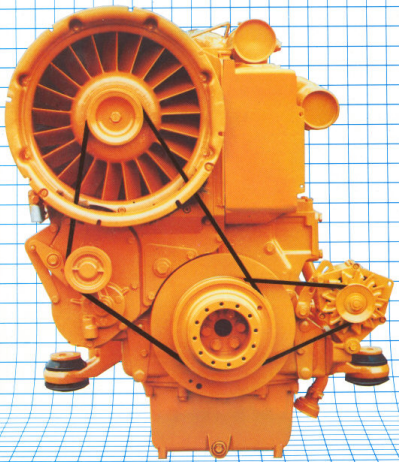
FL 413 FR

KHD DEUTZ



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In-line Engines of the FL 413 F Family

For years Deutz FL 413 F air-cooled diesel engines have been produced in large volumes on modern transfer assembly lines.

These robust engines have shown their power in many different applications under extreme climatic and operating conditions throughout the world, proving their optimum reliability and economy.

The development of the five and six cylinder in-line FL 413 FR engines met design requirements of high performance and narrow width for among other things, wheel loaders, crawler tractors, truck cranes, container lift trucks and stationary applications with cooling air discharge ducting to one side.

The in-line FL 413 FR engines cover a complete range from 64 kW (87 HP) to 141 kW (192 HP) at rated speeds between 1500 and 2500 RPM. All of these engines are built in accordance with the Deutz modular construction design featuring individual cylinders and a high degree of parts interchangeability for V-type and in-line engines. The cylinder units and many optional components are identical for all models of the engine family.

A good power-to-weight ratio, easy-to-maintain cooling system and outstanding operational economy are the highlights of Deutz air-cooling. Deutz air-cooled diesels are also distinguished by their low noise.

For applications that require strict sound emission control, noise reduction measures are comparatively inexpensive to provide on equipment and require a smaller space because of lower cooling air requirements as compared with water-cooled engines. Standard production models of the FL 413 F family are equipped with the fuel-efficient Deutz Direct-Injection System.

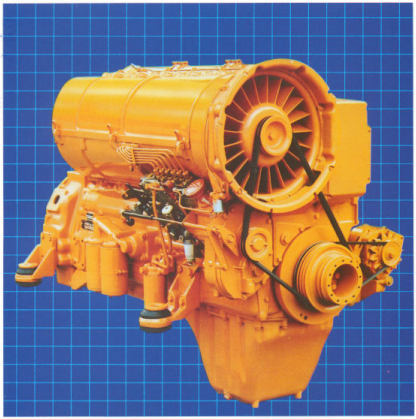
F6L 413 FR on test bench

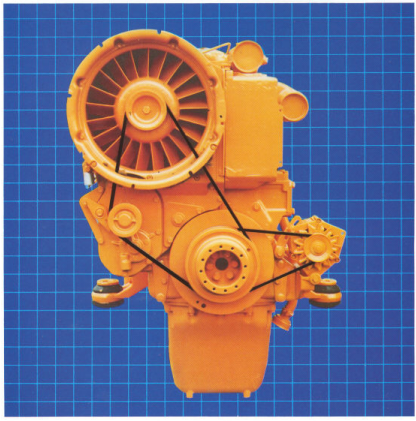
FL 413 FR Design Features

- Cylinder head:
  Individual cylinder heads of aluminium alloy
- Cylinder:
  Individually removable finned cylinders of grey cast-iron
- Valve arrangement:
  overhead type, installed in cylinder head
- Valve drive:
  via tappets and pushrods, by camshaft carried in trimetal bearing in the upper crankcase
- Camshaft drive:
  via helical spur gears at blower end from crankshaft
- Main bearings:
  Crankshaft running in trimetal bearings, including one locating bearing
- Big-end bearings:
  Trimetal plain bearings
- Piston with ring carriers:
  with two compression rings and one oil control ring. Splash oil-cooled.
- Vibration damper on crankshaft
- Engine lubrication:
  Forced-feed lubrication
- Lube oil filter:
  Two disposable full-flow filters
- Air cooling by axial-flow blower driven via double V-belts. Automatic V-belt tensioning device. Break monitoring by signal switch.

Only proven and tested components are used for engine assembly. Ultra-modern manufacturing methods, combined with systematic inspections and bench testing, guarantee the high quality of each engine.

Quality inspection

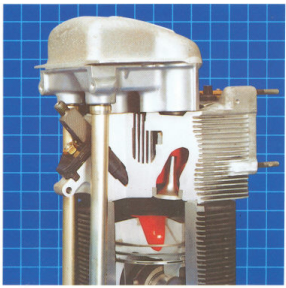




The Combustion Systems of the FL413FR Engines

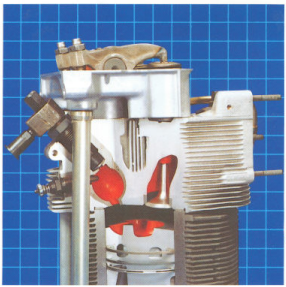
Deutz Direct Injection

Fuel is injected by the well-proven Deutz direct injection system. The combustion chamber has a swirl-type air inlet port, which produces a high-turbulence condition during the intake stroke. This swirling motion of the combustion air is accelerated during the compression stroke due to the deep, inclined piston bowl configuration. A smooth, quiet and efficient combustion process is thus attained, resulting in high performance and economical fuel consumption.



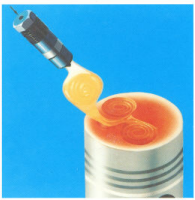
Deutz Two-Stage Combustion®

1st stage (precombustion): Precombustion takes place inside the swirl chamber under high turbulence, high temperature and pressure and rich fuel/air conditions. The rich fuel/air mix hinders the formation of nitric oxide. The hot chamber walls and the high-turbulence condition prevent the formation of odorous substances.



Result:
Reduced concentrations of nitric oxide, carbon monoxide, hydrocarbons, odorous substances, particulate carbon in the diesel exhaust.

2nd stage
(main combustion chamber): Combustion takes place under low pressure and relatively low temperature in the double-swirl cavity of the piston crown. Low temperature and unburnt fuel, combined with combustion products, prevent the further formation of nitric oxide. Excess air and high turbulence ensure complete combustion of carbon monoxide, hydrocarbons and particulate carbon.



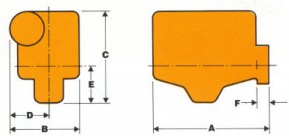
Technical data

Type		F5L413FR	F5L413FRW	F6L413FR	F6L413FRW
Number of cylinders		5	5	6	6
Bore/Stroke	mm	125/130	125/130	125/130	125/130
Piston displacement	l	7.977	7.977	9.572	9.572
Compression ratio		18	19.5	18	19.5
● Maximum rated speed	RPM	2500	2300	2500	2300
related mean piston speed	m/s	10.8	9.96	10.8	9.96
● ISO standard fuel stop power to DIN 6271 (ICFN)[1] at 1500 RPM	kW	64	–	77	–
at 2300 RPM	kW	94	80	112	96
related b.m.e.p.	bar	6.15	5.23	6.11	5.23
● ISO net brake fuel stop power to DIN 6271 (IFN)[1]					
a) intermittent service	kW	103	85	123	102
at speed	RPM	2500	3300	2500	2300
related b.m.e.p.	bar	6.20	5.56	6.17	5.56
b) highly intermittent service	kW	109	–	130	–
at speed	RPM	2500	–	2500	–
related b.m.e.p.	bar	6.56	–	6.52	–
● Automotive power to DIN 70020[1]	kW	118	–	141	–
at speed	RPM	2500	–	2500	–
related b.m.e.p.	bar	7.09	–	7.07	–
● Maximum torque	NM	510	406	613	487
at speed	RPM	1600	1500	1600	1500
● Minimum no-load speed	RPM	600	600	600	600
● Specific fuel consumption at the optimal point	g/kWh	217.5	230	217.5	230
Weight to VDMA, incl. complete cooling system	kg	710	710	790	790

For power for gensets and marine applications: Contact KHD head-office.
[1]) Flywheel net.

Conversion Factors

in.	=	mm x 0.0394
in.^{3}	=	l x 61.02
ft./min	=	m/s x 196.85
HP	=	kW x 1.34
PSI	=	bar x 14.5
lb/ft.	=	NM x 0.737
lb/HPh	=	g/kWh x 0.00165
lb	=	kg x 2.2



* with standard flywheel
** with standard oil pan, central oil sump

Table of dimensions

Engine		A*	B	C**	D	E**	F*	Adapter housing to SAE
F5L413FR	mm	1260	752	1004	387	376	116	1 + 2
F5L413FRW	mm	1260	790	1025	425	376	116	1 + 2
F6L413FR	mm	1425	752	1004	387	376	116	1 + 2
F6L413FRW	mm	1425	790	1025	425	376	116	1 + 2

Subject to alteration due to technical improvements.

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