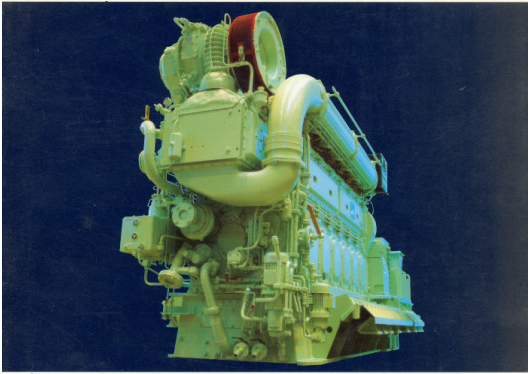
ULSTEIN

ULSTEIN BERGEN K-ENGINE



ULSTEIN BERGEN AS

"Seaborn Pride" – built by Schichau Seebeckwerft AG.

Ulstein Bergen AS has been found to conform to Quality System standard: BS5750: PART 1: ISO 9001, EN29001: 1987.

The Ulstein Bergen K-engine has proven its reliability over many years in world-wide service on fuels ranging from MDO to bunker fuels – thanks to our continuous development efforts. Overhaul periods for todays heavy fuel engines supersede those obtained with MDO only a few years ago.

LOW FUEL AND LUBRICATING OIL CONSUMPTION
The latest generation of turbo-chargers and the most modern fuel injection technology has been utilized to lower the fuel consumption to below 190 g/kWh. The specially developed ring pack maintains lubricating oil consumption at approximately 1.2 g/kWh.

LOW WEAR
Closely controlled metal temperatures and surface treated liners, ring-grooves, crankshaft pins and journals together with plated piston rings and armoured valve seats ensure low wear figures. Resulting in long component life and low spare part expenditure.

GOOD ACCESSIBILITY AND EASY OVERHAUL
Excellent accessibility for all maintenance work. Special tools such as hydraulic tighteners for the main bolt connections further reduce maintenance time.

UNIFORM MACHINERY
Most of the parts are identical for In-line and Vee-type making the K-engine ideally suited for the uniform machinery layout. This arrangement results in considerable advantages to the user.

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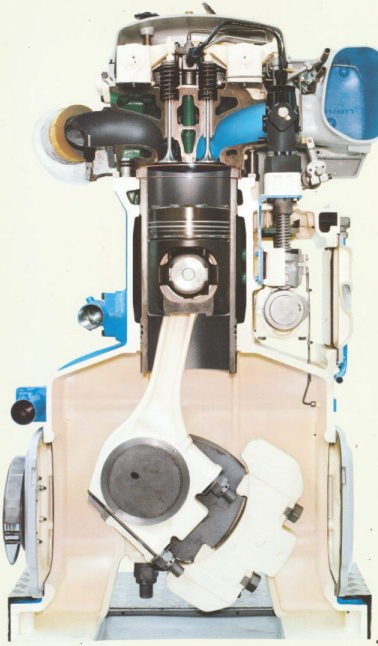
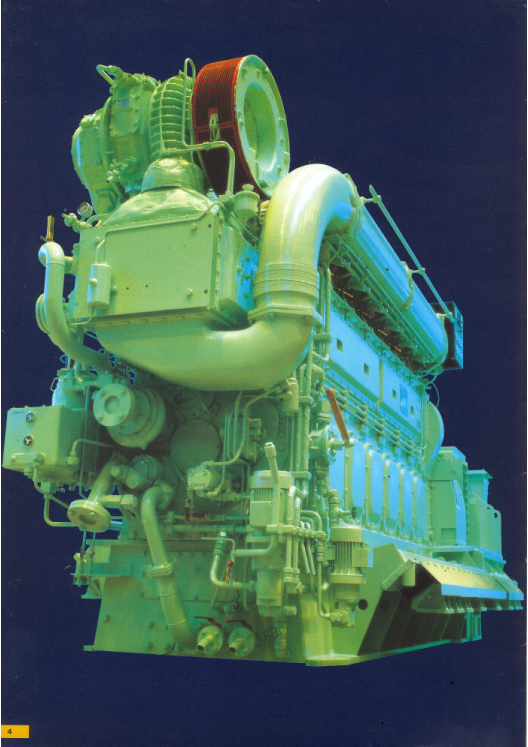
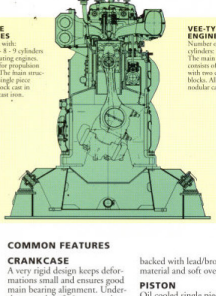
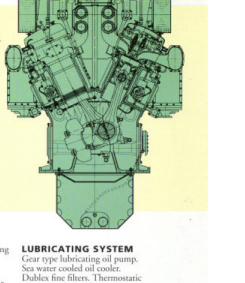




IN-LINE ENGINES
Available with:
3 - 5 - 6 - 8 - 9 cylinders for generating engines.
6 - 8 - 9 for propulsion engines. The main structure is a single piece engine block cast in nodular cast iron.



VEE-TYPE ENGINES
Number of cylinders: 12 - 16 - 18.
The main structure consists of a crankcase with two cylinder blocks. All cast in nodular cast iron.



COMMON FEATURES

CRANKCASE
A very rigid design keeps deformations small and ensures good main bearing alignment. Undershung crankshaft. Large crankcase doors. Crankcase relief valves.

CYLINDER LINER
Centrifugally cast in special wear resistant cast iron. Running surface is bathnitrided and plateau honed for better running in low wear and improved oil control.

CYLINDER HEAD
Double inlet and exhaust valves with armoured seats. Replaceable seat inserts in the cylinder head. The valve gear is lubricated from a separate system with its own pump. Individual rocker covers. Safety and indicator valve accessible from outside.

CRANKSHAFT
Fully forged. Continuous grain flow. Large diameter journals and pins for low bearing loads. Surface hardened journals and pins for low wear. Torsional vibration calculations for each installation.

CONNECTING ROD
Forged in alloy steel. Obliquely split big-end. Hydraulically tightened bolts.

MAIN AND BIG-END BEARINGS
Tri-metal thin walled shells. Steel backed with lead/bronze bearing material and soft overlay.

PISTON
Oil cooled single piece nodular cast iron design. Three compression and one oil control ring, all chromium plated on the running surface. The two upper ring grooves are hardened.

GOVERNOR
Hydraulic or electronic type depending on application.

FUEL INJECTION SYSTEM
Manufactured by L'Orange. Developed for 1500 bar pressure. Max. working pressure 1100 bar. Constant pressure unloading system for cavitation-free operation. Engine-driven feed pump and duplex filter. Double skinned high pressure pipe.

TURBOCHARGING SYSTEM
Impulse system except for 8- and 16-cylinder engines, which are equipped with a special Ulstein Bergen pulse converter system. BBC series 4A turbocharger. Exhaust bellows between every cylinder. Water cleaning of compressor (standard), and turbine (HFO engines). Two-stage charge air-cooler for HFO and special applications.

LUBRICATING SYSTEM
Gear type lubricating oil pump. Sea water cooled oil cooler. Duplex fine filters. Thermostatic valve on oil side. Electric priming pump. (Also manual priming pump for generating engines). Wet sump. (Dry sump option for propulsion engines).

COOLING WATER SYSTEM
Propulsion engines: Engine driven pumps. (Electrically driven pumps are optional).

Generating engines: Separate pumps. (Engine driven pumps are optional).

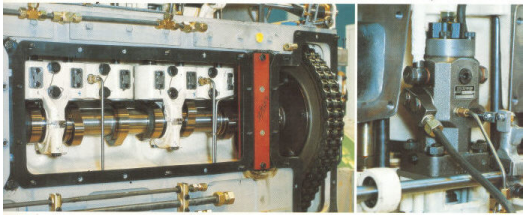
AIR STARTING SYSTEM
Air starting motor for 3- and 5-cylinder engines. For other In-line engines by compressed air to each cylinder in Vee-engines to each cylinder in one bank.

INSTRUMENTS
Temperature and pressure gauges and tachometer are mounted on the engines.

FLEXIBLE MOUNTINGS
(supercritical type).
This includes flexible pipe connections and is standard for generating engines. Can also be supplied for propulsion engines on special request.

Illustration on top, left: In-line generator version for flexible mounting. Illustration on top, right: Vee-type. Propulsion version.

HEAVY FUEL OPERATION REQUIRES SPECIAL DESIGN



INJECTION

High pressure under all speed and load conditions ensures good atomization and combustion.

NO FUEL LEAKAGE TO LUBRICATING OIL SYSTEM

The fuel pump is mounted on a separate base which serves as a deflector/collector of heavy fuel leaking past the fuel plunger. Fuel leakage is drained away and cannot reach lub. oil system.

NO CLOGGING OF FUEL PUMP RACK BY HEAVY FUEL

An Ulstein Bergen developed cleaning/lubricating system keeps the lower pump parts free from heavy fuel residues and lubricates the moving parts. This eliminates the risk of fuel rack sticking problems.

PISTON, RINGS AND LINER

Surface treatment and coatings provide the wear and corrosion resistance necessary to ensure low wear and long overhaul intervals.

EXHAUST VALVE

Nimonic valve head with welded-on hard seat facing provides excellent service on heavy fuel.

FUEL OIL TREATMENT

In addition to centrifugal purification, a two-stage filtering system, as used in the Ulstein Bergen fuel treatment system is required for removal of harmful solid particles, which are not removed by the centrifuge. This system has proven its efficiency over many years, even in exceptional cases where the fuel's catalyst content has been exceptionally high.

TECHNICAL DATA

Type	4 stroke, turbocharged with intercooler
Bore	250 mm
Stroke	300 mm
Engine speed	720/750/825/900/1000 RPM
Brake mean effective pressure	16.2 - 22 bar
Maximum continuous rating	141 - 223 kW/cyl. 192 - 303 BHP/cyl.
No. of cylinders	3 - 5 - 6 - 8 - 9 (In-line) 12 - 16 - 18 (Vee)
Output range	477 - 4010 kW 650 - 5455 BHP

FUEL SPECIFICATIONS

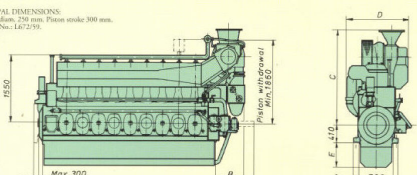
The engine is designed for unrestricted operation on fuels according to BS MA 100 grade M9 or CIMAC 12, specifications as shown.

Operation on fuels with a density of max. 1.010 g/ml is possible if the purification system is designed for handling such fuels.

Viscosity	(cSt/50°C)	700
Density	(g/ml)	0.991
Conradson Carbon	(%mass)	22
Water	(%mass)	1.0
Sulphur	(%mass)	5.0
Ash	(%mass)	0.2
Vanadium	(ppm)	600
Aluminium	(ppm)	30

Illustration on top, left: Camshaft arrangement. Illustration on top, right: Fuel oil pump.

PRINCIPAL DIMENSIONS:
Cylinder diam. 250 mm. Piston stroke 300 mm.
Drawing No.: L67/2/59.



TYPE KRM AND KRMB

All dimensions in mm.

ENGINE TYPE	A	B	C	D	E	Weight dry engine
KRM-6	3010	565	2039	1285	450	12700 kg.
KRMB-6	3010	565	2039	1285	450	12700 kg.
KRM-8	3770	652	2186	1465	550	15000 kg.
KRMB-8	3770	652	2186	1465	550	15000 kg.
KRM-9	4150	652	2186	1435	550	16700 kg.
KRMB-9	4150	652	2186	1435	550	16700 kg.

Dimensions given apply for engines with sump. Dry sump can be supplied upon request.
Front end P.T.O. for 100% load can also be delivered upon request.

TECHNICAL DATA

ENGINE TYPE		KRM-6	KRMB-6	KRM-8	KRMB-8	KRM-9	KRMB-9
Number of cylinders		6	6	8	8	9	9
Engine speed	RPM	750	825	750	825	750	825
Mean piston speed	m/sec.	7.5	8.25	7.5	8.25	7.5	8.25
Max. continuous rating (MCR)*	kW	1215	1335	1620	1780	1820	2005
Max. continuous rating (MCR)*	BHP (metric)	1650	1820	2205	2425	2480	2725
Mean effective pressure (BMEP)	bar	22	22	22	22	22	22
Specific fuel consumption*	g/kWh	194	196	194	196	194	196
Lubricating oil consumption	kg/h	1.5	1.7	1.9	2.3	2.2	2.6
Cooling water temp. engine outlet	°C	85	85	85	85	85	85
Exhaust gas temp. – at cyl. outlet	°C	390	405	390	405	390	405

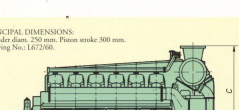
*Engine ratings are according to ISO 3046/1. They also meet conditions of max. 45°C ambient air temperature and max. 32°C sea water temperature. Specific fuel oil consumption is based on MDO with a net calorific value of 42.7 MJ/kg and no engine driven pumps. If engine driven pumps, add 1 g/kWh for each pump.

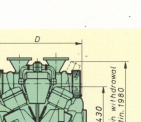
HEAVY FUEL OPERATION:
The engines are designed for operation on Heavy Fuel with viscosity up to 55 cSt. at 100°C. – ISO 8217 RMH55.
Ratings will be decided subject to type of application.

WASTE HEAT RECOVERY:
Necessary data for arranging waste heat recovery plants (exhaust gas and cooling water) are available upon request.

NOTE: Due to continuous development, some data may change.

PRINCIPAL DIMENSIONS:
Cylinder diam. 250 mm. Piston stroke 300 mm.
Drawing No.: L672/60.





TYPE KVM AND KVMB

All dimensions in mm.

ENGINE TYPE	A	B	C	D	Weight dry engine
KVM-12	3676	875	2091	2096	22500 kg.
KVMB-12	3676	875	2091	2096	22500 kg.
KVM-16	4636	875	2186	2414	28000 kg.
KVMB-16	4636	875	2186	2414	28000 kg.
KVM-18	5116	875	2186	2414	30500 kg.
KVMB-18	5116	875	2186	2414	30500 kg.

Dimensions given apply for engines with sump. Dry sump can be supplied upon request.
Front end P.T.O. for 100% load can also be delivered upon request.

TECHNICAL DATA

ENGINE TYPE		KVM-12	KVMB-12	KVM-16	KVMB-16	KVM-18	KVMB-18
Number of cylinders		12	12	16	16	18	18
Engine speed	RPM	750	825	750	825	750	825
Mean piston speed	m/sec.	7.5	8.25	7.5	8.25	7.5	8.25
Max. continuous rating (MCR)*	kW	2430	2675	3240	3565	3645	4010
Max. continuous rating (MCR)*	BHP (metric)	3305	3635	4405	4845	4955	5455
Mean effective pressure (BMEP)	bar	22	22	22	22	22	22
Specific fuel consumption*	g/kWh	192	194	192	194	192	194
Lubricating oil consumption	kg/h	2.9	3.5	3.9	4.6	4.4	5.2
Cooling water temp. engine outlet	°C	85	85	85	85	85	85
Exhaust gas temp. – at cyl. outlet	°C	390	405	390	405	390	405

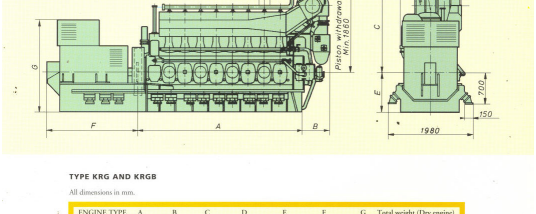
*Engine ratings are according to ISO 3046/1. They also meet conditions of max. 45°C ambient air temperature and max. 32°C sea water temperature. Specific fuel oil consumption is based on MDO with a net calorific value of 42.7 MJ/kg and no engine driven pumps. If engine driven pumps, add 1 g/kWh for each pump.

HEAVY FUEL OPERATION:
The engines are designed for operation on Heavy Fuel with viscosity up to 55 cSt. at 100°C – ISO 8217 RMH55. Ratings will be decided subject to type of application.

WASTE HEAT RECOVERY:
Necessary data for arranging waste heat recovery plants (exhaust gas and cooling water) are available upon request.

NOTE: Due to continuous development, some data may change.

PRINCIPAL DIMENSIONS:
Cylinder diam. 250 mm. Piston stroke 300 mm.
Drawing No.: L672/61.



TYPE KRG AND KRGB

All dimensions in mm.

ENGINE TYPE	A	B	C	D	E	F	G	Total weight (Dry engine)
KRG-3	2006	560	1855	1222	990	1905	1955	14200 kg
KRG-5	2766	615	2039	1285	910	1995	2075	17200 kg
KRG-6	3146	615	2039	1285	910	2085	2145	22450 kg
KRGB-6	3146	615	2039	1285	910	2085	2145	22450 kg
KRG-8	3906	702	2186	1465	910	2245	2145	27600 kg
KRGB-8	3906	702	2186	1465	910	2200	2145	27400 kg
KRG-9	4286	702	2186	1435	910	2245	2145	28500 kg
KRGB-9	4286	702	2186	1435	910	2245	2145	28500 kg

Dimensions given apply for flexible supported engines. Choice of alternator may effect the given dimensions and weights.

TECHNICAL DATA

ENGINE TYPE		KRG-3	KRGB-3	KRG-5	KRG-6	KRGB-6	KRG-8	KRGB-8	KRG-9	KRGB-9
Number of cylinders		3	3	5	6	6	8	8	9	9
Engine speed	RPM	720/750	900	720/750	720/750	900	720/750	900	720/750	900
Mean piston speed	m/sec.	7.2/7.5	9.0	7.2/7.5	7.2/7.5	9.0	7.2/7.5	9.0	7.2/7.5	9.0
Max. contin. rating,engine*	kW	585/605	665	885/920	1165/1215	1325	1555/1620	1765	1750/1820	1990
Max. contin. rating, altern. (Ø=0.9*)	kW	555/575	630	840/875	1110/1155	1260	1475/1540	1680	1660/1730	1890
Max. contin. rating, altern. (cos ø=0.8)kVA		690/720	790	1050/1095	1385/1445	1575	1843/1925	2100	2075/2165	2360
Mean effective pressure (BMEP)	bar	22	20	20	22	20	22	20	22	20
Specific fuel consumption*	g/kWh	197	199	194	194	196	194	196	194	196
Lubricating oil consumption	kg/h	0.6/0.7	0.9	0.9/1.0	1.3/1.5	1.7	1.7/1.9	2.3	1.9/2.2	2.6
Cooling water temp. engine outlet	°C	85	85	85	85	85	85	85	85	85
Exhaust gas temp. – at cylinder outlet	°C	390	420	420	390	420	390	420	390	420

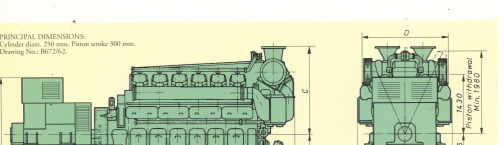
*Engine ratings are according to ISO 3046/1. They also meet conditions of max. 45°C ambient air temperature and max. 32°C sea water temperature. Specific fuel oil consumption is based on MDO with a net calorific value of 42.7 MJ/kg and no engine driven pumps. If engine driven pumps, add 1 g/kWh for each pump

HEAVY FUEL OPERATION:
The engines are designed for operation on Heavy Fuel with viscosity up to 55 cSt. at 100° C – ISO 8217 RMH55. Ratings will be decided subject to type of application.

WASTE HEAT RECOVERY:
Necessary data for arranging waste heat recovery plants (exhaust gas and cooling water) are available upon request.

NOTE: Due to continuous development, some data may change.

PRINCIPAL DIMENSIONS:
Cylinder diam. 250 mm. Piston stroke 300 mm.
Drawing No.: B672/62.



TYPE KVG AND KVGB

All dimensions in mm.

ENGINE TYPE	A	B	C	D	E	F	G	Total weight (Dry engine)
KVG-12	3862	875	2091	2096	980	2155	2455	35200 kg.
KVGB-12	3862	875	2091	2096	980	2200	2355	35600 kg.
KVG-16	4822	875	2186	2414	980	2347	2570	46700 kg.
KVGB-16	4822	875	2186	2414	980	2839	2320	45900 kg.
KVG-18	5302	875	2186	2414	1200	2427	2790	52100 kg.
KVGB-18	5302	875	2186	2414	1200	2919	2540	50900 kg.

Dimensions given apply for flexible supported engines. Choice of alternator may effect the given dimensions and weights.

TECHNICAL DATA

ENGINE TYPE			KVG-12	KVGB-12	KVG-16	KVGB-16	KVG-18	KVGB-18
Number of cylinders			12	12	16	16	18	18
Engine speed		RPM	720/750	900	720/750	900	720/750	900
Mean piston speed		m/sec.	7.2/7.5	9.0	7.2/7.5	9.0	7.2/7.5	9.0
Max. continuous rating, engine*		kW	2335/2430	2650	3130/3240	3535	3500/3645	3975
Max. continuous rating, altern. (P.f=0.95)		kW	2215/2310	2520	2955/3080	3360	3325/3460	3775
Max. continuous rating, altern. (cos φ=0.8)		kVA	2770/2885	3150	3695/3845	4195	4155/4330	4720
Mean effective pressure (BMEP)		bar	22	20	22	20	22	20
Specific fuel consumption*		g/kWh	192	194	192	194	192	194
Lubricating oil consumption		kg/h	2.6/2.9	3.4	3.4/3.9	4.6	3.9/4.4	5.2
Cooling water temp. engine outlet		°C	85	85	85	85	85	85
Exhaust gas temp. – at cylinder outlet		°C	390	420	390	420	390	420

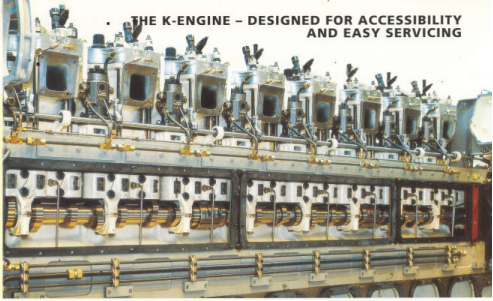
*Engine ratings are according to ISO 3046/1. They also meet conditions of max. 45°C ambient air temperature and max. 32°C sea water temperature. Specific fuel oil consumption is based on MDO with a net calorific value of 42.7 MJ/kg and no engine driven pumps. If engine driven pumps, add 1 g/kWh for each pump.

HEAVY FUEL OPERATION:
The engines are designed for operation on Heavy Fuel with viscosity up to 55 cSt. at 100° C – ISO 8217 RMH55.
Ratings will be decided subject to type of application.

WASTE HEAT RECOVERY:
Necessary data for arranging waste heat recovery plants (exhaust gas and cooling water) are available upon request.

NOTE: Due to continuous development, some data may change.

THE K-ENGINE – DESIGNED FOR ACCESSIBILITY AND EASY SERVICING



CAMSHAFT
Can be fitted out sideways in sections for repair. The shrunk-on cams can be individually changed if necessary.

CRANKCASE
Large crankcase doors and hydraulic tools for big-end and main bearing bolts.

CYLINDER HEAD
Cylinder head with slanted inlet and outlet flanges. Hydraulic tools for cylinder head nuts. After loosening the few, easily accessible nuts and fittings, the head can be lifted with gaskets in place. Refitting is just as easy.

Crankcase.

Cylinder head.

REFERENCES

1. *"Hilda Knutsen" – 2xKRG-6.*
Yard: AESA Juliana.
Product carrier.

2. *"Seabourn Pride" – 2xKVMB-12, 2xKRMB-8, 2xKRG-8, 1xKRG-6.*
Yard: Schichau Seebeckwerft AG.
Cruise vessel.

3. *"Polar Pioneer" – 5xKVG-18.*
Yard: Hitachi Zosen.
Semi-submersible drilling rig.

ULSTEIN BERGEN AS

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