General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in³	12,78 779,7
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	131 5,16
Stroke	mm in	158 6,22
Compression ratio		16,7
Compression pressure at 240 rpm	MPa psi	N/A
Max. static forward inclination:	°	0
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	5
Max. intermittent backward inclination while running:	°	17
Max. intermittent side inclination while running:	°	30
Idling speed	rpm	600 + 50
Rated speed R5	rpm	2300
	rpm	
	rpm	
Propeller selection range R5 (recommended)	rpm	2250-2350
	rpm	
	rpm	
Dry weight engine BT	kg lb	1560 3439
	kg lb	
	kg lb	
	kg lb	
	kg lb	

Performance	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Crankshaft power 1), 5)	5	kW	84	250	345	379	449	519	615	659	662	662
		hp	114	340	469	515	611	706	836	896	900	900
		kW										
		hp										
		kW										
		hp										
Propeller shaft power 1) (At full load) With drive IPS	5	kW	77	234	324	356	422	488	579	621	624	624
		hp	105	319	441	484	574	664	788	844	848	848
		kW										
		hp										
		kW										
		hp										
Propellershaft power at prop. load $x^{2,5}$ With drive IPS	5	kW	22	44	78	99	150	214	338	440	497	624
		hp	29	61	106	134	204	291	460	598	676	848
		kW										
		hp										
		kW										
		hp										
Propellershaft power at prop. load x^3 With drive IPS	5	kW	11	26	51	68	113	173	299	410	475	624
		hp	15	36	70	93	153	235	407	558	646	848
		kW										
		hp										
		kW										
		hp										
Torque at crankshaft 2)	5	Nm	1337	2984	3295	3290	3298	3304	3263	3146	3010	2749
		lbf ft	986	2201	2430	2427	2433	2437	2406	2321	2220	2027
		Nm										
		lbf ft										
		Nm										
		lbf ft										
Mean piston speed		m/s	3,2	4,2	5,3	5,8	6,8	7,9	9,5	10,5	11,1	12,1
		ft/s	10,4	13,8	17,3	19,0	22,5	25,9	31,1	34,6	36,3	39,7
Effective mean pressure 2)	5	MPa	1,31	2,93	3,24	3,24	3,24	3,25	3,21	3,09	2,96	2,70
		psi	190,7	425,7	469,9	469,3	470,5	471,3	465,4	448,8	429,4	392,1
		MPa										
		psi										
		MPa										
		psi										
Max combustion pressure 2)	5	MPa	13,5	19,8	19,5	19,4	19,4	19,2	18,8	18	17,6	16,9
		psi	1958	2872	2828	2814	2814	2785	2727	2611	2553	2451
		MPa										
		psi										
		MPa										
		psi										

Lubricating system

Specific lubricating oil consumption.	g/kWh	0,05
Max. oil volume including filters for all allowed installation inclinations:	litres	45
	US gal	11,89
Max. oil volume excluding filters for all allowed installation inclinations:	litres	40
	US gal	10,57
Min. oil volume excluding filters for all allowed installation inclinations:	litres	32
	US gal	8,45

Fuel system	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Specific fuel consumption 2)	5	g/kWh	248	209	198	197	199	200	204	207	207	208
		lb/hph	0,401	0,338	0,32	0,319	0,322	0,324	0,33	0,335	0,335	0,338
		g/kWh										
		lb/hph										
		g/kWh										
		lb/hph										
Fuel consumption, Test cycle E5	5	g/kWh	208,2									
		lb/hph	0,34									
		g/kWh										
		lb/hph										
		g/kWh										
		lb/hph										
Fuel consumption at prop. load x [2,5]	5	l/h	6,6	12,7	20,8	25,8	37,9	53,9	85,8	112,9	128,5	165,4
		US gal/h	1,8	3,3	5,5	6,8	10,0	14,2	22,7	29,8	33,9	43,7
		l/h										
		US gal/h										
		l/h										
		US gal/h										

Fuel system	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Fuel consumption at prop. load x [3]	5	l/h	4,1	8,1	14,6	18,9	29,6	44,9	77,0	105,9	123,3	165,4
		US gal/h	1,1	2,2	3,9	5,0	7,8	11,9	20,3	28,0	32,6	43,7
		l/h										
		US gal/h										
		l/h										
		US gal/h										
Fuel consumption at full load	5	l/h	24,9	62,4	81,7	89,4	106,8	124,1	149,9	163,0	163,6	165,1
		US gal/h	6,6	16,5	21,6	23,6	28,2	32,8	39,6	43,0	43,2	43,6
		l/h										
		US gal/h										
		l/h										
		US gal/h										

Intake and exhaust system	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Specific exhaust heating effect in percent of crankshaft power	5	%	59	62	60	62	66	68	72	74	73	73
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	5	°C	460	487	451	461	488	493	510	513	495	474
		°F	860	909	844	862	910	919	950	955	923	885
		°C										
		°F										
		°C										
		°F										
Permitted back pressure in the exhaust line at rated speed. (Installed back pressure)		kPa							Max	15		
		psi								2,2		
		kPa							Min			
		psi										

Intake and exhaust system	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA and relative humidity 30%.	5	m³/min	4,8	14,3	21,1	23,4	27,8	32,6	39,4	43,2	44,9	47,4
		cu.ft./min	168,9	505	745,1	825,2	980	1152	1390	1525	1585	1674
		m³/min										
		cu.ft./min										
		m³/min										
		cu.ft./min										
Charge air pressure Inlet manifold	5	kPa	42	216	282	287	292	313	329	334	336	333
		psi	6,1	31,3	40,9	41,6	42,4	45,4	47,7	48,4	48,7	48,3
		kPa										
		psi										
		kPa										
		psi										
Exhaust gas flow	5	m³/min	13,0	39,2	54,2	60,6	73,5	85,6	102,9	111,1	112,7	115,0
		cu.ft./min	459,7	1384	1913	2139	2594	3022	3633	3922	3981	4062
		m³/min										
		cu.ft./min										
		m³/min										
		cu.ft./min										

Cooling system	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Radiated heat in percent of crankshaft power.	5	%	8	7	7	7	7	7	7	7	7	7
Heat rejection to charge air cooler in percent of crankshaft power.	5	%	5	16	19	19	19	20	23	23	24	26
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, in percent of crankshaft power.	5	%	77	57	47	45	44	43	42	42	42	43
Coolant flow with fully open thermostat and std cooling system		l/min	90	150	252	282	335	380	480	516	528	600
		cu.ft./min	3,2	5,3	8,9	10,0	11,8	13,4	17,0	18,2	18,6	21,2
Extra water pump flow through charge air cooler		l/min	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		cu.ft./min										
Max. pump pressure at extra pump pressure side (pressure set system)		kPa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		psi										
Max. permissible temperature on coolant in engine outlet		°C	98									
		°F	208									
Coolant volume engine, including heat exchanger and charge air cooler		litres	57									
		US gal.	15,06									
Max. additional coolant for cabin heater etc. with std. Expansion tank		litres	15									
		US gal.	3,96									
Maximum coolant flow to cabin heater etc.		l/min	40									
		cu.ft./min	1,41									
Thermostat, start open at		°C	82									
		°F	180									
Thermostat, fully open at		°C	92									
		°F	198									

Raw water circuit	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Nominal raw water design flow	l/min cu.ft/min	190 6,7	230 8,1	270 9,5	290 10,2	342 12,1	387 13,7	430 15,2	438 15,5	428 15,1	415 14,7
Nominal raw water pump pressure head at design flow. (measured before and after pump)	kPa psi	18 2,6	30 4,4	45 6,5	65 9,4	84 12,2	104 15,1	123 17,8	123 17,8	120 17,4	113 16,4
Maximum raw water pump suction head	kPa psi	30 4,4									
Maximum additional pressure drop excl. reverse gear oil cooler	kPa psi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pressure drop over reverse gear oil cooler (optional equipment)	kPa psi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maximum raw water temperature entering heat exchanger	°C °F	30 86									

1 circuit keel cooling system	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Design point for keel cooler, engine outlet temperature	°C °F										
Maximum temperature to engine from external cooling system circuit	°C °F										
Maximum temperature to charge air cooler from external cooling system circuit	°C °F										
Coolant flow through keel cooler at design point	l/min cu.ft./min										
Maximum coolant flow through keel cooler	l/min cu.ft./min										
Pressure drop in external circuit, including piping	kPa psi										
Coolant volume engine, excl. heat exchangers	litres US gal.										

1 1/2 circuit keel cooling system (Two circuit system with one keel cooler)	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Design point for keel cooler, engine outlet temperature	°C °F										
Maximum temperature to charge air cooler from external cooling system circuit	°C °F										
Coolant flow through keel cooler at design point	l/min cu.ft./min										
Maximum coolant flow through keel cooler	l/min cu.ft./min										
Pressure drop in external circuit, including piping	kPa psi										
Coolant volume engine, excl. heat exchangers	litres US gal.										

2 circuit keel cooling system, LT	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Maximum temperature to charge air cooler from external LT-cooling system circuit	5	°C °F										
		°C °F										
		°C °F										
Coolant flow through keel cooler, LT-cooling system circuit	5	l/min cu.ft./min										
		l/min cu.ft./min										
		l/min cu.ft./min										
Pressure drop in external LT-cooling system circuit, including piping		kPa psi										
Coolant volume charge air cooler		litres US gal.										

2 circuit keel cooling system, HT	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Design point for keel cooler, engine outlet temperature	5	°C °F										
		°C °F										
		°C °F										
Maximum temperature to engine from external HT-cooling system circuit	5	°C °F										
		°C °F										
		°C °F										
Coolant flow through keel cooler, HT-cooling system circuit at design point	5	l/min cu.ft./min										
		l/min cu.ft./min										
		l/min cu.ft./min										
Maximun coolant flow through keel cooler, HT-cooling system circuit	5	l/min cu.ft./min										
		l/min cu.ft./min										
		l/min cu.ft./min										
Pressure drop in external HT-cooling system circuit, including piping		kPa psi										
Coolant volume engine, excl. heat exchangers		litres US gal.										

Emissions	Rating	rpm	600	800	1000	1100	1300	1500	1800	2000	2100	2300
Smoke at prop. load $x^{2,5}$	5	*BSU	0,1	0,2	0,4	0,5	0,5	0,3	0,3	0,4	0,3	0,4
		*BSU										
		*BSU										
Smoke at prop. load x^{3}	5	*BSU	0,0	0,1	0,3	0,6	0,6	0,3	0,3	0,4	0,3	0,4
		*BSU										
		*BSU										
Noise at prop. load $x^{2,5}$. 4)	5	dBA	98,6	107,5	108,3	107,9	107,8	109,5	111,8	113,9	115	116,1
		dBA										
		dBA										
Noise at prop. load x^{3}. 4)	5	dBA										
		dBA										
		dBA										

***NB.!** BSU are calculated values. Measured values are acc. to ISO 10054 in FSN units

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	**Signal**	**Unit**	**Range**	**Warning Initial Delay / Warning Delay**	**Warning Level**	**Derating Level**	**Shutdown Initial Delay / Shutdown Delay**	**Shutdown Level (Tolerance)**
Coolant level switch	Digital		ON/OFF	30 sec from start / 75 sec	Low (ON / Closed)	NA	NA	NA
Coolant temperature	50-0 kΩ	°C	- 40 - 140 ±1.5°C	30 sec from start / 2 sec	98	101 (soft 1)	NA	NA
Engine speed cam	Frequency	rpm		Instant	Lost signal	NA	NA	NA
Engine speed crank (80% remain trq.)	Frequency	rpm		Instant	Lost signal	2% trq. decr. per sec	NA	NA
Exhaust gas temperature	PT200	°C	-40 - 750 ± 2.5%	30 sec from start / 1 sec	560	585 (soft 2)	NA	NA
Exhaust wet gas temperature	PT200	°C	-40 - 750 ± 2.5%	30 sec from start / 1 sec	175	200 (soft 3)	NA	NA
Oil level sensor	Analouge		± 1.9mm	30 sec from start / 5 sec	Low level	NA	NA	NA
Oil temperature	50-0 kΩ	°C	-40 - 140 ±1.5°C	30 sec from start / 23 sec	130	135 (soft 4)	NA	NA
Gear oil temperature (EVC)	50-0 kΩ	°C	-30 - 130 ± 4%	NA	95	NA	NA	NA
Gear oil pressure (EVC)	0,5-4,5V	kPa	0 - 3000 ±3%	60 sec from start / 7 sec	700	NA	NA	NA

NA = Not applicable

Sensors (rpm dependent)	Signal	Unit	Range	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Notes
Charge air pressure	0,5-4,5 V	kPa	50 - 600 ± 4.2 kPa		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2300 rpm**	
Warning Level		kPa		30 sec from start / 2 sec	360	360	360	360	360	0% load
Warning Level		kPA		30 sec from start / 2 sec	360	303	343	362	361	100% load
Derating Level (50% remain trq.)		kPa		10% trq. decr. per sec	370	313	353	372	371	100% load
Charge air temperature	50-0 kΩ	°C	-40 - 130 ± 4%		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2300 rpm**	
Warning Level		kPa		90 sec from start / 23 sec	80	80	80	65	65	
Derating Level		kPa		Instant after warning	85	85	85	70	70	Soft derate 5
Fuel pressure	0,5-4,5 V	kPa	0-700 ± 2,5%		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2300 rpm**	
Warning Level		kPa		30 sec from start /	180	240	255	270	270	
Derating Level		kPa		NA	NA	NA	NA	NA	NA	
Oil pressure	0,5-4,5 V	kPa	0-700 ± 2,5%		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2300 rpm**	
Warning Level		kPa		30 sec from start / 3 sec	136	200	265	265	265	
Derating Level (30% remain trq.)		kPa		10% trq. decr. per sec	106	170	235	235	235	
Shutdown Level		NA	NA	NA	NA	NA	NA	NA	NA	

Remarks

Soft 1) Soft derate Coolant temp	**Speed / °C**	**101°C**	**103°C**	**106°C**
	1200	100%*	100%*	100%*
Remaining torque in %	1800	100%*	75%	50%

2300	100%*	75%	50%	

* Derate alarm but no torque reduction

Soft 2) Soft derate □	**Speed / °C**	**585°C**	**590°C**	**595°C**	**600°C**
Exhaust gas temp	1200	100%*	100%*	100%*	100%*
Remaining torque in %	1800	100%*	70%	60%	50%
* Derate alarm but no torque reduction	2300	100%*	70%	60%	50%

Soft 3) Soft derate	**Speed / °C**	**200°C**	**205°C**	**210°C**	**215°C**
Exhaust wet gas temp	1200	100%*	100%*	100%*	100%*
Remaining torque in %	1800	100%*	70%	60%	50%
* Derate alarm but no torque reduction	2300	100%*	70%	60%	50%

Soft 4) Soft derate oil temp	**Speed / °C**	**135°C**	**137°C**	**139°C**
	600	100%*	100%*	100%*
Remaining torque in %	1200	100%*	50%	30%
* Derate alarm but no torque reduction	1800	100%*	50%	30%

Soft 5) Soft derate Charge Air Temp	**Speed / °C**	**70°C**	**75°C**	**80°C**	**85°C**	**90°C**	**95°C**
	1200	100%*	100%*	100%*	100%*	100%*	100%*
Remaining torque in %	1500	100%*	100%*	100%*	100%*	50%	30%
* Derate alarm but no torque reduction	1800	100%*	100%*	60%	34%	30%	30%
	2000	100%*	50%	30%	30%	30%	30%
	2300	100%*	50%	30%	30%	30%	30%