SEBM011501

SHOP MANUAL

KOMATSU

68E-88E SERIES

DIESEL ENGINE

As a part of revision of this shop manual, special descriptions of the engines certified by the EPA (Environmental Protection Agency) are added to the latter half of the manual (Chapter 20).
For the descriptions other than the above, see the first half, since they are same as those of the conventional engines.

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Pages having no marks are those previously revised or made additions.

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			○	20-21	(1)									

Applicable machine, Serial number (Current Production Model)

Engine	Machine model	Machine Serial No.	Engine output (kW{HP}/rpm)	Remarks
3D68E-3G	PC12R-8	10001 and up	10.3{13.8}/2,450	
3D68E-3H	PC15R-8	10001 and up	11.2{15.0}/2,600	
3D74E-3C	PC20R-8	10001 and up	14.0{18.8}/2,600	
3D82AE-3E	PC25R-8	10001 and up	17.7{23.7}/2,400	
3D82AE-3F	PC27R-8	10001 and up	19.1{25.6}/2,600	
3D84E-3F	PC30R-8	10001 and up	20.6{27.6}/2,500	
	PC35R-8	35001 and up	20.6{27.6}/2,500	
4D84E-3B	PC50UU-2	12772-14992	29.4{39.4}/2,800	
4D84E-3C	PC50UU-2	14993 and up	29.4{39.4}/2,800	
4D84E-3D	PC40R-8	30001 and up	28.3{37.9}/2,500	
	PC45R-8	5001 and up	28.3{37.9}/2,500	

Application Category

Application code	Usage	Eng. Rev. type.	Revolution speed (rpm)
CL	Generator drive	Constant	1,500/1,800
CH			3,000/3,600
VM	General use	Variable	2,000 – 3,000
VH			3,000 – 3,600

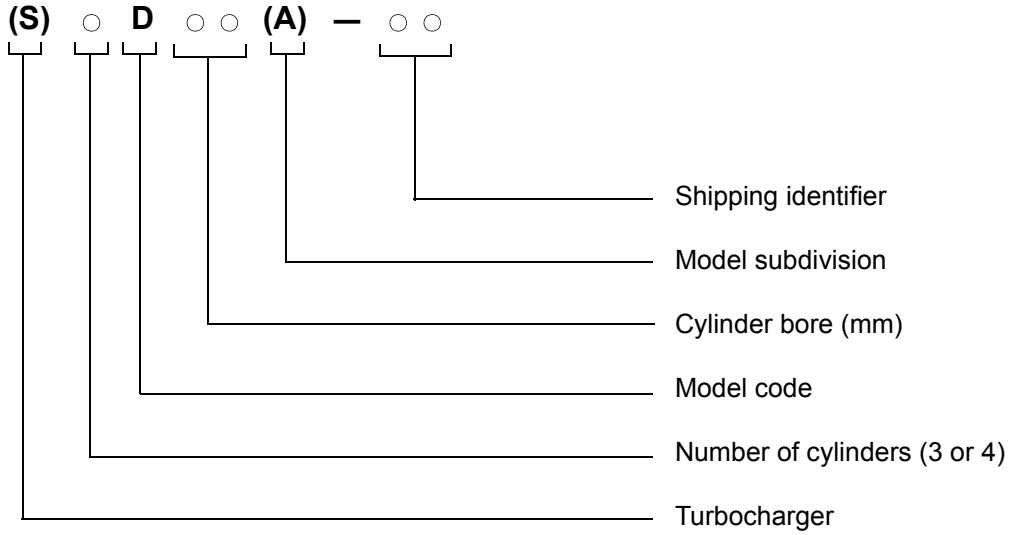
★ For engine application category described in Chapter 1, Specifications and Performance.

Notice
Pease update the part numbers and codes in this shop manual as follows.

[Method of updating]
Add YM in front of the part number and code.
(Note:This does not apply to all items. For details, see the Parts Book.)

(Example)
Update the part numbers and codes in this shop mnual: 172187-08520→YM172187-08520

Descriptive Breakdown of Model Name



Application Category

Application code	Usage	Eng. Rev. type.	Revolution speed (rpm)
CL	Generator drive	Constant	1,500/1,800
CH			3,000/3,600
VM	General use	Variable	2,000 – 3,000
VH			3,000 – 3,600

★ For engine application category described in Chapter 1, Specifications and Performance.

1. SPECIFICATIONS AND PERFORMANCE

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1.12 S3D84E 1-13
1.13 S4D84E 1-14

1.1 2D68E

Item \ Model			Unit	2D68E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Special swirl pre-combustion chamber					
	No. of cylinders – bore x Stroke		mm	2 – 68 x 72					
	Displacement		ℓ	0.523					
	Firing order		—	1 – 2					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max. rating	kW {HP}	5.74 {7.8}	6.25 {8.5}	6.84 {9.3}	7.43 {10.1}	7.94 {10.8}	8.46 {11.5}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,375^{+50}_{0}$	$2,570^{+50}_{0}$	$2,780^{+50}_{0}$	$2,970^{+50}_{0}$	$3,180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	23.0					
	Fuel injection timing (FID, B. T. D. C)		deg	14 ± 1					
	Compression pressure		MPa {kg/cm²}	3.24 ± 0.1{33 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$11.8\ ^{+1.0}_{0}\{120\ ^{+10}_{0}\}$					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	1.6/0.6					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	0.6 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Descharge type, 5 x ϕ290					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ95/ ϕ85					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	373.5 x 417 x 498 / 383.5 x 417 x 498					
	Dry weight (*2)		kg	55/65					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9	≦8	≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦30					
	Lubrica-tion oil pressure	Rated operation	MPa {kg/cm²}	0.25 ± 0.05 {2.5 ± 0.5}		0.29 ± 0.05 {3.0 ± 0.5}			0.34 ± 0.05 {3.5 ± 0.5}
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O}, Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O}, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.2 3D68E

Item \ Model			Unit	3D68E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Special swirl pre-combustion chamber					
	No. cylinders – bore x Stroke		mm	3 – 68 x 72					
	Displacement		ℓ	0.784					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max. rating	kW {HP}	8.6 {11.5}	9.4 {12.6}	10.3 {13.8}	11.2 {15.0}	12.0 {16.1}	12.9 {17.3}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,375^{+50}_{0}$	$2,570^{+50}_{0}$	$2,780^{+50}_{0}$	$2,970^{+50}_{0}$	$3,180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	23.0					
	Fuel injection timing (FID, B. T. D. C)		deg	14 ± 1					
	Compression pressure		MPa {kg/cm²}	3.24 ± 0.1{33 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$11.8\ ^{+1.0}_{0}\{120^{+10}_{0}\}$					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	2.4/1.0					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	0.9 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 5 x ϕ310					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ105/ϕ85					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	463.5 x 401 x 496 / 473.5 x 401 x 496					
	Dry weight (*2)		kg	70/81					
Performance	Governing performance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9	≦8	≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦30					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.25 ± 0.05 {2.5 ± 0.5}		0.29 ± 0.05 {3.0 ± 0.5}			0.34 ± 0.05 {3.5 ± 0.5}
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O}, Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O}, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.3 3D74E

Item \ Model			Unit	3D74E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Special swirl pre-combustion chamber					
	No. cylinders – bore x Stroke		mm	3 – 74 x 78					
	Displacement		ℓ	1.006					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max. rating	kW {HP}	11.0 {14.8}	12.1 {16.2}	13.2 {17.7}	14.3 {19.2}	15.5 {20.8}	16.6 {22.3}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,375^{+50}_{0}$	$2,570^{+50}_{0}$	$2,780^{+50}_{0}$	$2,970^{+50}_{0}$	$3,180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	23.0					
	Fuel injection timing (FID, B. T. D. C)		deg	14 ± 1					
	Compression pressure		MPa {kg/cm²}	3.43 ± 0.1{35 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$11.8\ ^{+1.0}_{0}\{120^{+10}_{0}\}$					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	2.4/1.0					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	0.9 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 5 x ϕ310					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ85					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	469.1 x 440 x 502 / 476.6 x 440 x 502					
	Dry weight (*2)		kg	85/102					
Performance	Governing performance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9	≦8	≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦30					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.25 ± 0.05 {2.5 ± 0.5}		0.29 ± 0.05 {3.0 ± 0.5}			0.34 ± 0.05 {3.5 ± 0.5}
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O}, Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O}, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.4 3D78AE

Item \ Model			Unit	3D78AE					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 78 x 84					
	Displacement		ℓ	1.204					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	13.2 {17.7}	14.6 {19.6}	15.9 {21.3}	17.2 {23.1}	18.5 {24.8}	19.9 {26.7}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,375^{+50}_{0}$	$2,570^{+50}_{0}$	$2,780^{+50}_{0}$	$2,970^{+50}_{0}$	$3,180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.14 ± 0.1{32 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{120^{+10}_{0}\}$					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	3.6/1.3					5.0/1.7
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	1.8 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 x ϕ335					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	520.5 x 489 x 565 / 528 x 489 x 565					
	Dry weight (*2)		kg	112/128					
Performance	Governing performance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9	≦8	≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.29 ± 0.05 {3.0 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.5 3D82AE

Item \ Model			Unit	3D82AE					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 82 x 84					
	Displacement		ℓ	1.330					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	14.6 {19.6}	16.0 {21.5}	17.5 {23.5}	19.0 {25.5}	20.5 {27.5}	21.9 {29.5}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,375^{+50}_{0}$	$2,570^{+50}_{0}$	$2,780^{+50}_{0}$	$2,970^{+50}_{0}$	$3,180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.04 ± 0.1{31 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}$ {200^{+10}_{0}}					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	5.0/1.7					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	1.8 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 x ϕ335					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	520.5 x 489 x 565 / 528 x 489 x 565					
	Dry weight (*2)		kg	112/128					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9	≦8	≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.29 ± 0.05 {3.0 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.6 3D82E

Item \ Model			Unit	3D82E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 82 x 90					
	Displacement		ℓ	1.425					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	15.5 {20.8}	16.9 {22.7}	18.4 {24.7}	19.9 {26.7}	21.3 {28.6}	23.2 {31.1}
	Max. revolution speed at no load		rpm	$2{,}160^{+50}_{0}$	$2{,}375^{+50}_{0}$	$2{,}570^{+50}_{0}$	$2{,}780^{+50}_{0}$	$2{,}970^{+50}_{0}$	$3{,}180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.04 ± 0.1{31 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	4.7/1.8					6.9/2.1
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.0 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 x ϕ335					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	556 x 486 x 623 / 564 x 486 x 623					
	Dry weight (*2)		kg	138/155					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦8		≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.7 3D84E

Item \ Model			Unit	3D84E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 84 x 90					
	Displacement		ℓ	1.496					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	16.4 {22.0}	18.1 {24.3}	19.7 {26.4}	21.3 {28.6}	23.0 {30.8}	24.6 {33.0}
	Max. revolution speed at no load		rpm	$2,175^{+50}_{0}$	$2,375^{+50}_{0}$	$2,600^{+50}_{0}$	$2,800^{+50}_{0}$	$3,000^{+50}_{0}$	$3,225^{+50}_{0}$
	Min. revolution speed at no load		rpm	≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.24 ± 0.1{33 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}$ {200^{+10}_{0}}					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	4.7/1.8					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.0 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 x ϕ335					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	556 x 486 x 623 / 564 x 486 x 623					
	Dry weight (*2)		kg	138/155					
Performance	Governing performance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9		≦8		≦7	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.8 3D88E

Item \ Model			Unit	3D88E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 88 x 90					
	Displacement		ℓ	1.642					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	18.0 {24.1}	19.9 {26.7}	21.6 {29.0}	23.5 {31.5}	25.2 {33.8}	27.1 {36.3}
	Max. revolution speed at no load		rpm	$2{,}175^{+50}_{0}$	$2{,}375^{+50}_{0}$	$2{,}600^{+50}_{0}$	$2{,}800^{+50}_{0}$	$3{,}000^{+50}_{0}$	$3{,}225^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.43 ± 0.1{35 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}$ {200^{+10}_{0}}					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	4.7/1.8				6.9/2.1	
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.0 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 x ϕ335					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	556 x 486 x 623 / 564 x 486 x 623					
	Dry weight (*2)		kg	138/155					
Performance	Governing performance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9		≦8		≦7	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MP {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.9 4D82E

Item \ Model			Unit	4D82E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	4 – 82 x 90					
	Displacement		ℓ	1.901					
	Firing order		—	1 – 3 – 4 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	20.6 {27.6}	22.6 {30.3}	24.5 {32.9}	26.5 {35.5}	28.5 {38.2}	30.5 {40.9}
	Max. revolution speed at no load		rpm	$2{,}160^{+50}_{0}$	$2{,}375^{+50}_{0}$	$2{,}570^{+50}_{0}$	$2{,}780^{+50}_{0}$	$2{,}970^{+50}_{0}$	$3{,}180^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.04 ± 0.1{31 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$					
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	5.8/2.3					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.7 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 ϕ 370					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	632 x 448.5 x 618 / 658 x 498.5 x 618					
	Dry weight (*2)		kg	160/170					
Performance	Governing performance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦8		≦7		≦6	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.10 4D84E

Item \ Model			Unit	4D84E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 84 x 90					
	Displacement		ℓ	1.995					
	Firing order		—	1 – 3 – 4 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	21.9 {29.4}	24.1 {32.3}	26.3 {35.3}	28.5 {38.2}	30.7 {41.2}	32.9 {44.1}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,400^{+50}_{0}$	$2,590^{+50}_{0}$	$2,810^{+50}_{0}$	$2,995^{+50}_{0}$	$3,210^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.24 ± 0.1{33 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$				$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$	
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	5.8/2.3					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.7 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 ϕ 370					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	632 x 498.5 x 618 / 658 x 498.5 x 618					
	Dry weight (*2)		kg	160/170					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9		≦8		≦7	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.11 4D88E

Item \ Model			Unit	4D88E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	4 – 88 x 90					
	Displacement		ℓ	2.189					
	Firing order		—	1 – 3 – 4 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	24.1 {32.3}	26.5 {35.5}	28.8 {38.6}	31.3 {42.0}	33.7 {45.2}	36.0 {48.3}
	Max. revolution speed at no load		rpm	$2,180^{+50}_{0}$	$2,400^{+50}_{0}$	$2,590^{+50}_{0}$	$2,810^{+50}_{0}$	$2,995^{+50}_{0}$	$3,210^{+50}_{0}$
	Min. revolution speed at no load			≦800					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	3.43 ± 0.1{35 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$				$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$	
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	5.8/2.3				7.9/2.5	
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.7 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 ϕ 370					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	632 x 498.5 x 618 / 658 x 498.5 x 618					
	Dry weight (*2)		kg	160/170					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9		≦8		≦7	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦25					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.12 S3D84E

Item \ Model			Unit	S3D84E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	3 – 84 x 90					
	Displacement		ℓ	1.496					
	Firing order		—	1 – 3 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	21.0 {28.2}	22.8 {30.6}	25.0 {33.5}	26.9 {36.1}	29.1 {39.0}	30.9 {41.4}
	Max. revolution speed at no load		rpm	$2{,}175^{+50}_{0}$	$2{,}375^{+50}_{0}$	$2{,}600^{+50}_{0}$	$2{,}800^{+50}_{0}$	$3{,}020^{+50}_{0}$	$3{,}240^{+50}_{0}$
	Min. revolution speed at no load			$\leqq 800^{+50}_{0}$					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	2.94 ± 0.1{30 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$				$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$	
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	4.8/1.9					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.0 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 x ϕ335					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	632 x 540 x 629 / 632 x 540 x 629					
	Dry weight (*2)		kg	147/160					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9		≦8		≦8	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦22					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing

1.13 S4D84E

Item \ Model			Unit	S4D84E					
Specifications	Application		—	VM					
	Type		—	Vertical, 4-cycle water-cooled diesel engine					
	Combustion system		—	Direct injection system					
	No. cylinders – bore x Stroke		mm	4 – 84 x 90					
	Displacement		ℓ	1.995					
	Firing order		—	1 – 3 – 4 – 2 – 1					
	Revolution speed		rpm	2,000	2,200	2,400	2,600	2,800	3,000
	Output (*1)	Continuous rating	kW {HP}	—	—	—	—	—	—
		Max.rating	kW {HP}	28.0 {37.5}	30.5 {40.9}	33.5 {44.9}	35.7 {47.9}	38.6 {51.8}	41.2 {55.3}
	Max. revolution speed at no load		rpm	$2{,}175^{+50}_{0}$	$2{,}375^{+50}_{0}$	$2{,}600^{+50}_{0}$	$2{,}800^{+50}_{0}$	$3{,}000^{+50}_{0}$	$3{,}225^{+50}_{0}$
	Min. revolution speed at no load			$\leqq 800^{+50}_{0}$					
	Direction of rotation		—	Counterclockwise (viewed from flywheel)					
	Power take off		—	Flywheel					
	Compression ratio		—	18.0					
	Fuel injection timing (FID, B. T. D. C)		deg	12 ± 1		14 ± 1		16 ± 1	
	Compression pressure		MPa {kg/cm²}	2.94 ± 0.1{30 ± 1}, at 250 rpm					
	Fuel injection pressure		MPa {kg/cm²}	$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$				$19.6^{+1.0}_{0}\{200^{+10}_{0}\}$	
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
	Lubrication system		—	Forced lubrication with trochoid pump					
	Lubrication oil capacity Max/Effective		ℓ	5.8/2.3					
	Recommended lubricating oil		—	API grade CC class or higher					
	Cooling system		—	Liquid cooling/Radiator					
	Cooling water capacity		ℓ	2.7 (for engine only)					
	Cooling fan No. of blade x dia.		mm	Pusher type, 6 ϕ 370					
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ110					
	Governor		—	Mechanical centrifugal governor (All speed type)					
	Starting system		—	Electrical					
	Dimensions L x W x H (*2)		mm	641 x 498.5 x 713 / 649 x 498.5 x 713					
	Dry weight (*2)		kg	165/175					
Performance	Governing perfor-mance (full speed range)	Transient speed difference	%	≦12					
		Steady state speed band	%	≦9		≦8		≦7	
		Recovery time	sec	≦6					
		Fluctuation of revolution	rpm	≦22					
	Lubrication oil pressure	Rated operation	MPa {kg/cm²}	0.34 ± 0.05 {3.5 ± 0.5}					
		Idling		≧0.06 {≧0.6}					

*1 Output conditions: Intake back pressure ≦ 2.45 kPa {250 mmH_2O},Exhaust back pressure ≦ 5.39 kPa {550 mmH_2O},other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

*2 Designation of engine dimension and dry weight in numerals.
Engine with back plate/with flywheel housing