CAT® Lift Trucks

Service Manual

Chassis & Mast

GC15K	AT81C-00011-up AT81D-00011-up AT81E-00011-up
GC18K	AT81C-00011-up AT81D-00011-up AT81E-00011-up
GC20K	AT82C-00011-up AT82D-00011-up AT82E-00011-up
GC20K HP	AT82C-90011-up AT82D-90011-up AT82E-90011-up
GC25K	AT82C-00011-up AT82D-00011-up AT82E-00011-up
GC25K HP	AT82C-90011-up AT82D-90011-up AT82E-90011-up
GC30K	AT83C-00011-up AT83D-00011-up AT83E-00011-up

For use with 4G63/4G64 Engine Service Manual and Liquefied Petroleum Gas Supplements.

99719-80150

FOREWORD

This service manual is a guide to servicing the 1-ton to 3-ton internal combustion cushion models of Cat™ Lift Trucks. The instructions are grouped by systems to serve the convenience of your ready reference.

Long productive life of your lift trucks depends to a great extent on correct servicing – the servicing consistent with what you will learn from this service manual. We hope you read the respective sections of this manual carefully and know all the components you will work on before attempting to start a test, repair or rebuild job.

For the items pertaining to the engines, refer to the following service manuals:

- 4G63/4G64 Gasoline Engine Service Manual (Pub. No. 99729-74120)
  For use with both gasoline and LP Gas engines.
- 4G63/4G64 LP Gas Supplement (Pub. No. 99729-85100)
  For use with LP Gas units with a "D" in the chassis serial number.
- 4G63/4G64 LP Gas Supplement (Pub. No. 99729-85110)
  For use with LP Gas units with an "E" in the chassis serial number.

Safety Related Signs

The following safety related signs are used in this service manual to emphasize important and critical instructions:

⚠ WARNING — Indicates a specific potential hazard resulting in serious bodily injury or death.

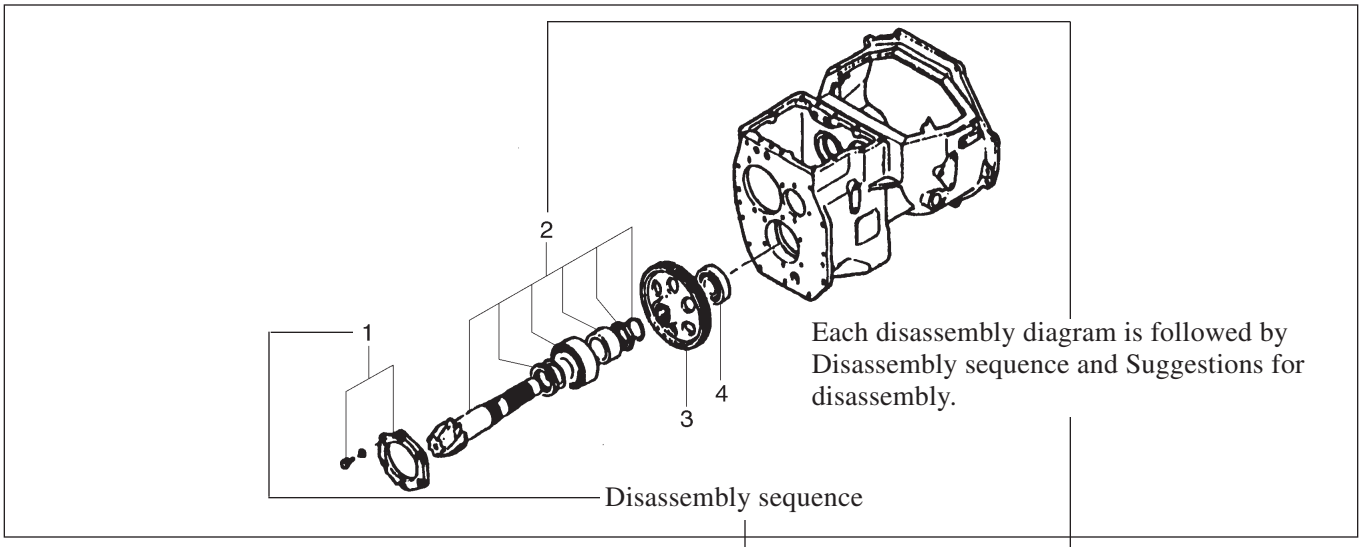
⚠ CAUTION — Indicates a specific potential hazard resulting in bodily injury, or damage to, or destruction of, the machine.

NOTE — Indicates a condition that can cause damage to, or shorten service life of, the machine.

Pub. No. 99719-80150

HOW TO READ THIS MANUAL

Disassembly diagram (example)

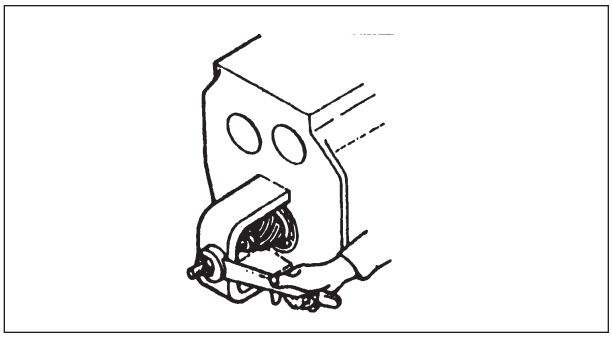


Sequence

1. Cover, Bolt, Washer (part name)
2. Output shaft (part name)

Suggestion for disassembly

(1) Output shaft removal



Unit: mm (in.)

Clearance between cylinder and piston	A	0.020 to 0.105 (0.00079 to 0.00413)
	B	0.15 (0.0059)

A: Standard value B: Repair or service limit

Symbols or abbreviations

OP .....Option

R1/4.....Taper pipe thread (external) 1/4 inch (formerly PT1/4)

Rc1/8.....Taper pipe thread (internal) 1/8 inch (formerly PT1/8)

G1/4A.....Straight pipe thread (external) 1/4 inch (formerly PF1/4-A)

Rp1/8.....Straight pipe thread (internal) 1/8 inch (formerly PS1/8)

SAFETY

⚠WARNING

The proper and safe lubrication and maintenance for this lift truck, recommended by Cat, are outlined in the OPERATION & MAINTENANCE MANUAL for these trucks.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the OPERATION & MAINTENANCE MANUAL before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this truck. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some of the truck components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all warning plates and decals on the truck before operating, lubricating or repairing the product.
2. Always wear protective glasses and protective shoes when working around trucks. In particular, wear protective glasses when pounding on any part of the truck or its attachments with a hammer or sledge. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.
3. Do not work on any truck that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the truck before performing any disassembly.

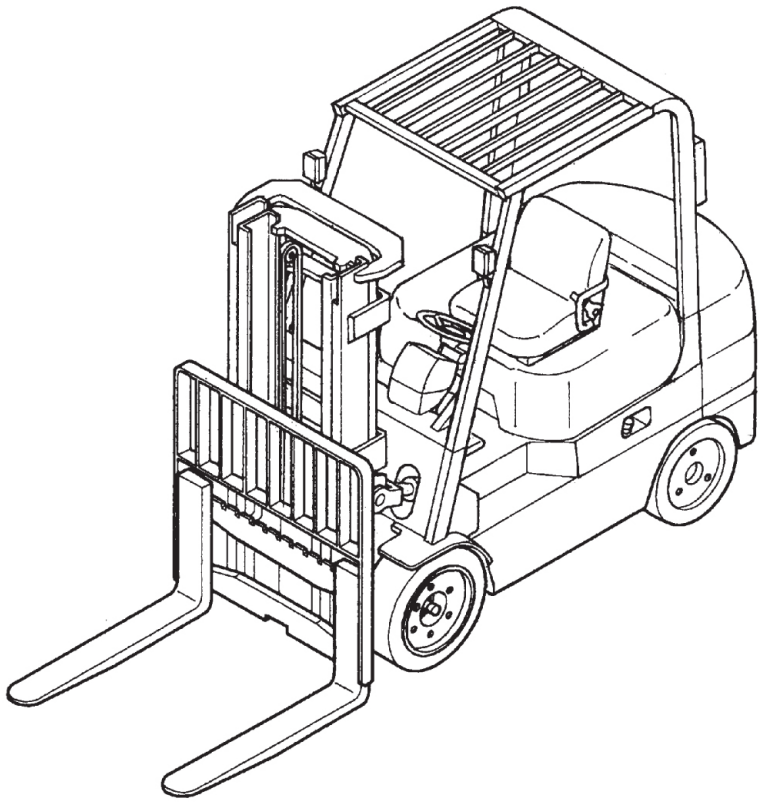
⚠WARNING

Do not operate this truck unless you have read and understand the instructions in the OPERATION & MAINTENANCE MANUAL. Improper truck operation is dangerous and could result in injury or death.

4. Lower the forks or other implements to the ground before performing any work on the truck. If this cannot be done, make sure the forks or other implements are blocked correctly to prevent them from dropping unexpectedly.
5. Use steps and grab handles (if applicable) when mounting or dismounting a truck. Clean any mud or debris from steps, walkways or work platforms before using. Always face truck when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
6. To avoid back injury, use a hoist when lifting components which weigh 23 kg (50 lb.) or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
7. To avoid burns, be alert for hot parts on trucks which have just been stopped and hot fluids in lines, tubes and compartments.
8. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure, before removing the last two bolts or nuts completely.
9. Be careful when removing filler caps, breathers and plugs on the truck. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the truck has just been stopped because fluids can be hot.

10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary. Do not mix metric fasteners with standard nuts and bolts.
12. If possible, make all repairs with the truck parked on a level, hard surface. Block truck so it does not roll while working on or under truck.
13. Disconnect battery and discharge any capacitors (electric trucks) before starting to work on truck. Hang "Do not Operate" tag in the Operator's Compartment.
14. Repairs, which require welding, should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.
15. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.
16. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution.
17. Always support the mast and carriage to keep carriage or attachments raised when maintenance or repair work is performed, which requires the mast in the raised position.
18. Loose or damaged fuel, lubricant and hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Do not check for leaks with your hands. Pin hole (very small) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause personal injury. Use cardboard or paper to locate pin hole leaks.
19. Tighten connections to the correct torque. Make sure that all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot exhaust components in event of a line, tube or seal failure, must be installed correctly.
20. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
21. Do not operate a truck if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.

Vehicle Exterior



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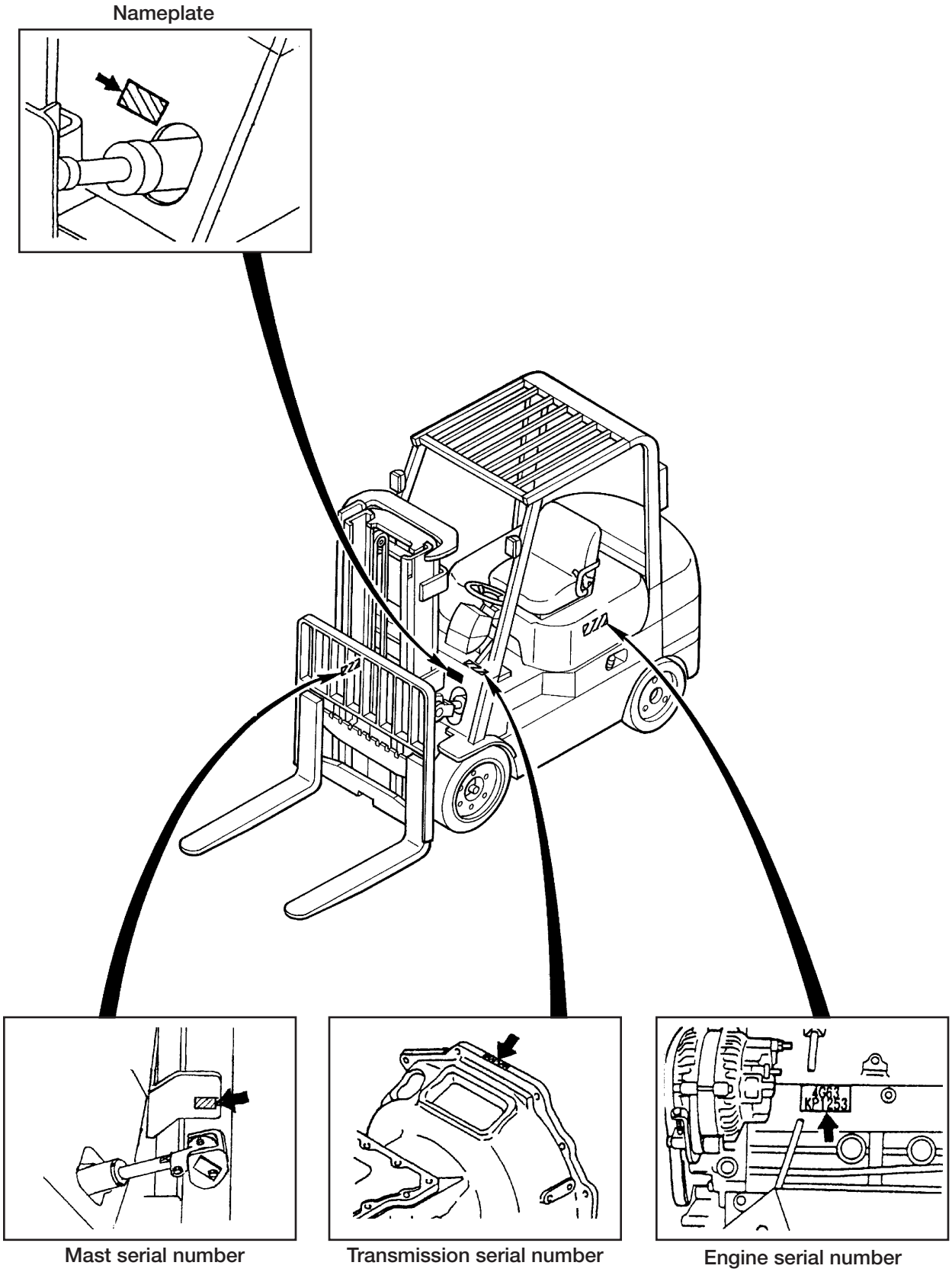
Models

Truck model	Model code – Serial number	Engine mounted
GC15K	AT81C – 00011- up AT81D – 00011- up AT81E – 00011- up	Mitsubishi 4G63 gasoline engine
GC18K	AT81C – 00011- up AT81D – 00011- up AT81E – 00011- up	
GC20K	AT82C – 00011- up AT82D – 00011- up AT82E – 00011- up	
GC25K	AT82C – 00011- up AT82D – 00011- up AT82E – 00011- up	
GC20K HO	AT82C – 90011- up AT82D – 90011- up AT82E – 90011- up	Mitsubishi 4G64 gasoline engine
GC25K HO	AT82C – 90011- up AT82C – 90011- up AT82C – 90011- up	
GC30K	AT83C – 00011- up AT83C – 00011- up AT83C – 00011- up	

Serial Number Locations



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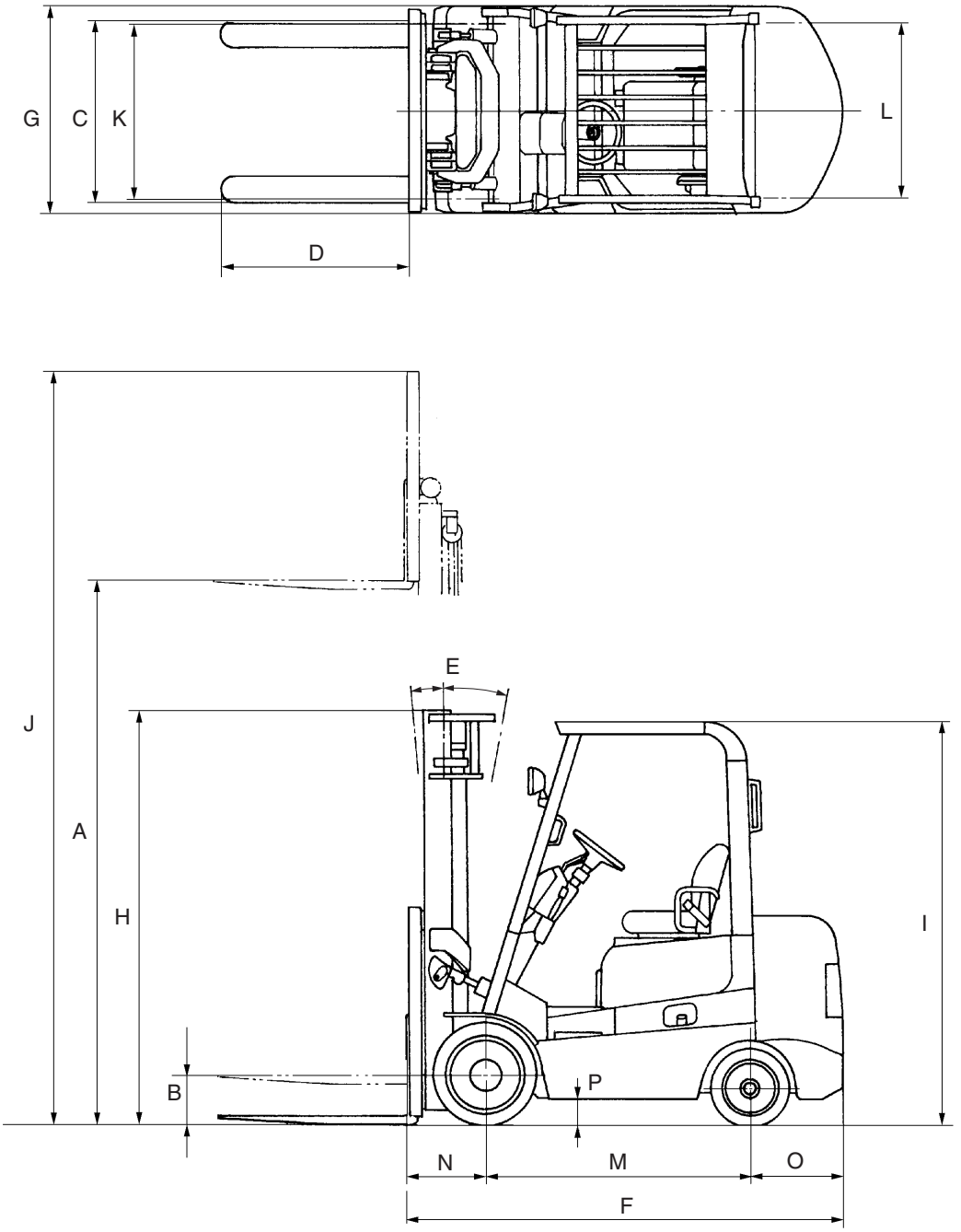
Dimensions



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Unit: mm (in.)

Ref. No.	Item \ Truck Model	1-ton models		2-ton models		3-ton models
		GC15K	GC18K	GC20K GC20K HP	GC25K GC25K HP	GC30K
A	Maximum fork height	3325 (131)		3340 (131)		3315 (130)
B	Free fork height	115 (4.5)		130 (5.1)		135 (5.3)
C	Fork spacing (out-to-out) minimum/maximum	200/820 (8.0/32.3)		200/920 (8.0/36.2)		200/960 (10/38)
D	Fork length	1067 (42)				
E	Tilt angle (forward–backward)	5–10°		5–10°		5–6°
F	Overall length	2055 (80.9)	2083 (82.0)	2227 (87.5)	2287 (90)	2455 (96.7)
G	Overall width (outside of tires)	945 (37.5)		1055 (41.5)		1105 (43.5)
H	Overall height (to top of mast lowered)	2105 (83)		2110 (83.5)		2155 (85)
I	Overall height (to top of overhead guard)	2022 (79.6)		2060 (81.1)		
J	Overall height (to top of mast extended)	4550 (179)		4565 (180)		4535 (176)
K	Trend (front)	793 (31.2)		877 (34.5)		902 (35.5)
L	Trend (rear)	826 (32.5)		922 (36.3)	897 (35.5)	897 (35.5)
M	Wheelbase	1190 (46.9)		1350 (53.1)		1500 (59.1)
N	Load moment constant	376 (14.8)		399 (15.7)		412 (16.2)
O	Rear overhang	479 (18.9)	507 (20.0)	475 (18.7)	532 (20.9)	529 (20.8)
P	Ground clearance (at frame)	95 (3.7)		130 (5.1)		

Technical Data (Standard Models)

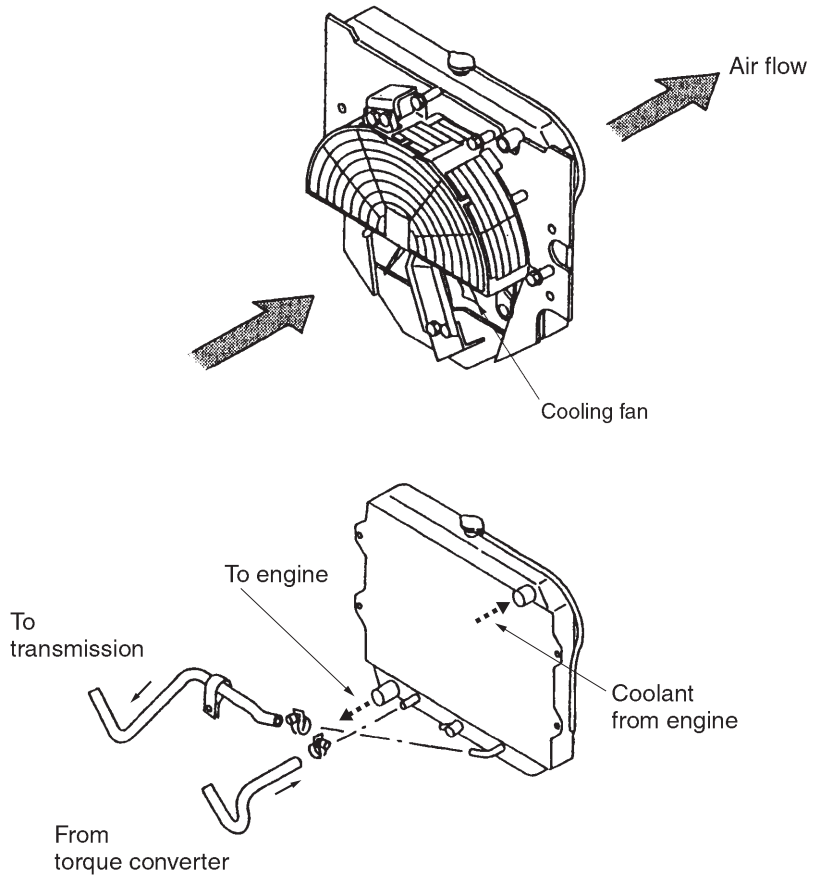
Item \ Truck Model			GC15K	GC18K	GC20K	GC25K	GC30K
Work performance	Rated capacity/load center kg/mm (lb/in.)		1500/500 (3000/24)	1800/500 (3500/24)	200/500 (4000/24)	2500/500 (5000/24)	3000/500 (6000/24)
	Maximum fork height mm (in.)		3300 (131)		3300 (131)		3300 (131)
	Lift speed (rated load) mm/sec (fpm)		590 (116)		510 (100)		470 (93)
	Lowering speed (rated load) mm/sec (fpm)		610 (120)		550 (108)		500 (98)
	Tilt angle (forward – backward)		5–10°		5–10°		5–6°
	Free fork height mm (in.)		115 (4.5)		130 (5.1)		135 (5.3)
Traveling performance	Travel speed (loaded) km/h (mph)	Forward	15 (9.3)		16 (9.9)		16 (9.9)
		Reverse	15 (9.3)		16 (9.9)		16 (9.9)
	Minimum turning radius mm (in.)		1760 (69.3)	1790 (70.4)	1945 (76.6)	2002 (78.8)	2169 (85.4)
	Gradeability (rated load) [at 1.6 km/h (1 mph)] % tan		35	31	25.5	21	23
Dimensions	Overall length mm (in.)		2949 (116.1)	2980 (117.3)	4335 (170.7)	4392 (172.9)	4559 (179.5)
	Overall width mm (in.)		945 (37.2)		1055 (41.5)		1105 (43.5)
	Overall height mm (in.)	To top of mast lowered	2105 (83)		2110 (83.1)		2155 (85)
		To top of mast extended	4550 (179)		4565 (180)		4535 (176)
		To top of overhead guard	2022 (79.6)		2060 (81.1)		2060 (81.1)
	Wheel base mm (in.)		1190 (46.9)		1350 (53.1)		1500 (59.1)
	Tread mm (in.)	Front	793 (31.2)		877 (34.5)		902 (35.5)
		Rear	826 (32.5)		922 (36.3)	897 (35.5)	897 (35.5)
	Load moment constant mm (in.)		376 (14.8)		399 (15.7)		412 (16.2)
	Rear overhang mm (in.)		479 (18.9)	507 (20.0)	475 (18.7)	532 (20.9)	529 (20.8)
	Ground clearance (at frame)		95 (3.7)		130 (5.1)		130 (5.1)
	Tire size mm (in.)	Front	18 × 6 × 12-1/8		21 × 7 × 15		21 × 8 × 15
		Rear	14 × 4-1/2 × 8		16 × 6 × 10-1/2		16 × 6 × 10-1/2
Service weight (empty) kg (lb)			2630 (5800)		3650 (8050)		4170 (9190)
Engine	Engine model		4G63		4G63		4G64
	Make		Mitsubishi Motors		Mitsubishi Motors		Mitsubishi Motors
	Type		Gasoline		Gasoline		Gasoline
	Cooling System		Water		Water		Water
	No. of cylinders - arrangement		4 -in-line		4 -in-line		4 -in-line
	No. of strokes		4		4		4
	Types of combustion chambers		Semi-spherical		Semi-spherical		Semi-spherical
	Valve arrangement		Overhead valve and OHC		Overhead valve and OHC		Overhead valve and OHC
	Type of cylinder liners		Integral with cylinder block		Integral with cylinder block		Integral with cylinder block
	Cylinder bore × stroke mm (in.)		85 × 88 (3.346 × 3.465)		85 × 88 (3.346 × 3.465)		86.5 × 100 (3.406 × 3.937)
	Displacement cc (cu in.)		1997 (121.8)		1997 (121.8)		2350 (143.4)

Item \ Truck Model			GC15K / GC18K	GC20K / GC25K	GC30K
Engine	Compression ratio		8.5 : 1	8.5 : 1	8.6 : 1
	Rated output Hp/rpm		46/2400	46/2400	57/2400
	Maximum torque N·m (kgf·m) [lbf·ft]/rpm		139 (14.2) [105]/1600	139 (14.2) [105]/1600	176 (18) [130]/1600
	Dimensions (length × width × height) mm (in.)		576 × 604.6 × 730.7 (22.7 × 23.8 × 28.8)	576 × 604.6 × 730.7 (22.7 × 23.8 × 28.8)	576×604.6×736.7 (22.7×23.8×29.0)
	Weight (service) kg (lb)		150 (330)	150 (330)	150 (330)
	Location		Rear	Rear	Rear
	Intake valves	Open BTDC	12°	12°	12°
		Close ABDC	40°	40°	40°
	Exhaust valves	Open BBDC	54°	54°	54°
		Close ATDC	6°	6°	6°
	Valve clearance mm	Intake valves	0.00 (hot)	0.00 (hot)	0.00 (hot)
		Exhaust valves	0.00 (hot)	0.00 (hot)	0.00 (hot)
	Ignition		Spark	Spark	Spark
	Firing order		1 - 3 - 4 - 2	1 - 3 - 4 - 2	1 - 3 - 4 - 2
	Ignition timing BTDC degree/rpm		4/700 ± 50 (gasoline)	9/700 ± 50 (LPG)	
	Fuel tank rated capacity liter (U.S. gal.)		34 (9)	46 (12)	56 (15)
Ignition system (gasoline models)	Ignition coil	Type	With external resistor	With external resistor	With external resistor
		Make	Mitsubishi Electric	Mitsubishi Electric	Mitsubishi Electric
	Distributor	Type	Non-contact point type (C.E.I.)	Non-contact point type (C.E.I.)	Non-contact point type (C.E.I.)
		Make	Mitsubishi Electric	Mitsubishi Electric	Mitsubishi Electric
		Spark advancer	Centrifugal pneumatic type	Centrifugal pneumatic type	Centrifugal pneumatic type
	Spark plugs	Type	W14EX-U	W14EX-U	W14EX-U
		Make	Denso	Denso	Denso
		Size mm (in.)	14 × 1.25 (0.55 × 0.049)	14 × 1.25 (0.55 × 0.049)	14 × 1.25 (0.55 × 0.049)
		Gap mm (in.)	0.7 to 0.8 (0.028 to 0.031)	0.7 to 0.8 (0.028 to 0.031)	0.7 to 0.8 (0.028 to 0.031)
Fuel system	Carburetor	Type	Down-draft	Down-draft	Down-draft
		Make	Mikuni Kogyo	Mikuni Kogyo	Mikuni Kogyo
	Governor	Type	Pneumatic	Pneumatic	Pneumatic
		Make	Mikuni Kogyo	Mikuni Kogyo	Mikuni Kogyo
	Fuel pump	Type	Diaphragm	Diaphragm	Diaphragm
		Make	Kyosan Electric	Kyosan Electric	Kyosan Electric
	Air cleaner	Type × number	Cyclone-paper element × 1	Cyclone-paper element × 1	Cyclone-paper element × 1
		Make	Nippon Rokaki	Nippon Rokaki	Nippon Rokaki
Lubrication system	Type		Pressure feed	Pressure feed	Pressure feed
	Oil pump		Gear type	Gear type	Gear type
	Oil filter		Paper-element type	Paper-element type	Paper-element type
	Refill capacities liter (U.S. gal.)	Oil pan	45 (1.2)	45 (1.2)	45 (1.2)
		Oil filter	0.3 (0.1)	0.3 (0.1)	0.3 (0.1)
		Total	4.8 (1.3)	4.8 (1.3)	4.8 (1.3)

Item \ Truck Model				GC15K	GC18K	GC20K	GC25K	GC30K
Cooling system	Type			Forced circulation		Forced circulation		Forced circulation
	Radiator			Corrugated fin (pressure) type		Corrugated fin (pressure) type		Corrugated fin (pressure) type
	Refill capacity liter (U.S. gal.)			9.85 (2.6)		9.85 (2.6)		9.85 (2.6)
	Water pump			Centrifugal type		Centrifugal type		Centrifugal type
	Thermostat			Wax type		Wax type		Wax type
Battery	Voltage V			12		12		12
	5-hr rating Ah			32		40		40
Alternator and regulator	Alternator type			3-phase		3-phase		3-phase
	Capacity V - A			12 - 65		12 - 65		12 - 65
	Regulator			Built-in IC type		Built-in IC type		Built-in IC type
Starter	Type			Lever-shift type		Lever-shift type		Lever-shift type
	Voltage - output V - kW			12 - 1.2		12 - 1.2		12 - 1.2
Power train	Torque converter	Type		3-element, 1-stage, 2-phase		3-element, 1-stage, 2-phase		3-element, 1-stage, 2-phase
		Model		Daikin XT027		Daikin DC6649		Daikin DC6649
		Stall torque ratio		2.8		3.0		3.0
	Powershaft transmission	Control and shift		Hydraulic column shift		Hydraulic column shift		Hydraulic column shift
		Ratios	Forward	2.913		2.913		2.913
			Reverse	2.913		2.913		2.913
	Reduction gear	Type of gears		Skew bevel		Skew bevel		Skew bevel
		Ratio		4.571		4.571		4.571
	Differential	Axle housing		Banjo		Banjo		Banjo
		Type of gears-number	Gears	Straight bevel - 2		Straight bevel - 2		straight bevel - 2
			Pinions	Straight bevel - 2		Straight bevel - 2		Straight bevel - 2
Steering system	Type			Full hydrostatic power stearing		Full hydrostatic power stearing		Full hydrostatic power stearing
	Turning angle	Inside		83°		83°		78°05´
		Outside		54°		56°		52°14´
	Steering wheel diameter mm (in.)			330 (13)		330 (13)		330 (13)
	Steering cylinder	Steering cylinder ID × rod OD mm (in.)		63.5 × 40 (2.5 × 1.575)		76.2 × 50 (3.0 × 1.97)		
		Effective stroke mm (in.)		195 (7.68)		210 (8.27)		
		Relief pressure kPa (kgf/cm²) [psi]		7845 (80) [1138]				
		Flow rate liter (U.S. gal.)/min		23 (6.07)				
Traveling system	Front axle			Full-floating tubular type		Full-floating tubular type		Full-floating tubular type
	Rear axle			Elliott type		Elliott type		Elliott type
	Mounting	Front wheels		Fixed type		Fixed type		Fixed type
		Rear wheels		Center-pivot type		Center-pivot type		Center-pivot type
	Wheel alignment	Toe-in mm (in.)		0		0		0
		Camber		1°		1°		1°
		Caster		0°		0°		0°
		Kingpin inclination		0°		0°		0°

Item \ Truck Model			GC15K	GC18K	GC20K	GC25K	GC30K
Brake system	Service brake	Type	Self-adjusting duo-servo		Self-adjusting duo-servo		Self-adjusting duo-servo
		Drum diameter mm (in.)	254 (10.00)		310 (12.20)		310 (12.20)
		Lining (length × width × thickness × number) mm (in.)	274.2 × 48.5 × 4.78 × 2 (10.80 × 1.91 × 0.19 × 2)		344 × 60.0 × 6.4 × 2 (13.54 × 2.36 × 0.24 × 2)		344×60.0×6.4×2 (13.54 × 2.36 × 0.24 × 2)
		Master cylinder ID mm (in.)	22.22 (0.8748)		22.22 (0.8748)		22.22 (0.8748)
		Wheel cylinder ID mm (in.)	22.22 (0.8748)		28.58 (1.1252)		28.58 (1.1252)
	Parking brake	Type	Mechanical, mounted on front wheels		Mechanical, mounted on front wheels		Mechanical, mounted on front wheels
Body-frame			Unitized type		Unitized type		Unitized type
Hydraulic system	Hydraulic pump	Type	Gear		Gear		Gear
		Model	Shimadzu SGP1-27		Shimadzu SGP1-30		Shimadzu SGP1-34
		Rated output liter (cu in.)	64.8 (3954) /2400 rpm		72.0 (4394) /2400 rpm		79.9 (4876) /2400 rpm
		Drive line	Universal joint		Universal joint		Universal joint
	Control valve	Model	Shimadzu MSV 04-3-7645				
		Relief pressure kPa (kgf/cm²) [psi]	18142^{+490}_{0} (185^{+5}_{0}) [2361^{+71}_{0}]		18142^{+490}_{0} (185^{+5}_{0}) [2361^{+71}_{0}]		18142^{+490}_{0} (185^{+5}_{0}) [2361^{+71}_{0}]
	Flow regulator valve	Type	Variable		Variable		Variable
		Regulated flow rate liter (cu in.)/min	50 ± 3 (3051 ± 183)		65 ± 3 (3967 ± 183)		75 ± 3 (4577 ± 183)
	Lift cylinders mm (in.)	ID	45 (1.77)		50 (1.97)		55 (2.17)
		Stroke	1650 (64.96)		1650 (64.96)		1600 (62.99)
	Tilt cylinders mm (in.)	ID	63 (2.48)		70 (2.76)		80 (3.15)
		Stroke	96 (3.78)		111 (4.37)		111 (4.37)
	Hydraulic tank capacity (approx.) liter (U.S. gal)		21 (5.5)		30 (7.9)		36 (9.5)
Mast and forks	Mast		Roller type CL		Roller type CL		Roller type CL
	Mast dimensions (Flange inside width × Flange × thk (F.R)×Flange thk (R.E) × Web thk)	Outer mm (in.)	100 × 17 × 19 × 11 (3.94 × 0.67 × 0.75 × 0.43)		115 × 22 × 27 × 12 (4.53 × 0.87 × 1.06 × 0.47)		
		Inner mm (in.)	100 × 17 × 19 × 10 (3.94 × 0.67 × 0.75 × 0.39)		115 × 22 × 23 × 11 (4.53 × 0.87 × 0.91 × 0.43)		
	Main rollers	Type	#6308 ball bearing		#6309 ball bearing		#6309 ball bearing
		Diam × width mm (in.)	100 × 27 (3.94 × 1.06)		115 × 30 (4.53 × 1.18)		
	Side rollers	Type	Lubricating type needle roller bearing		Lubricating type needle roller bearing		Lubricating type needle roller bearing
		Diam × width mm (in)	42 × 36 (1.65 × 1.42)		42 × 36 (1.65 × 1.42)		42×36 (1.65 × 1.42)
	Lift chains		BL534		BL634		BL834
	Fork (length × width × thickness) mm (in.)		1067 × 100 × 35 (42 × 4 × 1.4)		1067 × 100 × 40 (42 × 4 × 1.6)		1067 × 125 × 45 (42 × 5 × 1.8)
	Fork spacing (out-to-out) mm (in.)		200 to 820 (8 to 32.5)		200 to 920 (8 to 36)		200 to 960 (10 to 38)

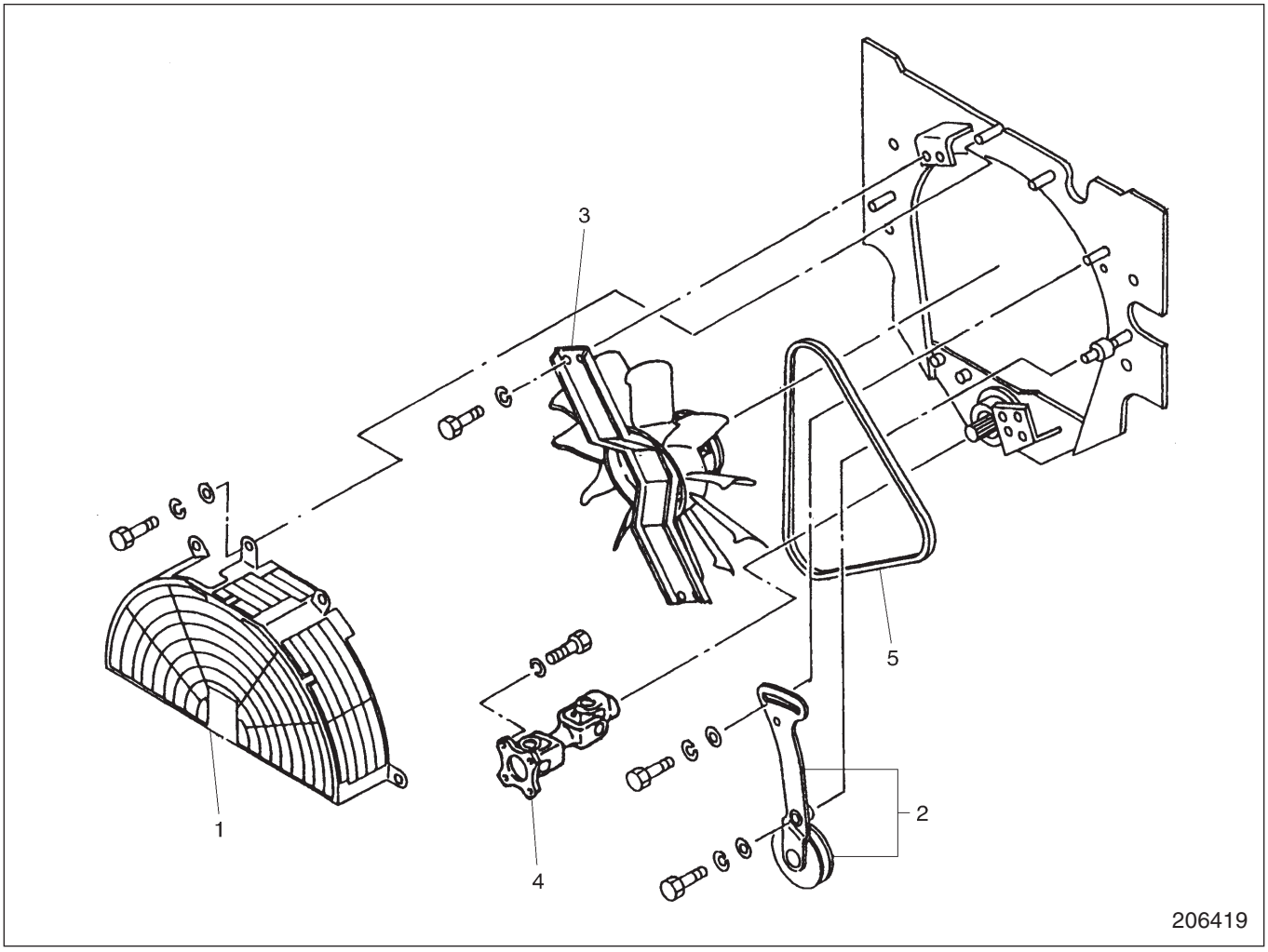
Structure and Function



The cooling fan is installed inside the engine compartment. This helps minimize radiator core clogging and retain high cooling efficiency even in continuous operation for hours. The radiator's lower tank has a built-in transmission oil cooler.

Removal and Installation

Fan Belt Removal



Sequence

1 Fan guard
2 Tensioner, Tensioner pulley
3 Support, Cooling fan
4 Universal joint
5 Fan belt

Start by:

Remove the engine hood and gas-filled cylinder.

Suggestions for Removal

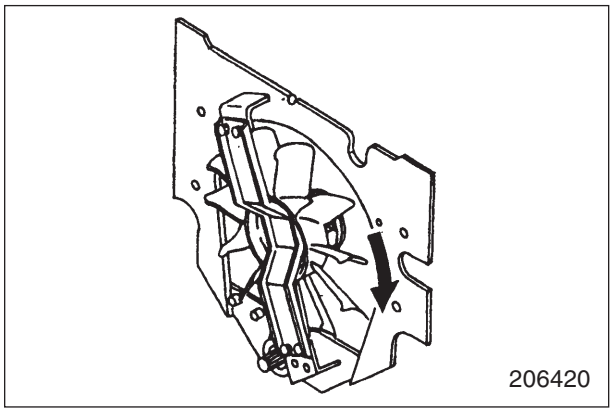
Make sure the muffler, engine and exhaust pipe is cool enough to touch with your hand.

Installation

To install, follow the reverse of removal procedure and take the following steps:

(1) After removing the belt, turn the fan to examine the bearings for abnormal noise. Replace the bearings if abnormally noisy.

(2) After installing the belt, push it inward midway between the pulleys to make sure the tensioner pulley moves freely before tightening the tensioner lock bolt and mounting bolt.



Inspection and Adjustment

Fan Belt Inspection

(1) Make sure the belt is free from oil, grease or other foreign matter. Replace the belt if necessary. A slightly dirty belt can be reused by cleaning with cloth or paper. Do not clean the belt with gasoline or the like.

(2) At the time of overhauling the engine or adjusting the belt tension, check the belt and replace it if defective.

Fan Belt Adjustment

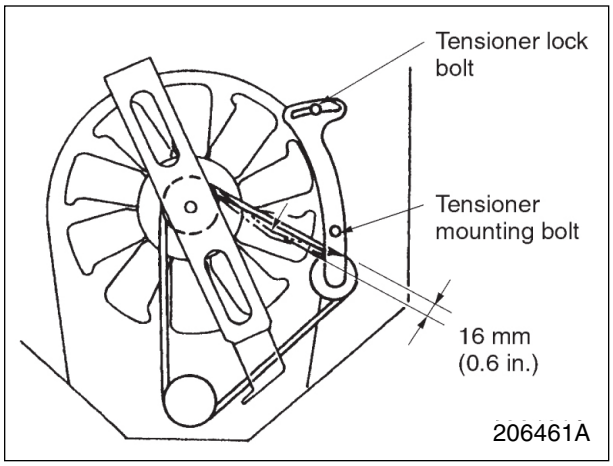
(1) Loosen the tensioner lock bolt and mounting bolt.

(2) Insert a small-diameter bar (or screwdriver) into the tension adjustment hole for leverage, and adjust the belt tension

(3) Adjust the belt so that its deflection is 16 mm (0.6 in.) when the belt is pushed downward with 98 N (10 kgf) [22 lbf] force exerted midway between the fan pulley and tensioner pulley.

(4) Tighten the tensioner lock bolt and mounting bolt.

(5) After the admustment, install the fan guard. If cracks or other abnormalities are found in the fan guard, replace the fan guard.

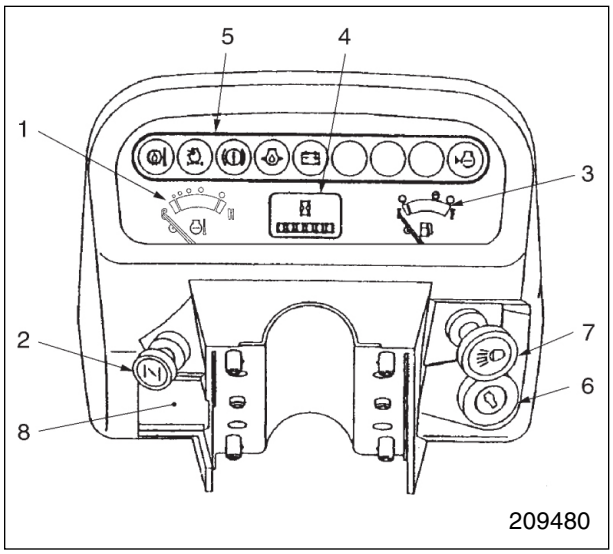


NOTE

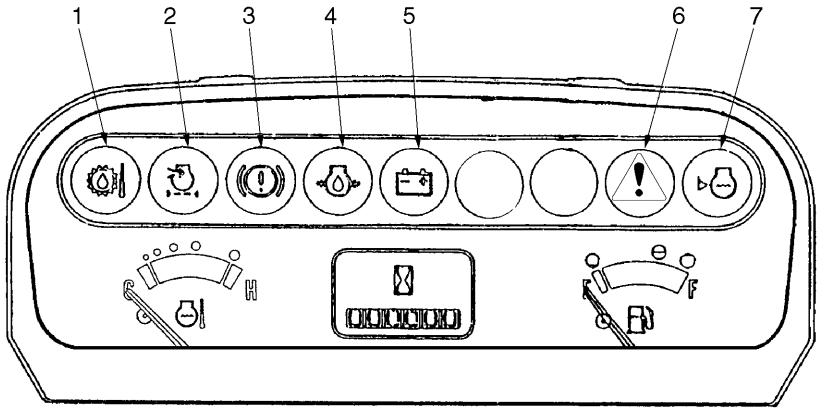
Be careful not to damage the radiator core with the bar (screwdriver) during belt tension adjustment.

Console Box

1 Engine coolant temperature gauge
2 Chock control
3 Fuel gauge
4 Service hourmeter
5 OK monitor
6 Starter switch
7 Lighting switch
8 Fuse box



OK Monitor



Function

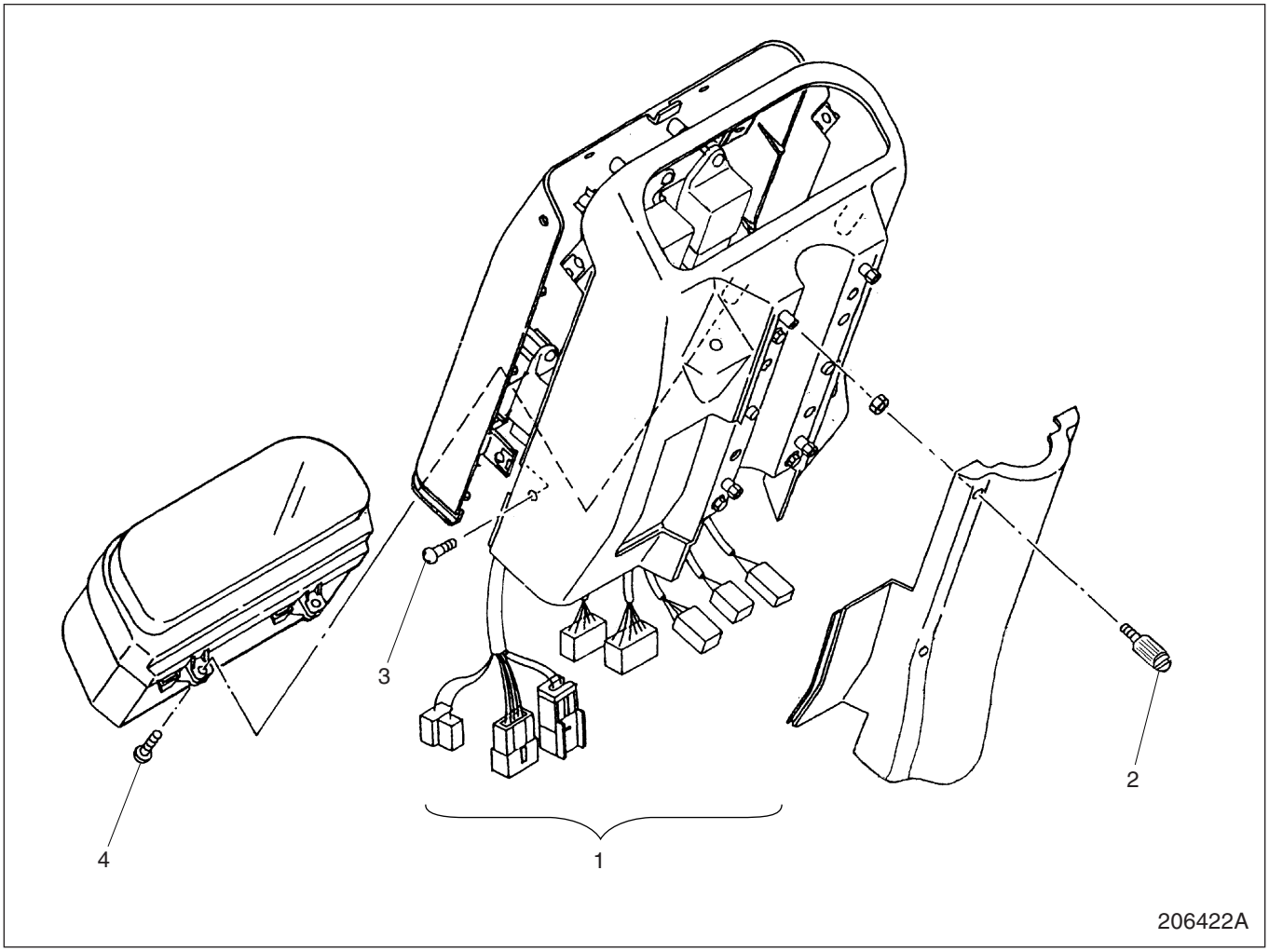
No.	Indicator light	OFF	ON or flickering	Remarks
1	Powershift transmission oil temp. indicator light	Normal	Overheating	Option
2	Air cleaner element indicator light	Normal	Clogged	Option
3	Brake fluid level indicator light	Normal	Low	
4	Engine oil pressure indicator light	Normal	Low	
5	Alternator not charging indicator light	Normal	Abnormal	
6	Check engine light	Normal	Service Engine	2004 Model
7	Engine coolant level indicator light	Normal	Low	Option

How to check indicator light bulbs

The bulbs are normal if the indicator lights 1, 2 and 3 come ON when the starter switch key is turned to I (ON) position. (The indicator lights will go OFF when the engine starts.)

Disassembly and Reassembly

Console Box



Disassembly

1. Disconnect the electrical wires at connectors 1. (In the gasoline models, disconnect the choke cable on the engine side.)
2. Remove screws 2 (four) securing the cover.
3. Remove screws 3 (six) and separate the front and rear panels.
4. Remove screws 4 (four) securing the instrument panel.

NOTE

To replace the instrument panel bulbs, remove screws 3 and 4.

Reassembly

To reassemble the console box, follow the reverse of disassembly procedure.

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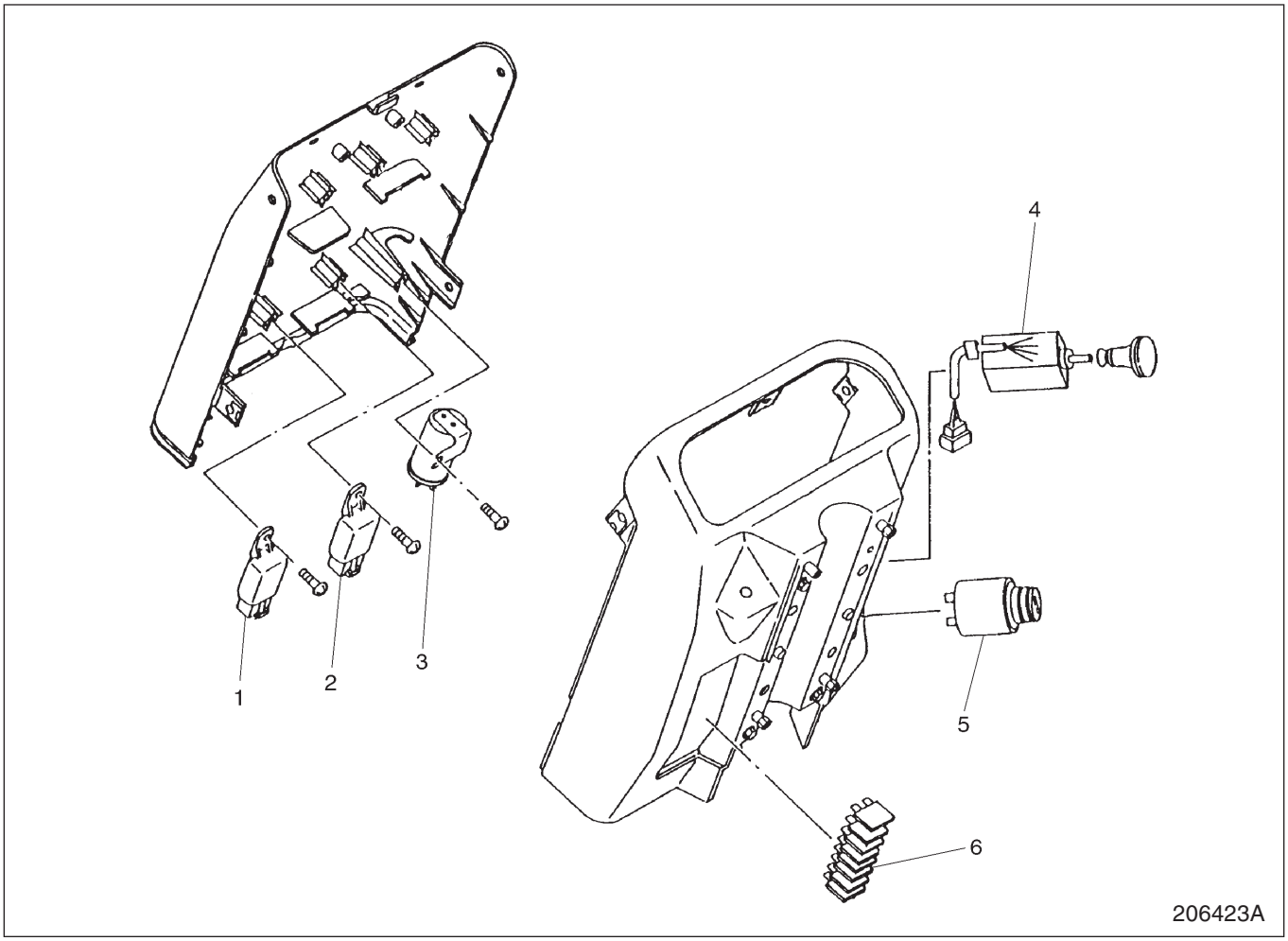
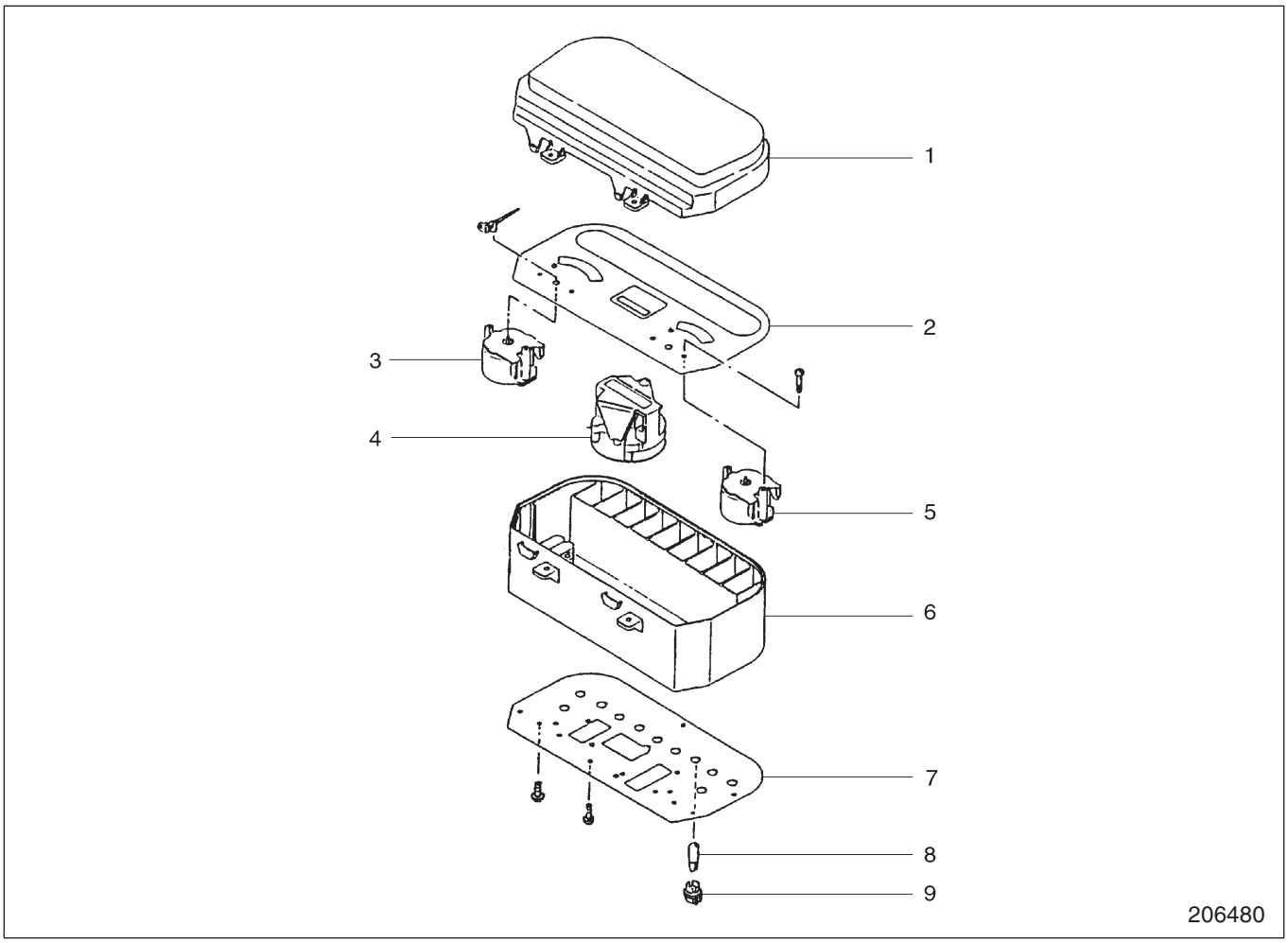
Components in Console Box



1 Power relay
2 Power relay
3 Turn signal relay
4 Lighting switch
5 Starter switch
6 Fuses

Combination Meter

Disassembly



Sequence

1 Meter cover
2 Dial
3 Engine coolant temperature gauge
4 Service hourmeter
5 Fuel gauge
6 Meter case
7 Printed circuit
8 Bulb
9 Socket

⚠ CAUTION

Be careful not to damage the printed circuit when disassembling the combination meter.

Reassembly

To reassemble the combination meter, follow the reverse of disassembly procedure.

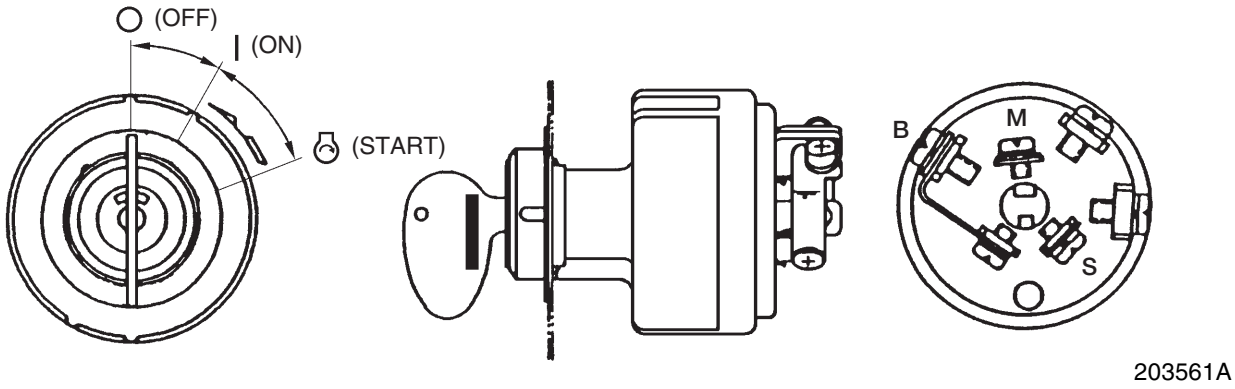
Bulb Replacement

For bulb replacement, remove the socket from the printed circuit by turning it to the left. For configuration of the indicator lights, refer to “OK Monitor”.

Major Electrical Components

Starter Switch (with Anti-Restart Lock)

This switch has a built-in anti-restart lock, so the key cannot be turned from | (ON) to (START) position while the engine is running.

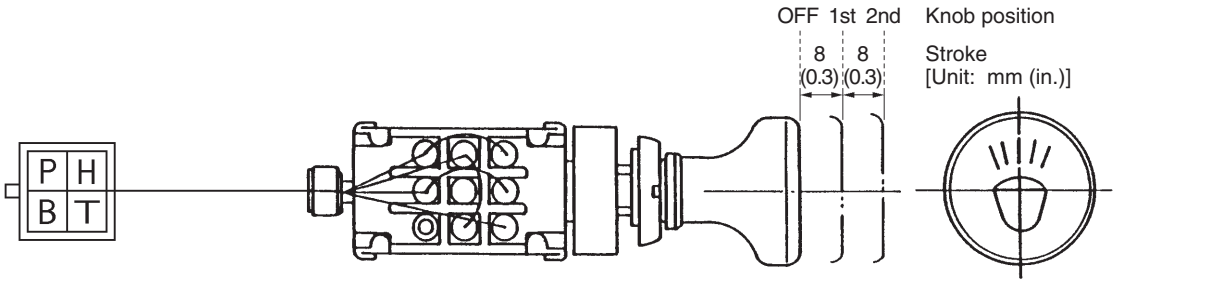


203561A

Connection Chart

Terminal / Component / Key position	B	M	S
(OFF)	Fuse box, battery, alternator	Fuse box, fuel-cut solenoid	Starter, neutral switch (powershift transmission models)
(OFF)	○		
(ON)	○	○	
(START)	○	○	○

Lighting Switch

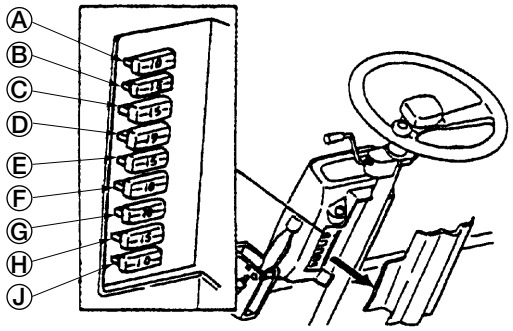


206481

Connection Chart

Terminal / Knob position / Component	B	T	H	P
	Battery (fuses)	Tail lamps, licence plate lamp, instrument lamp	Working lamps (option)	Head lamps
○ (OFF)				
1st position	○	○		○
2nd position	○	○	○	○

Fuse Box



Code	Amp	Circuit
A	10 A	SOLENOID (F-R)
B	15 A	Stop lamp, turn signals, backup lamps
C	15 A	Spare terminal
D	15 A	Tail lamps, clearance lamps, working lamps (option), Instrument panel lamps
E	15 A	Head lamps
F	10 A	Spare fuse
G	10 A	Horn
H	15 A	Fuel pump relay
J	10 A	Engine, ECU

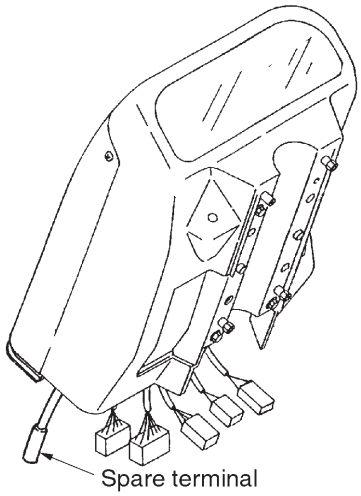
101441D

Spare Terminals

The spare terminal cord extends from the fuse box in the console box. (Another spare terminal is located on the chassis-side main harness.)

Cord color	Lg (yellowish green)

Removing the console box rear panel will expose this spare terminal which is fastened to the harness protector with vinyl tape.



206424

Battery Maintenance

1. State of charge and electrolyte specific gravity adjustment

S.G.: specific gravity

Specific gravity reading at 20°C (68°F)	State of charge	Adjustment
1.280 to 1.265	Fully charged	If difference in S.G. between any two cells is 0.020 or more, effect a high current discharge to minimize the difference and then recharge battery. Adjust S.G. during recharging.
1.260 to 1.225	One-half charged	Recharge battery and adjust electrolyte S.G. Make sure there is neither faulty components, loosely connected cord nor corroded connection.
1.220 or lower	Discharged	Recharge battery. If difference in S.G is large, adjust it during recharging.
If difference in S.G. is more than 0.040	A cell with a low S.G. is in shorted condition. Recharge until voltage and S.G. stabilize and have remained constant for more than 2 hours.	During recharging, adjust the S.G. to 1.280 and 1.265. If difference in S.G. is more than 0.040 and a low S.G. is found in certain cells only, replace battery.

2. Specific gravity reading and state of charge

To check the battery for state of charge, take hydrometer readings on its electrolyte. The battery may be fully charged if the S.G. reading is 1.280 to 1.265 at 20°C (68°F). The state of charge can be told from the way the electrolyte level goes down to expose the cell plates. If addition of distilled water is necessary every month or so, the battery is overcharged. If addition is not required for more than 3 months, it is likely that the battery is inadequately charged.

3. Charging precautions

(1) In slow charging, the charging current should be about 1/10 the capacity of the battery to be charged.

(2) In quick charging, the battery capacity in ampere should not be exceeded.

(3) During charging, adjust the charging current to prevent the electrolyte temperature from rising beyond 45°C (113°F).

(4) When connecting the cables to the battery, begin with the cable for the positive (+) terminal. When disconnecting them from the battery, begin with the cable for the negative (–) terminal.

⚠ CAUTION

Be sure to turn OFF the starter switch and lighting switch before disconnecting or connecting the battery cables to prevent the IC regulator from suffering damage.

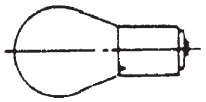
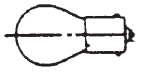
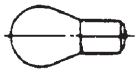
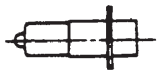
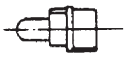
Maintenance Free Battery

Maintenance Free Batteries do not require a specific gravity check but the following checks are required to extend the life of your battery:

(1) Visually inspect the battery for container, cover or terminal damage that may have caused leakage of electrolyte or internal damage. If serious damage is found, replace the battery.

(2) Check the condition of the battery cables. Check for corrosion on the battery terminals and cable terminations. Make certain the ground cable is making a good connection where it is grounded, and likewise, check the connection of the cable to the starter relay and/or solenoid. Replace badly corroded cables or cables with defective terminations.

Lamp Bulb Specifications

Lamp description		No. of bulbs	Color of lends	Watts 12 V	Shape	Remarks
Head lamp		2	Frosted	27		
Combination lamps (front)	Turn signals	2	Amber	27		Option
	Clearance lamps	2	Frosted	10		Option
Combination lamps (rear)	Turn signals	2	Amber	23		Option
	Turn and stop lamps	2	Red	8/23		Option
	Back-up lamps	2	Frosted	10		Option
Workiing lamps (front and rear)		4	Frosted	55		Option
Instrument panel lamps Monitor indicator lights		9	Frosted	3		

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Troubleshooting

Starter System

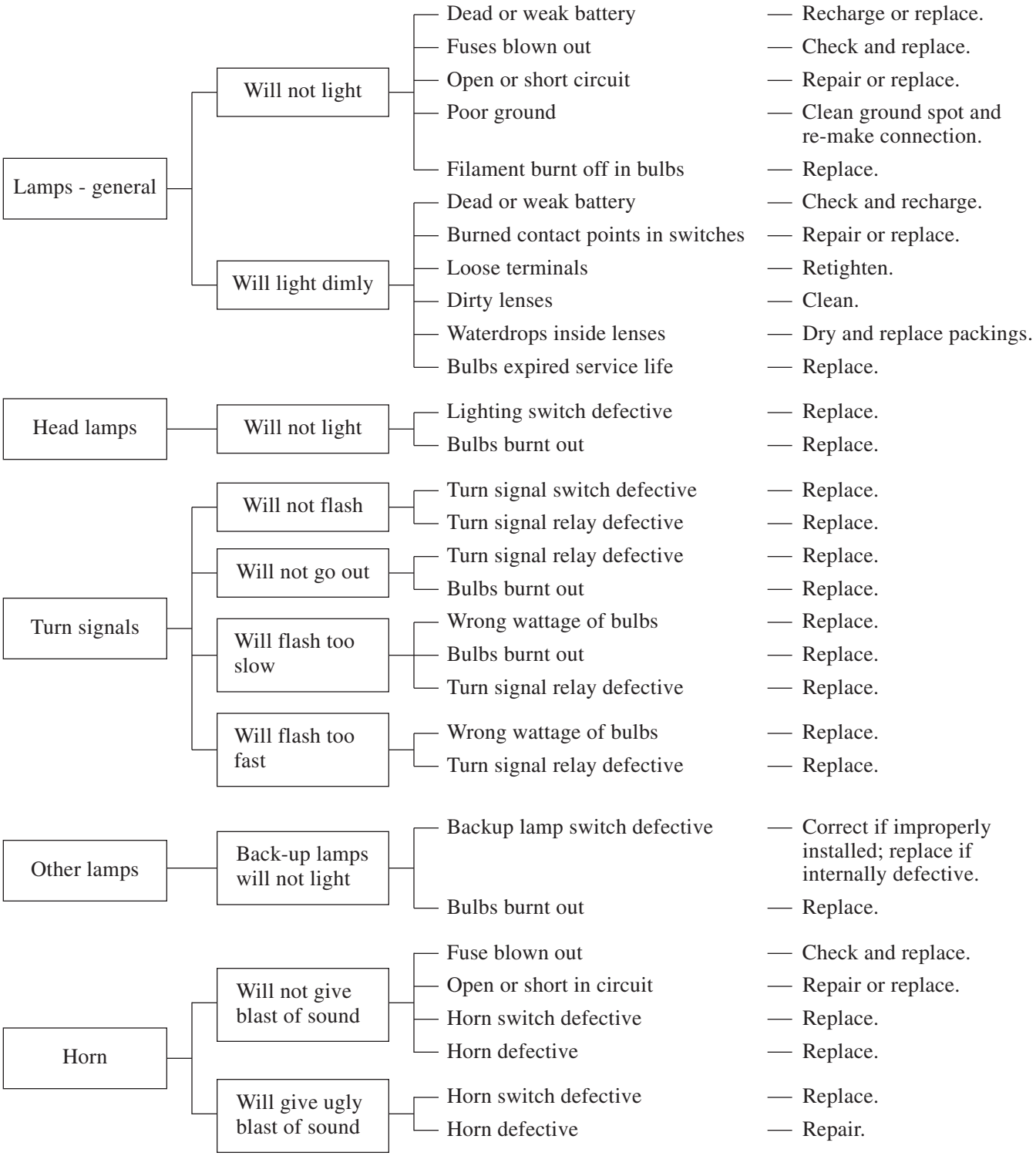
Starter switch	Starter will not crank engine	Dead or weak battery	Recharge or replace.
		Short or open in circuit	Repair or replace.
		Poor continuity in starter switch	Replace.
		Starter and starter relay defective	Replace.
	Turning off starter switch will not stop engine	Open or short circuit	Repair or replace.
		Timing control solenoid defective	Replace.
		Fuel cut solenoid defective	Replace.

Gauges

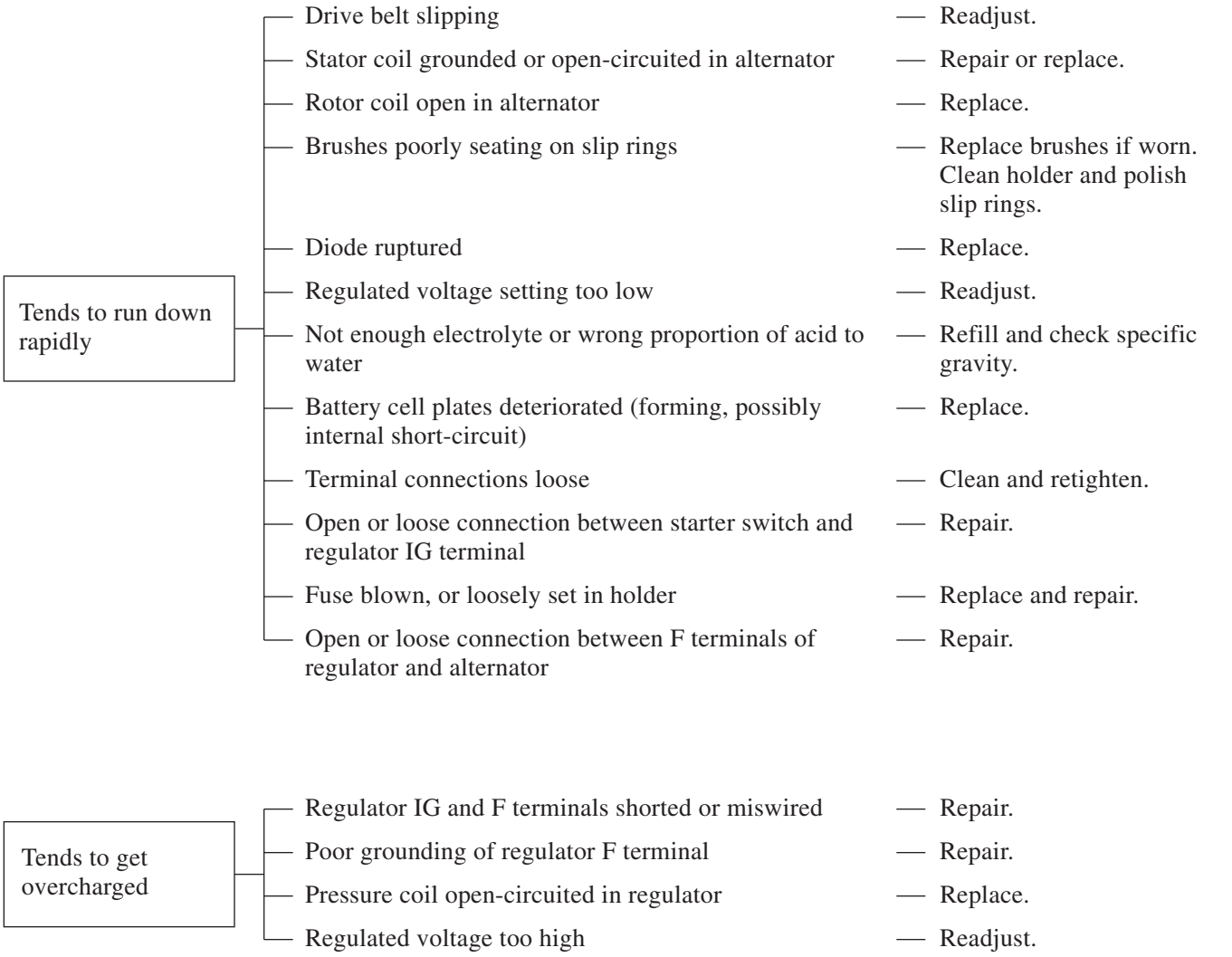
Engine coolant temperature	Will not indicate at all	Open or short in circuit	Repair or replace.
		Gauge internally defective	Replace.
		Gauge unit defective	Replace.
	Will not indicate accurately	Gauge or gauge unit not of the type called for	Replace.
		Loose terminal connection	Repair.
	Will indicate higher temperature than is actual	Ground in circuit between gauge and gauge unit	Repair.
		Gauge internally defective	Replace.

Fuel gauge	Will not indicate at all	Open or short in circuit	Repair or replace.
		Gauge internally defective	Replace.
		Gauge unit defective	Replace.
	Will not indicate accurately	Gauge or gauge unit not of the type called for	Replace.
		Loose terminal connection	Retighten.
	Will indicate “Full” regardless of the amount of fuel left in tank	Gauge unit poorly grounded	Repair.
		Gauge internally defective	Replace.
		Gauge unit defective	Replace.
	Will indicate “Empty” regardless of the amount of fuel left in tank	Short or open circuit in wiring between gauge and gauge unit	Repair.
		Gauge unit defective	Replace.
		Gauge internally defective	Replace.

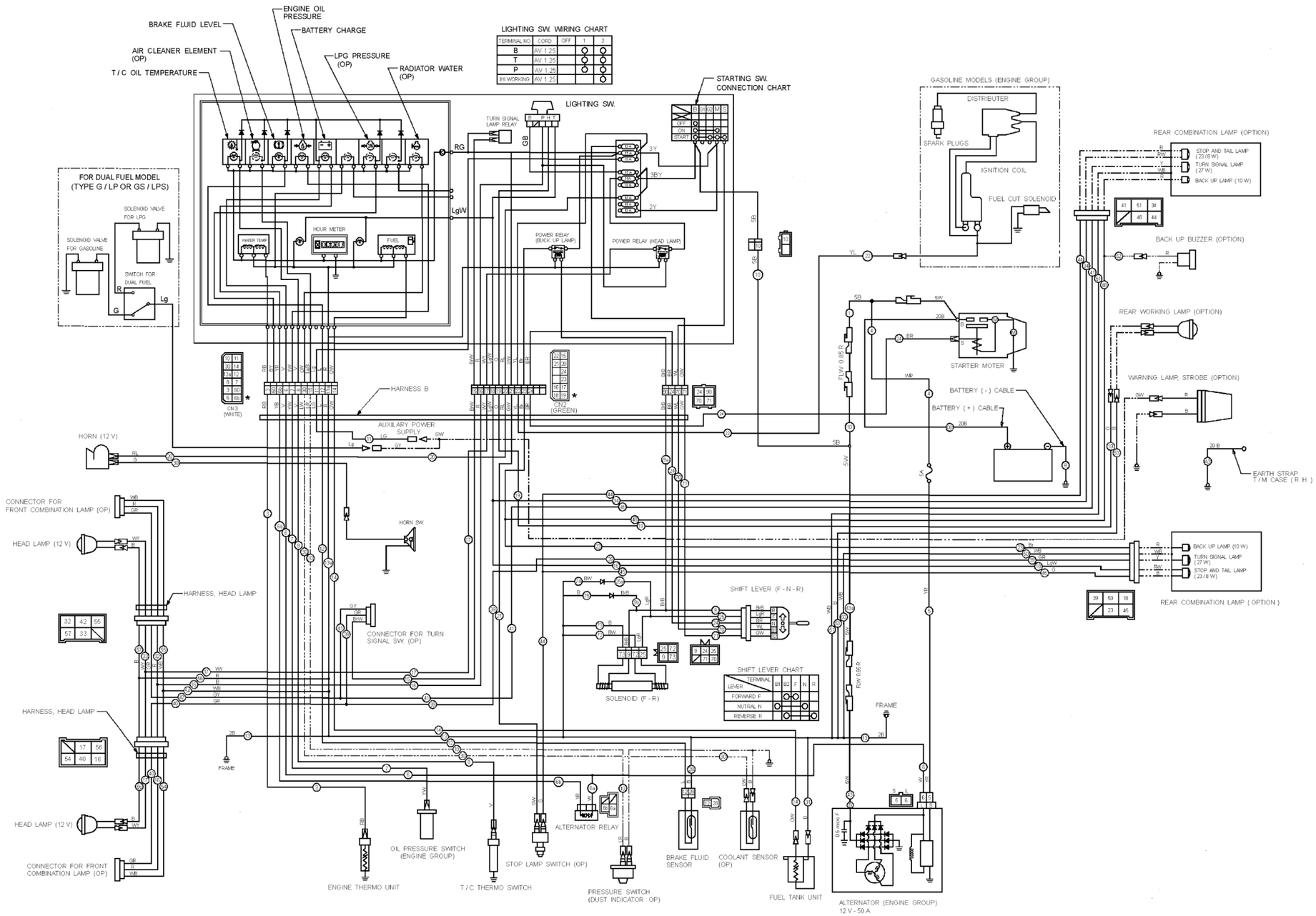
Lighting System



Battery


Tends to run down rapidly
Drive belt slipping — Readjust.
Stator coil grounded or open-circuited in alternator — Repair or replace.
Rotor coil open in alternator — Replace.
Brushes poorly seating on slip rings — Replace brushes if worn. Clean holder and polish slip rings.
Diode ruptured — Replace.
Regulated voltage setting too low — Readjust.
Not enough electrolyte or wrong proportion of acid to water — Refill and check specific gravity.
Battery cell plates deteriorated (forming, possibly internal short-circuit) — Replace.
Terminal connections loose — Clean and retighten.
Open or loose connection between starter switch and regulator IG terminal — Repair.
Fuse blown, or loosely set in holder — Replace and repair.
Open or loose connection between F terminals of regulator and alternator — Repair.
Tends to get overcharged
Regulator IG and F terminals shorted or miswired — Repair.
Poor grounding of regulator F terminal — Repair.
Pressure coil open-circuited in regulator — Replace.
Regulated voltage too high — Readjust.

Electrical Schematic



WIRE COLOR	CODE
BLACK	B
WHITE	W
RED	R
GREEN	G
YELLOW	Y
BROWN	Br
BLUE	L
LIGHT GREEN	Lg
VIOLET	V

4. MALE SIDE OF CONNECTOR SHOWN.
3. TERMINAL ARRANGEMENT OF CONNECTOR SHOWN BY MARK (•) MUST BE TO CONSOLE BOX INSTRUMENT ARRANGEMENT.
2. CIRCUIT SHOWN BY CHAIN DOUBLE DASH LINE (—·—·—) MUST BE OPTIONAL CIRCUIT.

NOTES : 1. UNLESS OTHERWISE SPECIFIED WIRE SIZE MUST BE 1.25mm².

CAT

Schematic No.	Use for	Truck No.	Serial No.
ES019 - 80150	99719 - 80150	GC15K	AT81C - 00011 - up
		GC18K	AT81C - 00011 - up
		GC20K	AT82C - 00011 - up
		GC20K HP	AT82C - 90011 - up
		GC25K	AT82C - 00011 - up
		GC25K HP	AT82C - 90011 - up
		GC30K	AT83C - 00011 - up