

# SHOP

# MANUAL

## KOMATSU

# D20A,P,S,Q-6

# D21A,P,S,Q-6

MACHINE MODEL	SERIAL No.	MACHINE MODEL	SERIAL No.
D20A-6	60001 and up	D21A-6	60001 and up
D20P-6	60001 and up	D21E-6	60001 and up
D20P-6A	60001 and up	D21P-6	60001 and up
D20PL-6	60001 and up	D21P-6A	60001 and up
D20PLL-6	60001 and up	D21P-6B	60001 and up
D20S-6	60001 and up	D21PL-6	60001 and up
D20Q-6	60001 and up	D21S-6	60001 and up
		D21S-6A	60001 and up
		D21Q-6	60001 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.
- D20, 21-6 mount the 4D95S-W-1 engine. For details of the engine, see the 95 Series Engine Shop Manual.

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## IMPORTANT SAFETY NOTICE

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



## SAFETY

### 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, 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

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 on to 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.

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## FOREWORD

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

### **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. Contact your KOMATSU distributor for the latest information.**



**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 strands	Dia. of strands (mm)	Cross section (mm <sup>2</sup> )			
01	11	0.32	0.88	2.4	12	Starting, lighting, signal etc.
02	26	0.32	2.09	3.1	20	Lighting, signal etc.
05	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		Starting	Charging	Lighting	Signal	Instrument	Other
	Classification							
1	Primary	Code	B	W	R	G	Y	L
		Color	Black	White	Red	Green	Yellow	Blue
2	Auxiliary	Code	BW	WR	RW	GW	YR	LW
		Color	Black & White	White & Red	Red & White	Green & White	Yellow & Red	Blue & White
3		Code	BY	WB	RB	GR	YB	LR
		Color	Black & Yellow	White & Black	Red & Black	Green & Red	Yellow & Black	Blue & Red
4		Code	BR	WL	RY	GY	YG	LY
		Color	Black & Red	White & Blue	Red & Yellow	Green & Yellow	Yellow & Green	Blue & Yellow
5		Code	—	WY	RG	GB	YL	LB
		Color	—	White & Yellow	Red & Green	Green & Black	Yellow & Blue	Blue & Black
6		Code	—	WG	RL	GL	YW	
		Color	—	White & Green	Red & Blue	Green & Blue	Yellow & White	

## WEIGHT TABLE D20A,P-6

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

Unit: kg

Machine Model	D20A-6	D20P-6	D20P-6A	D20PL-6	D20PLL-6
Serial No.	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up
Engine and main clutch assembly	351	351	351	351	351
• Engine assembly	285	285	285	285	285
• Main clutch assembly	66	66	66	66	66
Radiator assembly	24	24	24	24	24
Fuel tank assembly (with fuel)	129	129	129	129	129
Transmission assembly	58	58	58	58	58
Bevel gear shaft and steering clutch assembly	68	68	68	68	68
• Steering clutch assembly (each side)	19	19	19	19	19
• Brake band assembly (each side)	2	2	2	2	2
• Bevel gear shaft	5	5	5	5	5
• Bevel gear	5	5	5	5	5
Steering control valve assembly	9	9	9	9	9
Final drive case (each side)	27	27	32	32	51
Sprocket (each side)	30	30	30	30	30
Main frame assembly	361	411	361	411	411
• Main frame and steering case	353	403	353	403	403
• Sprocket shaft (each side)	14	14	18	18	26
Track group assembly (each side)	285	294	285	315	365
• Track frame (each side)	63	74	63	77	93
• Idler assembly (each side)	57	57	57	57	57
• Track roller assembly (each)	14	14	14	14	14
• Carrier roller assembly (each)	11	11	11	11	11
Track shoe assembly (each side)	550	805	805	878	1280
Cross bar	57	57	67	67	91
Hydraulic tank assembly	79	79	79	79	79
Hydraulic valve assembly	10	8	10	8	8
Blade lift cylinder assembly (each side)	14	17	14	17	16
Blade tilt cylinder assembly	15	13	15	13	13
Blade angle cylinder assembly (each side)	15	—	15	—	—

Unit: kg

Machine Model	D20A-6	D20P-6	D20P-6A	D20PL-6	D20PLL-6
Serial No.	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up
Power angle and tiltdozer assembly	385		412		
• Blade	172	—	195	—	—
• U-frame	146		146		
Straight tiltdozer assembly		345		379	420
• Blade		173		195	212
• Straight frame (each side)	—	44	—	44	46
• Blade tilt cylinder assembly		13		13	13
• Tilt brace		6		6	6
Radiator guard	31	98	31	98	98
Engine underguard	12	12	12	12	12
Transmission underguard	16	16	16	16	16
Hood	18	18	18	18	18
Loader frame	82	70	82	70	70
Operator's seat assembly	21	21	21	21	21
Canopy assembly	35	35	35	35	35
	(60)	(60)	(60)	(60)	(60)

- ★ (60): D20A-6 Serial No. 61022 and up  
D20P-6 Serial No. 60873 and up  
D20P-6A Serial No. 61109 and up  
D20PL-6 Serial No. 60145 and up  
D20PLL-6 Serial No. 60100 and up

## WEIGHT TABLE D21A, P-6



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

Unit: kg

Machine Model	D21A-6	D21E-6	D21P-6	D21P-6A	D21P-6B	D21PL-6
Serial No.	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up
Engine and damper assembly	305	305	305	305	305	305
• Engine assembly	288	288	288	288	288	288
• Damper assembly	17	17	17	17	17	17
Radiator assembly	24	24	24	24	24	24
Fuel tank assembly (with fuel)	129	129	129	129	129	129
HYDOROSHIFT transmission assembly	140	190	140	140	190	140
• Modulating valve assembly	6	6	6	6	6	6
• Speed and inching valve assembly	8	6	8	8	6	8
Bevel gear shaft and steering clutch assembly	68	68	68	68	68	68
• Steering clutch assembly (each side)	19	19	19	19	19	19
• Brake band assembly (each side)	2	2	2	2	2	2
• Bevel gear shaft	5	5	5	5	5	5
• Bevel gear	5	5	5	5	5	5
Steering control valve assembly	9	9	9	9	9	9
Final drive case (each side)	27	27	27	32	32	32
Sprocket (each side)	30	30	30	30	30	30
Main frame assembly	361	361	411	361	361	411
• Main frame and steering case	353	353	403	353	353	403
• Sprocket shaft (each side)	14	14	14	18	18	18
Track group assembly (each side)	285	320	294	285	320	315
• Track frame (each side)	63	77	74	63	77	77
• Idler assembly (each side)	57	57	57	57	57	57
• Track roller assembly (each)	14	14	14	14	14	14
• Carrier roller assembly (each)	11	11	11	11	11	11
Track shoe assembly (each side)	550	619	805	805	774	878
Cross bar	57	57	57	67	67	67

Unit: kg

Machine Model	D21A-6	D21E-6	D21P-6	D21P-6A	D21P-6B	D21PL-6
Serial No.	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up
Hydraulic tank assembly	79	79	79	79	79	79
Hydraulic valve assembly	10	10	8	10	10	8
Blade lift cylinder assembly (each side)	14	14	17	14	14	17
Blade tilt cylinder assembly	15	15	13	15	15	13
Blade angle cylinder assembly (each side)	15	15	—	15	15	—
Power angle and tilt/dozer assembly	385	397		412	424	
• Blade	172	172	—	195	195	—
• U-frame	146	156		146	156	
Straight tilt/dozer assembly			345			379
• Blade			173			195
• Straight frame (each side)	—	—	44	—	—	44
• Blade tilt cylinder assembly			13			13
• Tilt brace			6			6
Radiator guard	31	31	98	31	31	98
Engine underguard	12	12	12	12	12	12
Transmission underguard	16	16	16	16	16	16
Hood	18	18	18	18	18	18
Loader frame	82	82	70	82	82	70
Operator's seat assembly	21	21	21	21	21	21
Canopy assembly	35	35	35	35	35	35
	(60)		(60)	(60)		(60)

- ★ (60): D21A-6 Serial No. 61022 and up  
D21P-6 Serial No. 60873 and up  
D21P-6A Serial No. 61109 and up  
D21PL-6 Serial No. 60158 and up

# WEIGHT TABLE D20, 21S, Q-6

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

Unit: kg

Machine Model	D20S-6	D20Q-6	D21S-6	D21S-6A	D21Q-6
Serial No.	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up
Engine and main clutch assembly	351	351			
• Engine assembly	285	285	—	—	—
• Main clutch assembly	66	66			
Engine and damper assembly			305	305	305
• Engine assembly	—	—	288	288	288
• Damper assembly			17	17	17
Radiator assembly	24	24	24	24	24
Fuel tank assembly (with fuel)	129	129	129	129	129
Transmission assembly	58	58	—	—	—
HYDROSHIFT transmission assembly			140	190	140
• Modulating valve assembly	—	—	6	6	6
• Speed and inching valve assembly			8	6	8
Bevel gear shaft and steering clutch assembly	68	68	68	68	68
• Steering clutch assembly (each side)	19	19	19	19	19
• Brake band assembly (each side)	2	2	2	2	2
• Bevel gear shaft	5	5	5	5	5
• Bevel gear	5	5	5	5	5
Steering control valve assembly	9	9	9	9	9
Final drive case (each side)	27	32	27	27	32
Sprocket (each side)	30	30	30	30	30
Main frame assembly	361	361	361	361	361
• Main frame and steering case	353	353	353	353	353
• Sprocket shaft (each side)	14	18	14	14	18
Track group assembly (each side)	285	285	285	320	285
• Track frame (each side)	63	63	63	77	63
• Idler assembly (each side)	57	57	57	57	57
• Track roller assembly (each)	14	14	14	14	14
• Carrier roller assembly (each)	11	11	11	11	11

Unit: kg

Machine Model	D20S-6	D20Q-6	D21S-6	D21S-6A	D21Q-6
Serial No.	60001 and up	60001 and up	60001 and up	60001 and up	60001 and up
Track shoe assembly (each side)	577	805	577	669	805
Cross bar	57	67	57	57	67
Hydraulic tank assembly	79	79	79	79	79
Hydraulic valve assembly	8	8	8	8	8
Bucket lift cylinder assembly (each side)	30	30	30	30	30
Bucket dump cylinder assembly (each side)	16	16	16	16	16
Lift arm assembly	203	203	203	203	203
Bucket dump lever (each side)	18	18	18	18	18
Bucket assembly (with tooth)	204	221	204	200	221
Radiator guard	31	31	31	31	31
Engine underguard	12	12	12	12	12
Transmission underguard	16	16	16	16	16
Hood	18	18	18	18	18
Loader frame	181	181	181	200	181
Operator's seat assembly	21	21	21	21	21
Canopy assembly	35 (60)	35 (60)	35 (60)	35	35 (60)

- ★ (60): D20S-6 Serial No. 60092 and up  
D20Q-6 Serial No. 60071 and up  
D21S-6 Serial No. 60085 and up  
D21Q-6 Serial No. 60069 and up

# LIST OF LUBRICANT AND WATER

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE					CAPACITY (ℓ)			
		14 -10	32 0	50 10	68 20	86° F 30° C	Specified amount	Refill capacity		
Engine oil pan	Engine oil						8.0	7.0		
Transmission and bevel gear case							16.5 (D20-6)	16.5 (D20-6)		
Damper case							0.7 (D21-6)	0.7 (D21-6)		
Transmission case							13 (D21-6)	11 (D21-6)		
Transfer and bevel gear case							13 (D21-6)	13 (D21-6)		
Final drive case (each)							6 (D20,21A,E, P,S,Q-6)	6 (D20,21A,E, P,S,Q-6)		
							8 (D20,21P-6A,B, D20,21PL-6)	8 (D20,21P-6A,B, D20,21PL-6)		
							12 (D20PLL-6)	12 (D20PLL-6)		
Main clutch case							6 (D20-6)	6 (D20-6)		
Hydraulic tank							33 (D20,21A,E, S,Q-6 D20,21P-6A D21P-6B)	21 (D20,21A,E, S,Q-6 D20,21P-6A D21P-6B)		
							31 (D20,21P,PL, PLL-6)	21 (D20,21P,PL, PLL-6)		
Idler (each)						0.08	0.08			
Track roller (each)						0.08	0.08			
Carrier roller (each)						0.07	0.07			
Fuel tank	Diesel fuel	*				60	—			
Cooling system	Water	Add antifreeze				10	—			

\* ASTM D975 No. 1



**NOTE:**

(1) When fuel sulphur content is less than 0.5%, change oil in the oil pan every periodic maintenance hours described in this manual.

Change oil according to the following table if fuel sulphur content is above 0.5%.

Fuel sulphur content	Change interval of oil in engine oil pan
0.5 to 1.0%	1/2 of regular interval
Above 1.0%	1/4 of regular interval

(2) When starting the engine in an atmospheric temperature of lower than 0°C, be sure to use engine oil of SAE10W, SAE10W-30 and SAE15W-40, even though an atmospheric temperature goes up to 10°C more or less in the day time.

(3) Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.

ASTM: American Society of Testing and Material

SAE: Society of Automotive Engineers

Specified capacity: Total amount of oil including oil for components and oil in piping.

Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

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# ENGINE

## 12 TESTING AND ADJUSTING

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-  When carrying out testing, adjusting or troubleshooting, stop the machine on level ground, apply the lock levers and block the tracks.
-  When working in groups, use agreed signals and do not allow unauthorized persons near the machine.
-  When checking the water level in the radiator, wait for the water to cool. Do not remove the radiator cap while the water is hot. Boiling water may spurt out.
-  Be careful not to get caught in rotating parts.

# TESTING AND ADJUSTING DATA

Applicable machine model			D20 • 21-6	
Engine model			4D95S-W-1	
Item	Condition	Unit	Standard value	Permissible value
Engine speed	High idling speed	rpm	2500 – 2630	
	Low idling speed		730 – 790	
	Rated speed		2450	
Exhaust gas color	Quick acceleration	Bosch scale	4.0	6.0
	At high idling		1.5	2.5
Valve clearance (at cold)	Intake valve	mm	0.35	
	Exhaust valve		0.50	
Compression pressure (SAE30 oil)	Oil temperature: 40 – 60°C	kg/cm <sup>2</sup>	30	21
	(Engine speed)	(rpm)	(320 – 360)	(320 – 360)
Blow-by pressure (SAE30 oil)	Water temperature: Inside operating range At high idling	mmH <sub>2</sub> O	50	100
Oil pressure (Water temperature: Inside operating range)	At high idling	kg/cm <sup>2</sup>	3.5 – 6.0	2.45
	At low idling (SAE30)		1.0	0.7
	At low idling (SAE10W)		0.8	0.7
Oil temperature	All speed (oil in oil pan)	°C	80 – 110	120
Fuel injection timing	B.T.D.C.	degree	15 – 17	16
Fan belt tension (Alternator side)	Deflection when pushed with a force of 6 kg	mm	8	6 – 10

## TOOL LIST FOR TESTING AND ADJUSTING

No.	Testing and measuring item	Fault finding tool	Part No.	Remarks
1	Engine speed	Multi-tachometer	799-203-8000	Digital reading: 60 – 2,000 rpm (L range) 60 – 20,000 rpm (H range)
2	Water temperature, oil temperature	Digital temperature gauge or thermistor temperature gauge	799-101-6000 790-500-1300	–50 – 1,200°C
3	Lubrication oil pressure	Hydraulic tester	799-101-5000	0 – 20 kg/cm <sup>2</sup>
4	Compression pressure	Compression gauge	795-502-1590	0 – 70 kg/cm <sup>2</sup>
		Adapter	795-414-1110	
5	Blow-by pressure	Blow-by checker	799-201-1503	0 – 500 mmH <sub>2</sub> O
6	Valve clearance	Feeler gauge	795-125-1370	0.35, 0.50 mm
7	Exhaust gas color	Handy smoke checker	799-201-9000	Dirtiness 0 – 70% with standard color (Dirtiness % x 1/10 ≙ Bosch scale)
		Smoke meter	Commercially available	