

SHOP MANUAL

KOMATSU

AVANCE LOADER

WA380-3

MACHINE MODEL

SERIAL NUMBER

WA380-3

50001 and up

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- WA380-3 mount the S6D108 engine.
For details of the engine, see the 108 Series Engine Shop Manual.

CONTENTS

	No. of page
01 GENERAL	01-1
10 STRUCTURE AND FUNCTION	10-1
20 TESTING AND ADJUSTING	20-1
30 DISASSEMBLY AND ASSEMBLY	30-1
40 MAINTENANCE STANDARD	40-1

U42303

The affected pages are indicated by the use of the following marks. It is requested that necessary actions must be taken to these pages according to the list below.

Mark	Indication	Action required
○	Page to be newly added	Add
●	Page to be replaced	Replace
()	Page to be deleted	Discard

Pages having no marks are not revised at this time.

LIST OF REVISED PAGES

Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number
●	00- 1	⑤		10- 12			10- 55			10- 95			10-138	
	00- 2	②		10- 14			10- 56			10- 96			10-139	
●	00- 2-1	⑤		10- 15			10- 57			10- 97			10-140	
●	00- 2-2	⑤		10- 16			10- 58			10- 98			10-141	
●	00- 2-3	⑤		10- 17			10- 59	②		10- 99			10-142	
●	00- 2-4	⑤		10- 18			10- 60	②		10-100			10-143	③
	00- 3			10- 19			10- 61	②		10-101			10-143-1	③
	00- 4			10- 20			10- 62			10-103			10-143-2	③
	00- 5			10- 21			10- 63			10-104			10-144	
	00- 6			10- 22			10- 64			10-105	③		10-146	③
	00- 7			10- 23			10- 65	②		10-105-1	③		10-147	
	00- 8			10- 24			10- 66	②		10-105-2	③		10-148	③
	00- 9			10- 25			10- 67	②		10-106	③		10-149	
	00- 10			10- 26			10- 68			10-107			10-149-1	③
	00- 11			10- 27			10- 69	②		10-108			10-149-2	③
	00- 12			10- 28			10- 70			10-109			10-149-3	③
	00- 13			10- 29			10- 71			10-110			10-149-4	③
	00- 14			10- 30			10- 72			10-111			10-151	
	00- 15			10- 31			10- 73			10-112			10-152	
	00- 16			10- 32			10- 74			10-113			10-153	
	00- 17			10- 33			10- 75			10-114			10-155	
	00- 18			10- 34			10- 76			10-115			10-156	
	00- 19			10- 35			10- 77			10-116			10-157	
	01- 1	③		10- 36			10- 78			10-118			10-158	
	01- 2	③		10- 37			10- 79	④		10-119			10-159	
	01- 3	③		10- 38			10- 80	④		10-120			10-160	
	01- 4	③		10- 39			10- 82			10-121			10-161	
	01- 5	③		10- 40		○	10- 82-2	⑤		10-122			10-162	
	01- 6	③		10- 41		●	10- 83	⑤		10-123			10-163	
	01- 7	③		10- 42			10- 84			10-124			10-164	
	01- 8	③		10- 43			10- 85			10-125			10-165	
	01- 9	③		10- 44			10- 86			10-126			10-166	
	01- 10	③		10- 45			10- 87			10-127			10-167	
●	10- 1	⑤		10- 46			10- 88			10-128			10-168	
	10- 3			10- 47			10- 89	③		10-129			10-169	
	10- 4			10- 48			10- 90			10-130			10-170	
	10- 5			10- 49			10- 90-1	③		10-131			10-171	
	10- 6			10- 50			10- 90-2	③		10-132			10-172	
	10- 8			10- 51			10- 91	③		10-134			10-173	
	10- 9			10- 52			10- 92			10-135			10-174	
	10- 10			10- 53			10- 93			10-136			10-175	
	10- 11			10- 54			10- 94			10-137			10-176	

U42303

Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number
	10-177			20- 27	①		20-121	①		20-273	①		20-377	①
	10-178			20- 28	①		20-122	①		20-274	①		20-378	①
	10-179			20- 29	①		20-123	①		20-275	①		20-379	①
	10-180			20- 30	①		20-124	①		20-276	①		20-380	①
	10-181			20- 31	①		20-125	①		20-277	①		20-381	①
	10-182			20- 32	①		20-126	①		20-278	①		20-382	①
	10-183			20- 33	①		20-127	①		20-279	①		20-383	①
	10-184			20- 34	①		20-128	①		20-280	①		20-384	①
	10-185			20- 35	①		20-129	①		20-281	①		20-386	①
	10-186			20- 36	①		20-130	①		20-282	①		20-387	①
	10-187			20- 37	①		20-131	①		20-283	①		20-388	①
	10-188			20- 38	①		20-132	①		20-301	①		20-390	①
	10-189			20- 39	①		20-133	①		20-302	①		20-391	①
	10-190			20- 40	①		20-134	①		20-303	①		20-392	①
	10-191			20- 41	①		20-201	①		20-304	①		20-401	①
	10-192			20- 42	①		20-202	①		20-305	①		20-402	①
	10-193			20- 43	①		20-203	①		20-306	①		20-403	①
	10-194			20- 44	①		20-204	①		20-307	①		20-404	①
	10-195			20- 45	①		20-205	①		20-308	①		20-405	①
	10-196			20- 46	①		20-206	①		20-309	①		20-406	①
	10-197			20- 47	①		20-207	①		20-310	①		20-407	①
	10-198			20- 48	①		20-208	①		20-311	①		20-408	①
	10-199		○	20- 48-1	⑤		20-209	①		20-312	①		20-409	①
	10-200			20- 49	①		20-210	①		20-313	①		20-410	①
	10-201			20- 50	①		20-211	①		20-314	①		20-411	①
	10-202			20- 51	①		20-212	①		20-315	①		20-412	①
	10-203			20- 52	①		20-213	①		20-316	①		20-413	①
	10-204			20- 53	①		20-214	①		20-317	①		20-414	①
	10-205			20- 54	②		20-215	①		20-318	①		20-415	①
●	20- 1	⑤		20- 55	①		20-216	①		20-319	①		20-416	①
	20- 2	①		20- 56	①		20-217	①		20-320	①		20-417	①
	20- 3	①		20- 57	①		20-218	①		20-351	①		20-418	①
●	20- 4	⑤		20- 58	①		20-219	①		20-352	①		20-419	①
	20- 5	①		20- 59	①		20-251	①		20-353	①		20-420	①
	20- 6	①		20- 60	①		20-252	①		20-354	①		20-421	①
	20- 7	①		20- 61	①		20-253	①		20-355	①		20-422	①
	20- 8	④		20-101	①		20-254	①		20-356	①		20-423	①
	20- 9	①		20-102	①		20-255	①		20-357	①		20-451	①
	20-10	①		20-103	①		20-256	①		20-358	①		20-452	①
	20-11	①		20-104	①		20-257	①		20-359	①		20-453	①
	20-12	①		20-105	①		20-258	①		20-360	①		20-454	①
	20-13	①		20-106	①		20-259	①		20-361	①		20-455	①
	20-14	①		20-107	①		20-260	①		20-362	①		20-456	①
	20-15	①		20-108	①		20-261	①		20-364	①		20-457	①
	20-16	①		20-109	①		20-262	①		20-365	①		20-458	①
	20-17	①		20-110	①		20-263	①		20-366	①		20-459	①
	20-18	①		20-111	①		20-264	①		20-367	①		20-460	①
	20-19	①		20-112	①		20-265	①		20-368	①		20-461	①
	20-20	①		20-114	①		20-266	①		20-369	①		20-462	①
	20-21	①		20-115	①		20-267	①		20-370	①		20-463	①
	20-22	①		20-116	①		20-268	①		20-371	①		20-501	①
	20-23	①		20-117	①		20-269	①		20-372	①		20-502	①
	20-24	①		20-118	①		20-270	①		20-374	①		20-503	①
	20-25	①		20-119	①		20-271	①		20-375	①		20-504	①
	20-26	①		20-120	①		20-272	①		20-376	①		20-505	①

U42303

U42303

Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number
20-506		①	30- 27		②	30- 82		②	30-138		②	30-188		②
20-507		①	30- 28		②	30- 83		②	30-139		②	30-189		②
20-508		①	30- 29		②	30- 84		②	30-140		②	30-190		②
20-509		①	30- 30		②	30- 85		②	30-141		②	30-191		②
20-510		①	30- 31		②	30- 86		②	30-142		②	30-192		②
20-511		①	30- 32		②	30- 87		②	30-143		②	30-193		②
20-512		①	30- 33		②	30- 88		②	30-144		②	30-194		②
20-513		①	30- 34		②	30- 89		②	30-145		②	30-195		②
20-514		①	30- 35		②	30- 90		②	30-146		②	30-196		②
20-515		①	30- 36		②	30- 92		②	30-147		②	30-197		②
20-516		①	30- 37		②	30- 93		②	30-148		②	30-198		②
20-517		①	30- 38		②	30- 94		②	30-149		②	30-199		②
20-518		①	30- 39		②	30- 95		②	30-150		②	30-200		②
20-519		①	30- 40		②	30- 96		②	30-151		②	30-201		④
20-520		①	30- 41		②	30- 97		②	30-152		②	30-202		④
20-521		①	30- 42		②	30- 98		②	30-153		②	30-203		②
20-522		①	30- 43		②	30- 99		②	30-154		②	30-204		②
20-523		①	30- 44		②	30-100		②	30-155		②	30-205		②
20-524		①	30- 45		②	30-101		②	30-156		②	30-206		②
20-525		①	30- 46		②	30-102		②	30-157		②	30-207		④
20-526		①	30- 47		②	30-103		②	30-158		②	30-208		②
20-527		①	30- 48		②	30-104		②	30-159		②	30-209		②
20-528		①	30- 49		②	30-105		②	30-160		②	30-210		②
20-529		①	30- 50		②	30-106		②	30-161		②	30-211		②
20-530		①	30- 51		②	30-107		②	30-162		②	30-212		②
20-531		①	30- 52		②	30-108		②	30-163		②	30-213		②
20-532		①	30- 53		②	30-109		②	30-164		②	30-214		②
20-533		①	30- 54		②	30-110		②	30-165		②	30-215		②
30- 1		②	30- 55		②	30-111		②	30-166		②	30-216		②
30- 2		⑤	30- 56		②	30-112		②	30-167		②	30-217		②
30- 3		②	30- 57		②	30-113		②	30-168		②	30-218		②
30- 4		②	30- 58		②	30-114		②	30-169		②	30-219		②
30- 5		②	30- 59		②	30-115		②	30-170		②	30-220		②
30- 6		②	30- 60		②	30-116		②	30-171		②	30-221		②
30- 7		②	30- 61		②	30-117		②	30-172		②	30-222		②
30- 8		②	30- 62		②	30-118		②	30-173		②	30-223		②
30- 9		②	30- 63		②	30-119		②	30-174		②	30-224		②
30- 10		②	30- 64		②	30-120		②	30-175		②	30-225		②
30- 11		②	30- 65		②	30-121		②	30-176		②	30-226		②
30- 12		②	30- 66		②	30-122		②	30-177		②	30-227		②
30- 13		④	30- 67		②	30-123		②	30-178		②	30-228		②
30- 13-1		④	30- 68		②	30-124		②	30-179		②	30-229		②
30- 14		②	30- 69		②	30-125		②	30-180		②	30-230		②
30- 15		②	30- 70		②	30-126		②	30-181		②	30-231		②
30- 16		②	30- 71		②	30-127		②	30-182		②	30-232		②
30- 17		④	30- 72		②	30-128		②	30-183		②	30-233		②
30- 18		②	30- 73		②	30-129		②	30-184		②	30-234		②
30- 19		②	30- 74		②	30-130		②	○ 30-184-1		⑤	30-235		②
30- 20		②	30- 75		②	30-131		②	○ 30-184-2		⑤	30-236		②
30- 21		②	30- 76		②	30-132		②	○ 30-184-3		⑤	30-237		②
30- 22		②	30- 77		②	30-133		②	○ 30-184-4		⑤	30-238		②
30- 23		②	30- 78		②	30-134		②	○ 30-184-5		⑤	30-239		②
30- 24		②	30- 79		②	30-135		②	30-185		②	30-240		②
30- 25		②	30- 80		②	30-136		②	30-186		②	30-241		②
30- 26		②	30- 81		②	30-137		②	30-187		②	30-242		②

Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number	Mark	Pages	Revision number
	30-243	②									
	30-244	②									
	40- 1										
	40- 2										
	40- 3										
	40- 4										
	40- 5										
	40- 6										
	40- 7										
	40- 8										
	40- 10										
	40- 11										
	40- 12										
	40- 13										
	40- 14										
	40- 15										
	40- 16										
	40- 17										
	40- 18										
	40- 19										
	40- 20										
	40- 21										
	40- 22										
	40- 23										
	40- 24										
	40- 25										
	40- 26										
	40- 28										
	40- 29										
	40- 30										
	40- 31										
	40- 32										
	40- 33										
	40- 34										
	40- 36										
	40- 37										
	40- 38										
	40- 39										
	40- 40										
	40- 41										
	40- 42										
	40- 43										
	40- 44										
	40- 45										
	40- 46										
	40- 47										
	40- 48										
	40- 49										


U42303

SAFETY

SAFETY NOTICE

IMPORTANT SAFETY NOTICE

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

To prevent injury to workers, the symbol  is 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 and 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, hand shield, 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

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. 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.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. 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

11. 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.
12. 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.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (-) terminal first.
14. 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.
15. 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.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
Replace any damaged parts 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.
20. 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.
21. 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.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. 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.

FOREWORD

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 chapters; these chapters are further divided into the each main group of components.

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 AND ADJUSTING

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. Use the specifications given in the book with the latest date.

HOISTING INSTRUCTIONS

HOISTING

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 interference 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:

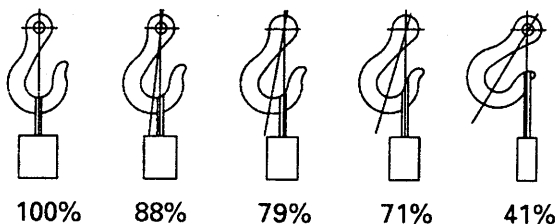
Wire ropes
(Standard "Z" or "S" twist ropes
without galvanizing)

Rope diameter mm	Allowable load	
	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 one-sixth or one-seventh of the breaking strength of the rope used.

- 2) Sling wire ropes from the middle portion of the hook.

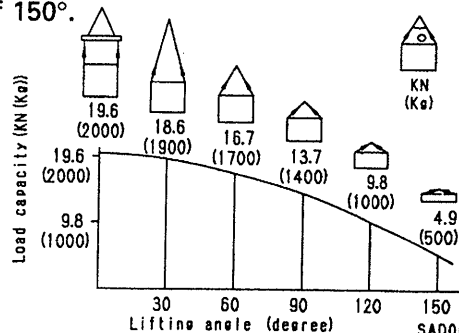
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



SAD00479

- 3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.
 - ⚠ 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 kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles. When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



COATING MATERIALS

★ The recommended coating materials such as adhesives, gasket sealants and greases used for disassembly and assembly are listed below.

★ For coating materials not listed below, use the equivalent of products shown in this list.


Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features
Adhesives	LT-1A	790-129-9030	150 g	Tube	<ul style="list-style-type: none"> Used to prevent rubber gaskets, rubber cushions, and cock plug from coming out.
	LT-1B	790-129-9050	20 g (2 pes.)	Polyethylene container	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Features: Resistance to heat and chemicals Used for anti-loosening and sealant purpose for bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardening agent)	Adhesive: 1 kg Hardening agent: 500 g	Can	<ul style="list-style-type: none"> Used as adhesive or sealant for metal, glass and plastic.
	LT-4	790-129-9040	250 g	Polyethylene container	<ul style="list-style-type: none"> Used as sealant for machined holes.
	Holtz MH 705	790-126-9120	75 g	Tube	<ul style="list-style-type: none"> Used as heat-resisting sealant for repairing engine.
	Three bond 1735	790-129-9140	50 g	Polyethylene container	<ul style="list-style-type: none"> 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	2 g	Polyethylene container	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Features: Resistance to heat, chemicals Used at joint portions subject to high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	<ul style="list-style-type: none"> Used as adhesive or sealant for gaskets and packing of power train case, etc.
	LG-3	790-129-9070	1 kg	Can	<ul style="list-style-type: none"> 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 resistance gasket for high temperature locations such as engine precombustion chamber, exhaust pipe, etc.


Category	Komatsu code	Part No.	Q'ty	Container	Main applications, features
Gasket sealant	LG-4	790-129-9020	200 g	Tube	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Features: Silicon based, resistance to heat, cold • Used as sealant for flange surface, tread. • Used as sealant for oil pan, final drive case, etc.
	LG-7	09920-00150	150 g	Tube	<ul style="list-style-type: none"> • Features: Silicon based, quick hardening type • Used as sealant for flywheel housing, intake manifold, oil an, thermostat housing, etc.
	Three bond 1211	790-129-9090	100 g	Tube	<ul style="list-style-type: none"> • Used as heat-resisting sealant for repairing engine.
Molybdenum disulphide lubricant	LM-G	09940-00051	60 g	Can	<ul style="list-style-type: none"> • Used as lubricant for sliding portion (to prevent from squeaking).
	LM-P	09940-00040	200 g	Tube	<ul style="list-style-type: none"> • 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 SYGA-160CNLI	Various	Various	<ul style="list-style-type: none"> • General purpose type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various	Various	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Used for places with heavy load

STANDARD TIGHTENING TORQUE

STANDARD TIGHTENING TORQUES OF BOLTS AND NUTS

Use these torques for metric bolts and nuts. (Always use torque wrench).

Thread diameter of bolt	Width across flats				
		Nm		kgm	
mm	mm				
6	10	13.2 ± 1.4		1.35 ± 0.15	
8	13	31 ± 3		3.2 ± 0.3	
10	17	66 ± 7		6.7 ± 0.7	
12	19	113 ± 10		11.5 ± 1	
14	22	177 ± 19		18 ± 2	
16	24	279 ± 30		28.5 ± 3	
18	27	382 ± 39		39 ± 4	
20	30	549 ± 59		56 ± 6	
22	32	745 ± 83		76 ± 8.5	
24	36	927 ± 103		94.5 ± 10.5	
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	3290 ± 340		335 ± 35	

Thread diameter of bolt	Width across flats				
		Nm		kgm	
mm	mm				
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	
		Nm	kgm
mm	mm		
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 OF O-RING BOSS CONNECTOR

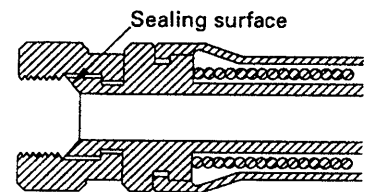
Use these torques for O-ring boss connector

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
02	14	Varies depending on type of connector.	34.3±4.9	3.5±0.5
03, 04	20		93.1±9.8	9.5±1
05, 06	24		142.1±19.6	14.5±2
10, 12	33		421.4±58.8	43±6
14	42		877.1±132.3	89.5±13.5

TIGHTENING TORQUE OF O-RING BOSS CONNECTOR

Use these torques for O-ring boss connector

Nominal No.	Thread diameter	Width across flat	Tightening torque	
	mm	mm	Nm	kgm
08	8	14	7.35±1.47	0.75±0.15
10	10	17	11.27±1.47	1.15±0.15
12	12	19	17.64±1.96	1.8±0.2
14	14	22	22.54±1.96	2.3±0.2
16	16	24	29.4±4.9	3±0.5
18	18	27	39.2±4.9	4±0.5
20	20	30	49±4.9	5±0.5
24	24	32	68.6±9.8	7±1
30	30	32	107.8±14.7	11±1.5
33	33	—	127.4±19.6	13±2
36	36	36	151.9±24.5	15.5±2.5
42	42	—	210.7±29.4	21.5±3
52	52	—	323.4±44.1	33±4.5



SAD00483

TIGHTENING TORQUES OF FLARE NUT

Use these torques for O-ring boss connector

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

TIGHTENING TORQUE FOR 102 SERIES ENGINE (BOLT AND NUTS)

Use these torques for metric bolts and nuts of 102 Series Engine.

Thread diameter	Tightening torque	
	Nm	kgm
mm		
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22

TIGHTENING TORQUE FOR 102 SERIES ENGINE (EYE JOINTS)

Use these torques for metric eye joints of 102 Series Engine.

Thread diameter	Tightening torque	
	Nm	kgm
mm		
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

TIGHTENING TORQUE FOR 102 SERIES ENGINE (TAPERED SCREWS)

Use these torques for inches tapered screws of 102 Series Engine.

Thread diameter	Tightening torque	
	Nm	kgm
inches		
1 / 16	3 ± 1	0.31 ± 0.10
1 / 8	8 ± 2	0.81 ± 0.20
1 / 4	12 ± 2	1.22 ± 0.20
3 / 8	15 ± 2	1.53 ± 0.41
1 / 2	24 ± 4	2.45 ± 0.41
3 / 4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

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: 5WB indicates a cable having a nominal number 5 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 strands (mm)	Cross section (mm ²)			
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		Charging	Ground	Starting	Lighting	Instrument	Signal	Other
	Classi- fication								
1	Pri- mary	Code	W	B	B	R	Y	G	L
		Color	White	Black	Black	Red	Yellow	Green	Blue
2	Auxi- liary	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 TABLE

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.
 - (1) Locate the number 50 in the vertical column at the left side, take this as (A), then draw a horizontal line from (A).
 - (2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
 - (3) Take the point where the two lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.
 2. Convert 550 mm into inches.
 - (1) The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
 - (2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
 - (3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

(B)

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
(A) 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

(C)

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

FOREWORD**CONVERSION TABLE****Liter to U.S. Gallon**

1ℓ = 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

1ℓ = 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