CEBM005002

Shop Manual

WA180-3MC

WHEEL LOADER

SERIAL NUMBERS **WA180-3MC - A81001** and UP

It is our policy to improve our products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Due to this continuous program of research and development, periodic revisions may be made to this publication. It is recommended that customers contact their distributor for information on the latest revision.

November 2001
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CONTENTS

PRODUCT PUBLICATIONS INFORMATION

Various product Parts and Service Publications are available to all **KOMATSU** construction equipment owners, including operation and maintenance manuals, parts books and service manuals.

Special publications, such as service tool, air conditioning and turbocharger service manuals are also available as well as selected Operation and Service manuals in foreign languages.

The Publications listed below are available for this particular machine(s).

DESCRIPTION	FORM NUMBER
PARTS BOOK - PAPER:	
Chassis and Engine	BEPB008500
PARTS BOOK - MICROFICHE:	
Chassis and Engine	BEPM008500
OPERATION AND MAINTENANCE MANUAL:	
Chassis and Engine	CEAM007500
SHOP MANUAL	
Chassis	CEBM005002
Engine	SEBM010011
SAFETY MANUAL	
Machine specific	WLT70-1

Parts and Service Publications can *only* be acquired by authorized KOMATSU distributors using the Komatsu America International Company Parts Inventory Processing System (PIPS)or the Extranet Literature Ording System.

If the PIPS system is not available at the distributor location, then the following Requisition for Technical Service Publications and Service Forms can be used. Form KDC91E is shown on the reverse side of this page.

REQUISITION FOR TECHNICAL SERVICE PUBLICATIONS AND SERVICE FORMS

COMPLETE FORM AND RETURN TO ——ö

DataKom Publishing Corporation
440 North Fairway Drive
Vernon Hills, IL 60061-8112 U.S.A.
Attn: Service Publications
Fax No. (847) 970-4186
Tel No. (847) 970-5887

SHIP TO ——ö

TYPE or PRINT ONLY ——ö

COMPANY NAME
ATTN.
STREET ADDRESS
CITY, STATE, ZIP CODE
COUNTRY

PURCHASE ORDER NO.

ORDER DATE

PHONE NO.	FAX NO.	SHIPPING METHOD	DISTR/BRANCH CODE

IMPORTANT - TO ASSURE SHIPMENT OF THE CORRECT PUBLICATION(S), THE MODEL NUMBER AND MACHINE SERIAL NUMBER MUST BE SHOWN.

QTY.	PUBLICATION FORM NO.	PARTS BOOK ⬇ P-Paper M-Microfiche		PUBLICATION DESCRIPTION	MODEL NUMBER	SERIAL NUMBER

KDC91E 072199

CURRENT PRICES WILL BE CHARGED

The affected pages are indicated by using the following marks. It is requested that necessary actions be taken to these pages according to the table below.

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❍	New page to be added	Add
●	Page to be replaced	Replace
( )	Page to be deleted	Discard

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SAFETY

SAFETY NOTICE

IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for the safe operation of your machine. The service and repair techniques recommended and described in this manual are both effective and safe methods of operation. Some of these operations require the use of tools specially designed for the purpose.

To prevent injury to workers, the symbols ⚠ and ⚠ are used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the OPERATION & MAINTENANCE MANUAL carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.

2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
- Always wear safety glasses when hitting parts with a hammer.
- Always wear safety glasses when grinding parts with a grinder, etc.

3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, glasses, cap and other clothes suited for welding work.

4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.

5. Keep all tools in good condition and learn the correct way to use them.

6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

1. Before adding oil or making repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.

2. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.

3. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.

4. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

1. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out. Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.

2. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned. Wait for the oil and water to cool before carrying out any work on the oil or water circuits.

3. Before starting work, remove the leads from the battery. ALWAYS remove the lead from the negative (-) terminal first.

4. When raising heavy components, use a hoist or crane. Check that the wire rope, chains and hooks are free from damage. Always use lifting equipment which has ample capacity. Install the lifting equipment at the correct places. Use a hoist or crane and operate slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.

5. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.

6. When removing components, be careful not to break or damage the wiring, Damaged wiring may cause electrical fires.

7. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips on to the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.

8. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.

9. Be sure to assemble all parts again in their original places. Replace any damaged part with new parts.
   - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.

10. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also check that connecting parts are correctly installed.

11. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.

12. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.

13. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.

14. Take care when removing or installing the tracks of track-type machines. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

GENERAL

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop. For ease of understanding, the manual is divided into the following sections. These sections are further divided into each main group of components.

GENERAL

This section lists the general machine dimensions, performance specifications, component weights, and fuel, coolant and lubricant specification charts.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

TESTING, ADJUSTING AND TROUBLESHOOTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs. Troubleshooting charts correlating “Problems” to “Causes” are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your distributor for the latest information.

HOW TO READ THE SHOP MANUAL

VOLUMES

Shop manuals are issued as a guide to carrying out repairs. They are divided as follows:

Chassis volume: Issued for every machine model
Engine volume: Issued for each engine series

Electrical volume: Each issued as one to cover all models
Attachment volume: Each issued as one to cover all models

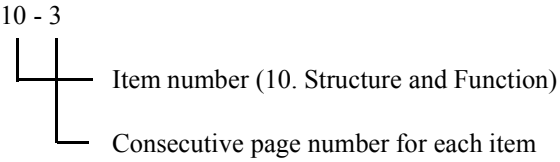
These various volumes are designed to avoid duplication of information. Therefore to deal with all repairs for any model, it is necessary that chassis, engine, electrical and attachment be available.

DISTRIBUTION AND UPDATING

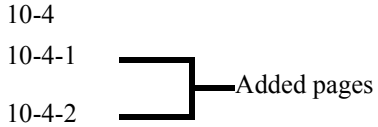
Any additions, amendments or other changes will be sent to your distributors. Get the most up-to-date information before you start any work.

FILING METHOD

1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number:
   Example:



3. Additional pages: Additional pages are indicated by a hyphen (-) and numbered after the page number. File as in the example.
   Example:



REVISED EDITION MARK

When a manual is revised, an edition mark (①②③…) is recorded on the bottom outside corner of the pages.

REVISIONS

Revised pages are shown at the LIST OF REVISED PAGES between the title page and SAFETY page.

SYMBOLS

So that the shop manual can be of ample practical use, important places for safety and quality are marked with the following symbols.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing the work.
★	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.
	Weight	Weight of parts or systems. Caution necessary when selecting hoisting wire or when working posture is important, etc.
	Tightening torque	Places that require special attention for tightening torque during assembly.
	Coat	Places to be coated with adhesives and lubricants etc.
	Oil, water	Places where oil, water or fuel must be added, and the capacity.
	Drain	Places where oil or water must be drained, and quantity to be drained.

HOISTING INSTRUCTIONS

HOISTING

WARNING! Heavy parts (25 kg or more) must be lifted with a hoist etc. In the DISASSEMBLY AND ASSEMBLY section, every part weighing 25 kg or more is indicated clearly with the symbol

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:

1. Check for removal of all bolts fastening the part to the relative parts.
2. Check for existence of another part causing interface with the part to be removed.

WIRE ROPES

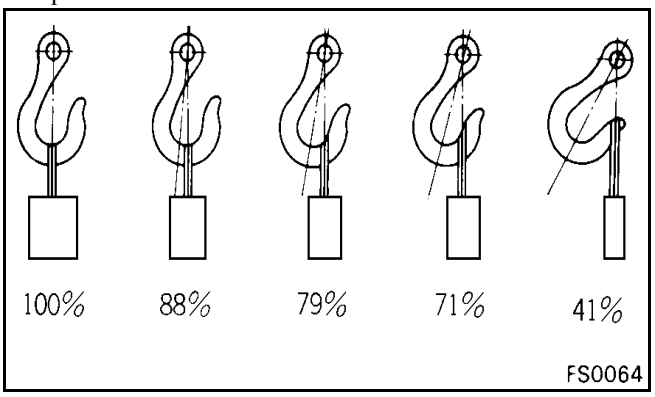
1. Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

Rope diameter	Allowable load	
mm	kN	tons
10	9.8	1.0
11.2	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ The allowable load value is estimated to be 1/6 or 1/7 of the breaking strength of the rope used.

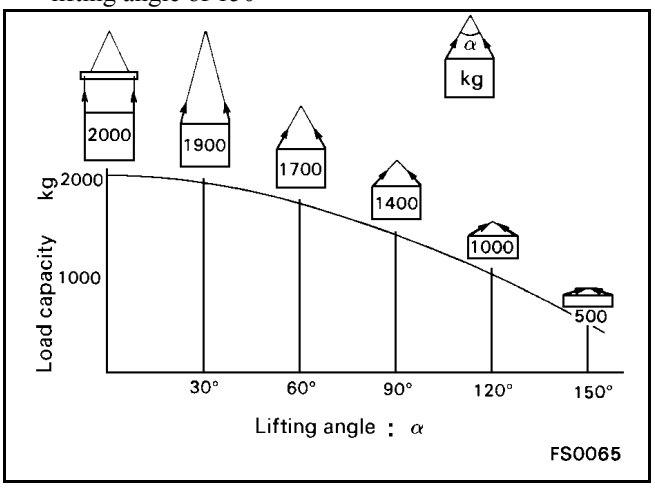
2. Sling wire ropes from the middle portion of the hook. Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



3. Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.

WARNING! Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident

4. Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various hanging angles. When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120° hanging angle. On the other hand, two ropes are subject to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°



COATING MATERIALS

★ The recommended coating materials prescribed in the shop manuals are listed below.

Category	Code	Part No.	Quantity	Container	Main applications, features
Adhesives	LT-1A	790-129-9030	150 g	Tube	• Used to prevent rubber gaskets, rubber cushions and cork plugs from coming out
	LT-1B	790-129-9050	20 g (2 pes.)	Polyethylene container	• Used in places requiring an immediately effective, strong adhesive. • Used for plastics (except polyethylene, polypropylene, tetrafluoroethylene, and vinyl chloride), rubber, metal and non-metal.
	LT-2	09940-00030	50 g	Polyethylene container	• Features: Resistance to heat, chemicals • Used for anti-loosening and sealant purposes for bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardening agent)	Adhesive: 1 kg Hardening agent: 500 g	Can	• Used as adhesive or sealant for metal, glass or plastic.
	LT-4	790-129-9040	250 g	Polyethylene container	• Used as sealant for machined holes.
	Holtz MH 705	790-126-9120	75 g	Tube	• Used as heat-resisting sealant for repairing engine.
	Three bond 1735	179-129-9140	2 g	Polyethylene container	• Quick hardening type adhesive. • Cure time: within 5 sec. to 3 min. • Used mainly for adhesion of metals, rubbers, plastics and woods.
	Aron-alpha 201	790-129-9130	50 g	Polyethylene container	• Quick hardening type adhesive. • Quick cure type (max. strength after 30 minutes). • Used mainly for adhesion of rubbers, plastics and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	• Features: Resistance to heat, chemicals • Used at joint portions subject to high temperature.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	• Used as adhesive or sealant for gaskets and packing of power train case, etc.
	LG-3	790-129-9070	1 kg	Can	• Features: Resistance to heat • Used as sealant for flange surfaces and bolts at high temperature locations; used to prevent seizure. • Used as sealant for heat resistant gasket for at high temperature locations such as engine pre-combustion chamber, exhaust pipe.

Category	Code	Part No.	Quantity	Container	Main applications, features
Gasket sealant	LG-4	790-129-9020	200 g	Tube	• Features: Resistance to water, oil • Used as sealant for flange surface, thread. • Also possible to use as sealant for flanges with large clearance. • Used as sealant for mating surfaces of final drive case, transmission case.
	LG-5	790-129-9080	1 kg	Polyethylene container	• Used as sealant for various threads, pipe joints, flanges. • Used as sealant for tapered plugs, elbows, nipples of hydraulic piping.
	LG-6	09940-00011	250 g	Tube	• Features: Silicon based, resistant to heat, cold. • Used as sealant for flange surface, thread. • Used as sealant for oil pan, final drive case, etc.
	LG-7	09920-00150	150 g	Tube	• Features: Silicon based, quick hardening type. • Used as sealant for flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	Three bond 1211	790-129-9090	100 g	Tube	• Used as heat-resisting sealant for repairing engines.
Molybdenum disulphide lubricant	LM-G	09940-00051	60 g	Can	• Used as lubricant for sliding parts (to prevent squeaking).
	LM-P	09940-00040	200 g	Tube	• Used to prevent seizure or scuffing of the thread when press fitting or shrink fitting. • Used as lubricant for linkage, bearings, etc.
Grease	G2-LI	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA160CNLI	Various	Various	• General purpose type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYG2-160CNCA	Various	Various	• Used for normal temperature, light load bearing at places in contact with water or steam.
	Molybdenum disulphide lubricant	SYG2-400M	400 g (10 per case)	Belows type	• Used for places with heavy load.

STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUE OF BOLTS AND NUTS

The following charts give the standard tightening torques of bolts and nuts. Exceptions are given in DISASSEMBLY AND ASSEMBLY.

Thread diameter of bolt	Width across flats		
mm	mm	Nm	kgm
6	10	13.2 ±1.4	1.35 ±0.15
8	13	31.4 ±2.9	3.20 ±0.3
10	17	65.7 ±6.8	6.70 ±0.7
12	19	112 ±9.8	11.5 ±1.0
14	22	177 ±19	18 ±2.0
16	24	279 ±29	28.5 ±3
18	27	383 ±39	39 ±4
20	30	549 ±58	56 ±6
22	32	745 ±78	76 ±8
24	36	927 ±98	94.5 ±10
27	41	1320 ±140	135 ±15
30	46	1720 ±190	175 ±20
33	50	2210 ±240	225 ±25
36	55	2750 ±290	280 ±30
39	60	3280 ±340	335 ±35

Thread diameter of bolt	Width across flats	
mm	mm	Nm	kgm
6	10	7.85 ± 1.95	0.8 ± 0.2
8	13	18.6 ± 4.9	1.9 ± 0.5
10	14	40.2 ± 5.9	4.1 ± 0.6
12	27	82.35 ± 7.85	8.4 ± 0.8

TIGHTENING TORQUE OF HOSE NUTS

Use these torques for hose nuts.

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02	14	19	24.5 ± 4.9	2.5 ± 0.5
03	18	24	49 ± 19.6	5 ± 2
04	22	27	78.5 ± 19.6	8 ± 2
05	24	32	137.3 ± 29.4	14 ± 3
06	30	36	176.5 ± 29.4	18 ± 3
10	33	41	196.1 ± 49	20 ± 5
12	36	46	245.2 ± 49	25 ± 5
14	42	55	294.2 ± 49	30 ± 5

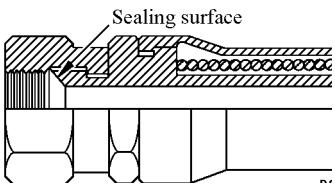
TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

Use these torques for split flange bolts.

Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
10	14	65.7 ± 6.8	6.7 ± 0.7
12	17	112 ± 9.8	11.5 ± 1
16	22	279 ± 29	28.5 ± 3

TIGHTENING TORQUE FOR FLARED NUTS

Use these torques for flared part of nut.



Thread diameter	Width across flat	Tightening torque	
mm	mm	Nm	kgm
14	19	24.5 ±4.9	2.5 ±0.5
18	24	49 ±19.6	5 ±2
22	27	78.5 ±19.6	8 ±2
24	32	137.3 ±29.4	14 ±3
30	36	176.5 ±29.4	18 ±3
33	41	196.1 ±49	20 ±5
36	46	245.2 ±49	25 ±5
42	55	294.2 ±49	30 ±5

ELECTRIC WIRE CODE

In the wiring diagrams, various colors and symbols are employed to indicate the thickness of wires. This wire code table will help you understand WIRING DIAGRAMS.
Example: 05WB indicates a cable having a nominal number 05 and white coating with black stripe.

CLASSIFICATION BY THICKNESS

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number of strands	Dia. Of strand (mm)	Cross section (mm)			
0.85	11	0.32	0.88	2.4	12	Starting, lighting, signal etc.
2	26	0.32	2.09	3.1	20	Lighting, signal etc.
5	65	0.32	5.23	4.6	37	Charging and signal
15	84	0.45	13.36	7.0	59	Starting (Glow plug)
40	85	0.80	42.73	11.4	135	Starting
60	127	0.80	63.84	13.6	178	Starting
100	217	0.80	109.1	17.6	230	Starting

CLASSIFICATION BY COLOR AND CODE

Priority	Circuits Classification		Charging	Ground	Starting	Lighting	Instrument	Signal	Other
1	Primary	Code	W	B	B	R	Y	G	L
		Color	White	Black	Black	Red	Yellow	Green	Blue
2	Auxiliary	Code	WR	—	BW	RW	YR	GW	LW
		Color	White & Red	—	Black & White	Red & White	Yellow & Red	Green & White	Blue & White
3		Code	WB	—	BY	RB	YB	GR	LR
		Color	White & Black	—	Black & Yellow	Red & Black	Yellow & Black	Green & Red	Blue & Red
4		Code	WL	—	BR	RY	YG	GY	LY
		Color	White & Blue	—	Black & Red	Red & Yellow	Yellow & Green	Green & Yellow	Blue & Yellow
5		Code	WG	—	—	RG	YL	GB	LB
		Color	White & Green	—	—	Red & Green	Yellow & Blue	Green & Black	Blue & Black
6		Code	—	—	—	RL	YW	GL	—
		Color	—	—	—	Red & Blue	Yellow & White	Green & Blue	—

CONVERSION TABLES

METHOD OF USING THE CONVERSION TABLE

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

EXAMPLE

- Method of using the Conversion Table to convert from millimeters to inches.

1. Convert 55 mm into inches.
   A. Locate the number 50 in the vertical column at the left side, take this as ①, then draw a horizontal line from ①.

   B. Locate the number 5 in the row across the top, take this as ②, then draw a perpendicular line down from ②.

   C. Take the point where the two lines cross as ③. This point ③ gives the value when converting from millimeters to inches. Therefore, 55 millimeters = 2.165 inches.

2. Convert 550 mm into inches.
   A. The number 550 does not appear in the table, so divide by 10 (move the decimal one place to the left) to convert it to 55 mm.

   B. Carry out the same procedure as above to convert 55 mm to 2.165 inches.

   C. The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimeters to inches ② 1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
						③				
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

① (row 50)

Millimeters to Inches **1 mm = 0.03937 in**

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound **1 kg = 2.2046 lb**

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Liter to U.S. Gallon **1 L = 0.2642 U.S. Gal**

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Liter to U.K. Gallon **1 L = 0.21997 U.K. Gal**

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft. lb. **1 kgm = 7.233 ft. lb.**

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.63	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm^2 to lb/in^2 **1 kg/cm^2 = 14.2233lb/in^2**

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1010	1024	1038	1053	1067	1081	1095	1109	1124
80	1138	1152	1166	1181	1195	1209	1223	1237	1252	1266
90	1280	1294	1309	1323	1337	1351	1365	1380	1394	1408
100	1422	1437	1451	1465	1479	1493	1508	1522	1536	1550
110	1565	1579	1593	1607	1621	1636	1650	1664	1678	1693
120	1707	1721	1735	1749	1764	1778	1792	1806	1821	1835
130	1849	1863	1877	1892	1906	1920	19324	1949	1963	1977
140	1991	2005	2034	2048	2062	2077	2091	2105	2119	
150	2134	2148	2162	2176	2190	2205	2219	2233	2247	2262
160	2276	2290	2304	2318	2333	2347	2361	2375	2389	2404
170	2418	2432	2446	2460	2475	2489	2503	2518	2532	2546
180	2560	2574	2589	2603	2617	2631	2646	2660	2674	2688
190	2702	2717	2731	2745	2759	2773	2788	2802	2816	2830
200	2845	2859	2873	2887	2901	2916	2930	2944	2958	2973
210	2987	3001	3015	3030	3044	3058	3072	3086	3101	3115
220	3129	3143	3158	3172	3186	3200	3214	3229	3243	3257
230	3271	3286	3300	3314	3328	3343	3357	3371	3385	3399
240	3414	3428	3442	3456	3470	3485	3499	3513	3527	3542

Temperature

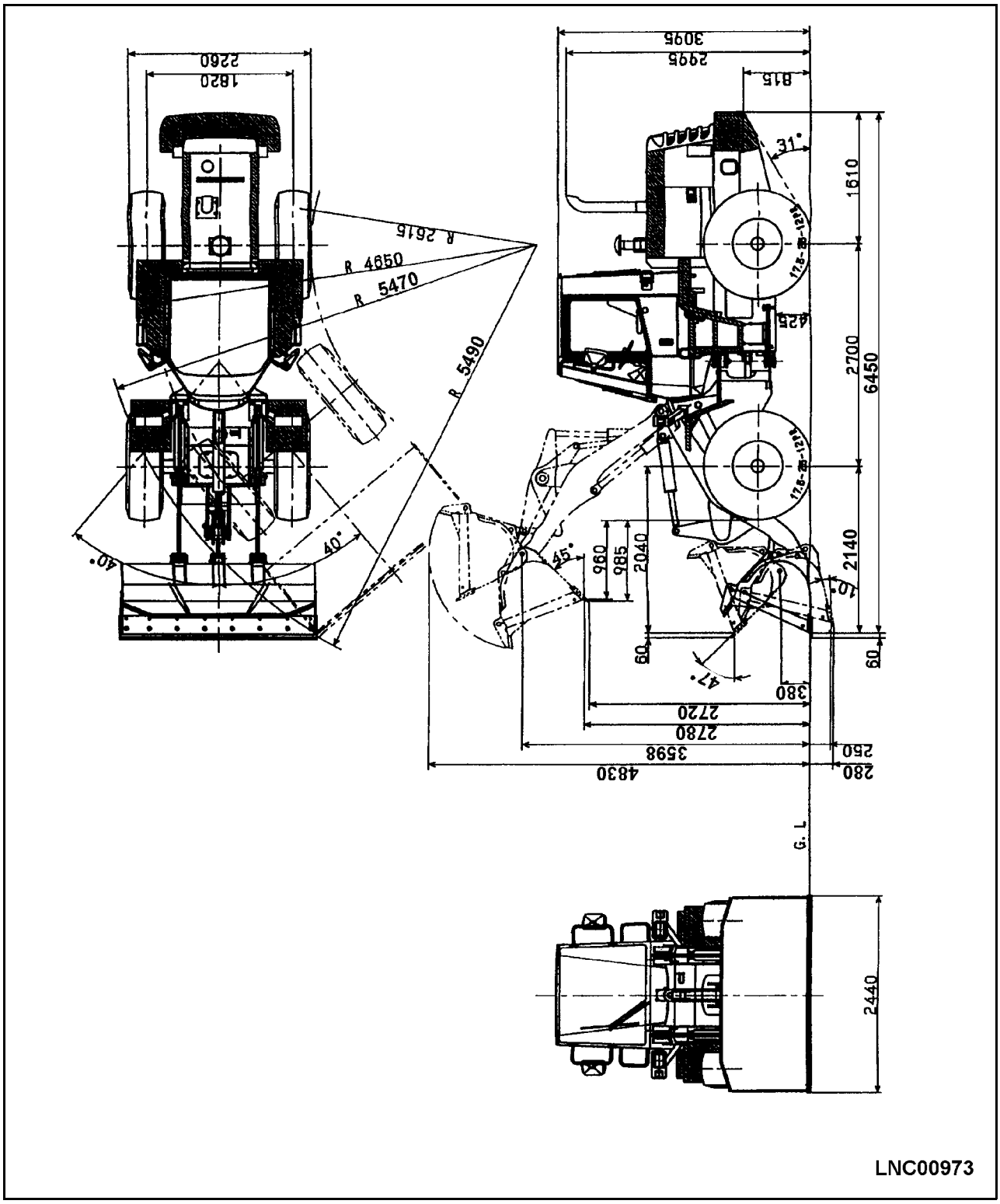
Fahrenheit Centigrade Conversion; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vise versa is to enter the accompanying table in the center or boldface column of figures. These figures refer to the temperature in either Fahrenheit or Centigrade degrees. If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left. If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

°C		°F	°C		°F	°C		°F	°C		°F
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	117.8
-37.2	.35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-7.2	19	66.2	12.2	54	129.2	31.7	89	192.2
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	30	86.0	18.3	65	149.0	37.8	100	212.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	175	347.0

01 GENERAL

SPECIFICATION DRAWING

Unit: mm



SPECIFICATIONS

Machine model		WA180-3MC	Serial No.	A81001 and up
Weight	Operating weight		kg (lb)	9350 (20610)
	Distribution (front)		kg (lb)	3610 (7960)
	Distribution (rear)		kg (lb)	5740 (12650)
Performance	Bucket capacity (piled)		m^3 (yd^3)	1.9 (2.49)
	Rated load		kg (lb)	3040 (6700)
	Travel speed	FORWARD 1st	km/h (mph)	7.2 (4.5)
		FORWARD 2nd	km/h (mph)	12.0 (7.5)
		FORWARD 3rd	km/h (mph)	22.0 (13.7)
		FORWARD 4th	km/h (mph)	34.5 (21.4)
		REVERSE 1st	km/h (mph)	7.1 (4.8)
		REVERSE 2nd	km/h (mph)	12.3 (7.8)
		REVERSE 3rd	km/h (mph)	20.5 (14.2)
		REVERSE 4th	km/h (mph)	32.3 (21.7)
	Max. rimpull	FORWARD	N (lbf)	81395 (18298)
	Gradeability		deg	25
	Min. turning radius	Center of outside wheel	mm (ft)	5490 (18)
		Outside portion of chassis	mm (ft)	4650 (15.25)
Dimensions	Overall length (with B.O.C.)		mm (ft)	6510 (21.36)
	Overall width (chassis)		mm (ft)	2260 (7.41)
	Bucket width	cutting edge	mm (ft)	2440 (8.00)
	Overall height	top of ROPS cab	mm (ft)	3095 (10.15)
		bucket raised	mm (ft)	4830 (15.85)
	Wheel base		mm (ft)	2700 (8.85)
	Tread		mm (ft)	1820 (5.97)
	Minimum ground clearance		mm (ft)	425 (16.73)
	Height of bucket hinge pin		mm (ft)	3595 (11.79)
	Dumping clearance (tip of edge)		mm (ft)	2720 (8.92)
	Dumping reach (tip of edge)		mm (ft)	990 (3.25)
	Bucket dump angle		deg	46
	Bucket tilt angle (travel position)		deg	47
	Digging depth (10° dump)		mm (ft)	280 (0.92)

Machine model			WA180-3MC	Serial No.	A81001 and up
Engine	Model				S6D102E-1
	Type				Direct Injection (Aspiration, Turbo charged)
	No. of cylinders - bore x stroke				6 - 102 mm x 120 mm
	Piston displacement			L (in^3)	5.88 (359)
	Performance	Flywheel horsepower		kW/rpm (HP/rpm)	89 (120)
		Maximum torque (gross)		Nm (lbf ft)	483 (357)
		High idling speed		rpm	2600
		Low idling speed		rpm	850
	Starting motor				24 V 4.5 kW
	Alternator				24 V 50 A
	Battery				12 V 110 Ah x 2
Power train	Torque converter				3-element, 1-stage, single-phase (Komatsu TCA30-6Z)
	Transmission				spur gear, constant-mesh multiple-disc, hydraulic actuated, modulation type
	Reduction gear				Single bevel gear
	Differential				Straight bevel gear, torque proportioning
	Final drive				Planetary gear, single reduction
Axle, wheel	Drive type				Front / rear wheel drive
	Front axle				Fixed frame, semi-floating
	Rear axle				Center pin support type, semi-floating
	Tire				17.5 - 25 x 12 pr (L2)
	Wheel rim				25 x 13.00
	Inflation pressure		Front tire	kPa (psi [lbf/in^2])	294 (42.64)
			Rear tire	kPa (psi [lbf/in^2])	294 (42.64)
Brakes	Main brake			Front/rear wheel independent wet-type sealed disc brakes with hydraulic booster	
	Parking brake			Thrust shaft (transmission shaft) braking, wet-type disc brake, mechanical type	

Machine model		WA180-3MC	Serial No.	A81001 and up
Hydraulic system	Hydraulic pump delivery	Torque converter, transmission pump	Liter/min (gal/min)	90.5 (23.9)
		Steering pump	Liter/min (gal/min)	106 (28.0)
		PPC pump	Liter/min (gal/min)	21 (5.5)
		Work equipment pump	Liter/min (gal/min)	144 (38.0)
	Control valve set pressure	Transmission valve	kg/cm^2 (lbf/in^2)	23 / 327.1
		Steering demand valve	kg/cm^2 (lbf/in^2)	Spool type 210 (2986.9)
		Main control valve	kg/cm^2 (lbf/in^2)	Spool type 210 (2986.9)
	Cylinder	Steering cylinder No. - bore x stroke	mm	Reciprocating piston 2 - 60 x 340
		Boom cylinder No. - bore x stroke	mm	Reciprocating piston 2 - 120 x 622
		Bucket cylinder No. - bore x stroke	mm	Reciprocating piston 1 - 130 x 423
Work equipment	Link type			Single Z bar link
	bucket edge type			Flat edge with bolt on cutting edge

WARNING! This weight table is a guide for use when transporting or handling components.

Unit: kg (lb)

Machine model	WA180-3MC
Serial number	A81001 and up
Engine (dry) (with air cleaner and muffler)	540 (1190.5)
Radiator (dry)	80 (176.37)
Torque converter (dry)	35 (77.16)
Transmission with torque converter (dry)	480 (1058.22)
Center drive shaft	11 (24.25)
Front drive shaft	12 (26.45)
Rear drive shaft	6 (13.22)
Axle pivot	69 (152.11)
Front axle	387 (853.18)
Rear axle	393 (866.41)
Wheel (each)	71 (156.52)
Tire (each)	106 (233.69)
Orbit-roll valve	8 (17.63)
Priority valve	6 (13.22)
Steering cylinder (each)	14 (30.86)
Hydraulic tank (dry)	53 (116.84)
Work equipment / steering pump	10 (22.04)
Brake booster	11 (24.25)
PPC valve	3.1 (6.8)
Main control valve	21 (46.29)
Boom (Lift) cylinder (each)	80 (175)
Bucket (Dump) cylinder	56 (123.45)
Engine hood with side panels	127 (279.98)
Front frame	750 (1653.44)
Rear frame	612 (1349.23)
Bucket link (with bushing)	17 (37.47)
Bellcrank (with bushing)	125 (275.57)
Boom (Lifting arm) (with bushing)	520 (1146.4)
Bucket with bolt on cutting edge	750 (1553)

Machine model	WA180-3MC
Serial number	**A81001 and up**
Counterweight	1210 (2667.59)
Fuel tank	80 (176.37)
Battery (each)	30 (66.13)
Cab assembly with floor	1060 (2336.9)
Cab (ROPS)	500 (1102.31)
Operator’s seat	40 (88.18)

Unit: kg (lb)

LIST OF LUBRICANT AND WATER

Reservoir	Kind of fluid	Ambient Temperature									Capacity	
		-22 -30	-4 -20	14 -10	32 0	50 10	68 20	86 30	104 40	122°F 50°C	Specified	Refill
Engine oil pan	Engine oil	SAE 5W- 30									22 L 5.8 gal	19.5 L 5.1 gal
			SAE 10W-30									
				SAE 15W-40								
Brake											1 L 0.26 gal	1 L 0.26 gal
			SAE 5W									
Transmission case											35 L 9.2 gal	30 L 7.9 gal
			SAE 10W									
Hydraulic system											90 L 23.8 gal	64 L 16.9 gal
			SAE 10W									
Axle (front & rear) (each)	Axle oil	See Note 1									17 L 4.5 gal	17 L 4.5 gal
Pins	Grease										---	---
			NLGI No. 2									
Fuel tank	Diesel fuel										184 L 48.6 gal	---
					ASTM D975 No. 2							
			*									
Cooling system	Coolant										25.5 L 6.7 gal	---
			Add Anti-freeze Coolant									
* ASTM D975 No. 1												

Other equipment will be necessary, when operating the machine at temperatures below -20^{o} C (-4^{o} F), therefore consult your Komatsu distributor for your needs.

Note 1: For axle oil, use only the recommended oil as follows.

SHELL:	DONAX TT or TD
CALTEX:	RPM TRACTOR HYDRAULIC FLUID
CHEVRON:	TRACTOR HYDRAULIC FLUID
TEXACO:	TDH OIL
MOBIL:	MOBIL 424

It is possible to substitute engine oil SAE 30 API classification CD for axle oil. Although increased brake noise may result, durability is not affected.

ENGINE OIL SPECIFICATIONS

NORMAL OPERATION

Oil performance recommendations are as follows:
The use of a quality engine lubricating oil combined with appropriate oil and filter change intervals are critical factors in maintaining engine performance and durability.

SAE 15W-40 multi-viscosity oil meeting the American Petroleum Institute (API) performance classification of CF-4, CF-4/SG, CG-4, CG-4/SH is recommended.

Remark

CC/CD or CD/SF oils may be used in areas where CE oil is not yet available but the oil change interval must be reduced to one half the interval given in the maintenance schedule

A sulfated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit and oil consumption control. the sulfated ash must not exceed 1.85 mass percent. The sulfated ash limit of 1.85 mass percent has been placed on all engine lubricating oils recommended for use in the engine. Higher ash oils can cause valve and/or piston damage and lead to excessive oil consumption.

The API service symbol displays the appropriate oil categories; the lower half may contain words to describe oil energy conserving features. The center section identifies the SAE oil viscosity grade.

Oil viscosity recommendations are as follows:

The use of a multi-graded lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures.

While SAE 15W-40 multi-viscosity oil is recommended for most operating climates, refer to the previous chart for oil viscosity recommendations for extreme climates.

Remark

Limited use of low viscosity oils, such as 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below -5° C (23° F). However, continuous use of low viscosity oil can decrease engine life due to wear.

Single graded oils may be used if multi-graded oil is not available. But be sure to use oil that matches the temperature shown in the table.

Special break-in lubricating oils are not recommended for a new or rebuilt engine. Use the same type of oil during the break-in as specified for normal operation.

Additional information regarding lubricating oil availability throughout the world is available in the "E.M.A. Lubricating Oils Data Book For Heavy Duty Automotive and Industrial Engines". The data book may be ordered from the Engine Manufacturers Association, One Illinois Center, 111 East Wacker Drive,Chicago, Il U.S.A. 60601. The telephone number is (312) 644-6610.

ARCTIC OPERATION

If an engine is operated in ambient temperatures consistently below -23° C (-10° F) and there are no provisions to keep the engine warm when it is not in operation, use a synthetic API performance classification CE or CF-4 engine oil with adequate low temperature properties such as SAE 5W-20 or 5W-30.

The oil supplier must be responsible for meeting the performance service specifications.
IMPORTANT: The use of a synthetic base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as; corrosion, deposits and wear.

DIESEL FUEL SPECIFICATIONS

WARNING! Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.

★ Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the injection pump and nozzles.

For normal service above -12° C (+10° F), the use of ASTM Grade No. 2-D diesel fuel with a minimum Cetane number of 40 is recommended. The use of No. 2-D diesel fuel will result in optimum engine performance under most operating conditions. Fuels with Cetane numbers higher than 40 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.

At operating temperatures below -12° C (+10° F), use ASTM Grade No. 1-D diesel fuel. The use of lighter fuels can reduce fuel economy.

Where a winterized blend of Grade No. 2-D and No. 1-D fuels is available, it may be substituted for Grade No. 1-D fuel. However, it is the supplier's responsibility to provide the fuel for the anticipated ambient temperature.

Use a low sulfur content fuel having a cloud point that is at least 10 degrees below the lowest expected fuel temperature. Cloud point is the temperature at which crystals begin to form in the fuel. The viscosity of the fuel must be kept above 1.3 cSt to provide adequate fuel system lubrication.

COOLANT SPECIFICATIONS

GENERAL

Selection and maintenance of the engine coolant is important to long engine life. The following information provides recommendations for selecting the engine coolant and maintaining the coolant inhibitors.

Heavy duty diesel engines require a balanced coolant mixture of water, antifreeze, and supplemental coolant additives. Supplemental coolant additive recommendations are included in the section entitled Inhibitors Conditioners. The coolant mixture **must** be drained and replaced at the specified service interval shown in the OPERATION & MAINTENANCE MANUAL, or every two years of operation, whichever comes first.

WATER

Use water which has a low mineral content. Water used in conjunction with antifreeze, coolant filters and inhibited water must meet the following standards:

Total Hardness - Not to exceed 170 parts per million (10 grains/gallon maximum) to prevent scale deposits. Water containing dissolved magnesium and calcium (the usual reason for water hardness) above the specified amount will cause scale deposits to develop in the engine.

Chlorides - Not to exceed 40 parts per million (2.5 grains/gallon maximum) to prevent corrosion.

Sulfites - Not to exceed 100 parts per million (5.8 grains/gallon maximum) to prevent corrosion.

Dissolved Solids - Not to exceed 340 parts per million (20 grains/gallon maximum) to minimize sludge deposits, scale deposits, corrosion or a combination of these.

If any of the above requirements cannot be met, use distilled, de-ionized, or de-mineralized water. To determine if local water supplies meet these standards, water samples can be tested by water treatment laboratories. Softened water that is prepared using common salt (sodium chloride) contains excessive amounts of chlorides and should not be used.

★ Never use water alone in the cooling system because corrosion will occur.

ANTIFREEZE

In climates where the temperature is above -37° C (-34° F), use a coolant mixture that contains 50 percent antifreeze. **Antifreeze is essential in any climate**. It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Do **not** use more than 50 percent antifreeze in the mixture unless additional freeze protection is required. **Never** use more than 68 percent antifreeze under any condition.

An antifreeze concentration greater than 68% will adversely affect freeze protection and heat transfer rates. Antifreeze concentrations between 68 and 100% actually have a higher freezing point than a 68% antifreeze concentration and should not be used due to reduced heat transfer rates.

Low silicate ethylene glycol antifreeze is recommended. The antifreeze should contain no more than 0.1% anhydrous alkali metasilicate. Low silicate antifreeze is recommended to avoid the formation of silica-gel (hydro-gel). This gel formation can occur when the cooling system contains an over concentration of high silicate antifreeze and/or supplemental coolant additive. DO NOT use methanol or alcohol as an antifreeze because of its low boiling point.

Antifreeze may retain its freeze protection for more than one season but coolant conditioners must be added to maintain corrosion protection.

Antifreeze formulated with methoxy propanol, or propylene glycol, is not recommended for this system.

★ Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing. Antifreeze containing sealer or anti-leak additives should NOT be used in this system. Sealer or anti-leak additives will cause plugging problems in the cooling system.

Check the solution periodically and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing.

The following table shows the approximate percentage of antifreeze solution required for various temperatures.

Approximate Freezing Point	Percentage of Antifreeze Concentration by Volume	Specific Gravity at 16°C (60°F)
0°C (+32°F)	0	1.000
-7°C (+20°F)	15	1.025
-12°C (+10°F)	25	1.040
-18°C (0°F)	33	1.053
-23°C (-10°F)	40	1.062
-29°C (-20°F)	45	1.070
-34°C (-30°F)	48	1.074
-40°C (-40°F)	53	1.080
-46°C (-50°F)	56	1.083
-51°C (-60°F)	59	1.088
-57°C (-70°F)	62	1.092
-62°C (-80°F)	65	1.095
-68°C (-90°F)	67	1.097
-69°C (-92°F)	68	1.098

In tropical climates where antifreeze availability may be limited, use a corrosion inhibitor DCA4, to protect the engine cooling system.

INHIBITORS/CONDITIONERS

1. All cooling system inhibitors, including those in antifreeze solutions, become depleted through normal operation. If the inhibitors in antifreeze are allowed to become depleted, the antifreeze becomes corrosive and attacks and coats the metallic surfaces of the cooling system which reduces heat transfer. Cooling system conditioners which contain these inhibitors must be added to maintain corrosion protection.

2. Soluble oil is not recommended for use in this engine as its use will reduce heat transfer.

3. There are no miracle additives that will increase heat transfer or prevent overheating. Conditioned water is still the best coolant.

4. DCA4 is recommended to inhibit corrosion in the cooling system for the following reasons:

    - Improved compatibility with high silicate antifreezes to minimize hydro-gel formation if over concentration occurs.
    - Provides engine protection in the following areas:
        - Solder corrosion/bloom
        - Copper corrosion/erosion/stress cracking
        - Oil fouling
        - Cylinder liner cavitation corrosion
        - Aluminum cavitation corrosion
        - Seal and gasket degradation

Maintenance of Cooling System Inhibitors

Keeping the engine coolant properly inhibited will keep the engine and radiator free of rust, scale deposits and corrosion.

New machines are delivered with antifreeze protection. Service at regular scheduled intervals specified in the OPERATION & MAINTENANCE MANUAL with a service DCA4 filter.

Each time the coolant is drained and replaced, the coolant must be recharged with DCA4. New coolant can be correctly charged with supplemental coolant additives by using DCA4 filters or DCA4 concentrate listed in the table entitled, DCA4 Unit Guide.

If coolant is added between drain intervals, additional DCA4 will be required.

Coolant Testing for Conditioner Concentration

When the cooling system is maintained as recommended, the conditioner concentration should be satisfactory. The DCA4 concentration must not fall below 1.0 unit per 3.8 L (1 U.S. gal.) or exceed 2 units per 3.8 L (1 U.S. gal.) of coolant. The only accurate method for testing chemical concentrations in coolant with mixed chemical compounds is a laboratory analysis. For this reason, the coolant inhibitor should be maintained as shown in the OPERATION & MAINTENANCE MANUAL.

★ Inadequate concentration of the coolant additive can result in major corrosive damage to cooling system components. Over concentration can cause formation of gel that can cause restriction, plugging of passages and overheating.

Replenishing Coolant Conditioner

Install a precharge DCA4 filter when the coolant is changed or a significant (more than 50%) coolant loss occurs. Install a service DCA4 filter as specified in the OPERATION & MAINTENANCE MANUAL When antifreeze is added, add coolant conditioner equal to 1.0 unit per 3.8 L (1 U.S. gal.) of antifreeze.

Mixing of DCA4 and other supplemental coolant additives is not recommended because there is currently no test kit available to measure concentration levels with mixed chemical solutions.

DCA4 Unit Maintenance Guide

Use supplemental coolant additives (corrosion inhibitors) to protect the engine cooling system from corrosion. Antifreeze alone does **not** provide enough corrosion protection for a heavy duty diesel engine. Supplemental corrosion protection **must** be supplied through periodic additions of supplemental coolant additives to the coolant.

To protect against corrosion, a new coolant charge **must** be brought up to 0.26 DCA4 unit per liter (one unit per U.S. gal.) of coolant (initial charge). Maintain the correct DCA4 concentration by changing the service coolant filter at each engine oil and filter change interval.

Each time the coolant is drained and replaced, the coolant **must** be recharged with supplemental coolant additives. Use the appropriate DCA4 spin-on filter listed in following table. The coolant mixture **must** be drained and replaced as defined under General.

The amount of replacement inhibitor is determined by the length of the service interval and the cooling system capacity. Refer to the DCA4 Unit Guide for the selection of the correct filter to replenish the DCA4.

If coolant is added between drain intervals, additional DCA4 will be required. Check the coolant DCA4 concentration level anytime make-up coolant is added to the system. The DCA4 concentration **must not** fall below 0.13 units per liter or exceed 0.5 units per liter (0.5 units per U.S. gallon or exceed 2 units per U.S. gallon).

DCA4 Unit Guide

Fleetguard Part No.	DCA4 Units
DCA4 Coolant Filter	
WF-2070	2
WF-2071	4
WF-2072	6
WF-2073	8
WF-2074	12
WF-2075	15
WF-2076	23
WF-2077	0
DCA4 Liquid	
DCA60L	4 (1 pint)
DCA80L	1,760 (55 U.S. gal.)
DCA4 Powder	
DCA95	20

DCA4 Precharge and Service Filters

System Capacity		Precharge Filter (See NOTE 1)	Service Filter (See NOTE 3)
Liters	US Gallons		
19 to 26	5 to 7	WF-2072	WF-2070
26 to 38	**7 to 10**	**WF-2073**	**WF-2071**
38 to 57	10 to 15	WF-2074	WF-2071
57 to 76	15 to 20	WF-2075	WF-2071
76 to 114	20 to 30	WF-2076	WF-2072
114 to 190	30 to 50	(See NOTE 2)	WF-2073

NOTE 1 - After draining and replacing coolant, always precharge the cooling system to maintain the DCA4 concentration between 1.0 and 2.0 units per 3.8 L (1 U.S. gal.).

★ When performing service which requires draining the cooling system, discard the coolant. Reusing coolant can introduce contaminates or over concentrated chemicals, resulting in premature failure of cooling system components.

NOTE 2 - To precharge cooling systems larger than 114 L (30 U.S. gal.), do the following:

- Install appropriate service filter listed in the above table based on cooling system capacity.
  Example: 360 L (95 U.S. gal.) cooling system capacity
  -15 Units (1) WF-2075 Filter
  80 Units
- The answer represents the additional units required to precharge the cooling system. Four bottles of powder, part number DCA95, will provide a sufficient amount of DCA4 units (80) to precharge the example cooling system.
- Install the appropriate service filter at the next and subsequent maintenance intervals.

NOTE 3 - Change the coolant filter at every engine oil and filter change interval to protect the cooling system.

Maintain a nominal concentration of 1.0 DCA4 unit per 3.8 L (1 U.S. gal.) of coolant in the system. Less than 0.5 unit per 3.8 L (1 U.S. gal.) indicates an under-concentrated coolant solution. More than 2.0 units per 3.8 L (1 U.S. gal.) indicates an over-concentrated coolant solution.

To check the DCA4 concentration level, use the Fleet guard coolant test kit, CC2626. Instructions are included with the test kit.

DCA4 Unit Concentration Guide

Number of Solution A Drops to Cause Color Change	Coolant Condition	Action Required
0 to 10 Drops	Extremely under-concentrated - less than 0.4 DCA4 units per 3.8 L (1 U.S. gal.)	Initially charge the system to a minimum of 1.0 DCA4 unit per 3.8 L (1 U.S. gal.)
11 to 16 Drops	Marginally under-concentrated - 0.45 to 0.8 DCA4 units per 3.8 L (1 U.S. gal.)	Add DCA4 liquid units to maintain 1.0 DCA4 unit per 3.8 L (1 U.S. gal.) minimum or change the DCA4 coolant filter
17 to 25 Drops	Acceptable - 0.85 to 1.3 DCA4 units per 3.8 L (1 U.S. gal.)	NONE
26 to 35 Drops	Highly acceptable - 1.35 to 2.0 DCA4 units per 3.8 L (1 U.S. gal.)	NONE
36 to 55 Drops	Marginally over-concentrated - 2.1 to 3.3 DCA4 units per 3.8 L (1 U.S. gal.)	Review maintenance practice
Over 55 Drops	Extremely over-concentrated	Drain 50% of the coolant and replace with water anti-freeze mixture. Retest the system for correct DCA4 unit concentration.