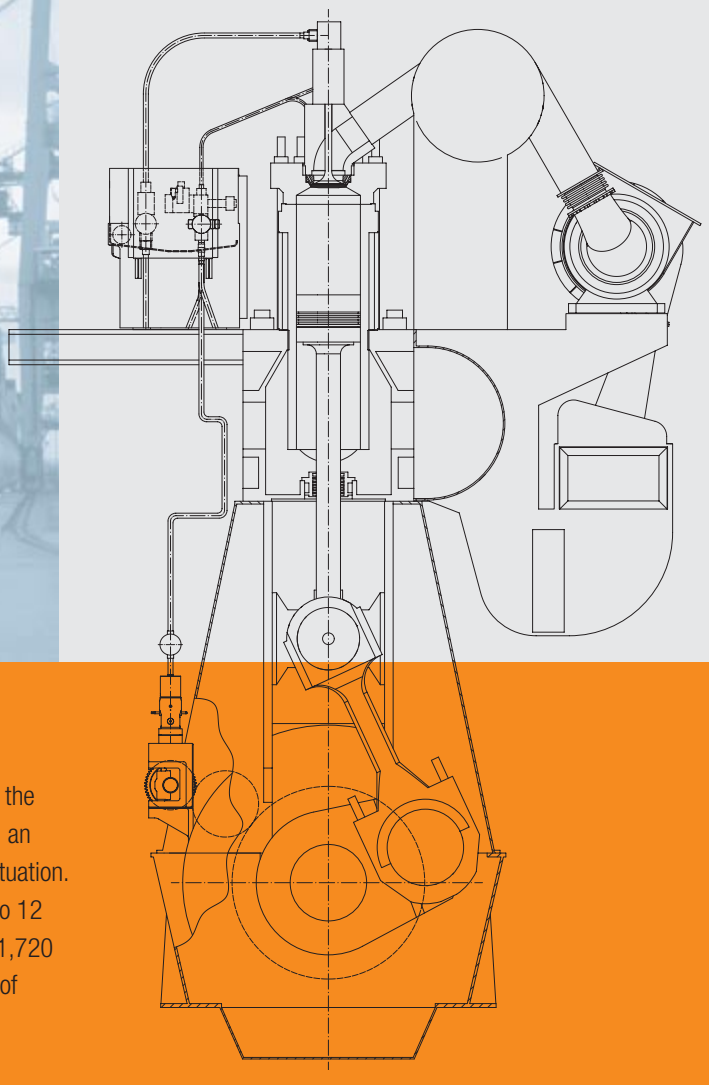
WÄRTSILÄ **RT-flex**



WÄRTSILÄ RT-FLEX82C

The Wärtsilä RT-flex82C is a low-speed two-stroke marine diesel engine of the crosshead type with uniflow scavenging. It is designed from the outset with an electronically-controlled common-rail system for fuel injection and valve actuation.

Of 820 mm cylinder bore by 2646 mm piston stroke, it is built with six to 12 cylinders in-line, providing maximum continuous power outputs between 21,720 and 54,240 kW at 87 to 102 rpm. It is thus highly suited to the propulsion of panamax containerships with capacities up to about 4500 TEU.

The key benefits of the Wärtsilä RT-flex82C are:

- Optimum fit to ship, with extended layout flexibility
- High reliability
- Three years' operation between overhauls
- Economical fuel consumption over the whole operating range
- Low cylinder oil consumption
- Low ancillary power requirements
- Low exhaust gas emissions
- Capable of extremely low, stable running speeds.

EXTENDED LAYOUT FIELD

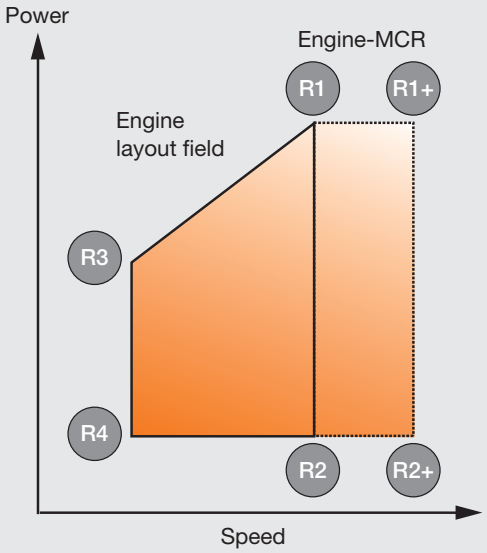
For the RT-flex82C, the layout field, as defined in other Wärtsilä low-speed engines by the power/speed rating points R1, R2, R3 and R4, is extended to higher speeds defined by the additional points R1+ and R2+ (see chart overleaf). Any power and speed within the engine layout field may be selected as the Contract-MCR (CMCR) point for an engine. This extension to the usual layout field gives greater flexibility in the selection of engine speed to obtain the optimum fit to ship and propeller requirements and best installation economy.

WÄRTSILÄ RT-FLEX COMMON-RAIL SYSTEM

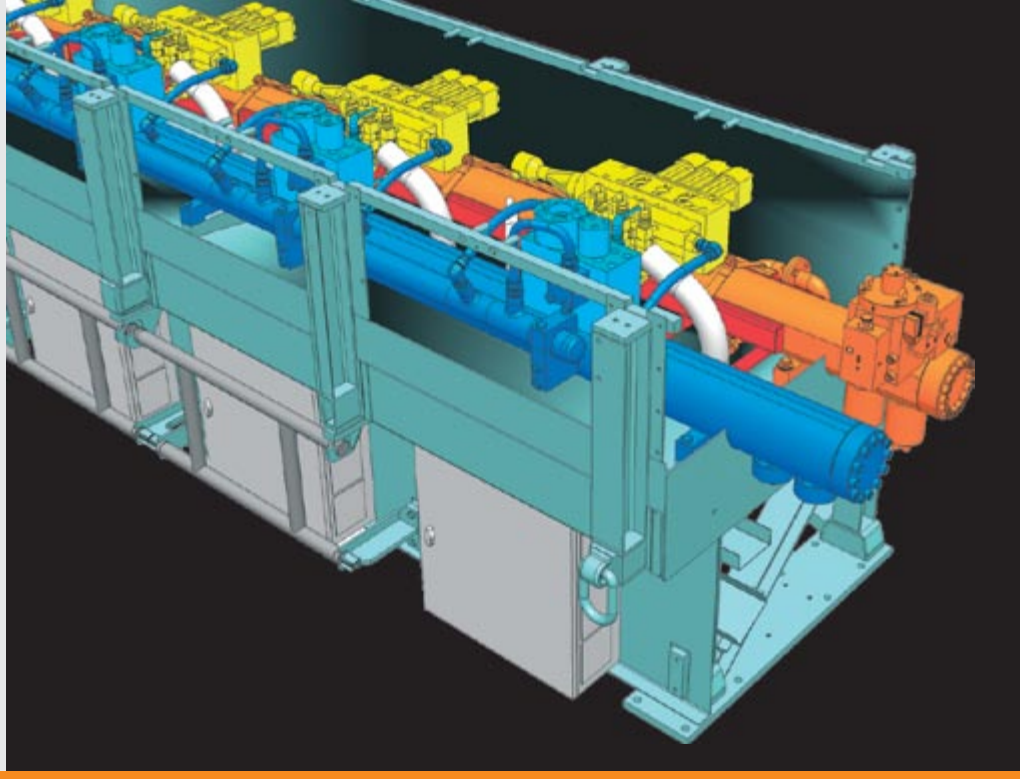
Instead of the usual mechanically-controlled fuel injection pumps and exhaust valve drives of Wärtsilä RTA engines, the RT-flex82C has an electronically-controlled common-rail system in which fuel oil and servo oil are delivered at regulated pressures to rail pipes arranged in a rail unit along the side of the cylinders. Heated fuel oil is delivered, ready for injection, at pressures up to 1000 bar. Servo oil is drawn from the engine lubrication system through an automatic self-cleaning fine filter and delivered at pressures up to 200 bar.

Fuel injection and exhaust valve operation are controlled by individual control units for

WÄRTSILÄ



Extended layout field for RT-flex82C. The contract maximum continuous rating may be selected at any power/speed rating within the defined field.



RT-flex82C rail unit with the injection control units mounted on the fuel oil rail (orange), and the exhaust valve actuators on the servo oil rail (blue).

each cylinder. The control units are directly mounted on the single-piece rail pipes and are controlled using servo oil through Wärtsilä electro-hydraulic rail valves.

Fuel oil and servo oil are supplied to the common-rail system from the very compact supply unit mounted on the side of the engine at the after end. The supply unit is driven through gearing from the crankshaft and is equipped with a number of fuel supply pumps, the number of pumps depending upon the number of engine cylinders and power output. The fuel supply pumps make several strokes during each crankshaft revolution owing to the drive gear ratio. Fuel delivery volume and rail pressure are regulated through suction control of the fuel supply pumps. The servo oil pumps are also incorporated in the supply unit.

All RT-flex functions are governed by the Wärtsilä Engine Control System (WECS) which triggers the electro-hydraulic rail valves for the respective functions. The master input comes from the crank angle sensor which delivers the absolute crank position. WECS communicates directly with the ship's machinery control system.

Reliability and safety have had the utmost priority in the RT-flex system. There is also extensive duplication in the system for redundancy, in the supply pumps, main delivery pipes, crank angle sensors, electronic control units, etc.

FUEL CONSUMPTION FLEXIBILITY

By allowing injection pressures and timing to be optimised at all loads, RT-flex engines have lower fuel consumption at part loads compared with conventional camshaft-type engines. Advantage has been taken of the complete flexibility in fuel injection and valve operation allowed by the common-rail system to offer, through Delta Tuning, even lower specific fuel consumption at less than 90% load.

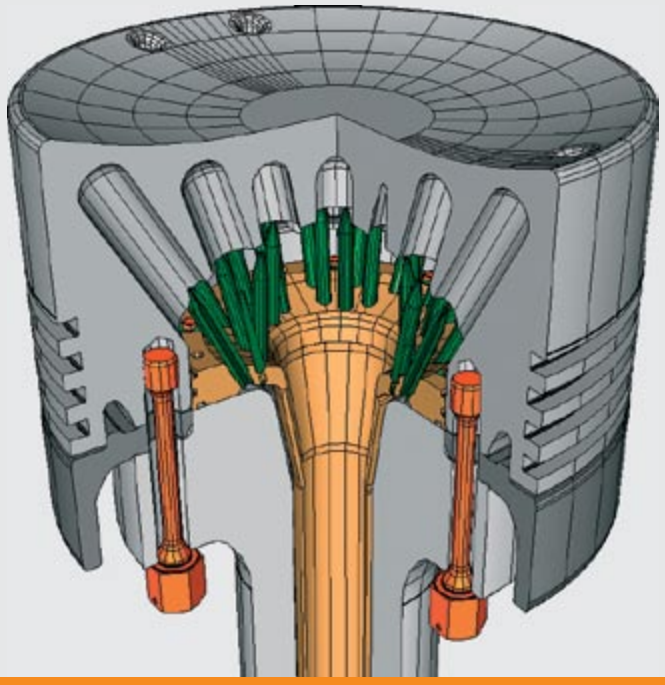
ENVIRONMENTAL COMPLIANCE

The RT-flex system gives important benefits in environmental compliance. The most obvious is the smokeless operation of RT-flex engines at all engine speeds. The flexibility of the RT-flex system facilitates the ready compliance of the engines with the NO_X regulation of Annex VI of the MARPOL 73/78 convention.

VERY SLOW RUNNING

RT-flex engines are able to run very stably at very low speeds, slower than camshaft-type engines. They can run without smoking at 10-12% nominal speed. This is made possible by precise control of injection, optimised injection

Cylinder cover assembly.



Piston with jet-shaker oil cooling for optimum temperatures and their distribution across the piston crown.

Operating principle of the Wärtsilä Pulse Lubrication System with multiple jets of cylinder lubricating oil from each of a number of quills arranged around the cylinder liner ensuring optimum distribution of cylinder lubricating oil.

pressures, optimised valve timing, and shutting off individual injectors at low speeds.

RIGID STRUCTURE

The Wärtsilä RT-flex82C has a well-proven type of structure based on existing Wärtsilä low-speed engine types. The double-walled bedplate is surmounted by a fabricated monobloc column and a cast-iron monobloc cylinder block, all secured by pre-tensioned vertical tie rods. The whole structure is very sturdy with low stresses and high stiffness.

The tilting-pad thrust bearing is integrated in the bedplate. The gear drive for the supply unit allows a very compact and thus stiff thrust bearing in a closed, rigid housing.

RUNNING GEAR

The RT-flex82C has a semi-built crankshaft. The main, bottom-end and crosshead bearings all have running surfaces of white metal on steel shells.

The crosshead has a full-width lower half bearing. The crosshead pin is of a uniform diameter and the two guide shoes are single steel castings with white metal-lined running surfaces.

The piston rod gland is of a proven design with highly-effective dirt scraping action in the top part and system oil scraping ability in the lower part. System oil losses are minimised as there is a complete internal recirculation of scraped-off oil back to the crankcase.

BORE-COOLED CYLINDER COVER

The bore-cooled cylinder cover is secured by eight elastic studs. It has a single, central exhaust valve housed in a bolted-on valve cage. There are three fuel injection valves, each separately supplied and controlled from the common-rail system.

The piston comprises a forged steel crown with a very short skirt. It has combined jet-shaker oil cooling and is equipped with four piston rings of the same thickness.

PISTON-RUNNING BEHAVIOUR

The RT-flex82C uses proven design features for excellent piston-running behaviour and long times between overhauls.

The cylinder liner is given a physically good running surface by careful machining and full plateau honing. The piston rings all have a chromium-ceramic coating and the piston ring grooves are chromium plated. An anti-polishing ring is fitted to prevent the build up of carbon deposits on the piston crown.

Surface temperatures of the cylinder liners are optimised to ensure that the engines are insensitive to fuel sulphur levels.

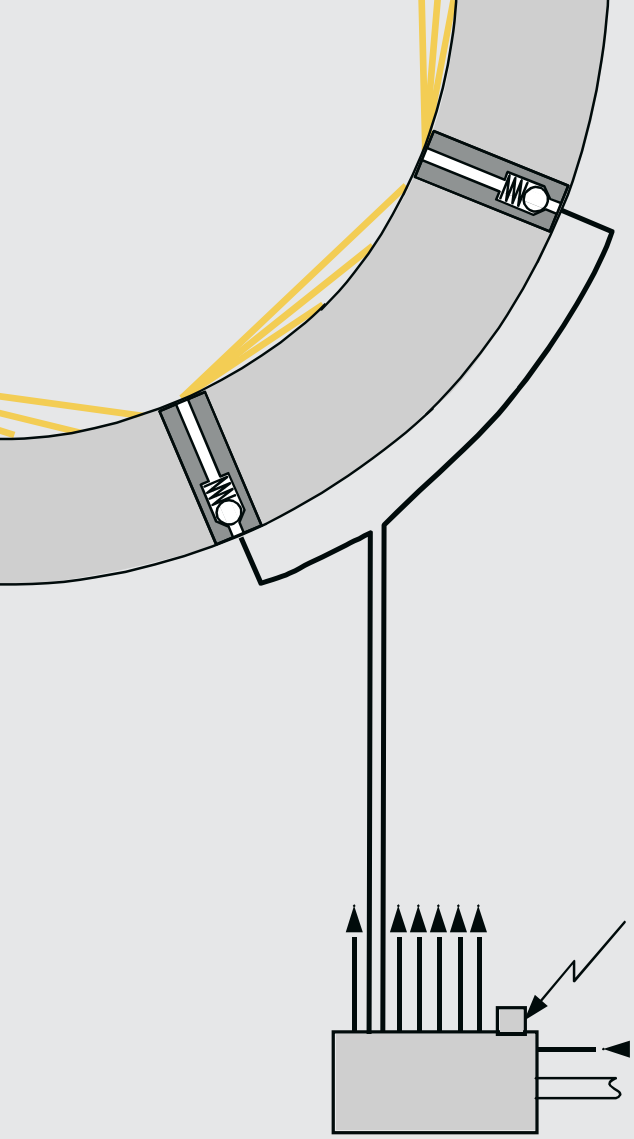
Cylinder lubrication is provided by the Wärtsilä Pulse Lubrication System which enables much lower lubricating oil feed rates than with previous systems while improving the distribution of cylinder lubricating oil on the running surface of the cylinder liner.

The Pulse Lubricating System features precise, electronic control of feed rate and timing with full flexibility in settings. It involves the spraying of cylinder lubricating oil as jets on to the liner surface from a single row of quills arranged around the liner, each quill having a number of nozzle holes. The oil jets are individually directed to separate, evenly distributed points on the liner surface. There is no atomisation and no loss of lubricating oil to the scavenge air. The quills are reliable, simple non-return valves.

TURBOCHARGING AND SCAVENGING

Scavenge air is delivered by a constant-pressure turbocharging system with one or more high-efficiency exhaust gas turbochargers. For starting and during slow running, the air delivery is augmented by two electrically-driven auxiliary blowers.

The scavenge air receiver is of simplified design with horizontally-arranged cooler and the auxiliary blowers. Special attention has been given to removing water condensate before the



Schematic of the Pulse Lubrication System. There is a lubricating module for each cylinder, delivering timed, metered quantities of cylinder oil to the quills in the respective cylinder.

air enters the cylinder. The high-efficiency water separator is provided with ample drainage. Compact coolers are employed to minimise the width of the engine.

INSTALLATION ASPECTS

Careful attention has been given to facilitating installation of the engine in the ship. The seating involves a modest number of holding-down bolts and side stoppers, and there are no end stoppers, thrust brackets or fitted bolts. Thrust transmission is by thrust sleeves on a number of holding-down bolts. All ancillaries and their arrangement are optimised to reduce installation time and operating costs, with minimum electrical requirements.

Wärtsilä Switzerland Ltd
P.O. Box 414, CH-8401 Winterthur, Switzerland
● Tel. +41 52 262 49 22 ● Fax +41 52 262 07 18

WARTSILA.COM

WÄRTSILÄ RT-flex

MAIN DATA WÄRTSILÄ RT-FLEX82C

Cylinder bore	820 mm
Piston stroke	2646 mm
Speed	87–102 rpm
Mean effective pressure at R1/R1+	20.0/19.0 bar
Piston speed at R1/R1+	8.6/9.0 m/s
Fuel specification:	
Fuel oil	730 cSt/50°C 7200 sR1/100°F ISO 8217, category ISO-F-RMK 55

RATED POWER: PROPULSION ENGINES

Cyl.	Output in kW/bhp at							
	102 rpm				87 rpm			
	R1+		R2+		R3		R4	
	kW	bhp	kW	bhp	kW	bhp	kW	bhp
6	27 120	36 900	21 720	29 520	24 300	33 060	21 720	29 520
7	31 640	43 050	25 340	34 440	28 350	38 570	25 340	34 440
8	36 160	49 200	28 960	39 360	32 400	44 080	28 960	39 360
9	40 680	55 350	32 580	44 280	36 450	49 590	32 580	44 280
10	45 200	61 500	36 200	49 200	40 500	55 100	36 200	49 200
11	49 720	67 650	39 820	54 120	44 550	60 610	39 820	54 120
12	54 240	73 800	43 440	59 040	48 600	66 120	43 440	59 040

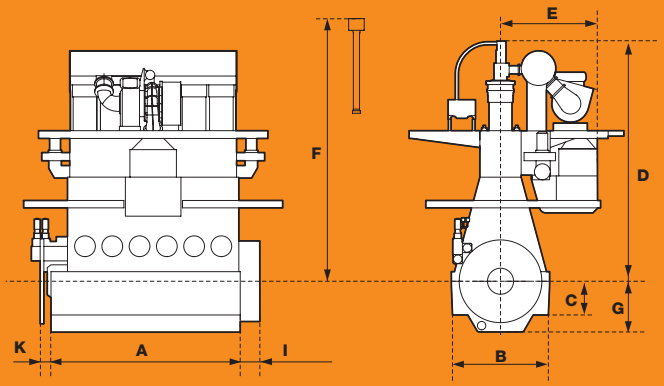
BRAKE SPECIFIC FUEL CONSUMPTION (BSFC)

	g/kWh	g/bhph	g/kWh	g/bhph	g/kWh	g/bhph	g/kWh	g/bhph
Load 100%	169	124	165	121	171	126	167	123
BMEP, bar	19.0		15.2		20.0		17.9	

PRINCIPAL ENGINE DIMENSIONS (MM) AND WEIGHTS (TONNES)

Cyl.	A	B	C	D	F*	G	I	K	Weight
6	10 415	4 550	1 640	11 170	13 100	2 260	850	765	800
7	11 920	4 550	1 640	11 170	13 100	2 260	850	765	910
8	14 425	4 550	1 640	11 170	13 100	2 260	850	765	1 030
9	15 930	4 550	1 640	11 170	13 100	2 260	850	765	1 130
10	17 435	4 550	1 640	11 170	13 100	2 260	850	765	1 230
11	18 940	4 550	1 640	11 170	13 100	2 260	850	765	1 340
12	20 445	4 550	1 640	11 170	13 100	2 260	850	765	1 440

* Standard piston dismantling height, can be reduced with tilted piston withdrawal.



WÄRTSILÄ