WSM

WORKSHOP MANUAL

T1880,T2080,T2380

Kubota

KiSC issued 02, 2016 A

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GENERAL

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SPECIFICATIONS

Model			T1880	T2080	T2380
Engine	Model		GH540V	**[T2080, T2080A]** GH710V **[T2080A2]** GH737V	**[T2380, T2380A]** GH720V **[T2380A2]** GH738V
	Type		OHV air cooled gasoline engine		
	Number of cylinders		1	2	
	Total displacement		**[T1880A,A2]** 597 cm^3 (36.4 cu.in.)	725 cm^3 (44.2 cu.in.)	
			[T1880] • SN. ≥ 3831112033 597 cm^3 (36.4 cu.in. • SN. ≤ 3831112032 535 cm^3 (32.6 cu.in.)	725 cm^3 (44.2 cu.in.)	
	Max. horse power		13.4 kW (18 HP)	14.9 kW (20 HP)	**[Except T1880A2, T2080A2, T2380A2]** 17.2 kW (23 HP) **[T1880A2, T2080A2, T2380A2]** 16.4 kW (22 HP)
	Bore and stroke		**[T1880A, A2]** • 94 × 86 mm (3.70 × 3.38 in.)	83 x 67 mm (3.27 x 2.64 in.)	
			[T1880] • SN. ≥ 3831112033 94 × 86 mm (3.70 × 3.38 in.) • SN. ≤ 3831112032 89 × 86 mm (3.50 × 3.38 in.)	83 x 67 mm (3.27 x 2.64 in.)	
	Fuel		Automobile unleaded or regular gasoline		
	Starter		Electric starter with battery		
	Lubrication		Full pressure lubrication		
	Cooling		Forced air cooled		
	Battery type		U1L-9 (12 V, 300CCA)		
	Spark plug		Champion RC12YC		
Capacities	Fuel tank		**[T1880A, A2, T2080A, A2, T2380A, A2]** 13.5 L (3.57 U.S.gals, 2.97 Imp.gals) **[T1880, T2080, T2380]** 15 L (3.9 U.S.gals, 3.2 Imp.gals)		
	Engine crankcase		1.5 L (1.6 U.S.qts, 1.3 Imp.qts)	1.8 L (1.9 U.S.qts, 1.5 Imp.qts)	
	Hydrostatic transmission case		2.70 to 2.75 L (2.85 to 2.90 U.S.qts, 2.38 to 2.41 Imp.qts)		
Machine	PTO		Belt		
	Direction of revolution		Clockwise viewed from top		
	Revolution (PTO speed)		3200 min^{-1} (rpm)		
	PTO clutch		Belt tension		
	Transmission		Hydrostatic transmission		
	Traveling speed	Forward	0.0 to 9.0 km/h (0.0 to 5.6 mph)		
		Reverse	0.0 to 5.0 km/h (0.0 to 3.1 mph)		
	Brake		External disk type		
	Tires	Front	15 × 6.00-6		
		Rear	22 × 11.00-10		

NOTE: *Manufacture's estimate
The company reserves the right to change the specifications without notice.

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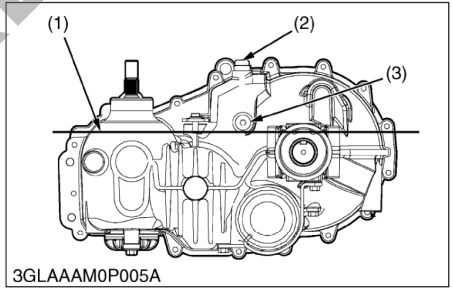
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4. LUBRICANTS AND FUEL

No.	Place	Capacity		Lubricants and fuel
		T1880	T2080, T2380	
1	Engine crankcase	1.5 L 1.6 U.S.qts 1.3 Imp.qts	–	Engine oil: API service classification SG, SH, SJ or higher Below 0 °C (32 °F): SAE 5W-20 or 5W-30 Above 0 °C (32 °F): SAE 10W-30
		–	1.6 to 1.8 L 1.7 to 1.9 U.S.qts 1.4 to 1.5 Imp.qts	Engine oil: API service classification SG, SH, SJ or higher Below 0 °C (32 °F): SAE 5W-20 or 5W-30 Above −18 °C (0 °F): SAE 10W-30
2	Hydrostatic transmission	2.70 to 2.75 L 2.85 to 2.90 U.S.qts 2.38 to 2.41 Imp.qts		Engine oil: API service classification SL SAE 20W-50
3	King pins	Until grease over flows		Multipurpose EP2 Grease (NLGI Grade No. 2)
4	Front axle pivot pin Brake pedal shaft Seat adjuster Speed control pedal shaft Throttle cable PTO clutch cable Mower brake cable Mower link	Moderate amount		Oil or spray type grease
5	Fuel tank	**[T1880A, A2, T2080A, A2, T2380A, A2]** 13.5 L 3.57 U.S.gals 2.97 Imp.gals		• Automobile unleaded or regular gasoline • Unleaded gasoline 87 octane or higher
		[T1880, T2080, T2380] 15 L 3.9 U.S.gals 3.2 Imp.gals		

■ **NOTE**

- **Engine oil:**
  Oil used in the engine should have an American Petroleum Institute (API) service classification and proper SAE Engine Oil according to the ambient temperatures as shown above.
- **Indicated capacity of oil are manufacture's estimate.**
- **Gasohol (up to 10 % ethyl alcohol, 90 % unleaded gasoline by volume) or Methyl Tertiary Butyl Ether (MTBE) and unleaded gasoline blends (up to a maximum of 15 % MTBE by volume) are approved for the engine. Other gasoline/ alcohol blends are not approved.**



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Hydrostatic Transmission

Checking oil level :

Be sure to check the oil level (1) when the transmission is cold. Remove the oil level check port plug (3). The correct level should be even with the bottom of the port. If necessary to add oil, remove breather tube and add from top port plug. Be sure to use correct oil which is specified in the above LUBRICANTS table.

(1) Oil Level
(2) Top Port Plug
(3) Oil Level Check Port Plug

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6. MAINTENANCE CHECK LIST

The following servicing tasks No.1 to 20 should be carried out on the machine at the stated running-time intervals.

No.	Items			Used hours (Hr)													After since	Refe-rence page	
				25	50	100	150	200	250	300	350	400	450	500	550	600			
1	PTO Belt tension		Adjust	★	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hrs	G-27	*3
2	Mower brake		Check Adjust		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hrs	G-28	
3	Brake pedal play		Check	★	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hrs	G-22	*3
4	King pin		Greasing	★	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hrs	G-29	*3
5	Air cleaner (T1880)	Precleaner element	Clean	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 25 Hrs or 2 months	G-25	*1
		Air cleaner element	Replace			☆		☆		☆		☆		☆		☆	every 100 Hrs or annually	G-34	
	Air cleaner (T2080, T2380)	Precleaner element	Clean	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 25 Hrs	G-26	*1
			Replace			☆		☆		☆		☆		☆		☆	every 100 Hrs	G-35, 36	
		Air cleaner element	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 25 Hrs	G-27	*2
			Replace			☆		☆		☆		☆		☆		☆	every 100 Hrs	G-35, 36	
6	Carbon canister air filter [Except T1880, T2080, T2380]		Check		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hrs	G-29	*2
7	Tire pressure		Change			☆		☆		☆		☆		☆		☆	every 50 Hrs	G-16	
8	Engine oil		Change			☆		☆		☆		☆		☆		☆	every 100 Hrs or annually	G-30	
9	Engine shroud		Clean			☆		☆		☆		☆		☆		☆	every 100 Hrs	G-30	

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■ **IMPORTANT**

- **The jobs indicated by ★ must be done initially.**
  ***1 Precleaner element should be cleaned more often in dusty conditions than in normal conditions.**
  ***2 Clean or replace as necessary.**
  ***3 The initial 25 hours should not be a replacement cycle.**
  ***4 Replace if any deterioration (crack, hardening, scar, or deformation) or damage occurred.**
- **GASOLINE ENGINE EMISSION RELATED MAINTENANCE INSTRUCTIONS:**
  1. Non-warranty maintenance, repair, or replacement of the emission control devices and systems should be performed by a qualified repair establishment or individual which has the experience and equipment to perform such work.
  See the Emissions Warranty Statement.
  2. To ensure the best quality and reliability, use new KUBOTA Genuine parts or their equivalents for repair and replacement, whenever you have maintenance done.

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2. HYDRAULIC SCHEMATIC

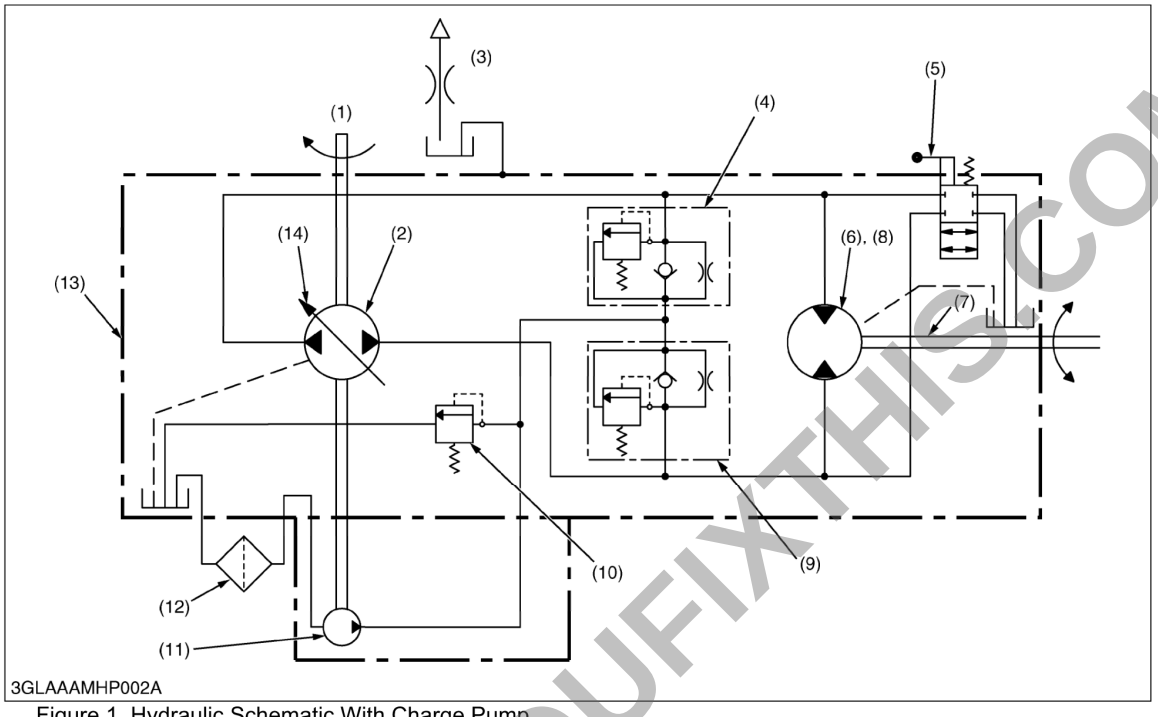


Figure 1, Hydraulic Schematic With Charge Pump

(1) Input Shaft
(2) Cylinder Block Assembly (Pump)
(3) Vent
(4) Check Valve
(5) Bypass Actuator
(6) Cylinder Block Assembly (Motor)
(7) Motor Shaft
(8) Fixed Swashplate
(9) Check Valve
(10) Charge Relief
(11) Charge Pump
(12) Oil Filter
(13) Transaxle Housing
(14) Variable Swashplate

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Excessive Vibration	Loose engine mounting nuts	Tighten mounting nuts.	1-S13
Engine Will Not Crank	Engine jammed	Check engine to find trouble and repair.	–
	Battery discharged	Check battery specific gravity, and charge or replace battery.	G-32, 33
	Starter malfunctioning	Repair or replace starter.	P-S46 Q-S49
	Slow blow fuse blown	Replace slow blow fuse.	G-45
	Main switch defective	Repair or replace main switch.	8-S8
	PTO switch defective	Replace PTO switch.	8-S10
	Brake switch defective	Replace brake switch.	–
	Reverse switch defective	Replace reverse switch or adjust reverse switch gap.	8-S11
	Seat switch defective	Replace seat switch.	8-S10
	Wiring harness disconnected	Connect wiring harness.	8-S7
Engine Cranks Slowly but Does Not Start	Battery charge low	Check battery specific gravity, and charge or replace battery.	G-32, 33
	Battery cables loose, corroded or worn	Repair or replace cables.	8-S7
	Increased resistance of moving parts	Repair or replace moving parts.	–
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil.	G-9

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5. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

Screws, bolts, and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

Indication on top of bolt	⬡ 4 No-grade or 4T						⬡ 7 7T						⬡ 9 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit / Diameter	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6 (6 mm, 0.24 in.)	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10 (10 mm, 0.39 in.)	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12 (12 mm, 0.47 in.)	63 to 72	6.4 to 7.4	47 to 53	–	–	–	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5	–	–	–	124 to 147	12.6 to 15.0	91.2 to 108	–	–	–	167 to 196	17.0 to 20.0	123 to 144
M16 (16 mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141	–	–	–	197 to 225	20.0 to 23.0	145 to 166	–	–	–	260 to 304	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	246 to 284	25.0 to 29.0	181 to 209	–	–	–	275 to 318	28.0 to 32.5	203 to 235	–	–	–	344 to 402	35.0 to 41.0	254 to 296
M20 (20 mm, 0.79 in.)	334 to 392	34.0 to 40.0	246 to 289	–	–	–	368 to 431	37.5 to 44.0	272 to 318	–	–	–	491 to 568	50.0 to 58.0	362 to 419

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[2] METRIC SCREWS, BOLTS AND NUTS

Grade	Property class 8.8 ⬡ 8.8			Property class 10.9 ⬡ 10.9		
Unit / Nominal Diameter	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	24 to 27	2.4 to 2.8	18 to 20	30 to 34	3.0 to 3.5	22 to 25
M10	48 to 55	4.9 to 5.7	36 to 41	61 to 70	6.2 to 7.2	45 to 52
M12	78 to 90	7.9 to 9.2	58 to 66	103 to 117	10.5 to 12.0	76 to 86.7
M14	124 to 147	12.6 to 15.0	91.2 to 108	167 to 196	17.0 to 20.0	123 to 144
M16	197 to 225	20.0 to 23.0	145 to 166	260 to 304	26.5 to 31.0	192 to 224

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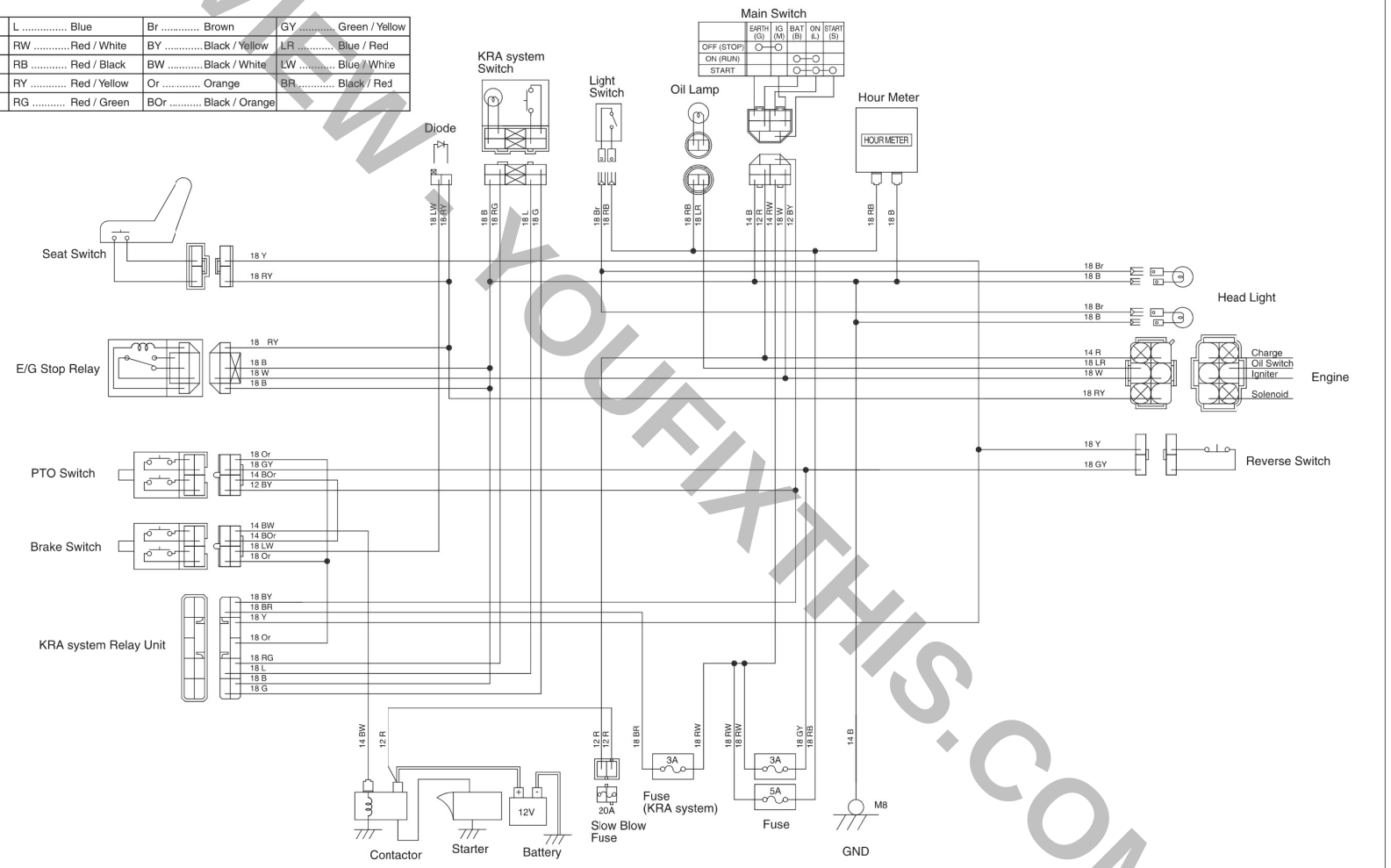
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1. WIRING DIAGRAM

[1] T1880

Color of Wiring

R ..... Red	L ..... Blue	Br ..... Brown	GY ..... Green / Yellow
G ..... Green	RW ..... Red / White	BY ..... Black / Yellow	LR ..... Blue / Red
B ..... Black	RB ..... Red / Black	BW ..... Black / White	LW ..... Blue / White
W ..... White	RY ..... Red / Yellow	Or ..... Orange	BR ..... Black / Red
Y ..... Yellow	RG ..... Red / Green	BOr ..... Black / Orange	



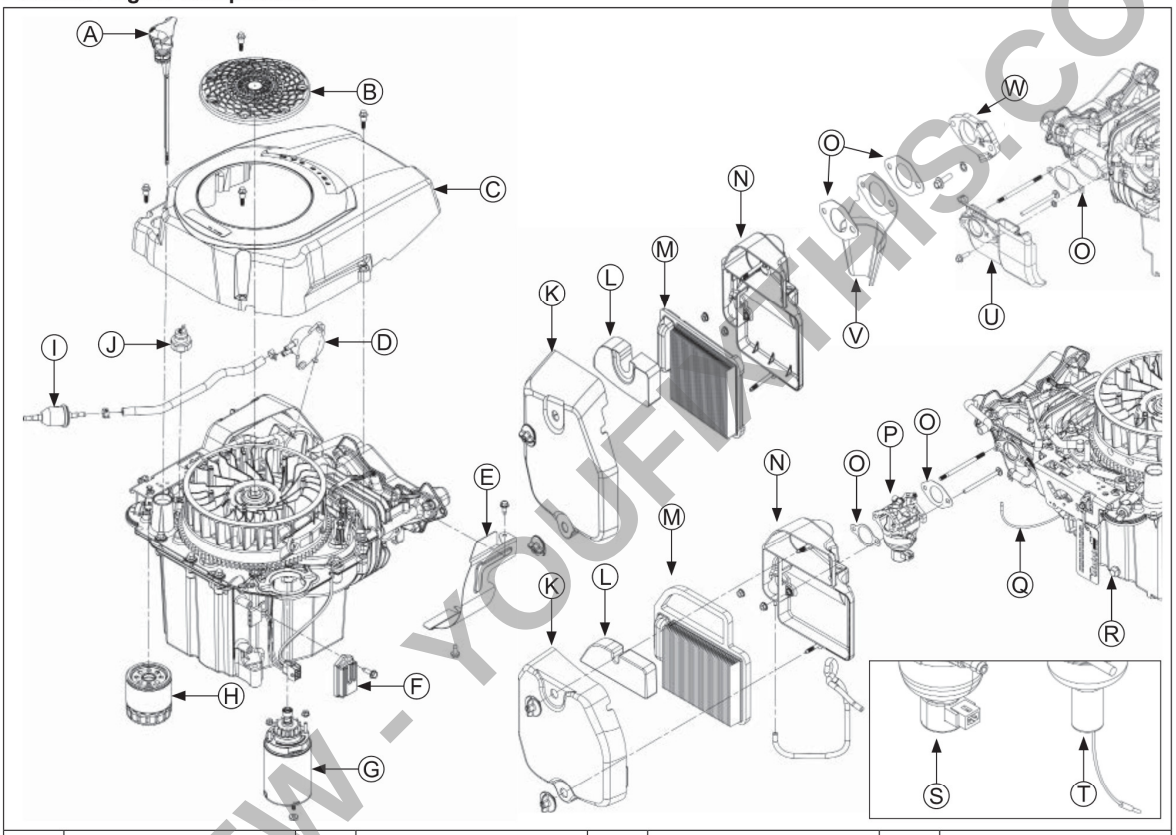
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Disassembly/Inspection and Service

	⚠ WARNING	Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (–) battery cable from battery.
	Accidental Starts can cause severe injury or death. Disconnect and ground spark plug lead(s) before servicing.	

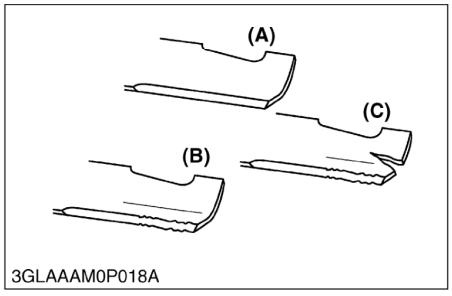
External Engine Components



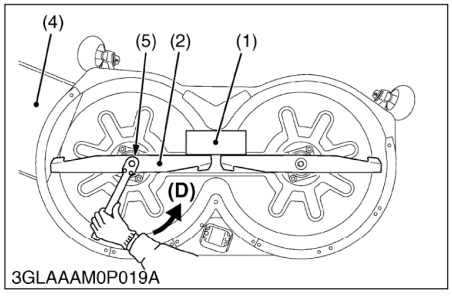
A	Oil Fill/Dipstick	**B**	Debris Screen	**C**	Blower Housing	**D**	Fuel Pump
E	Cylinder Head Baffle	**F**	Rectifier-Regulator	**G**	Electric Starter	**H**	Oil Filter
I	Fuel Filter	**J**	Oil Sentry™	**K**	Air Cleaner Cover	**L**	Precleaner
M	Air Cleaner Element	**N**	Air Cleaner Base	**O**	Gasket	**P**	Carburetor
Q	Ground Wire	**R**	Oil Drain Plug	**S**	Nikki Fuel Solenoid	**T**	Walbro Fuel Solenoid
U	Heat Deflector	**V**	Heat Shield	**W**	Carburetor Spacer		

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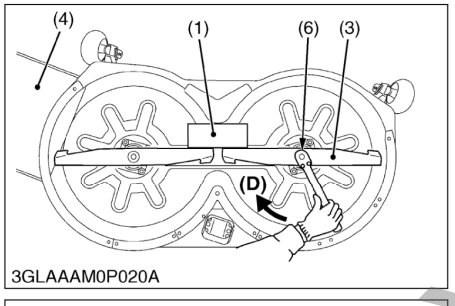
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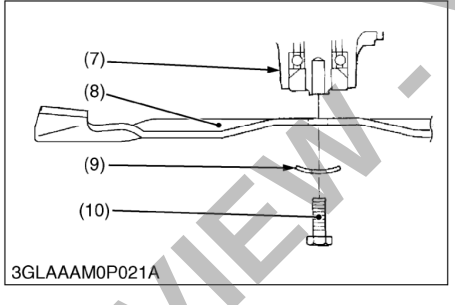
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Checking and Replacing Blade

WARNING

To avoid serious injury:

- **Be sure to stop the engine and remove the key.**
- **Blades may be sharp. When you handle blades, wear heavy gloves or wrap end of blade with a rag.**
- **Before checking or replacing the blade, wipe grass and mud off the top and inside of the mower.**
  Especially clean up the inside of the belt cover, because otherwise the belt life will be reduced.

■ **Checking**

The blade cutting edges should be kept sharp at all times.
Sharpen the cutting edges, if they resemble blade **(B)**.
Replace the blades if they appear similar to blade **(C)**.

■ **Replacing**

1. Remove the mower deck from the machine and turn it over to expose the blades.
2. Wedge a block (1) of wood between the blade and mower housing as illustrated.
3. The bolt (5) for black blade (2) has right hand threads, turn counterclockwise to loosen.
   The bolt (6) for red blade (3) has left hand threads, turn clockwise to loosen.

■ **NOTE**

- **Use the proper size box or socket wrench to tighten or loosen the blade mounting bolt.**
- **Black blade to be assembled at discharge deflector (black color) side.**
  Red blade to be assembled at mower deck wall (red color) side.

4. To sharpen the blades yourself, clamp the blade securely in a vise.
   Use a large mill file and file along the original level until sharp.
5. To check the blade for balance, place a small rod through the center hole. If the blade is not balanced, file the heavy side of the blade until balance is achieved.

■ **IMPORTANT**

- **To attach blades, be sure to install the cup washer (9) between the blade and bolt head (10).**

■ **NOTE**

- **Make sure that the cup washer is not flattened out or worn; this may cause blade to slip excessively.**
  Replace the cup washer if either is damaged.

■ **IMPORTANT**

- **Tighten the bolt of the all blades from 103 to 117 N·m of torque (76.0 to 86.7 lbf·ft, 10.5 to 12.0 kgf·m).**

(1) Block
(2) Blade (Black)
(3) Blade (Red)
(4) Discharge Deflector
(5) Bolt (Right Hand Thread)
(6) Bolt (Left Hand Thread)
(7) Spindle Holder
(8) Blade
(9) Cup Washer
(10) Bolt

(A) New Blade
(B) Worn Blade
(C) Cracked Blade
(D) "Loosen"

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36. G730™ TRANSAXLE PARTS LIST

1	Housing, Main	56	Seal, Lip 17 x 40 x 7	146	Washer, .343 x 1.500 x .062
2	Housing, Side	57	Ring, Retaining 2.06 Internal	147	Spring, Extension .57 x 2”
4	Plug 9/16-18 (metal)	60	Bearing, Thrust	152	Gear, bevel 14t spline id
6	Pin .25 x .375	64	Cylinder Block (Motor)	153	Gear, bevel 10t
7	Hfhcs 1/4-20 x 1.25”	65	Bearing, Thrust Ball 30 x 52 x 13	154	Pin, .499 x 1.20
10	Seal, Lip .625 x 1.0	69	Cylinder Block (Pump)	155	Ring, spiral retaining - 87
12	Fitting Assembly, Metal	70	Washer .63 x 1.0 x .05	170	Puck, brake
20	Center section, chrg	71	Ring, Retaining 62 External	171	Rotor, brake
22	Plate, bypass	72	Gear, Reduction 14T	172	Plate, puck
23	Filter, oil	73	Shaft, Motor	173	Rhcs 5/16-24 (special)
24	Check Plug or Shock Valve	74	Washer .72 x 1.16 x .04	174	Yoke, brake
25	Check Plug or Shock Valve	80	Washer .5 x 1.0 x .03	175	Bolt, hex head 1/4-20 x 1 w / patch
26	Seal, plug 1.250 x .250	81	Gear, Reduction 45T	176	Bolt, hex hd 1/4-20 x 2 w / patch
27	Hfhcs 3/8-16 x 1.5 (Patch)	82	Gear, Reduction 11T	177	Pin, brk .31 x .73 Plated
30	Seal, Lip .375 x .75 x .25	83	Pin, Jack Shaft	178	Spring, comp brake anti-drag
31	Ring, Retaining .375 External	90	Ring, Retaining 2.06 Internal	179	Arm, Brake
32	Rod, Bypass	91	Gear, Bull 60T	181	Nut, Castle 5/16-24 PL
33	Ring, Retaining .750 Internal	92	Spacer, 1.04 x 1.65 x .22	182	Pin, Cotter 3/32 x 3/4
34	Arm, Bypass	94	Shaft, Axle	183	Spacer .26 x .88 x .87
35	Ring, Retaining .375 External	95	Bearing, Ball 1.0 x 52 x 15 Open 6205M	184	Washer .27 x .88 x .12
40	Trunnion, Swashplate	96	Seal, Lip 25 x 52 x 10 TC (Gray)	185	Spring, Brake Arm Bias
41	Seal, Lip 18 x 32 x 7	105	Screw, Hex Flange Head 1/4-20 x .75	190	Barbed Cap
43	Arm, Neutral RH	106	Guard, Filter	191	Hose
44	Arm, Control	130	Tube, Connecting	192	Plug 9/16-18 (Metal)
45	Washer .34 x .88 x .06	131	Gerotor assembly (1.9 Cc/rev)	193	Plug 9/16-18 (Metal)
46	Twhcs 5/16-24 x 1.00 (Patch)	132	O-ring, -137, 0.103 x 2.050	194	Plug 9/16-18 (Plastic)
48	Spacer	133	Cover, charge pump	195	Plug 9/16-18 (Metal)
49	Spacer	134	Screw, Hex Flange Head 1/4-20 x .75	200	Kit, Seal
52	Input Shaft	140	Spacer .320 x 1.005 x .179	201	Kit, Center Section
53	Bearing, Ball 17 x 40 x 12 Open 6203	141	Arm, Neutral	202	Kit, Charge Relief
54	Ring, Retaining Wire .561 I.D.	142	SHCS 5/16-24 x 1 Patch	203	Kit, Charge
55	Washer 1.23 x 1.56 x .04	145	Assembly, rtn bidirectional		

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SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.

It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.

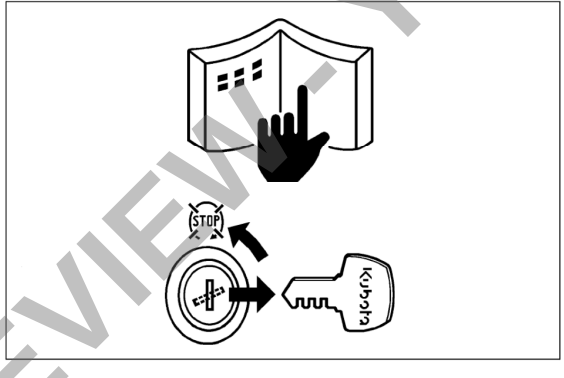
DANGER : **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

WARNING : **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

CAUTION : **Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**

■ **IMPORTANT** : **Indicates that equipment or property damage could result if instructions are not followed.**

■ **NOTE** : **Gives helpful information.**

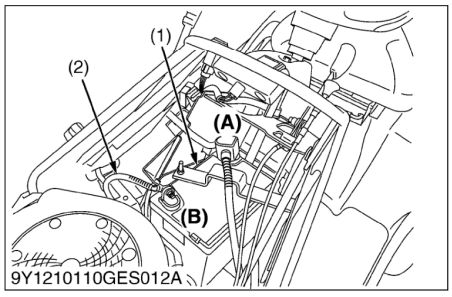


BEFORE SERVICING AND REPAIRING

- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground, and set the parking brake.
- Lower the implement to the ground.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.
- Hang a "**DO NOT OPERATE**" tag in operator station.

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Battery (Continued)

(For non-accessible maintenance-free type batteries.) Maintenance-free, non-accessible batteries are designed to eliminate the need to add water. Yet the volume of electrolyte above plates may eventually become depleted due to abnormal conditions such as high heat or improper regulator setting. Use a voltmeter to check the state of charge. (See reference chart below to determine if charging is necessary.)

Battery voltage	Reference state of charge
12.6	100 % (Full charge)
12.4	75 %
12.2	50 %
12.0	25 %
11.8	0 %

DANGER

To avoid serious injury or death:

- **When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.**

WARNING

To avoid serious injury:

- **When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first.**
- **Never check battery charge by placing a metal object across the posts.**
  Use a voltmeter or hydrometer.

1. To slow charge the battery, connect the battery positive terminal to the charger positive terminal and the negative to the negative, then charge for at least 1 hour at 6 to 10 amperes.
2. A boost charge is only for emergencies. It will partially charge the battery at a high rate and in a short time. When using a boost charged battery, it is necessary to recharge the battery as early as possible.
   Failure to do this will shorten the battery's service life.
3. When the specific gravity of electrolyte is between 1.27 and 1.29 the charging is completed.

■ Battery for storage

1. When storing the machine for a long period, remove the battery from machine, adjust the electrolyte to the proper level and store in a dry place out of direct sunlight.
2. The battery self-discharges while it is stored.
   Recharge it once every 3 months in hot seasons and once every 6 months in cold seasons.

(1) Battery
(2) Ground Cable
(A) Positive Cable
(B) Negative Cable

W1048036

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2. SERVICING SPECIFICATIONS

Item	Factory Specification	Allowable Limit
Clearance **"A"** between the stopper and HST arm	0.6 to 1.3 mm 0.024 to 0.051 in.	–

W1013874

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Hard Lifting	Gas spring defective	Replace	6-S3, S7
	Stuck lift link	Repair	6-S7
Operator will Experience Bottoming and / or Topping of Seat Suspension	Suspension defective (T2080, T2380)	Replace	6-S3, S6

W1014322

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Blade Does Not Rotate	Weakened or broken PTO tension spring	Adjust or replace	G-27, 9-S6
	Damaged PTO belt	Replace	9-S7
	Damaged mower belt	Check and replace	G-21, 9-S7, S8
Mower Belt Slipping	Belt tension incorrect	Adjust or replace	9-S6
	Worn mower belt	Replace	G-21, 9-S7, S8
	Mower deck plugged	Unplug and clean mower deck	–
	Debris in pulleys	Clean	–
Discharge Chute Plugged	Grass too wet	Wait for grass to dry	–
	Grass too long	Raise cutting height and cut grass twice	9-S11
	Cutting too low	Raise cutting height	9-S11
	Engine speed too low	Mow at full throttle	–
	Ground speed too fast	Slow down	–
Streaking of Grass Uncut	Ground speed too fast	Slow down	–
	Engine speed too low	Mow at full throttle	–
	Grass too long	Raise cutting height and cut grass twice	9-S11
	Blades dull or damaged	Replace blades or sharpen blades	9-S5
	Debris in mower deck	Clean mower deck	–
Uneven Cut	Mower deck not level	Level mower deck	9-S9
	Ground speed too fast	Slow down	–
	Blades dull or damaged	Sharpen blades	9-S5
	Blades worn	Replace blades	9-S5
	Low tire inflation	Add air to correct	G-16
	Anti-scalp rollers not adjusted correctly	Adjust correctly	9-S11

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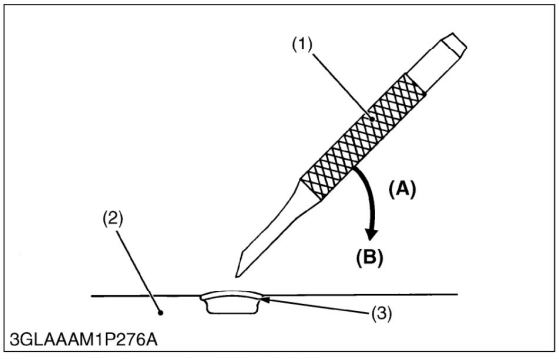


Figure 5-6. Removing Welch Plug.

(1) Tool No. KO1018
(2) Do not Allow Tip to Strike Carburetor Body
(3) Welch Plug
(A) Pry Out Plug
(B) Pierce Plug with Tip

Main Fuel Jet Removal
The main jet is pressed into the side of the tower portion of the body. Removal is not recommended, unless a high-altitude kit is being installed, in which case the removal instructions will be included in the kit.

Fuel Inlet Seat Removal
The fuel inlet seat is pressed into the carburetor body, do not attempt to remove it. If necessary, clean it in place with aerosol carburetor cleaner.

Choke shaft removal
1. Because the edges of the choke plate are beveled, mark the choke plate and carburetor body, to ensure correct reassembly. See Figure 5-7.
   Also note the choke plate position in the bore, and the position of the choke lever and choke return spring.

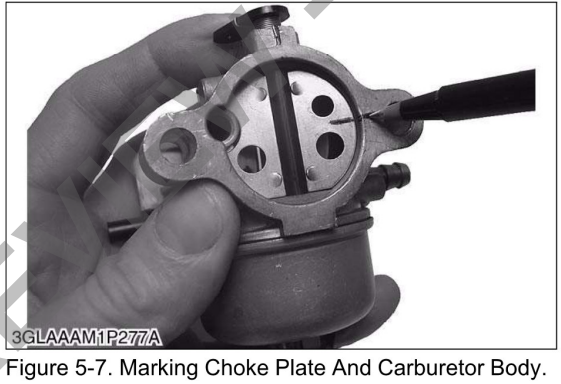


Figure 5-7. Marking Choke Plate And Carburetor Body.

2. The choke plate is inserted into a slot in the choke shaft. Grasp the choke plate with pliers, and pull it out of the slot. See Figure 5-8.

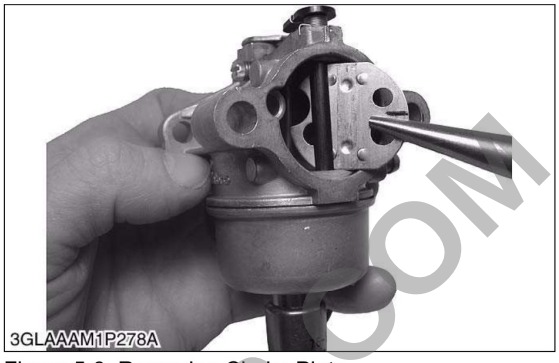


Figure 5-8. Removing Choke Plate.

3. Remove the choke shaft and choke return spring.

Throttle Shaft Removal
Do not attempt to remove the throttle shaft, as repair kits are not available. Throttle shaft wear is normally accompanied by corresponding wear to the carburetor body, making it impractical to attempt a cost-effective repair. Replace the entire carburetor if the throttle shaft is worn.

(4) Cleaning

WARNING
- **Flammable Solvents!**
  carburetor cleaners and solvents are extremely flammable. Keep sparks, flames, and other sources of ignition away from the area. Follow the cleaner manufacturer's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent.

All parts should be cleaned thoroughly using a commercial carburetor cleaner. Make sure all gum deposits are removed from the following areas.
- Carburetor body and bore; especially the areas where the throttle plate, choke plate and shafts are seated.
- Idle fuel and idle ports in carburetor bore, main jet, bowl vent, and fuel inlet needle and seat.
- Float and float hinge.
- Fuel bowl.
- Throttle plate, choke plate, throttle shaft, and choke shaft.

NOTE
- **Do not submerge the carburetor in cleaner or solvent when plastic, fiber, rubber, foam seals or gaskets are installed. The cleaner may damage these components.**

(5) Inspection

Carefully inspect all components and replace those that are worn or damaged.
- Inspect the carburetor body for cracks, holes, and other wear or damage.
  for wear or damage.
- Inspect the float for cracks, holes, and missing or damaged float tabs. Check the float hinge and pin

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required. The piston pin is part of the piston assembly; if the pin boss or the pin are worn or damaged, a new piston assembly is required.

Ring failure is usually indicated by excessive oil consumption and blue exhaust smoke. When rings fail, oil is allowed to enter the combustion chamber where it is burned along with the fuel. High oil consumption can also occur when the piston ring end gap is incorrect because the ring cannot properly conform to the cylinder wall under this condition. Oil control is also lost when ring gaps are not staggered during installation.

When cylinder temperatures get too high, lacquer and varnish collect on pistons causing rings to stick which results in rapid wear. A worn ring usually takes on a shiny or bright appearance.

Scratches on rings and pistons are caused by abrasive material such as carbon, dirt, or pieces of hard metal.

Detonation damage occurs when a portion of the fuel charge ignites spontaneously from heat and pressure shortly after ignition. This creates two flame fronts that meet and explode to create extreme hammering pressures on a specific area of the piston. Detonation generally occurs from using low octane fuels.

Preignition or ignition of the fuel charge before the timed spark can cause damage similar to detonation. Preignition damage is often more severe than detonation damage. Preignition is caused by a hot spot in the combustion chamber from sources such as glowing carbon deposits, blocked fins, improperly seated valve, or wrong spark plug. See Figure 9-12 for some common types of piston and ring damage.

Replacement pistons are available in STD and 0.08 mm (0.003 in.) oversize, which include new rings and piston pins. Service replacement piston ring sets are also available separately. Always use new piston rings when installing pistons. Never reuse old rings.

The cylinder bore must be deglazed before service ring sets are used.



3GLAAAM1P160A

Stuck, Broken Rings



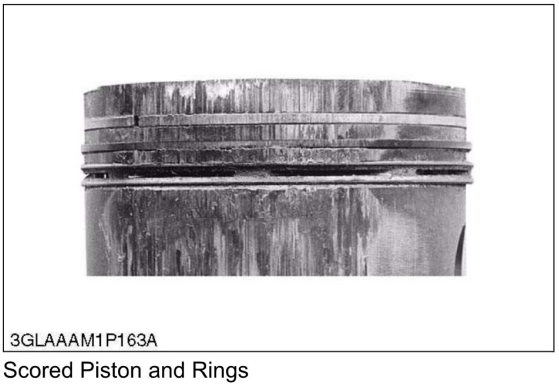
3GLAAAM1P161A

Overheated or Deteriorated Oil



3GLAAAM1P162A

Abrasive Scratched Rings



3GLAAAM1P163A

Scored Piston and Rings

Figure 9-12. Common Types of Piston and Ring Damage.

Some important points to remember when servicing piston rings:

1. If the cylinder bore is within the wear limits (refer to “1. GENERAL, [7]”) and the old piston is within wear limits, free of score or scuff marks, the old piston may be reused.
2. Remove old rings and clean up grooves. Never reuse old rings.
3. Before installing the rings on the piston, place each of the top two rings in its running area in the cylinder bore and check the end gap (see Figure 9-13). Compare to the listed specifications.

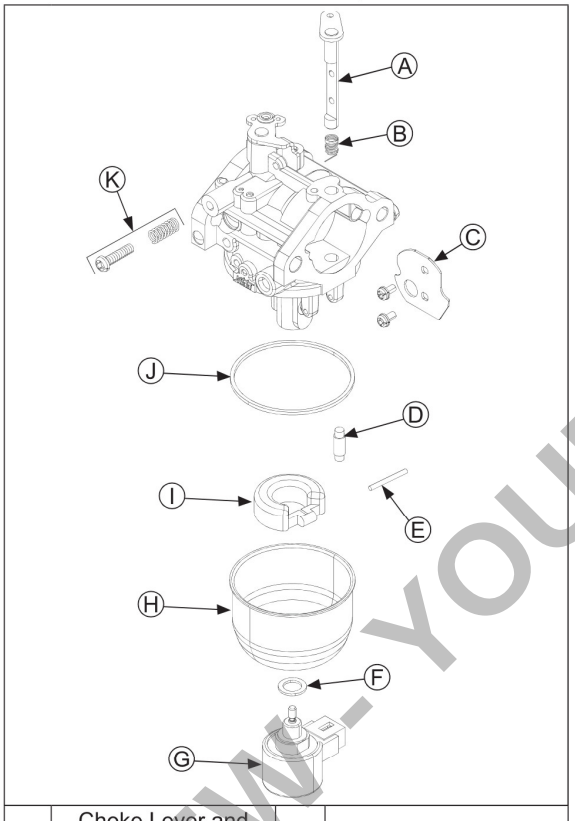
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CARBURETOR

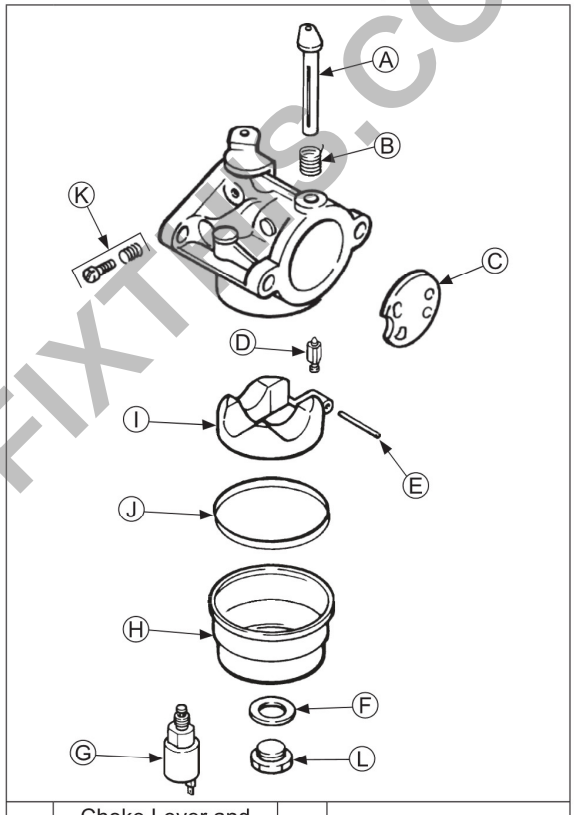
	**⚠ WARNING** Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running.	Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent.

Nikki One-Barrel Carburetor Components



A	Choke Lever and Shaft	**B**	Choke Return Spring
C	Choke Plate	**D**	Fuel Inlet Needle
E	Float Pin	**F**	Bowl Retaining Screw Gasket
G	Fuel Shut-Off Solenoid	**H**	Fuel Bowl
I	Float	**J**	Bowl Gasket
K	Low Idle Speed Adjusting Spring and Screw		

Walbro One-Barrel Carburetor Components



A	Choke Lever and Shaft	**B**	Choke Return Spring
C	Choke Plate	**D**	Fuel Inlet Needle
E	Float Pin	**F**	Bowl Retaining Screw Gasket
G	Fuel Shut-Off Solenoid	**H**	Fuel Bowl
I	Float	**J**	Bowl Gasket
K	Low Idle Speed Adjusting Spring and Screw	**L**	Bowl Retaining Screw

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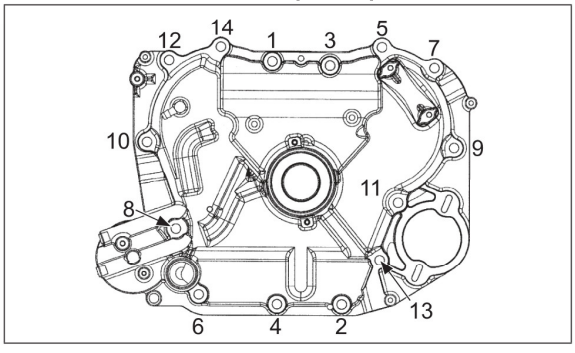
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Install Flywheel Side Oil Seal

Lubricate outside diameter and lip of flywheel end oil seal. Support closure plate and install oil seal. Using a seal driver, drive seal to a depth of 5 mm (0.196 in.) in seal bore.

Install Closure Plate Gasket, Closure Plate, and Wiring Harness

Closure Plate Fastener Torque Sequence



NOTE: A special gasket used between closure plate and crankcase controls crankshaft endplay, no shimming is required. Do not use RTV sealant in place of gasket.

NOTE: Engines with first generation balance weight: Apply grease to outside flat surfaces of balance weight guide shoe. Position guide shoe so solid end is toward crankshaft. Make sure guide shoe stays in this position during step 2.

1. Make sure sealing surfaces of crankcase and closure plate are clean, dry, and free of any nicks or burrs. Install a new closure plate gasket onto crankcase.
2. Ensure gasket, cover plate, and governor gear assembly, have been properly assembled to closure plate. Start closure plate onto crankcase. Be sure guide shoe (models with First Generation Balance Weight), is aligned with guide channel in closure plate, and cam shafts and governor gear shaft are aligned with their mating bearing surfaces. As closure plate is lowered into final position, rotate crankshaft slightly to help engage governor gear.
3. Install screws securing closure plate to crankcase, with any clamps for wiring harness and sheathed RFI suppression spark plug lead (#5 location, if equipped). If wiring harness was separated from closure plate, route harness through clamps and slot in closure plate. Close clamps to retain harness.
4. Torque closure plate fasteners to 24.5 N·m (216 in. lb.) using sequence shown.

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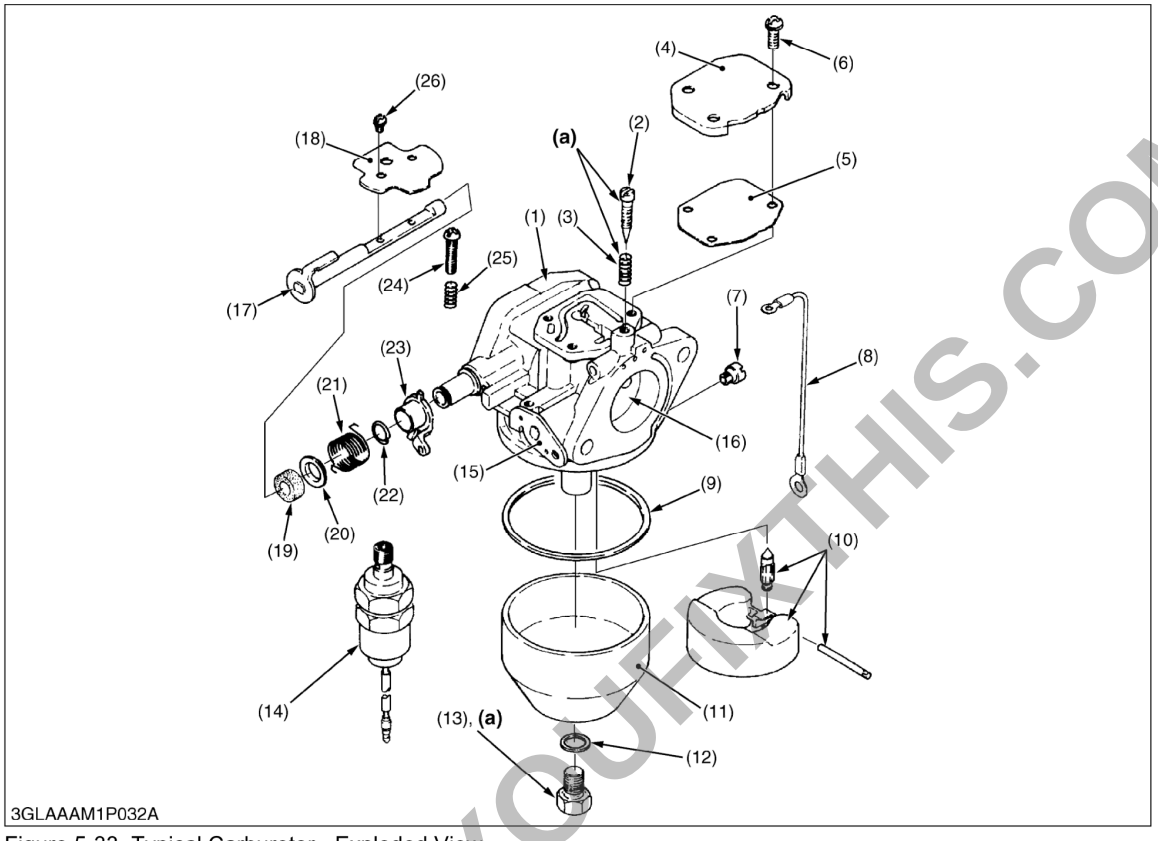


Figure 5-33. Typical Carburetor - Exploded View.

(1) Carburetor Body
(2) Idle Fuel Adjusting Screw
(3) Idle Fuel Adjusting Spring
(4) Passage Cover
(5) Cover Gasket
(6) Cover Retaining Screw
(7) Main Jet
(8) Ground Lead (Solenoid Only)
(9) Fuel Bowl Gasket
(10) Float Kit
(11) Fuel Bowl
(12) Bowl Retaining Screw Gasket
(13) Bowl Retaining Screw
(14) Shut-Off Solenoid Assembly (our models)
(15) Throttle Shaft / Lever
(16) Throttle Plate
(17) Choke Shaft
(18) Choke Plate
(19) Air Filter
(20) Collar
(21) Spring
(22) Ring
(23) Choke Lever
(24) Idle Speed Screw
(25) Idle Speed Spring
(26) Setscrew (Plates -4)

(a) Some Models Only

Inspection / Repair

To clean vent ports, seats etc., use a good commercially available carburetor solvent, such as Gumout™, and clean, dry compressed air to blow out internal channels and ports. Use a suitable shop rag to prevent debris from hitting someone.

Carefully inspect all components and replace those that are worn or damaged.

- Inspect the carburetor body for cracks, holes and other wear or damage.
- Inspect the float for cracks, holes, and missing or damaged float tabs. Check the float hinge and shaft for wear or damage.
- Inspect the fuel inlet needle and seat for wear or damage.
- Inspect the tip of the low idle fuel adjusting needle (if equipped), for wear or grooves.
- The choke plate is spring loaded. Check to make sure it moves freely.

Always use new gaskets when servicing or reinstalling carburetors. Repair kits are available which include new gaskets and other components.

Service/repair kits available for affiliated components are:

- Carburetor Repair Kit
- Float Kit
- Solenoid Assembly Kit

Reassembly Procedure

Reassembly is essentially the reverse of the disassembly procedure. Use new gaskets, springs and adjusting screws as provided in the carburetor repair kit. Also use new carburetor and intake manifold gaskets. Set the idle speed (rpm) adjusting screw (if equipped) 2-1/4 turns open for initial adjustment and make final adjustments as described earlier.

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Replacement pistons are available in STD bore size, and 0.25 mm (0.010 in.) oversize. Replacement pistons include new piston ring sets and new piston pins.

Replacement ring sets are also available separately for STD, and 0.25 mm (0.010 in.) oversize pistons. Always use new piston rings when installing pistons. Never use old rings.

Some important points to remember when servicing piston rings:

1. The cylinder bore must be de-glazed before service ring sets are used.
2. If the cylinder bore does not need re-boring and if the old piston is within wear limits and free of score or scuff marks, the old piston may be reused.
3. Remove the old rings and clean up the grooves. Never reuse old rings.
4. Before installing the new rings on the piston, place the top two rings, each in turn, in its running area in the cylinder bore and check the end gap. (See Figure 9-7.) Compare the ring gap to the measurements in Section 1, Specifications and Tolerances.

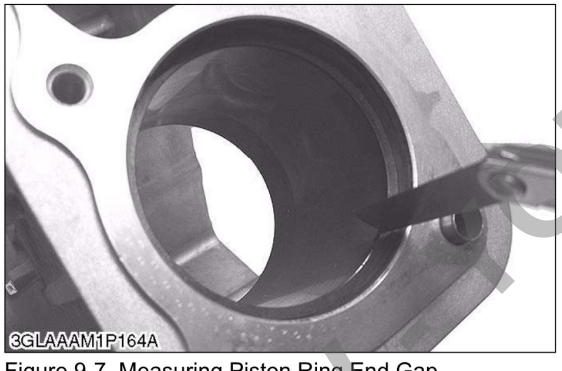


Figure 9-7. Measuring Piston Ring End Gap.

5. After installing the new compression (top and middle) rings on the piston, check the piston-to-ring side clearance. Compare the clearance to specifications listed in Section 1, Specifications and Tolerances. If the side clearance is greater than specified, a new piston must be used. Refer to Figure 9-8.



Figure 9-8. Measuring Piston Ring Side Clearance.

Install New Piston Rings

To install new piston rings, proceed as follows:

■ **NOTE**

- **Install rings correctly. Ring installation instructions are usually included with new ring sets. Follow instructions carefully. Use a piston ring expander to install rings (see Figure 9-9). Install the bottom (oil control) ring first and the top compression ring last. Refer to Figure 9-10.**

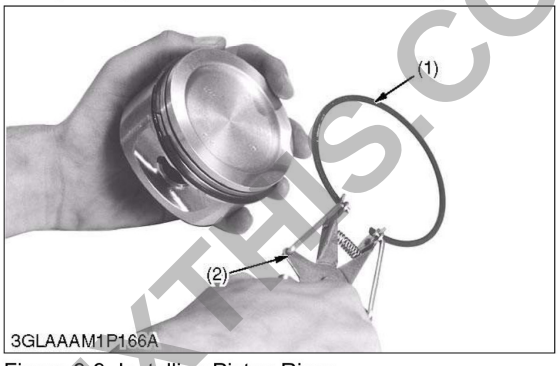


Figure 9-9. Installing Piston Rings.

(1) Piston Ring (2) Piston Ring Expander

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CRANKCASE VACUUM TEST



⚠ WARNING

Carbon Monoxide can cause severe nausea, fainting or death.

Avoid inhaling exhaust fumes.

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled.



⚠ WARNING

Rotating Parts can cause severe injury.

Stay away while engine is in operation.

Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate engine with covers, shrouds, or guards removed.

A partial vacuum should be present in crankcase when engine is operating. Pressure in crankcase (normally caused by a clogged or improperly assembled breather) can cause oil to be forced out at oil seals, gaskets, or other available spots.

Crankcase vacuum is best measured with either a water manometer or a vacuum gauge. Complete instructions are provided in kits.

To test crankcase vacuum with manometer:

1. Insert rubber stopper into oil fill hole. Be sure pinch clamp is installed on hose and use tapered adapters to connect hose between stopper and one manometer tube. Leave other tube open to atmosphere. Check that water level in manometer is at 0 line. Make sure pinch clamp is closed.
2. Start engine and run no-load high speed.
3. Open clamp and note water level in tube.

   Level in engine side should be a minimum of 10.2 cm (4 in.) above level in open side.

   If level in engine side is less than specified (low/no vacuum), or level in engine side is lower than level in open side (pressure), check for conditions in table below.
4. Close pinch clamp before stopping engine.

To test crankcase vacuum with vacuum/pressure gauge:

1. Remove dipstick or oil fill plug/cap.
2. Install adapter into oil fill/dipstick tube opening, upside down over end of a small diameter dipstick tube, or directly into engine if a tube is not used. Insert barbed gauge fitting into hole in stopper.
3. Run engine and observe gauge reading.

   Analog tester–needle movement to left of 0 is a vacuum, and movement to right indicates a pressure.

   Digital tester–depress test button on top of tester.

   Crankcase vacuum should be a minimum of 10.2 cm (4 in.) of water. If reading is below specification, or if pressure is present, check table below for possible causes and conclusions.

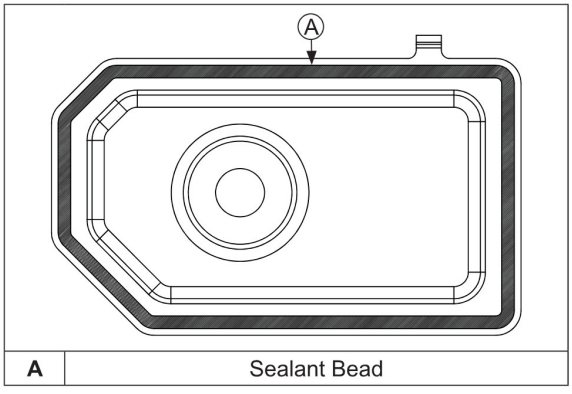
Condition	Conclusion
Crankcase breather clogged or inoperative.	NOTE: If breather is integral part of valve cover and cannot be serviced separately, replace valve cover and recheck pressure. Disassemble breather, clean parts thoroughly, check sealing surfaces for flatness, reassemble, and recheck pressure.
Seals and/or gaskets leaking. Loose or improperly torque fasteners.	Replace all worn or damaged seals and gaskets. Make sure all fasteners are tightened securely. Use appropriate torque valves and sequences when necessary.
Piston blow by or leaky valves (confirm by inspecting components).	Recondition piston, rings, cylinder bore, valves and valves guides.
Restricted exhaust.	Check exhaust screen/spark arrestor (if equipped). Clean or replace as needed. Repair or replace any other damaged/restricted muffler or exhaust system parts.

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Install Breather Reed and Breather Reed Cover

Breather Reed Cover Sealant



A	Sealant Bead

NOTE: RTV sealant should be allowed to cure a minimum of 1 hour before engine is started.

1. Install breather reed, followed by retainer over passage hole and mounting hole in crankcase. Hold in position and secure with mounting stud. Torque stud to 6.2 N·m (55 in. lb.) into a new, cored hole, or 4.0 N·m (35 in. lb.) into a used hole.
2. Invert breather reed cover and apply a 1.5 mm (1/16 in.) bead of RTV sealant to perimeter flange of cover as shown. Use Loctite® 5900™ or 5910™.
3. Immediately install breather reed cover over mounting stud and onto crankcase. Do not allow RTV sealant to come in contact with breather reed, or reed sealing surface.
4. Secure with a new sealing washer and M5 nut. Torque nut to 1.3 N·m (12 in. lb.). Check that a complete seal has occurred by RTV sealant being squeezed out around entire flange perimeter.

Install Stator and Backing Plate

1. Apply pipe sealant with Teflon® (Loctite® PST® 592™ or equivalent) to stator mounting holes.
2. Position stator aligning mounting holes so leads are at bottom, toward crankcase.
3. Install and torque screws to 8.8 N·m (78 in. lb.).
4. Install backing plate. Secure with screws. Torque screws in a crisscross pattern to 7.3 N·m (65 in. lb.).

Install Flywheel and Fan



⚠ CAUTION

Damaging Crankshaft and Flywheel can cause personal injury.

Using improper procedures can lead to broken fragments. Broken fragments could be thrown from engine. Always observe and use precautions and procedures when installing flywheel.

NOTE: Before installing flywheel, make sure crankshaft taper and flywheel hub are clean, dry, and completely free of lubricants. Presence of lubricants can cause flywheel to be overstressed and damaged when screw is torqued to specifications.

NOTE: Make sure flywheel key is installed properly in keyway. Flywheel can become cracked or damaged if key is not installed properly.

1. Install flywheel key into keyway of crankshaft. Make sure key is properly seated and parallel with shaft taper.
2. Install flywheel onto crankshaft being careful not to shift flywheel key.
3. Install fan onto flywheel, so locating pins fit into corresponding recesses. Drive 2 retainers down completely.
4. Install fan mounting plate onto fan, aligning 4 cutouts, followed by heavy flat washer and screw.
5. Use a flywheel strap wrench or holding tool to hold flywheel. Torque screw securing flywheel to crankshaft to 74.5 N·m (55 ft. lb.).

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