

Technical data TAD941VE

220kW / 2000rpm

General

In-line four stroke diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel

Number of cylinders			6
Displacement, total		liters	9,36
		in ³	571
Firing order			1-5-3-6-2-4
Bore		mm	120
		in	4,72
Stroke		mm	138
		in	5,43
Compression ratio			20,2
Dry weight	Engine only, excluding cooling system	kg	1015
		lb	2238
	Power pac	kg	1354
		lb	2985
Wet weight	Engine only, excluding cooling system	kg	1065
		lb	2348
	Power pac	kg	1404
		lb	3095

Performance			r/min	1500	1800	2000	2100
ICFN Power	220 kW	without fan	kW	208	217	220	220
			hp	283	295	299	299
		with fan ratio 0,9	kW	201	205	204	201
		890 mm	hp	273	279	277	273
220 kW		without fan	kW	208	217	220	220
			hp	283	295	299	299
		with fan ratio 0,9	kW	204	210	210	208
		750 mm	hp	277	286	286	283
Torque at:	ICFN Power 220 kW		Nm	1324	1151	1050	1000
			lbf ft	977	849	775	738
Mean piston speed			m/s	6,9	8,3	9,2	9,7
			ft/sec	22,6	27,2	30,2	31,7

Performance			r/min	1500	1800	2000	2100
Effective mean pressure at:	ICFN Power 220 kW		Mpa	1,78	1,54	1,41	1,34
			psi	258	224	204	195
Max combustion pressure at:	ICFN Power 220 kW		Mpa	16,1	16,7	16,7	16,6
			psi	2335	2422	2422	2407
Total mass moment of inertia , J			kgm ²	2,6			
Std fly wheel included			lbft ²	61,6			
Degree of irregularity at:	ICFN Power 220 kW			1:56	1:108	1:172	1:219
Friction Power			kW	28	39	48	51
			hp	38	53	65	69
Time from start to idle speed at ambient temperature:	°C		15	1			
			0	2			
			-20*	5			

* With manifold heater engaged, lubrication oil 15W/40 and block heater.

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Cold start performance

*Cold start ambient temperature limit.	without starting aid	°C	0	2*170 Amp
		°F	32	
	with manifold heater 4 kW	°C	-5	
	°F	23		
	with manifold heater 4 kW and blockheater	°C	-35	2*225 Amp
		°F	-31	
*Specify oil and fuel quality	<-15°C Lubrication oil 15/40w Fuel VSD >-15°C Lubrication oil 0/30w Fuel MK1			

Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
Plug in type	Calix	1,5	48	7,5 °C

* See also general section in the sales guide

Derating

The engine may be operated up to 1000 m altitude and 40 °C ambient air

Altitude derating factor at rated power < 3000 m	% / m	See graph
Altitude derating factor at rated power > 3000 m	% / m	See graph
Ambient temperature derating factor	% / °C	No derating
Humidity		No derating

Lubrication system

		r/min	1500	1800	2000	2100
Lubricating oil consumption at max rpm at:	ICFN Power 220 kW	liter/h			0,056	
		US gal/h			0,0148	
Oil system capacity including filters		liter			40	
		US gal			10,57	
Oil sump capacity:	Max	liter			35	
		US gal			9,25	
	Min	liter			28	
		US gal			7,40	
Oil change intervals/specifications	VDS-2	h			600	
	VDS, ACEA, E3	h			400	
	ACEA E2, API CF, CF-4, CG-4	h			250	
Engine angularity limits:	front up	°			30	
	front down	°			30	
	side tilt	°			30	
Oil pressure at rated speed		kPa			350 - 600	
		psi			51 - 87	
Oil pressure shut down switch setting		kPa			250	
		psi			36	
Lubrication oil temperature in sump:	max	°C			125	
		°F			257	
Oil filter micron size		mm			0,040	

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Fuel system

		r/min	1500	1800	2000	2100
ICFN Power 220 kW Specific fuel consumption at:	25%	g/kWh lb/hph	246 0,399	276 0,447	296 0,480	312 0,506
	50%	g/kWh lb/hph	212 0,344	223 0,361	236 0,383	245 0,397
	75%	g/kWh lb/hph	200 0,324	207 0,336	216 0,350	223 0,361
	100%	g/kWh lb/hph	198 0,321	203 0,329	210 0,340	218 0,353
Recommended fuel to conform to			ASTM-D975-No2, DIN 51601, EN 590			
System return flow		l/h US gal/h	36 9,5			
System supply flow at rated speed		l/h US gal/h	108 28,5			
Fuel supply line restriction, maximum allowable		kPa psi	10 1,5			
Fuel return line restriction, maximum allowable		kPa psi	20 2,9			
Fuel supply line max. pressure, engine stopped		kPa psi	0			
Maximum allowable inlet fuel temp		°C	50			
Prefilter / Waterseparator micron size		mm	0,005			

Intake and exhaust system

		r/min	1500	1800	2000	2100
Air consumption at:	ICFN Power 220 kW	kg/s	0,30	0,36	0,40	0,43
Air intake restriction, clean filter(s)		kPa In wc	2 8,0			
Max allowable air intake restriction		kPa In wc	5 20,1			
Heat rejection to exhaust at:	ICFN Power 220 kW	kW BTU/min	137 7791	150 8530	161 9156	166 9440
Exhaust gas temperature after turbine at:	ICFN Power 220 kW	°C °F	360 680	360 680	370 698	400 752
Max allowable back pressure in exhaust line		kPa In wc	10,0 40,2	13,0 52,2	15,0 60,2	15,0 60,2
Exhaust gas flow at:	ICFN Power 220 kW	m³/min cfm	33,7 1190	37,8 1335	40,5 1430	41,6 1469
Exhaust gas smoke	ICFN Power 220 kW	Bosch Units	0,17	0,28	0,41	0,34

Cooling system

		r/min	1500	1800	2000	2100
Heat rejection radiation from engine at:	ICFN Power 220 kW	kW BTU/min	13 762	14 781	16 907	17 987
Heat rejection to coolant at:	ICFN Power 220 kW	kW BTU/min	88 4997	91 5164	96 5442	99 5635
Recommended coolant	Volvo coolant or Volvo anticorrosion additive together with clean fresh water					
Radiator cooling system type	Closed circuit					
Charge air temp after CAC		°C °F	41 106	45 113	45 113	45 113
Charge air temp after turbo compressor		°C °F	141 286	151 304	159 318	170 338
Max allowable pressure drop (Turbo outlet to manifold)		kPa In wc	15 60,2	15 60,2	15 60,2	15 60,2
Boost pressure		kPa In wc	141 566,1	151 606,3	159 638,4	166 666,5
Heat rejection to CAC		kW BTU/min	34 1934	46 2616	52 2957	57 3242

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Cooling system

Cooling system		r/min	1500	1800	2000	2100
Radiator core area	(std. Size)	m ²	0,8			
		sq.ft.	8,61			
Radiator core thickness	(std. Size)	mm	52			
		in	2,05			
Intercooler core area	(std. Size)	m ²	0,89			
		foot ²	9,58			
Intercooler core thickness	(std. Size)	mm	68			
		in	2,68			
Fan diameter	890 mm	mm	890			
		in	35,04			
	750 mm	mm	750			
		in	29,53			
Fan power consumption	890 mm	kW	7,0	12,0	16,0	19,0
		hp	10	16	22	26
	750 mm	kW	4,0	7,0	10,0	12,0
		hp	5	10	14	16
Fan drive ratio	fan Ø890		0,9			
	fan Ø750		0,9			
Coolant capacity:	engine	liter	17			
		US gal	4,5			
	std. 0,8m ² radiator with hoses	liter	24			
		US gal	6,3			
Coolant pump	drive/ratio	belt/1,50:1				
Coolant flow including radiator restriction		l/s	4,7	5,6	6,3	6,6
		cu ft/min	9,9	11,9	13,2	13,9
Maximum external coolant system restriction incl. piping		kPa	55,0			
		psi	8,0			
Thermostat:	start to open	°C	82			
		°F	180			
	fully open	°C	92			
		°F	198			
Maximum static pressure head		kPa	100			
		psi	14,5			
Maximum pressure cap setting		kPa	70			
		psi	10,2			
Maximum top tank temperature		°C	103			
		°F	217			
Minimum temperature entering engine		°C	68			
		°F	154			
Shutdown switch setting		°C	98			
		°F	208			
Recommended drawdown capacity		10% of total cooling system capacity				

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Cooling performance: **0,8 m² radiator and 890mm fan. Fan ratio 0,9**

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 103°C TTT and 50% antifreeze

Engine speed rpm	Engine power hp	Air on temp		Air flow kg/s	Max additional external restriction	
		°C	°F		Pa	psi
2100	220	65	149	6,9	990	0,144
	299	55	131	5,1	1590	0,231
		45	113	4	1970	0,286
1800	217	65	149	6,2	710	0,103
	295	55	131	4,6	1150	0,167
		45	113	3,6	1490	0,216

Engine management system Versatile

Functionality	Alternatives	Default setting
Governor mode	Isochronous/droop Switchable during operation	Isochronous
Governor droop	0 - 5%	
Governor response	Adjustable PID-constants	
Idle speed	600 - 1200 rpm	600 rpm
Stop function	Energized to run / stop	Energized to stop
Preheating function		
Lamp test	ON/OFF	ON

Engine protection		Alarm level		Engine protection		
Parameter	Unit	Setting range	Default setting	Level	Action. Default/Alternative	
Oil temp	°C	120 - 130	125	Setting +3	Torque reduction	
Oil pressure	Low idle	kPa	NA	160,0	130,000	Torque reduction
	Rated speed	kPa	NA	225	195,000	Torque reduction
Oil level		NA	Low level	NA	NA	
Piston cooling pressure >1000 rpm	kPa	NA	NA	NA	NA	
Coolant temp	°C	95 - 101	98	Setting +7	Torque reduction	
Coolant level		See coling system	On	Low level	Torque reduction	
Fuel feed pressure	Low idle	kPa	NA	100	NA	NA
Water in fuel		Water Present	NA	NA	NA	
Crank case pressure	kPa	Rapid Increase of Press			Torque reduction	
Air filter pressure drop		NA	NA	NA	NA	
Altitude, above sea	m	NA	NA	1200	Automatic derating, see section derating	
Charge air temp	°C	NA	80	91,000	Torque reduction	
Charge air pressurer	kPa	NA	325	350,000	Torque reduction	
Engine speed	rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	NA	

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Engine management system Power pac

Functionality	Alternatives	Default setting
Governor mode	Isochronous/droop Switchable during operation	Isochronous
Governor droop	0 - 5%	
Governor response	Adjustable PID-constants	
Idle speed	600 - 1200 rpm	600 rpm
Stop function	Energized to run / stop	Energized to stop
Lamp test	ON/OFF	ON

Engine protection		Alarm level		Engine protection		
Parameter	Unit	Setting range	Default setting	Level	Action. Default/Alternative	
Oil temp	°C	120 - 130	125	Setting +3	Shut down	
Oil pressure	Low idle	kPa	NA	160,0	130,000	Shut down
	Rated speed	kPa	NA	225	195,000	Shut down
Oil level		NA	Low level	NA	NA	
Piston cooling pressure >1000 rpm	kPa	NA	NA	NA	NA	
Coolant temp	°C	95 - 101	98	Setting +7	Shut down	
Coolant level		See coling system	On	Low level	Shut down	
Fuel feed pressure	Low idle	kPa	NA	100	NA	NA
Water in fuel		Water Present	NA	NA	NA	
Crank case pressure	kPa	Rapid Increase of Press			Shut down	
Air filter pressure drop		NA	NA	NA	NA	
Altitude, above sea	m	NA	NA	1200	Automatic derating, see section derating	
Charge air temp	°C	NA	80	91,000	Shut down	
Charge air pressurer	kPa	NA	325	350,000	Shut down	
Engine speed	rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	NA	

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Electrical system

Voltage and type		24V / Insulated from earth				
Alternator:	make	Bosch				
	output	Amp 80				
	tacho output	Hz/alternator rev. 6				
	drive ratio	4,5				
Starter motor:	make	Melco				
	type	90P55				
	output	kW	5,5			
		hp	7,5			
Starter motor solenoid:	pull current	Amp	N/A			
	hold current	Amp	2			
Number of teeth on:	flywheel	153				
	starter motor	11				
Inrush current at +20°C	Amp	1000				
Cranking current at +20°C	Amp	428				
Crank engine speed at 20°C	rpm	75				
Starter motor battery capacity	max	Ah	2x143 570A DIN			
	min at +5°C	Ah	2x88 400A DIN			
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	42	42	35	26
		hp	57	57	48	35
	max down	kW	152	200	226	234
		hp	207	272	307	318
	max right	kW	26	39	41	34
		hp	35	53	56	46
Timing gear at compressor PTO max continuous:	Nm	150				
	lbf ft	111				
Speed ratio direction of rotation viewed from flywheel side	1,29:1/anti-clockwise					
Speed ratio direction of rotation viewed from flywheel side	1,74:1/anti-clockwise					
Speed ratio direction of rotation viewed from flywheel side	-					
Max allowed bending moment in flywheel housing	Nm	7000				
	lbf ft	5163				
Max. rear main bearing load	N	3000				
	lbf	674,4				