation and combustion process

The engines feature high-pressure direct injection with VCO five-hole nozzles that have no blind holes.

This mixture formation and combustion process has five main advantages:

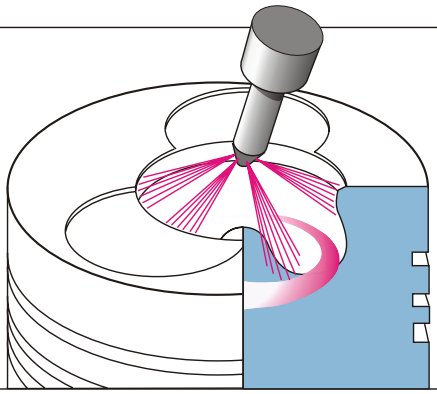
1. Very high combustion-chamber load capacity for maximum power output.

2. Exhaust emission levels well below the specified limits for the USA, Europe, and Japan. (For more information on this, see next pages.)

3. The combustion noise is subjectively "softer" and contributes to the Silent Pack's noise optimization.

4. The cold-start performance is particularly good:
   Even without pre-heating, the engines are able to start at temperatures well below the cold-start limit of 15 °C. With a pre-heat system and 24 V starting equipment, trouble-free starting is possible down to 32 °C (if filterable fuel and an appropriate engine-oil viscosity are used).

5. The combustion process uses fuel very frugally. Despite additional mass balancing and exhaust gas optimization, fuel consumption levels below 225 g/kWh are normal for standard equipment.

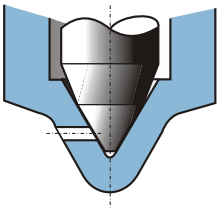


Combustion process
DI - NA

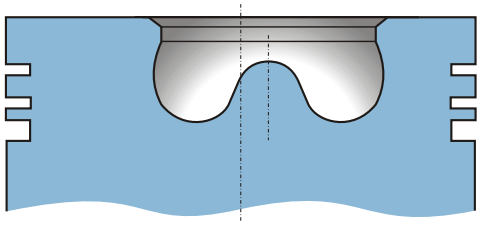
High-pressure injection system
with PFR1K90 individual plug-in pumps
and five-hole VCO nozzles

Low-swirl intake port
Recessed "Omega" combustion chamber
Compression ratio: 18.7 : 1

VCO nozzle



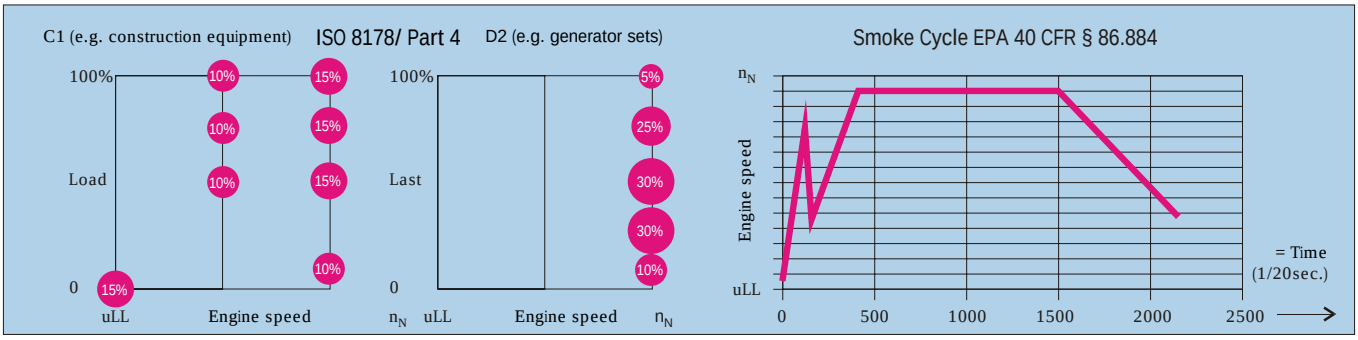
Geometry of the combustion chamber bowl



Low exhaust emissions for environmental protection:

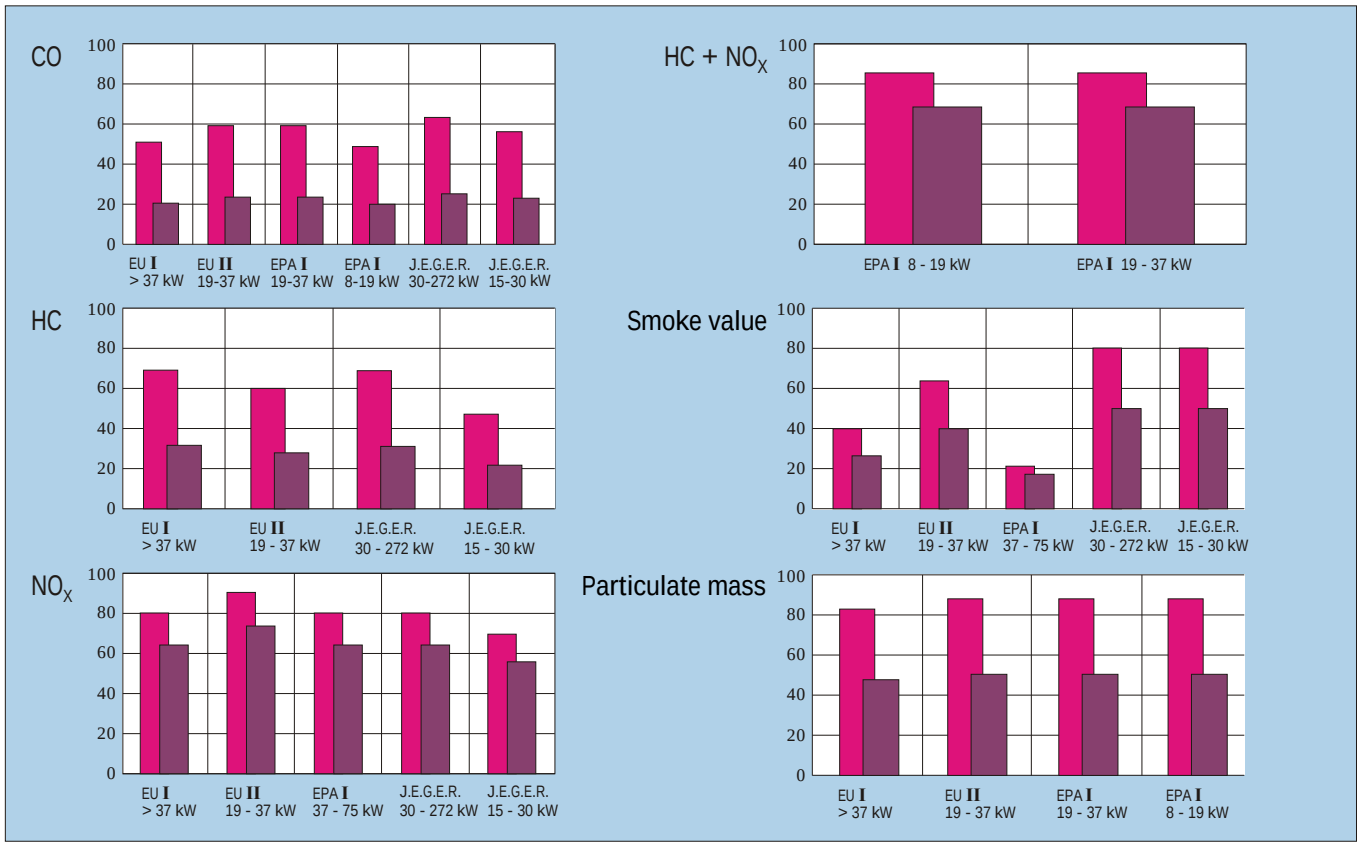
Environmental protection authorities for the various regions in which equipment is used have established their own exhaust emissions limits in many cases. HATZ . L 41 C and . M 41 diesel engines lie well below the currently valid limits. This makes the new . L 41 C and . M 41 engines the right choice for operating environmentally acceptable equipment for the long period until new limits are established in 2004 and 2005.

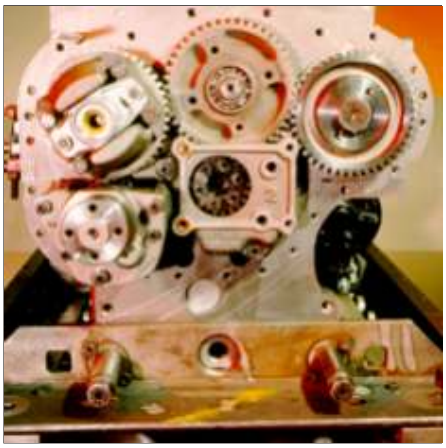
Test cycles



Exhaust emission test results
(C1, D2, smoke)

Range of all variations for the L/ M 41 model series as a percentage of the limit



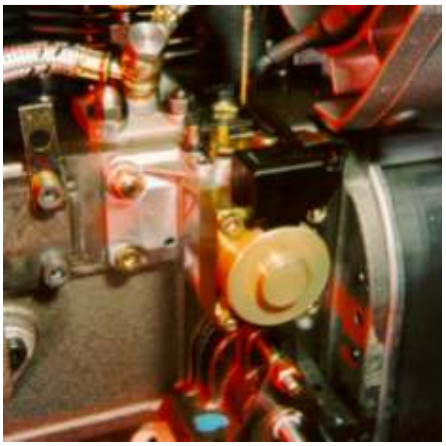


Reliability and life span

HATZ . L 41 C and . M 41 engines have extremely long service lives because their designs feature details that are configured for no-compromise reliability.

This is made possible by the drive components for the camshafts, the injection pumps, the oil pump and the hydraulic pump.

HATZ uses torsionally rigid gears for these drives! They are helical-cut so that they run quietly for long, trouble-free engine operating periods.

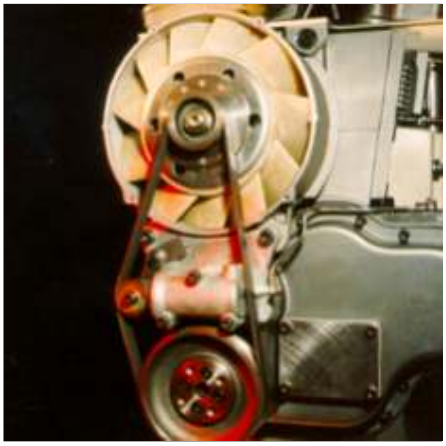


The automatic engine protector

The optionally available automatic engine protector reacts to lubricating oil pressure. When the pressure is insufficient (for example, if lubricating oil has not been added in time), the automatic engine protector automatically shuts the engine down before damage arises. This hydraulic/mechanical device ensures optimum reliability.

An additional solenoid makes the automatic engine protector even more convenient:

When the "ignition key" is moved to the 0 position, the engine shuts down as in a passenger car.



The cooling fan drive

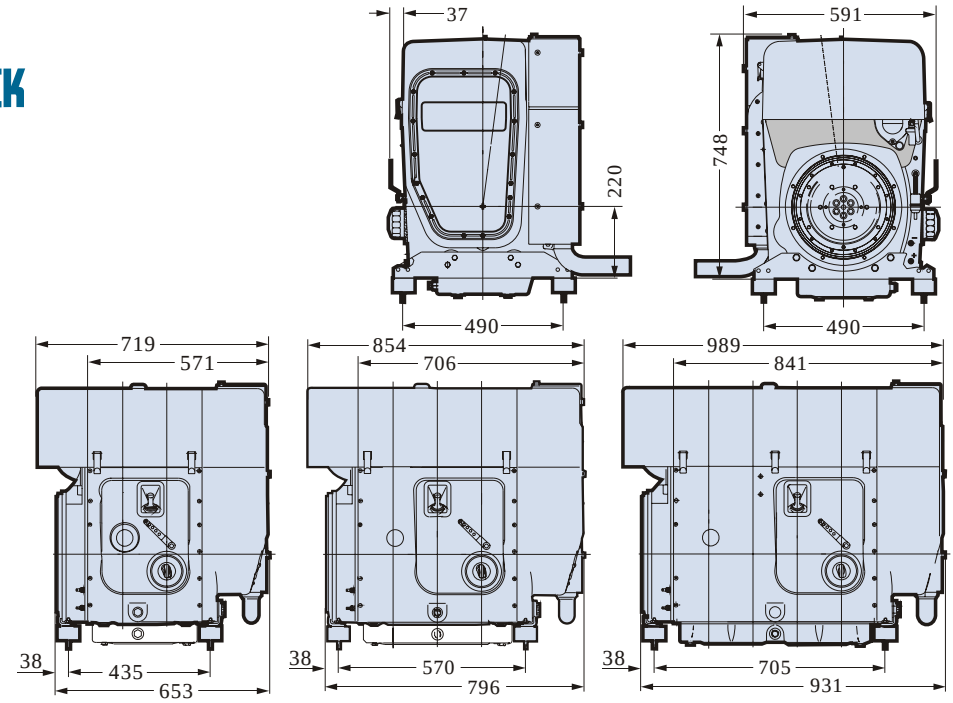
The cooling fan is driven by a durable Poly-V belt that is maintained at the right tension by a hydraulically loaded tensioner pulley.

If after many thousands of operating hours a belt should tear because it was not replaced in time, the engine still suffers no damage. This is because the belt-tensioner simultaneously and automatically triggers a simple, mechanical shut-off device.

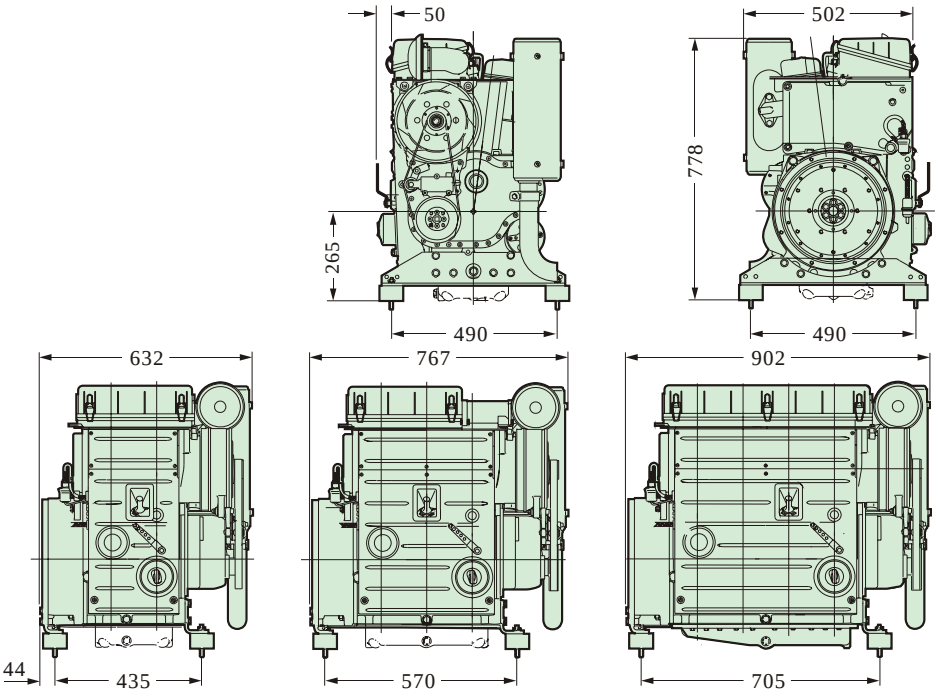
The . L 41 C and Silent Packs and the . M 41 standard engines have been created "from the same mold."
The Silent Pack's noise-protection capsule fits over the engine like a glove.
The installation dimensions for the Silent Pack are nearly identical with those for the unencapsulated engine!

SilentPACK

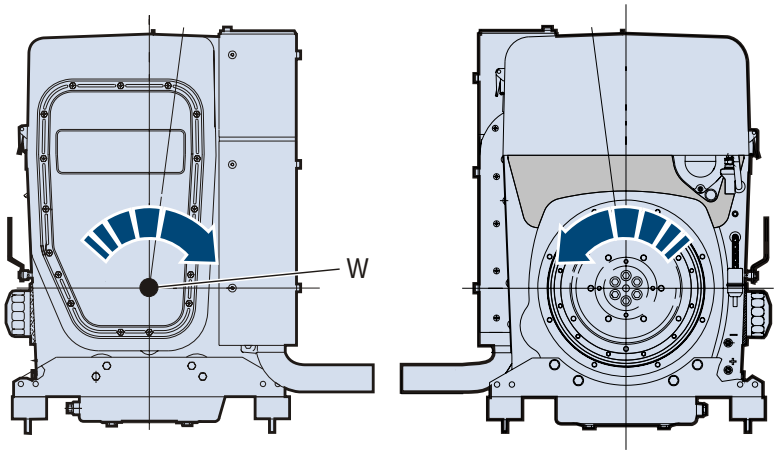
2L41C
3L41C
4L41C



2M41
3M41
4M41

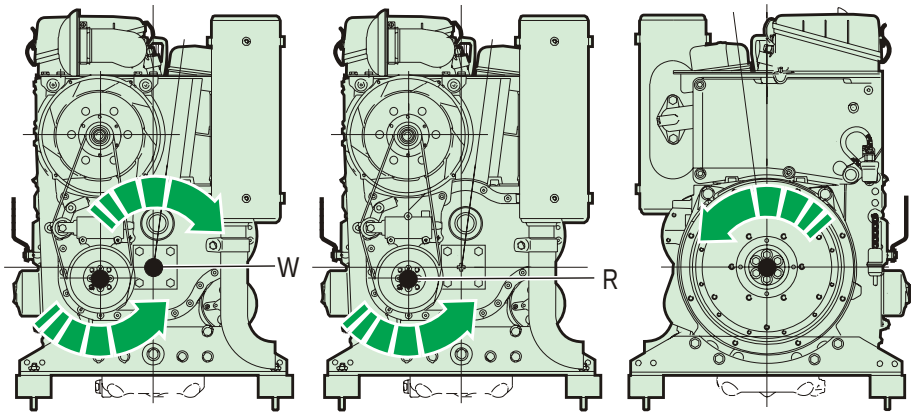


2 L 41 C • 3 L 41 C • 4 L 41 C

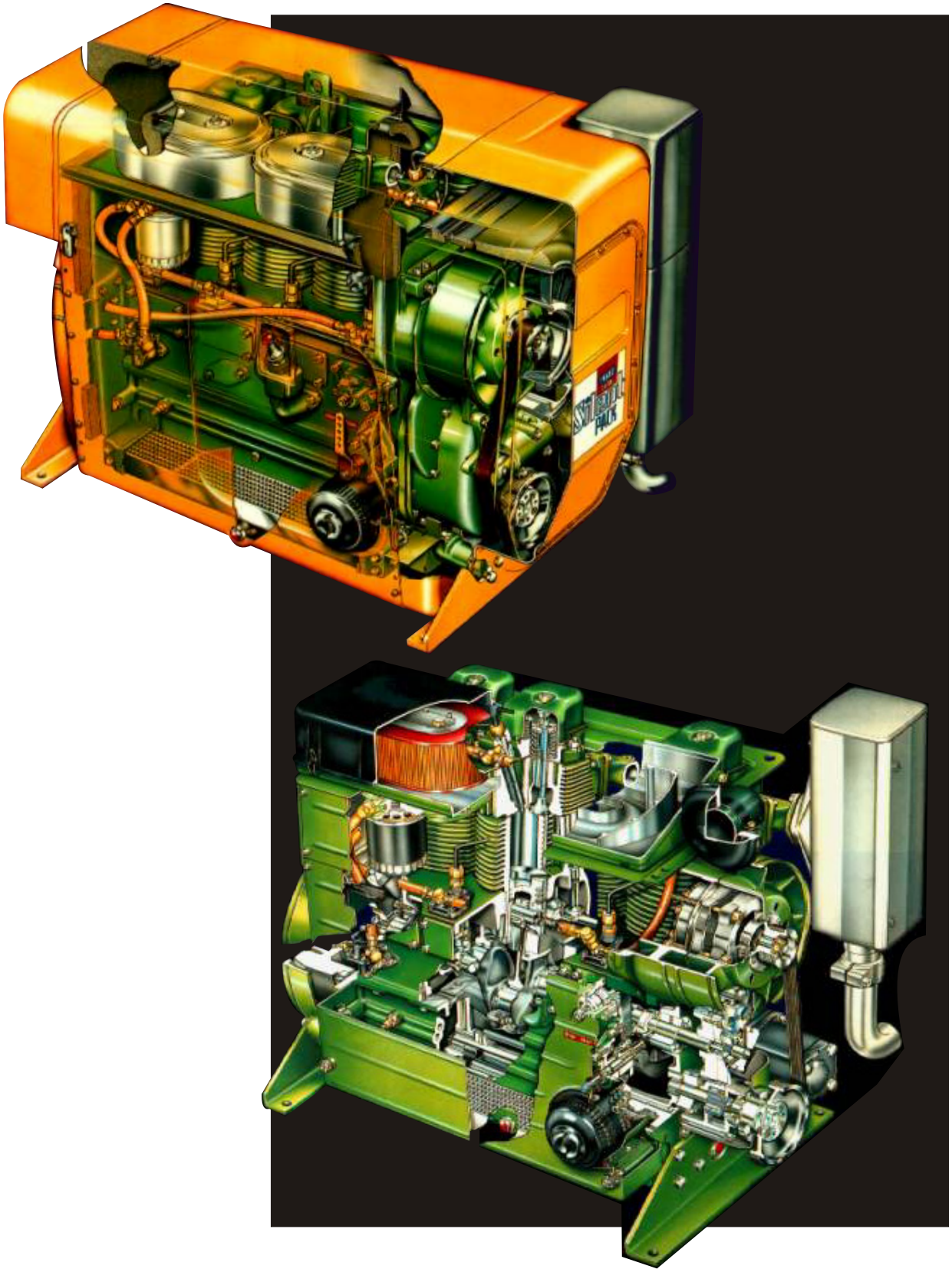


Main power-take-off at flywheel with engine speed
W, Power-take-off crankshaft-governor side with engine speed
max. permissible torque 70 Nm
Engine flangeable at flywheel side

2 M 41 • 3 M 41 • 4 M 41



Main power-take-off at flywheel with engine speed
W, Power-take-off crankshaft-governor side with engine speed
max. permissible torque 70 Nm
R, Power-take-off belt pulley with engine speed
max. permissible torque 32 Nm
Engine flangeable at flywheel side

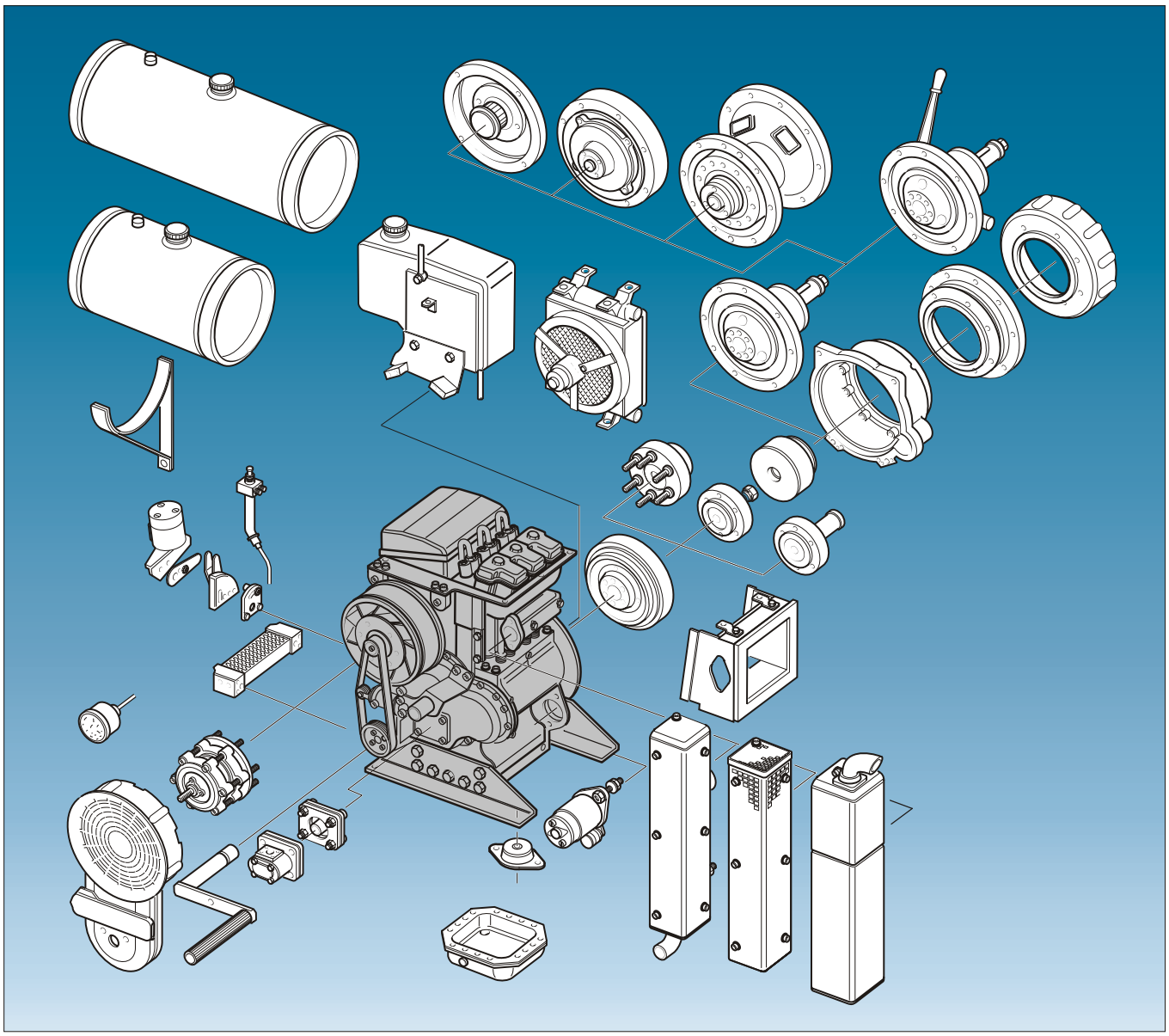


Universal application

Flexibility of equipment and Application

Large variety of applications for developing countries and high-tech products for industrial countries.

- Flangeable
- Different flange sizes
- Various of power-take-offs can be installed
- Hydraulic pump drive possible
- Electric start 12 V and 24 V
- Crank handle start for specific applications possible



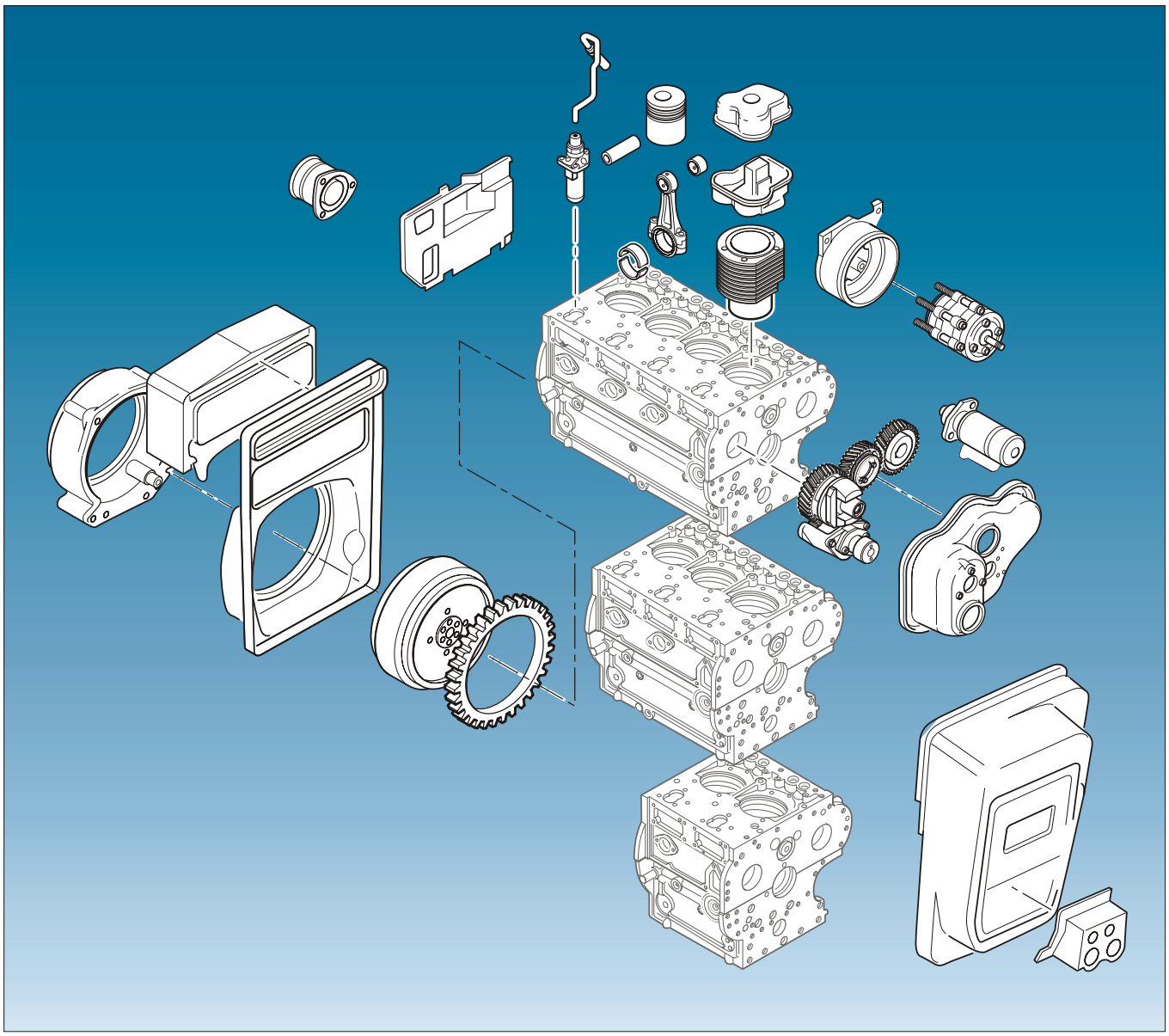
Multi-cylinder engines, modular design

Identical parts for the L and M Series, for 2-, 3- and 4-cylinder engines

- Cylinder heads
- Cylinders
- Pistons
- Conrods
- Bearings
- Injection nozzels
- Injection pumps
- Oil pump
- Alternator
- Air filter
- Governor
- and other small parts

Your advantage

- Low spare parts stock
- Low use of capital for the spare parts requirements
- Low storage space requirement
- Spare parts stock simplified
- Know-how for repairs identical for 8 engine types



The HATZ Silent Pack is the quietest engine for equipment installation in its class – and it's ready for immediate application

The Hatz Silent Pack has every conceivable feature that an optimal built-in diesel engine should possess by today's standards.

Extremely quiet

See the following page

Ready for operation

With an air cleaner attached, exhaust silencing and a cable loom for starting and monitoring). Nothing is loose, everything is ready for installation

Easily accessible

Provided with servicing points easily accessible from the outside or under a cover with quick-release fasteners; hydraulic pumps can also be installed under the sound-absorbing enclosure to reduce noise emissions

Noise insulation

Supported on feet that are insulated against structure-borne noise and can be mounted on frames or plates (which means that hardly any structure-borne noise is transferred to the equipment)

Balancer shafts

Equipped with additional mass balancer shafts which suppress disturbing vibration before it can even arise

Low installed dimensions

Designed to occupy only a minimum of space, since the noise-protection capsule fits closely around the engine block

Optimum cooling air flow

Equipped with cool-air ducting that regulates thermal conditions in the noise-protection capsule so that the Silent Pack can be operated in all known climate zones (in a hot, dusty desert or in Alaska's icy winter).

The Hatz Silent Pack is a perfect example of what we mean when we say:

"Mount it, bolt it on, start it up
and hear just how pleasant it sounds."

The Silent Pack is an engine from the L-family with noise-proof capsule.

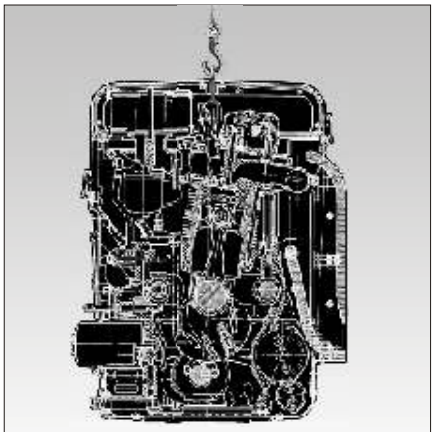
The capsule reduces the engine noice by 90 % to 10 % = 10 dBA.

10 Silent Packs are as silent as a no-encapsulated diesel engine.

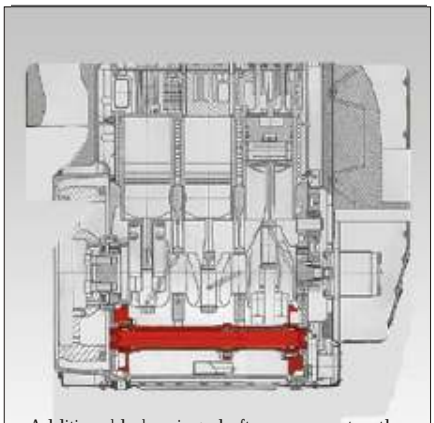
Output and constant load are not affected by the capsule. The easy accessibility of maintenance and operating points remains unchanged.

Noisy auxiliary drives can be incorporated in the capsule.

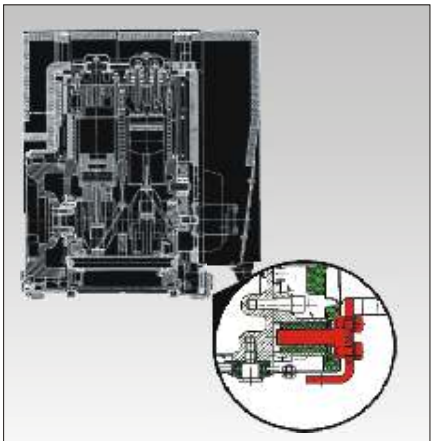
The capsule is made of 1 mm sheet metal. Inside the capsule the engine noise is reduced by reflection and the capsule is fixed to the engine, insulated against structure-borne noise.
The capsule is smaller and more handy than other noise reduction engine cowlings and it is just as efficient, compared with expensive and heavy encapsulations of machines.



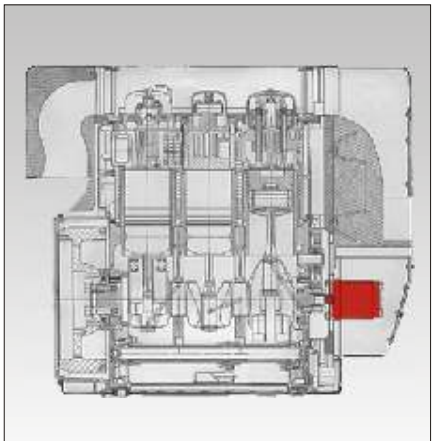
Transport and storage is as simple as with conventional engines



Additional balancing shaft compensates the moment of inertia of 2- and 3-cylinder engines and the inertia forces or 2nd order of the 4-cylinder model



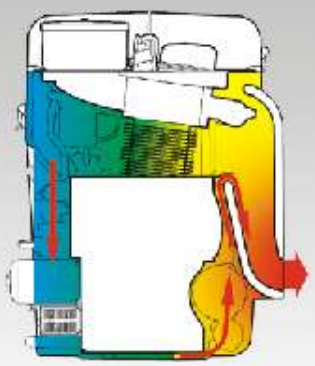
Engine brackets are insulated against structure-borne noise



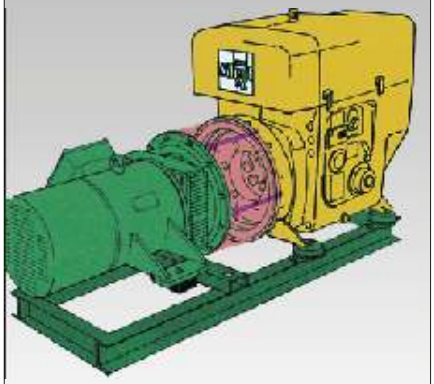
Noisy auxiliary drives are integrated in the capsule

HATZ DIESEL

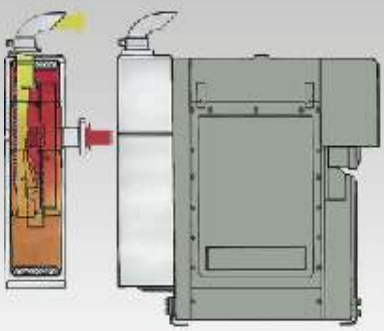
Silent PACK



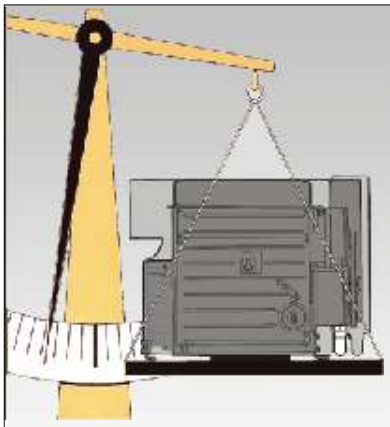
The radiant heat of the engine block is forced out by the cooling air



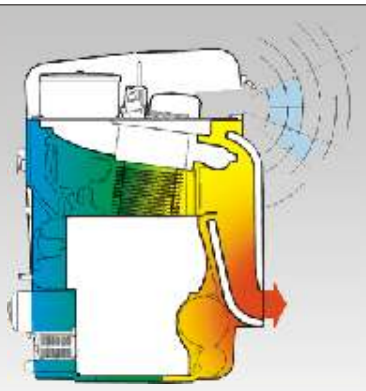
The Silent Pack is a flangeable engine for universal application



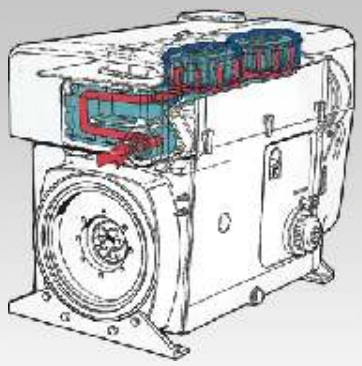
A high-efficiency exhaust silencer is mounted, integrated into contour of capsule and seperately encapsulated



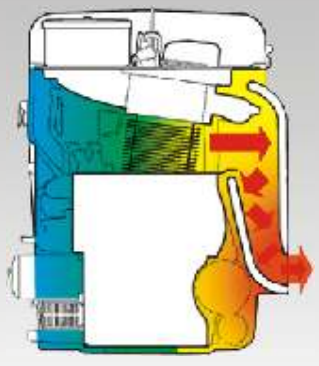
Almost identica installation configurations, the extra weight is insignificantl



A capsule must be tight ! Unintended opening influences ist efficiency considerably



Effective air-intake noise dampening



Necessary openings in the capsule are acoustically dampened by means of soft absorption material and angular noise reflexions within the capsule

Easy maintenance

The maintenance of HATZ Diesel engines is limited to a few and absolutely neccessary points. External access is basically given for the necessary elements of oil control, refilling of oil, oil change and replacement of oil filter. Cleaning the air filter is simple because of its easy accessibility.

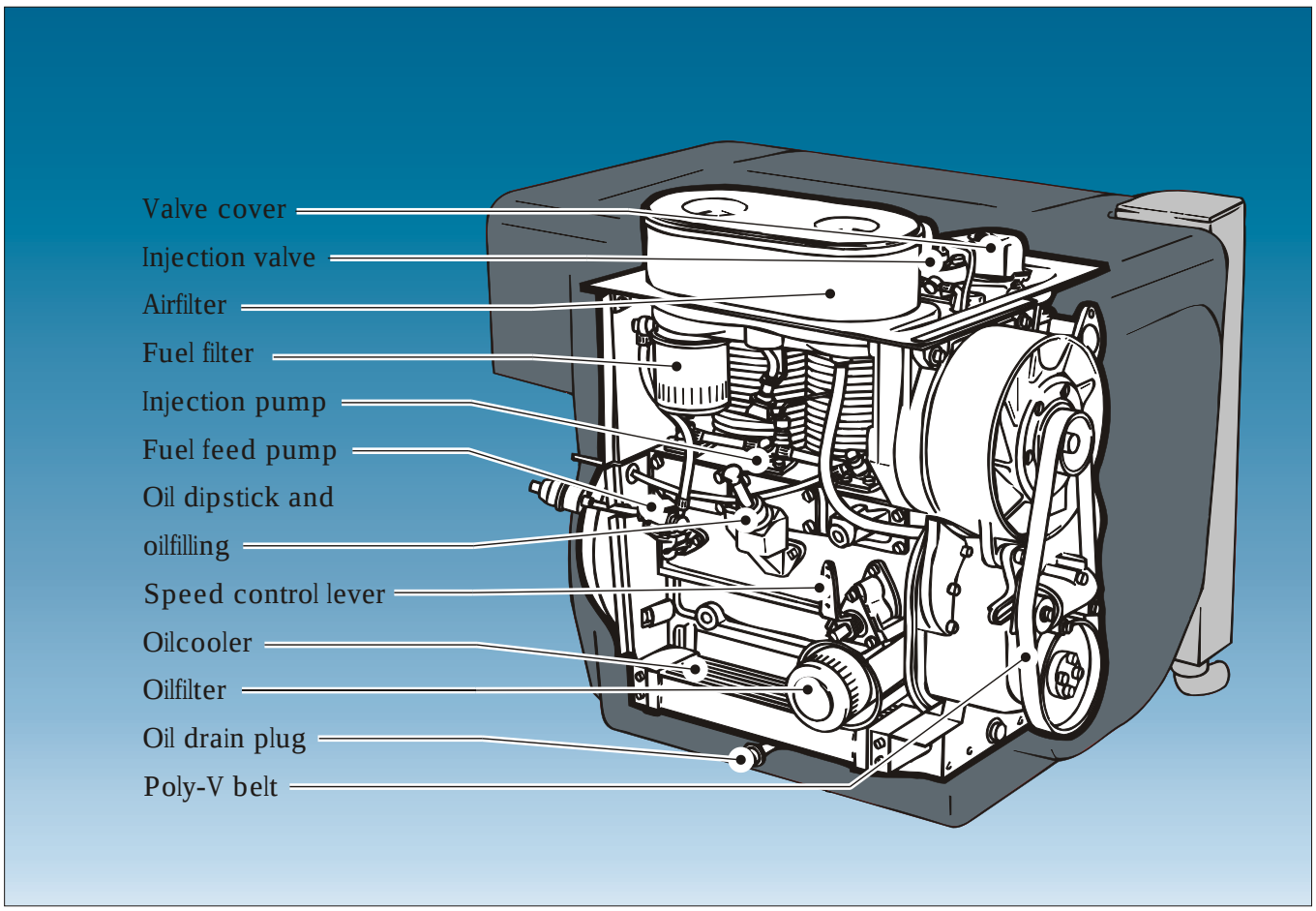
Dry-type air filters are equipped with an indicator which signals in time if maintenance is neccessary.

Well-dimensioned covers allow valve adjustment.

The blower fan and alternator are driven by a durable Poly-V belt.

The capsule allows the same good accessibility for all operating and maintenance work. Adequately dimensioned covers, equipped with quick-release couplings, ensure accessibility.

A characteristic of all HATZ engines is the placement of all operating and maintenance points at one side of the engine only.



Quality and durability

HATZ Diesel engines are built to last. Use of the best possible materials and components, state-of-the art production facilities and uncompromising quality assurance make a product that sets standards in respect of durability and strength.

“Built to last” also means leaving out components that are likely to fail. The engines have an axial-type blower fan.

A delta-pattern drive has been avoided. The alternator also carries of the blower fan. A long-lasting Poly-V belt is used; it is hydraulically tensioned. Service carried out in time ensures durability.

According to experience, maintenance work is only carried out carefully if it requires little time, material and know-how. The common characteristics of all HATZ Diesel engines therefore are: only a few maintenance points with maintenance work kept as simple as possible.

HATZ Diesel engines supervise themselves with an intelligent auto-protection device. If limit values are exceeded or are too low, for example cylinder head temperature too high, oil pressure too low, contamination of air filter or insufficient battery charging, the engine stops auto- matically before any failure occurs.

Last but not least:

HATZ Diesel engines are maintained by HATZ Service worldwide in 107 countries.

HATZ Service means the optimum availability of spare parts, professionally equipped workshops, first-class trained personnel and genuine readiness to serve the customer.