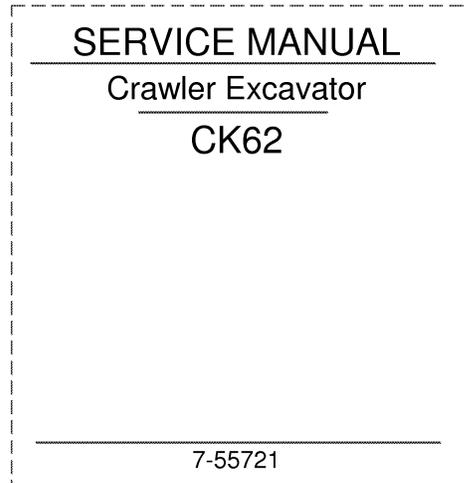


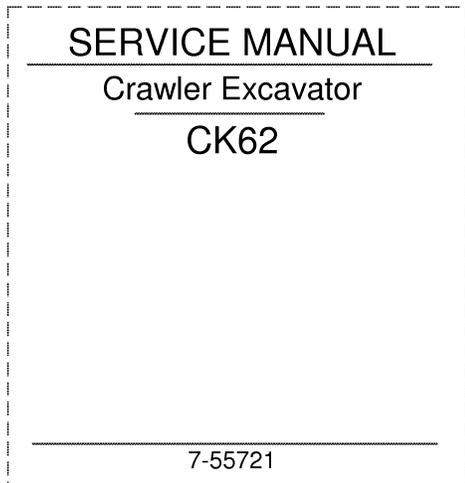
1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



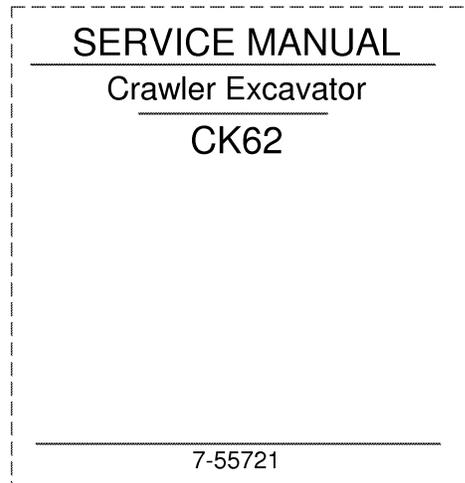
1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

## CK62 Crawler Excavator

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# Section 1001

## SAFETY INSTRUCTIONS, GENERAL INFORMATION AND TORQUE SPECIFICATIONS



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## SAFETY



*This symbol means ATTENTION ! BECOME ALERT ! YOUR SAFETY IS INVOLVED. The message that follows the symbol contains important information about safety. Carefully read the message, Make sure you fully understand the causes of possible injury or death.*

To prevent injury always follow the Warning, Caution and Danger notes in this section and throughout the manual.

Put the warning tag shown below on the key for the keyswitch when servicing or repairing the machine. One warning tag is supplied with each machine. Additional tags Part Number 331-4614 are available from your service parts supplier.



B004



*Read the operator's manual to familiarize yourself with the correct control functions.*



*Operate the machine and equipment controls from the seat position only. Any other method could result in serious injury.*



*This is a one man machine, no riders allowed.*



*Before starting engine, study Operator's Manual safety messages. Read all safety signs on machine. Clear the area of other persons. Learn and practise safe use of controls before operating.*

*It is your responsibility to understand and follow manufacturers instructions on machine operation, service, and to observe pertinent laws and regulations. Operator's and Service Manuals may be obtained from your J.I. CASE dealer.*



*If you wear clothing that is too loose or do not use the correct safety equipment for your job, you can be injured. Always wear clothing that will not catch on objects. Extra safety equipment that can be required includes hard hat, safety shoes, ear protection, eye or face protection, heavy gloves and reflector clothing.*



*When working in the area of the fan belt with the engine running, avoid loose clothing if possible, and use extreme caution.*



*When doing checks and tests on the equipment hydraulics, follow the procedures as they are written. DO NOT change the procedure.*



*When putting the hydraulic cylinders on this machine through the necessary cycles to check operation or to remove air from a circuit, make sure all people are out of the way.*



*Use insulated gloves or mittens when working with hot parts.*



*Lower all attachments to the ground or use stands to safety support the attachments before you do any maintenance or service.*



*Pin sized and smaller streams of hydraulic oil under pressure can penetrate the skin and result in serious infection. If hydraulic oil under pressure does penetrate the skin, seek medical treatment immediately. Maintain all hoses and tubes in good condition. Make sure all connections are tight. Make a replacement of any tube or hose that is damaged or thought to be damaged. DO NOT use your hand to check for leaks, use a piece of cardboard or wood.*



*When removing hardened pins such as a pivot pin, or a hardened shaft, use a soft head (brass or bronze) hammer or use a driver made from brass or bronze and a steel head hammer.*



*When using a hammer to remove and install pivot pins or separate parts using compressed air or using a grinder, wear eye protection that completely encloses the eyes (approved goggles or other approved eye protectors).*



*Use suitable floor (service) jacks or chain hoist to raise wheels or tracks off the floor. Always block machine in place with suitable safety stands.*



*When servicing or repairing the machine. Keep the shop floor and operator's compartment and steps free of oil, water, grease, tools, etc. Use an oil absorbing material and or shop cloths as required. Use safe practices at all times.*



*Some components of this machine are very heavy. Use suitable lifting equipment or additional help as instructed in this Service Manual.*



*Engine exhaust fumes can cause death. If it is necessary to start the engine in a closed place, remove the exhaust fumes from the area with an exhaust pipe extension. Open the doors and get outside air into the area.*



*When the battery electrolyte is frozen, the battery can explode if (1), you try to charge the battery, or (2), you try to jump start and run the engine. To prevent the battery electrolyte from freezing, try to keep the battery at full charge. If you do not follow these instructions, you or others in the area can be injured.*



*Batteries contain acid and explosive gas. Explosions can result from sparks, flames or wrong cable connections. To connect the jumper cables correctly to the battery of this machine see the Operator's Manual. Failure to follow these instructions can cause serious injury or death.*

## GENERAL INFORMATION

### CLEANING

Clean all metal components, except bearings, with steam or white spirit. Do not use caustic soda when steam-cleaning. After cleaning, dry and oil the components. Clean oil lines with compressed air. Clean bearings in kerosene, dry them completely and oil them.

### INSPECTIONS

Carefully examine all disassembled components. Replace all parts showing signs of wear or damage. Light scores and scratches can be removed by honing or with a buffing compound. Fast, abnormal wear of components can be avoided by careful examination and early detection of wear and pitting.

### BEARINGS

Check that bearings run freely. Replace bearings that show signs of too much play or seizing. Clean bearings in a good solvent or kerosene and allow them to dry naturally. **DO NOT DRY BEARINGS WITH COMPRESSED AIR.**

### NEEDLE BEARINGS

Before installing needle bearings in their housing, remove any metal edges inside or around the housing. When installing bearings with a hydraulic press, grease the inside and the outside of the bearing with petroleum jelly.

### GEARS

Check all gears for signs of damage or wear. Replace damaged or worn gears.

### SEAL RINGS, O RINGS AND FLAT SEALS

Always install new seal rings, O-rings and flat seals, if removed. Lubricate seal rings and O-rings with petroleum jelly.

### SHAFTS

Check all shafts showing signs of damage or wear. Check particularly to make sure that any surface of the shaft in contact with bearings or seal rings is not damaged.

### SERVICE PARTS

Always use genuine CASE service parts. To order service parts, see the Spare Parts Catalog and remember to give the correct reference of the necessary CASE part. No warranty claims will be considered for failures involving parts which are not of CASE origin.

### LUBRICATION

Never use oil or grease which is different from that specified in the Operator's Manual or the Service Manual. No warranty claims will be considered for failures due to the use of wrong oil or grease.

## STANDARD FASTENER TORQUE SPECIFICATIONS

Unless otherwise specified, use the following torque specifications. Lubricate the threads with engine oil or ordinary grease.

STANDARD SIZE \ SCREWS	4	7	9
M6	7.8 to 9.3 Nm (5.75 to 6.86 lb ft)	9.8 to 11.3 Nm (7.23 to 8.33 lb ft)	12.3 to 14.2 Nm (9.07 to 10.47 lb ft)
M8	17.7 to 20.6 Nm (13.0 to 15.2 lb ft)	23.5 to 27.5 Nm (17.34 to 20.29 lb ft)	29.4 to 34.3 Nm (21.6 to 25.31 lb ft)
M10	39.2 to 45.1 Nm (28.9 to 33.28 lb ft)	48.0 to 55.9 Nm (35.42 to 41.25 lb ft)	60.8 to 70.6 Nm (44.8 to 52.10 lb ft)
M12	62.8 to 72.6 Nm (46.3 to 53.5 lb ft)	77.5 to 90.2 Nm (57.19 to 66.56 lb ft)	103.0 to 117.7 Nm (76.0 to 86.86 lb ft)
M14	107.9 to 125.5 Nm (79.6 to 92.6 lb ft)	123.6 to 147.1 Nm (91.2 to 108.5 lb ft)	166.7 to 196.1 Nm (123.0 to 144.7 lb ft)
M16	166.7 to 191.2 Nm (123.0 to 141.0 lb ft)	196.1 to 225.6 Nm (144.7 to 166.49 lb ft)	259.9 to 304.0 Nm (191.8 to 224.3 lb ft)
M18	245.2 to 284.4 Nm (180.9 to 209.88 lb ft)	274.6 to 318.7 Nm (202.6 to 235.2 lb ft)	343.2 to 402.1 Nm (253.2 to 296.74 lb ft)
M20	333.4 to 392.2 Nm (246.0 to 289.44 lb ft)	367.7 to 431.5 Nm (271.36 to 318.44 lb ft)	490.3 to 568.8 Nm (361.8 to 419.77 lb ft)

## HYDRAULIC CONNECTION TORQUE SPECIFICATIONS

### HOSE FITTINGS

THREAD SIZE	NUTS	FLARED FITTINGS	WRENCH SIZE
1/8"	7.80 to 11.80 Nm (5.75 to 8.7 lb ft)	14.71 to 19.61 Nm (10.85 to 14.47 lb ft)	17 mm
1/4"	24.50 to 29.40 Nm (18.8 to 21.6 lb ft)	36.30 to 44.10 Nm (26.7 to 32.5 lb ft)	19 mm
3/8"	49.00 to 53.90 Nm (36.0 to 39.7 lb ft)	39.20 to 49.00 Nm (28.9 to 36 lb ft)	22 mm
1/2"	58.80 to 63.70 Nm (43.4 to 47.0 lb ft)	49.00 to 68.60 Nm (36.0 to 50.6 lb ft)	27 mm
3/4"	117.70 to 127.50 Nm (86.8 to 94.0 lb ft)	127.50 to 147.10 Nm (94.0 to 108.5 lb ft)	36 mm
1"	137.30 to 147.10 Nm (101.3 to 108.5 lb ft)	147.10 to 166.10 Nm (108.5 to 122.5 lb ft)	41 mm

### CONNECTORS

THREAD SIZE	TAPERED THREAD	STRAIGHT THREAD	WRENCH SIZE
1/8"	19.60 to 29.40 Nm (14.46 to 21.7 lb ft)	—————	17 mm
1/4"	36.30 to 46.10 Nm (26.8 to 34.0 lb ft)	58.80 to 78.50 Nm (43.4 to 57.0 lb ft)	19 mm
3/8"	39.20 to 49.00 Nm (28.9 to 36.2 lb ft)	78.50 to 98.10 Nm (58.0 to 72.4 lb ft)	23 mm
1/2"	49.00 to 68.60 Nm (36.2 to 50.6 lb ft)	117.70 to 137.30 Nm (86.8 to 101.3 lb ft)	26 mm

### LINE NUTS

TUBE SIZE (OUTER DIAMETER)	NUTS	WRENCH SIZE
8 mm	29.40 to 39.20 Nm (21.7 to 29.0 lb ft)	17 mm
10 mm	39.20 to 44.10 Nm (29.0 to 32.5 lb ft)	19 mm
12 mm	53.99 to 63.70 Nm (39.9 to 47.0 lb ft)	21 mm
16 mm	88.30 to 98.10 Nm (65.16 to 72.4 lb ft)	29 mm
18 mm	127.50 to 137.30 Nm (94.0 to 101.3 lb ft)	32 mm
27.20 mm	235.40 to 254.97 Nm (173.7 to 188.2 lb ft)	41 mm



# Section 1002

## GENERAL SPECIFICATIONS

1002



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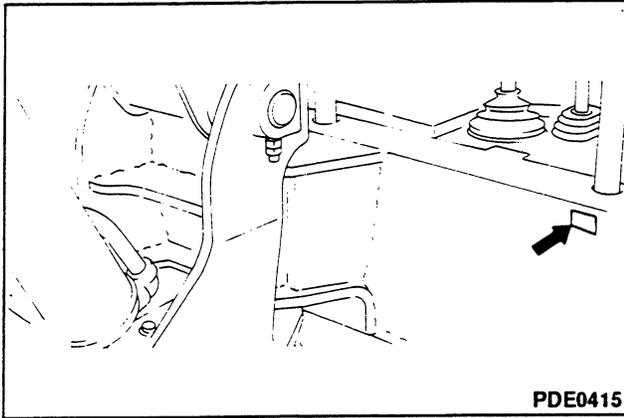
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## MODEL AND SERIAL NUMBERS

When ordering parts or requesting information or assistance, always give the model and serial numbers of your machine.

Write the model and serial numbers of your machine below:

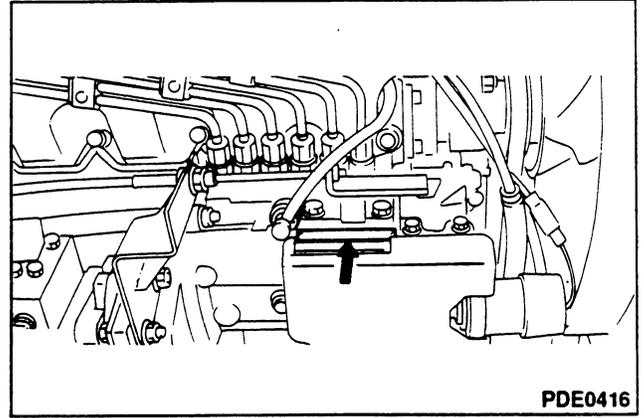
### MACHINE



Model \_\_\_\_\_

Serial number \_\_\_\_\_

### ENGINE



Serial number \_\_\_\_\_

## GENERAL SPECIFICATIONS

### Capacities

Engine Oil Capacity (with filter change).....	11.8 L	(3.1 US gal)
Engine Cooling System.....	9.4 L	(2.5 US gal)
Radiator.....	8.4 L	(2.2 US gal)
Fuel tank.....	74 L	(19.5 US gal)
Hydraulic Oil Reservoir.....	138 L	(36.4 US gal)
Total Hydraulic Circuit Capacity.....	173 L	(45.7 US gal)
Travel Reduction Gear Case.....	3.5 L	(0.9 US gal)
Swing Reduction Gear Case.....	2.2 L	(0.6 US gal)
Track Lower Roller.....	0.07 L	(0.02 US gal)
Track Idler.....	0.04 L	(0.01 US gal)

### Machine Performance

Drawbar Pull.....	38700 N
Travel Speed :	
First Gear.....	1.6 km/hr (1 mph)
Second Gear.....	3.1 km/hr (1.9 mph)
Gradeability.....	58%

### Electrical System

#### Alternator :

Voltage.....	12 volts
Output.....	420 Watts
Rotor Winding Resistance.....	4.2 ohms
No-load Voltage (cold).....	14 volts, between 1050 and 1350 rpm
Nominal Output (cold).....	14 volts - 25 amps at 4000 rpm
Speed in Relation to Crankshaft.....	1.8
Brush Length (minimum).....	10 mm (0.4 in)

#### Battery :

Battery Voltage.....	12 volts
Battery Amperage.....	110 amps

#### Starter Motor :

Voltage.....	12 volts
Output.....	1.4 KWatts
Brush Length.....	12.7 mm (0.5 in)
Commutator Bar Diameter.....	29 mm (1.1 in)
Difference between Commutator Bar Diameters.....	0.4 mm (0.01 in)
Commutator Bar Groove Depth.....	0.2 mm (0.007 in)

### Lubricants and Fluids

Battery.....	drinking or distilled water
Coolant Solution.....	Refer to Page 8
Engine Lubrication.....	Refer to Page 9
Hydraulic Fluid.....	Hydraulic fluid
Travel Reduction Gear Lubricant.....	CASE GEAR LUBE (85W-140)
Swing Reduction Gear Lubricant.....	CASE GEAR LUBE (85W-140)
Lower Roller and Idler Lubricant.....	CASE IH N°1 SAE 80 mono-grade engine oil
Turntable Bearing Lubricant.....	CASE IH molybisulphide grease
Grease Fitting Lubricant.....	CASE IH molybisulphide grease

## Hydraulic Circuit

Engine Speed, without load.....	2850 rpm
Hydraulic Oil Temperature during testing.....	45 to 50°C (113 to 122°F)
Main Relief Valve, A1.....	200 to 210 bar (2900 to 3045 psi)
Main Relief Valve, A2.....	200 to 210 bar (2900 to 3045 psi)
Main Relief Valve, A3.....	195 to 205 bar (2828 to 2973 psi)
Main Relief Valve, A4.....	145 to 155 bar (2102 to 2248 psi)
Pressure Limiter.....	37 to 40 bar (537 to 580 psi)
Secondary Relief Valves :	
Boom : raising, lowering.....	240 to 260 bar (3480 to 3770 psi)
Dipper : extending, retracting.....	245 to 265 bar (3553 to 3843 psi)
Dozer Blade : lowering.....	235 to 255 bar (3408 to 3698 psi)
RH Travel : forward, reverse.....	235 to 255 bar (3408 to 3698 psi)
LH Travel : forward, reverse.....	235 to 255 bar (3408 to 3698 psi)
Swing : right-hand, left-hand.....	215 to 235 bar (3118 to 3408 psi)

### Operating Speed in Seconds :

		Reference Value	Authorised Limit	Notes	
Boom Cylinder	Raising	2.6 to 3.2	3.8	(1)	
	Lowering	2.5 to 3.1	3.7	(1)	
Dipper Cylinder	Retracting	3.5 to 4.1	4.9	(2)	
	Extending	2.5 to 3.1	3.7	(2)	
Bucket Cylinder	Closing	3.8 to 4.4	5.3	(2)	
	Opening	2.3 to 2.9	3.5	(2)	
Swing	Left	19.4 to 21.2	25.4	(3)	
	Right	19.4 to 21.2	25.4	(3)	
Dozer Blade Cylinder	Raising	1.9 to 2.5	3.0	(2)	
	Lowering	2.5 to 3.1	3.7	(2)	
Offset Cylinder	Left	4.7 to 5.7	6.8	50°	
	Right	5.5 to 6.5	7.8	50°	
Travel	Forward	1st Speed	21.2 to 24.0	28.8	(4)
		2nd Speed	10.6 to 12.9	15.5	(4)
Swing Start	Left/Right	1.8 to 2.5	3.0	0° à 90°	

- (1) Ground - maximum height without end of stroke cushioning.  
 (2) Complete cylinder stroke.  
 (3) Three complete rotations.  
 (4) Distance 10 m (32 ft 8 in).

## Pumps :

	P1, P2	P3	P4
Pump Rotation Speed	2600 rpm	2193 rpm	2193 rpm
Test Pressure	Main Relief Valve Pressure		
Theoretical Displacement	16.8 cm <sup>3</sup> (1.02 in <sup>3</sup> )	16.8 cm <sup>3</sup> (1.02 in <sup>3</sup> )	3 cm <sup>3</sup> (0.2 in <sup>3</sup> )
Theoretical Output	43.7 l/mn (11.5 US gal/mn)	36.9 l/mn (9.7 US gal/mn)	6.6 l/mn (1.7 US gal/mn)
Maximum Authorised Displacement for 85% use	14.3 cm <sup>3</sup> (0.9 in <sup>3</sup> )	14.3 cm <sup>3</sup> (0.9 in <sup>3</sup> )	
Maximum Authorised Output for 85% use	37.1 l/mn (9.8 US gal/mn)	31.4 l/mn (8.3 US gal/mn)	5.6 l/mn (1.5 US gal/mn)
Maximum Working Displacement 80% use	13.4 cm <sup>3</sup> (0.8 in <sup>3</sup> )	13.4 cm <sup>3</sup> (0.8 in <sup>3</sup> )	
Maximum Working Output for 80% use	35.0 l/mn (9.2 US gal/mn)	29.5 l/mn (7.8 US gal/mn)	5.3 l/mn (1.4 US gal/mn)

P1 : First body, main pump

P2 : Second body, main pump

P3 : Swing pump

P4 : Servo-pump

### Tracks, Rollers and Idlers

Track Tension.....	40 to 45 mm (1.6 to 1.8 in)
Shaft Wear :	Reference Value..... 540 mm (21.27 in)
	Maximum Wear.....554 mm (21.82 in)
Link Wear :	Reference Value.....75 mm (2.95 in)
	Maximum Wear.....70mm (2.75 in)
	Reference Value.....70 mm (2.75 in)
	Maximum Wear.....65 mm (2.56 in)
Pad Wear :	Reference Value.....18 mm (0.70 in)
	Maximum Wear.....9 mm (0.35 in)
Link Pin Wear : -	Reference Value.....23.8 mm (0.93 in)
	Maximum Wear.....22.3 mm (0.87 in)
Link Bearing Wear (OD) :	Reference Value.....41.2 mm (1.62 in)
	Maximum Wear.....39.7 mm (1.56 in)
Link Bearing Wear (ID) :	Reference Value.....24.3 mm (0.95 in)
	Maximum Wear.....25.8 mm (1.01 in)
Idler Outer Surface Wear (Width) :	Reference Value.....91 mm (3.58 in)
	Maximum Wear.....83 mm (3.27 in)
Idler Outer Surface Wear (Guide width) :	Reference Value.....39 mm (1.53 in)
	Maximum Wear.....33 mm (1.30 in)
Idler Outer Surface Wear (OD) :	Reference Value.....360 mm (14.18 in)
	Maximum Wear.....352 mm (13.86 in)

<b>Roller Outer Surface Wear</b> (Guide width) :	Reference Value.....	36 mm (1.41 in)
	Maximum Wear.....	30 mm (1.18 in)
<b>Roller Outer Surface Wear</b> (OD) :	Reference Value.....	104 mm (4.09 in)
	Maximum Wear.....	99 mm (3.90 in)
<b>Roller Outer Surface Wear</b> (ID) :	Reference Value.....	100 mm (3.94 in)
	Maximum Wear.....	95 mm (3.74 in)
<b>Drive Sprocket Wear (OD) :</b>	Reference Value.....	474 mm (18.67 in)
	Maximum Wear.....	466 mm (18.36 in)
<b>Drive Sprocket Wear (Width) :</b>	Reference Value.....	39 mm (1.53 in)
	Maximum Wear.....	35 mm (1.37 in)

### Machine Weight

With Boom, 1.55 m (61 in) Dipper and 180 L (0.21 yd<sup>3</sup>) Bucket.....5940 kg (13097 lb)

# ENGINE SPECIFICATIONS

## Run-In Instructions

For an increase in working life, greater performance and more economical operation, pay particular attention to the engine during the first 20 operating hours.

During this period, follow the recommendations listed below :

1. Warm up the engine before you use it under load.
2. Do not idle the engine for long periods.
3. Keep a close watch on the indicator lamps.
4. Frequently check the engine oil and coolant levels.

The following operations must be carried out in addition to those given in the Servicing Chart.

After the first 35 hours.....Change the engine oil

## Engine Cooling System

Coolant Solution.....Ethylene-glycol

**WARNING :** *When using ethylene-glycol coolant solutions, always have a minimum of 50% ethylene-glycol in the cooling system. Do not put more than 50% ethylene-glycol in the cooling system unless the ambient air temperature is below -36°C (-37°F) More than 50% ethylene-glycol decreases heat transfer, with the result that the engine surface temperature is higher than normal.*

Thermostat.....Starts to open at 80.5°C (176.9°F)  
completely open at 95°C (203°F)

Radiator Cap.....0.6 to 0.9 bar (8.7 to 13 psi)

## Engine Lubrication

### Engine Oil Type

CASE IH N°1 engine oil is recommended for your engine. This oil ensures correct lubrication of your engine in all working conditions. If CASE IH N°1 Multi-grade oil is not available, use CASE IH N°1 single grade oil.

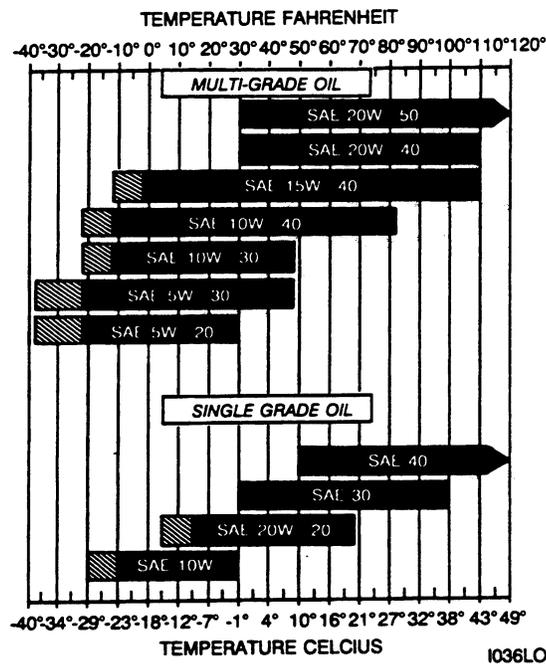
If you cannot obtain CASE IH N°1 single grade oil, only use API grade CD engine oil.

See the chart below for recommended viscosity in different temperatures.

**NOTE : DO NOT put performance additives or other oil additive products into the engine crankcase.**

### Engine Oil Viscosity

#### AMBIENT AIR TEMPERATURE RANGES



## GENERAL ENGINE SPECIFICATIONS

### General Specifications

Make and Model.....	KUBOTA S2800D
Type.....	6 cylinder, four stroke engine
Rating : SAE.....	44 KW (60 HP)
DIN 6270.....	40.5 KW (55 HP)
Firing Order.....	1, 5, 3, 6, 2, 4
Bore x Stroke.....	85 x 82 mm (3.34 x 3.23 in)
Total Displacement.....	2791 cm <sup>3</sup> (170.2 in <sup>3</sup> )
Tappet Clearance (cold).....	0.18 to 0.22 mm (0.007 to 0.008 in)
Compression Ratio.....	21
Engine Speed :	
High Idle.....	2850 rpm
Low Idle.....	1000 to 1100 rpm
Direction of Rotation.....	Counterclockwise, as seen from the flywheel

### Pistons

Number of Rings per Piston.....	3
Number of Compression Rings.....	2
Number of Oil Rings (two pieces).....	1

### Main Bearings

Number of Bearings.....	7
Type of Bearing.....	replaceable

### Lubrication System

Type of System.....	forced feed
Oil Pressure :	
At Low Idle.....	0.49 bar (7.11 psi)
At Nominal Speed.....	2.9 to 4.4 bar (42.06 to 63.8 psi)
Oil Pump.....	Rotor Type
Oil Filter.....	Full Flow Type
Oil Capacity (with Filter Change).....	11.8 L (31 US gal)

### Fuel System

Fuel Injection Pump.....	Bosch K Mini-Pump
Pump Timing (static).....	23° to 25° before TDC
Injection Pressure.....	137 to 147 bar (1987 to 2132 psi)
Pump Governor.....	Mechanical, Centrifugal Ball Type
Injectors.....	Throttle Type

## ENGINE SPECIFICATION DETAILS

### Cylinder Head

	Reference values	Wear Limit
Warpage.....		0.05 per 100 mm (0.00197 per 3.94 in)
Top Clearance.....	0.7 to 0.9 mm (0.02758 to 0.03546 in)	
Cylinder Head Gasket Thickness :		
Free.....	1.37 to 1.53 mm (0.05397 to 0.06028 in)	
Compressed.....	1.12 to 1.28 mm (0.04412 to 0.05043 in)	
Cylinder Head Gasket Shim Thickness.....	0.2 mm (0.00788 in)	
Piston Protrusion above Cylinder Block (TDC).....	0.26 to 0.41 mm (0.01024 to 0.01615 in)	
Compression Pressure (battery start).....	30.4 bar (440.8 psi)	22.7 bar (329.15 psi)
Variation between Cylinders.....		10%

### Valves (Intake and Exhaust)

Valve Clearance (cold).....	0.18 to 0.22 mm (0.00709 to 0.00866 in)	
Valve Seat Width.....	2.12 mm (0.08352 in)	
Valve Seat Angle.....	45°	
Valve Surface Angle.....	45.5°	
Valve Head Thickness.....	0.9 to 1.1 mm (0.03546 to 0.04334 in)	0.85 mm (0.03349 in)
Valve Recession below Head Surface .....	1.1 to 1.3 mm (0.04334 to 0.05122 in)	1.6 mm (0.06304 in)
Clearance between Valve Stems and Guides.....	0.04 to 0.07 mm (0.00157 to 0.00275 in)	0.10 mm (0.00394 in)
Valve Stem OD.....	7.960 to 7.975 mm (0.31362 to 0.31421 in)	
Valve Guide ID.....	8.015 to 8.030 mm (0.31579 to 0.31638 in)	

### Timing

Intake Opening Advance (IOA).....	20° before T.D.C.
Intake Closing Retard (ICR).....	45° after B.D.C.
Exhaust Opening Advance (EOA).....	50° before B.D.C.
Exhaust Closing Retard (ECR).....	15° after T.D.C.

## Engine Specification Details (continued)

### Valve Springs

	Reference values	Wear Limit
Free Length.....	41.7 to 42.2 mm (1.64298 to 1.66268 in)	41.2 mm (1.62328 in)
Tilt.....	1.0 mm (0.0394 in)	
Compression Force/Compressed Length.....	117 N (12 kgf)/35.15 mm (1.38491 in)	100 N (10.2 kgf)/35.15 mm (1.38491 in)

### Rocker Arm Assembly

Clearance between Rocker Arm Bushing and Shaft.....	0.018 to 0.070 mm (0.00070 to 0.00275 in)	0.15 mm (0.00591 in)
Rocker Arm Shaft OD.....	13.973 to 13.984 mm (0.55053 to 0.55096 in)	
Rocker Arm Bushing ID.....	14.002 to 14.043 mm (0.55167 to 0.55329 in)	

### Tappets

Clearance between Tappet and Guide.....	0.020 to 0.062 mm (0.00078 to 0.00244 in)	0.07 mm (0.00275 in)
Tappet OD.....	23.959 to 23.980 mm (0.94398 to 0.94481 in)	
Tappet Guide ID.....	24.000 to 24.021 mm (0.9456 to 0.94642 in)	

### Camshaft

Camshaft Axial Clearance.....	0.07 to 0.22 mm (0.00275 to 0.00866 in)	0.3 mm (0.01182 in)
Camshaft Alignment.....		0.08 mm (0.00315 in)
Cam Height (Intake and Exhaust).....	33.36 mm (1.31438 in)	33.31 mm (1.31241 in)
Camshaft Lubrication Clearance.....	0.050 to 0.091 mm (0.00197 to 0.00358 in)	0.15 mm (0.001591 in)
Camshaft Journal OD.....	39.934 to 39.950 mm (1.57339 to 1.57403 in)	39.88 mm (1.57127 in)
Camshaft Bearing ID.....	40.000 to 40.025 mm (1.576 to 1.57698 in)	

## Engine Specification Details (continued)

### Timing Gear

	Reference Values	Wear Limit
Timing Gear Backlash.....	0.04 to 0.11 mm (0.00157 to 0.00433 in)	0.15 mm (0.00591 in)
Idler Gear Axial Clearance.....	0.20 to 0.51 mm (0.00788 to 0.02009 in)	0.9 mm (0.03546 in)
Clearance between Idler Gear Shaft and Idler Gear Bushing.....	0.020 to 0.054 mm (0.00078 to 0.00212 in)	0.1 mm (0.00394 in)
Idler Gear Shaft OD.....	27.967 to 27.980 mm (1.10189 to 1.10241 in)	
Idler Gear Bushing ID.....	28.000 to 28.021 mm (1.1032 to 1.10402 in)	
(Service Part Dimensions)		
Clearance between Idler Gear Shaft and Idler Gear Bushing.....	0.020 to 0.079 mm (0.00078 to 0.00311 in)	0.1 mm (0.00394 in)
Idler Gear Bushing ID.....	28.000 to 28.046 mm (1.1032 to 1.10501 in)	

### Cylinder Sleeves

Cylinder Sleeve ID.....	76.000 to 76.019 mm	76.17 mm
	(2.9944 to 2.99514 in)	(3.00109 in)
	82.000 to 82.022 mm	82.17 mm
	(3.2308 to 3.23166 in)	(3.23749 in)
Oversize Cylinder Sleeve ID.....	85.000 to 85.022 mm	85.17 or + 0.15 mm
	(3.349 to 3.34986 in)	(3.35569 or + 0.00591 in)
	76.500 to 76.519 mm	76.67 mm
	(3.0141 to 3.01484 in)	(3.02079 in)
Sleeve Top to Cylinder Block Surface.....	82.500 to 82.522 mm	82.67 mm
	(3.2509 to 3.25136 in)	(3.25719 in)
	85.500 to 85.522 mm	85.67 mm or + 0.15 mm
	(3.3687 to 3.36956 in)	(3.37539 or + 0.00591 in)
	-0.025 to +0.025 mm	
	(-0.00098 to + 0.00098 in)	

**Engine Specification Details (continued)****Piston/Piston Rings**

	Reference Values	Wear Limit
Piston OD at 5.5 mm (0.2167 in) from bottom.....	75.915 to 75.935 mm (2.99105 to 2.99183 in) 81.915 to 81.935 mm (3.22745 to 3.22823 in) 84.915 to 84.935 mm (3.34565 to 3.34643 in)	
Piston Pin Bore ID.....	23.000 to 23.013 mm (0.9062 to 0.90671 in)	23.05 mm (0.90817 in)
Piston Pin to Piston Pin Bore.....	-0.011 to +0.011 mm (-0.00043 to +0.00043 in)	
Clearance between N°2 Compression Ring and Groove.....	0.093 to 0.120 mm (0.00366 to 0.00472 in)	0.2 mm (0.00788 in)
Width of N°2 Compression Ring Groove.....	2.055 to 2.070 mm (0.08096 to 0.08155 in)	
Width of N°2 Compression Ring.....	1.950 to 1.962 mm (0.07683 to 0.07730 in)	
Clearance between Oil Ring and Groove.....	0.020 to 0.052 mm (0.00078 to 0.00204 in)	0.15 mm (0.00591 in)
Width of Oil Ring Groove.....	5.010 to 5.030 mm (0.19739 to 0.19818 in)	
Width of Oil Ring.....	4.978 to 4.990 mm (0.19613 to 0.19660 in)	
Ring Gap :		
N° 1 and 2 Compression Ring.....	0.30 to 0.45 mm .. (0.01182 to 0.01773 in)	1.25 mm (0.04925 in)
Oil Ring .....	.25 to 0.40 mm .. (0.985 to 0.01576 in)	1.25 mm (0.04925 in)
Piston and Ring Oversize.....	+0.5 mm (+0.0197 in)	

**Crankshaft**

Crankshaft Alignment.....		0.08 mm (0.00315 in)
Lubrication Clearance between Crankshaft N° 1 Bearing and Crankshaft.....	0.040 to 0.0118 mm (0.00157 to 0.00046 in)	0.20 mm (0.00788 in)
Journal OD.....	51.921 to 51.940 mm (2.04568 to 2.04643 in)	
Crankshaft N° 1 Bearing ID.....	51.980 to 52.039 mm (2.04801 to 2.05033 in)	
Lubrication Clearance between Crankshaft N° 2 Bearing and Crankshaft.....	0.040 to 0.104 mm (0.00157 to 0.00409 in)	0.20 mm (0.00788 in)
Crankshaft N° 2 Bearing ID.....	51.980 to 52.025 mm (2.04801 to 2.04978 in)	

## Engine Specification Details (continued)

### Crankshaft (continued)

	Reference Values	Wear Limit
Lubrication Clearance between Connecting Rod Journal and Connecting Rod Bearing.....	0.035 to 0.093 mm (0.00137 to 0.00366 in)	0.20 mm (0.00788 in)
Connecting Rod Journal OD.....	43.959 to 43.975 mm (1.73198 to 1.73261 in)	
Connecting Rod Bearing ID.....	44.010 to 44.052 mm (1.73399 to 1.73564 in)	
Crankshaft Axial Clearance.....	0.15 to 0.31 mm (0.00591 to 0.01221 in)	0.5 mm (0.0197 in)
Thickness of Crankshaft Thrust Bearing.....	1.97 to 2.00 mm (0.07761 to 0.0788 in)	
Crankshaft N° 1 and 2 Bearing and Connecting Rod Bearing Undersize.....	-0.2 mm, -0.4 mm (-0.00788, -0.01576 in)	
Crankshaft Thrust Bearing Oversize.....	+0.2 mm, +0.4 mm (+0.00788, +0.01576 in)	

### Connecting Rods

Connecting Rod Alignment.....		0.05 mm (0.00197 in)
Clearance between Piston Pin and Connecting Rod Small End Bearing.....	0.014 to 0.038 mm (0.00055 to 0.00149 in)	0.15 mm (0.00591 in)
Piston Pin OD.....	23.002 to 23.011 mm (0.90627 to 0.90663 in)	
Connecting Rod Small End Bearing ID.....	23.025 to 23.040 mm (0.90718 to 0.90777 in)	
(Service Part Dimensions)		
Clearance between Piston Pin and Connecting Rod Small End Bearing.....	0.015 to 0.067 mm (0.00059 to 0.00263 in)	0.15 mm (0.00591 in)
Connecting Rod Small End Bearing ID.....	23.026 to 23.069 mm (0.90722 to 0.90891 in)	
Connecting Rod End Play.....	0.4 to 0.6 mm (0.01576 to 0.02364 in)	0.8 mm (0.03152 in)

### Flywheel

Flywheel OD.....	335 mm (13.199 in)	
Sway.....		0.05 mm (0.00197 in)

### Oil Pump

Rotor Lobe Clearance.....	0.10 to 0.16 mm (0.00394 to 0.00630 in)	0.20 mm (0.00788 in)
Radial Clearance between Outer Rotor and Pump Housing.....	0.11 to 0.19 mm (0.00433 to 0.00748 in)	0.25 mm (0.00985 in)
End Clearance between Rotor and Cover.....	0.105 to 0.150 mm (0.00413 to 0.00591 in)	0.20 mm (0.00788 in)

**Engine Specification Details (continued)****Relief Valve**

	Reference Values	Wear Limit
Regulating Pressure.....	3.4 to 4.4 bar (49.3 to 63.8 psi)	

**Oil Filter**

By-pass Valve Opening Pressure.....Pressure difference of 1.0 bar (14.5 psi)

**Fanbelt**

Belt Deflection under 98 N (10 kgf) pressure.....7 to 9 mm  
(0.2758 to 0.3546 in)

**Radiator (not included in basic unit)**

Water Tightness.....Water tight at specified pressure 1.4 bar (20.3 psi)  
Radiator Cap Opening Pressure.....10 seconds or more  
0.9 to 0.6 bar (13.1 to 8.7 psi)

**Thermostat**

Valve Opening Pressure.....80.5 to 83.5°C  
(176.9°F to 182.3°F)  
Valve Fully Opened.....95°C  
(203°F)

**Fuel Injection Pump**

Order of Injection.....1-5-3-6-2-4  
Injection Timing (static).....23° to 25° before TDC  
Pump Element Fuel Tightness.....147 bar (2132 psi)  
Delivery Valve Fuel Tightness.....10 seconds or more .....5 seconds  
98 to 93 bar 98 to 93 bar  
(1421 to 1349 psi) (1421 to 1349 psi)

**Injectors**

Injection Pressure.....137 to 147 bar  
(1986.50 to 2131.50 psi)

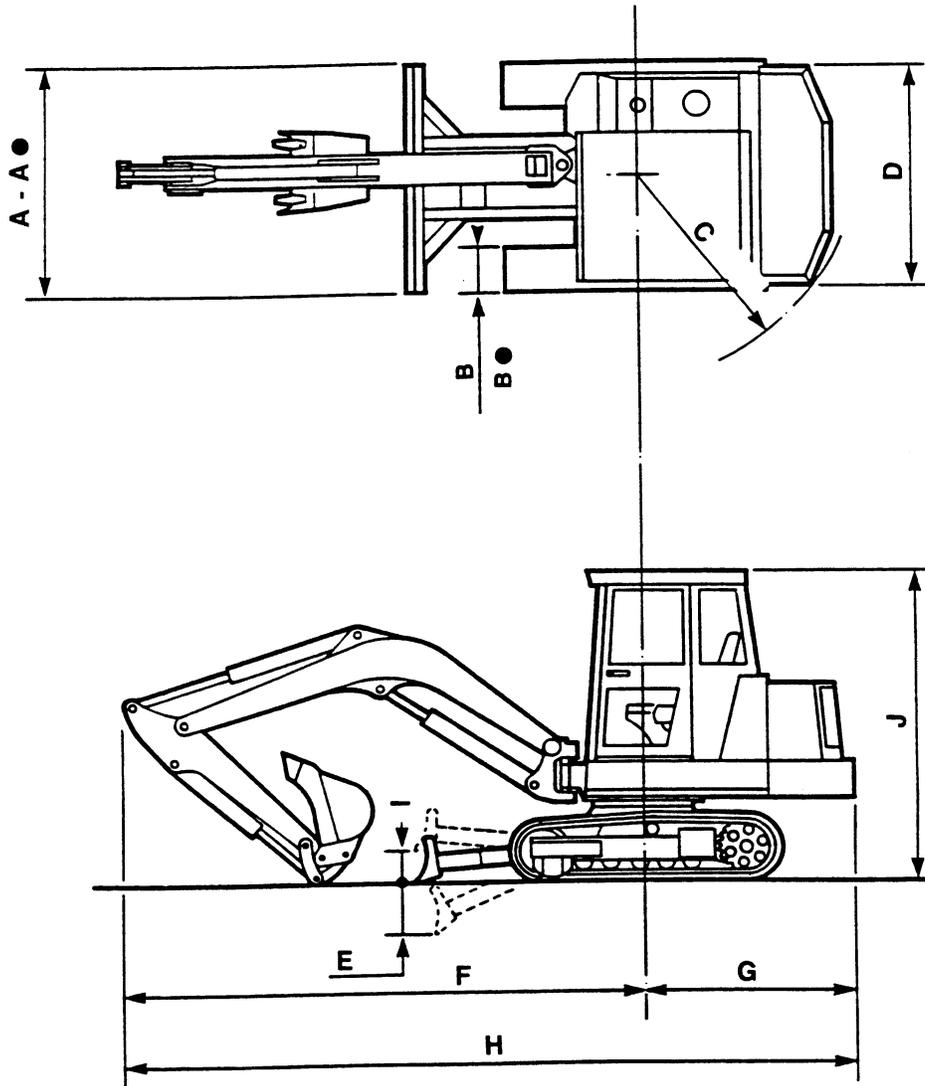
**Fuel Tightness**

at the Injector Valve Seat.....At a pressure of 128 bar (1856 psi)  
fuel must not be able to pass  
the valve seat

## SPECIAL TORQUES

Fuel Injection Line Connectors.....	29.4 to 49 Nm (21.6 to 36.2 lb ft)
M11 Cylinder Head Screws.....	93.2 to 98.1 Nm (68.8 to 72.4 lb ft)
Fan Pulley Screws.....	196 to 215.7 Nm (144.5 to 159.2 lb ft)
M10 Crankcase Mounting Screws.....	48.1 to 55.9 Nm (35.5 to 41.2 lb ft)
M12 Crankcase Mounting Screws.....	77.5 to 90.2 Nm (57.2 to 66.5 lb ft)
Connecting Rod Big End Screws (without flange).....	36.3 to 41.2 Nm (26.7 to 30.4 lb ft)
Connecting Rod Big End Screws (with flange).....	44.1 to 49 Nm (32.5 to 36.2 lb ft)
Engine Flywheel Mounting Screws.....	98.1 to 107.9 Nm (72.4 to 79.6 lb ft)
Bearing Mounting Screws (without flange).....	29.4 to 34.3 Nm (21.7 to 25.3 lb ft)
Bearing Mounting Screws (with flange).....	36.3 to 41.2 Nm (26.7 to 30.4 lb ft)
Bearing Cap Mounting Screws (without flange).....	29.4 to 34.3 Nm (21.6 to 25.3 lb ft)
Bearing Cap Mounting Screws (with flange).....	36.3 to 41.2 Nm (26.7 to 30.4 lb ft)
Oil Pump Gear Retaining Nut.....	77.5 to 90.2 Nm (57.2 to 66.5 lb ft)
Fan Belt Pulley Retaining Nut.....	123 to 147 Nm (90.7 to 108.4 lb ft)
Rocker Arm Support Stand.....	23.5 to 27.5 Nm (17.3 to 20.3 lb ft)
Drain Plug.....	44.1 to 49 Nm (32.5 to 36.2 lb ft)
Glow Plug.....	19.6 to 24.5 Nm (14.5 to 18.0 lb ft)
Nozzle Holder Body.....	29.4 to 49 Nm (21.6 to 36.2 lb ft)
Injector Retaining Nut.....	78.5 to 98.1 Nm (58.0 to 72.4 lb ft)
Delivery Valve Support.....	39.2 to 49 Nm (28.9 to 36.2 lb ft)

# GENERAL DIMENSIONS

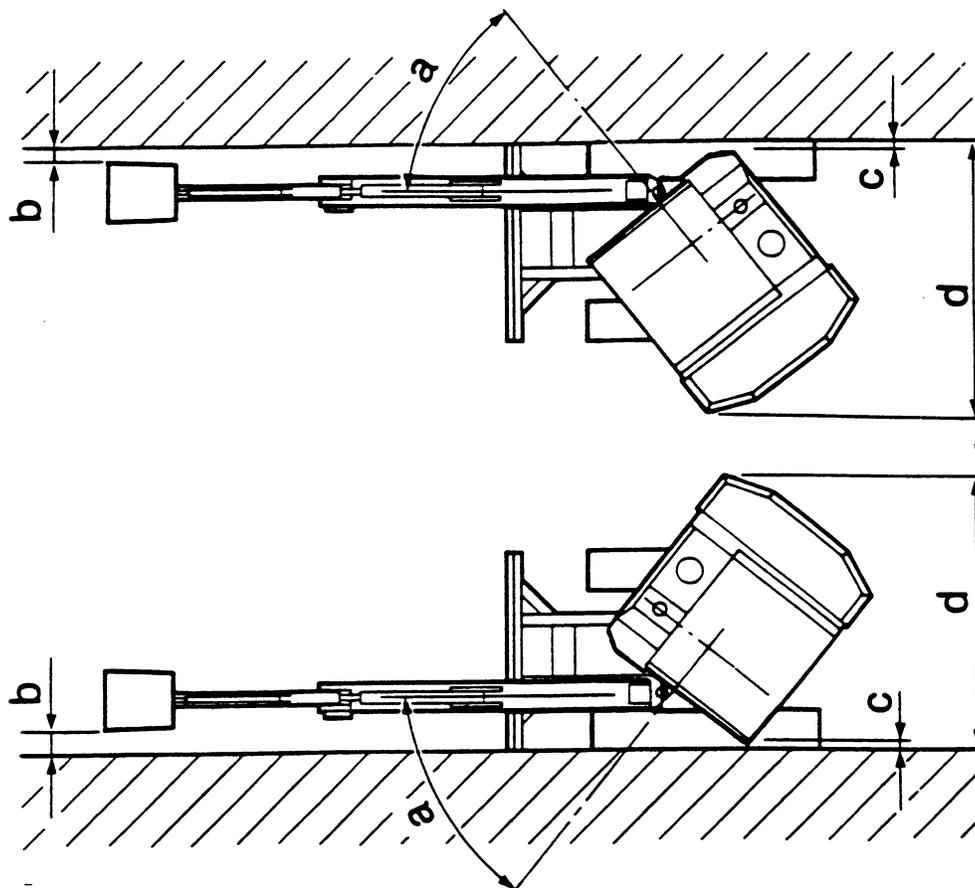


- A : 6 ft 5 inch, 2 m
- A ● : 7 ft, 2.15 m
- B : 1 ft 3 inch, 0.40 m
- B ● : 1 ft 8 inch, 0.55 m
- C : 5 ft 5 inch, 1.68 m
- D : 5 ft 9 inch, 1.84 m

- E : 1 ft 4 inch, 0.43 m
- F : 13 ft 7 inch, 4.22 m
- G : 5 ft 5 inch, 1.68 m
- H : 19 ft 3 inch, 5.91 m
- I : 11 inch, 0.28 m
- J : 8 ft 1 inch, 2.48 m

PDE0418

● Not available in certain countries.



PDE0419

	Left	Right
a.....	50 °	50°
b.....	6.7 inch, 0.17 m	9.4 inch, 0.24 m
c.....	7.5 inch, 0.19 m	7.9 inch, 0.20 m
d.....	106.2 inch, 2.70 m	104.3 inch, 2.65 m

**NOTE :** With 180 L (0.21 yd<sup>3</sup>) bucket.