SAITO

Large Single Cylinder 4-Stroke Engines

INSTRUCTION MANUAL

Version 2005

- **FA-120 Special**
- **FA-120S Golden Knight**
- **FA-150**
- **FA-150 Golden Knight**
- **FA-180**
- **FA-180 Golden Knight**
- **FA-220a**
- **FA-220a Golden Knight**

VERY IMPORTANT

Failure to read and follow these instructions before you proceed to start your engine may result in engine damage and the voiding of your warranty.

Introduction

Congratulations on purchasing a Saito™ 4-cycle engine. When cared for properly, these high-quality, finely crafted engines offer many years of modeling enjoyment.

This instruction manual has been developed to ensure optimum performance from the Saito engine you have purchased. The instructions must be read through completely and understood thoroughly prior to mounting and running the engine.

Safety Instructions

This model engine will give you considerable pleasure, satisfaction, and performance if you strictly follow these safety instructions and heed the warnings for its safe and proper use. Remember at all times it is not a toy, but a precision-built machine with more than enough power to cause harm if misused or if the safety precautions are not observed.

You should always:

1. Mount the engine securely in a “bench mount” or high-quality motor mount. Never clamp the engine in a vice.

2. When running the engine, be sure all spectators, especially children, are at least 20 feet away.

3. Use the correct size and pitch of propeller for your engine; refer to the "Propeller Chart" on page 14 of this manual.

4. It is extremely important to balance the propeller prior to installation of the engine. Failure to do so may cause damage to the Saito engine and/or the airframe. Install the propeller with the convex (curved) side facing forward. Securely tighten the propeller nut against the washer and propeller. An anti-loosening nut (or “jam” nut) is suggested for all 4-cycle engines.

5. Inspect the tightness of the propeller nut prior to each flight.

6. Keep your face and body away from the path of the propeller blades when starting or running your engine.

7. Never allow your hands to come close to the propeller. Utilize either a “start stick (HAN113)” or electric starter to start the engine.

8. Discard any propeller that is nicked, scratched, cracked or damaged in any way.

9. Make all carburetor adjustments from behind the propeller.

10. To stop the engine, cut off the fuel supply (pinch or disconnect the fuel line to the carburetor) or use the throttle linkage to shut off the air.

Do not use hands, fingers, or any other part of the body to stop the propeller.

Do not throw any object into a propeller to stop it.

It is highly recommended that:

- Safety glasses or goggles be used when starting and running your engine.
- You do not run the engine in the vicinity of loose gravel or sand. The propeller may throw such materials into your face and eyes. The engine may also ingest these harmful materials.
- Loose clothing should be avoided when operating your model engine. Loose clothing may become entangled in the propeller, creating the possibility of bodily harm. Also, all loose objects (screwdrivers, pencils, nickel cadmium starters, etc.) should be removed from your pockets so that they do not fall into the propeller.
- Glow plug clips and cords are kept away from the propeller.
- Your glow fuel is kept in a safe place well away from sparks, heat, or anything that can ignite the fuel.

Beware:

- Model engines get very hot while running. Do not attempt to handle them until they have cooled.
- Always run your model engines in a well-ventilated area. Similar to automotive engines, model engines produce possible harmful carbon monoxide fumes.
- Remember that model engines produce a substantial amount of power, more than enough to seriously injure people and/or do considerable damage to property. Always use common sense, skill and constant observation of safety precautions.

Disassembly

Do *not* needlessly disassemble your Saito™ engine. Only qualified individuals should perform engine repairs. Damage due to improper disassembly will not be covered under warranty. If it becomes necessary to repair the engine, such as after a crash, you can send your engine to the authorized service center at:

Horizon Hobby, Inc.
Attention: Saito Service
4105 Fieldstone Road
Champaign, IL 61822
Phone: (217) 355-9511

Engine Parts Identification

It is important to be able to identify the parts of your Saito™ engine. Attached you will find an exploded view of a Saito 4-stroke engine, as well as charts that include part numbers and descriptions. This will assist you in easily and rapidly identifying the respective parts of your Saito engine.

Support Equipment
The following items, which are not included with your Saito engine, are necessary in order to operate the model engine:

1. Fuel. For maximum protection and longevity of their engines, Saito recommends a fuel containing 20% oil and 10–15% nitro methane. If this blend is **not** readily available, the next best selection is a high quality 2-cycle glow fuel, such as Hangar 9® Aero-Blend, Omega, Cool Power, K&B, Power Master, etc. Use of fuels composed entirely of castor oil is not recommended. A mix of synthetic-castor oil is acceptable and can be found in the various fuels described above.

2. Propeller. Refer to the "Propeller Selection" chart, located on page 14, to determine the best initial propeller for your particular application. Propellers should be balanced prior to use.

3. Glow Plug Battery. Your glow plug may be properly heated by several different sources. The Hangar 9 Power Panel (HAN106), when accompanied by a 12-volt Sealed Lead Acid Battery (HAN102) and a Glow Plug Locking Socket (HAN120) is an ideal source of heat for your glow plug. A conventional 1.5-volt heavy-duty dry cell battery with a Glow Plug Locking Socket (HAN120) or alligator clips may also be used. Additionally, there are several very good glow-starters (nickel cadmium-powered glow plug igniters)(HAN7101) that work well.

4. Glow Plug Wrench. Used to remove and tighten glow plugs. The Hangar 9 Long Reach Plug Wrench (HAN2510) is an excellent wrench to utilize, as a longer shaft may be necessary to access the glow plug. This depends mostly upon engine installation.

5. Manual or Electric Starter. For manual starts, a "Start Stick (HAN113)" is highly recommended. Never use your fingers to start any model engine. To do so invites injury. There are a variety of electric starters on the market. The Hangar 9® PowerPro Heavy-Duty 12V starter (HAN162) will work perfectly on all Saito engines.

6. Tachometer. The use of a tachometer for setting the high-speed needle valve prior to flight is encouraged. It will also be helpful when setting the idle adjustment of the carburetor(s). The Hangar 9 Micro Digital Tachometer (HAN156) is a good choice.

Break-In

The first run on any engine, whether 2-cycle or 4-cycle, is critical to the future of the engine itself. During this time, metal mating parts (piston and cylinder, ball bearings, etc.) wear in. Care must be taken that the engine is clean and free of any dust or grit that may have accumulated while building the model.

There are two accepted methods for breaking in a new engine: test stand mounted and run or aircraft mounted and run. Either method is acceptable; however, mounting the engine to a test stand allows the engine to be observed throughout its operation, as well as elevating it above the ground and away from harmful dust and dirt.

Note: Because your engine may have been sitting for an extended period of time prior to running it, a few drops of light oil applied through the crankcase breather nipple (19 on the exploded view) and down the push-rod tubes (40) will ensure proper lubrication for the first run.

Regardless of the mounting method chosen for break-in, the following procedures are applicable:

1. Use of a fuel as described in the "Support Equipment" section on page 3 of this manual for "break-in" purposes is perfectly acceptable.

2. Your engine includes the Saito™ SAIP400S glow plug. Use the proper glow plugs. The Hangar 9® Four Cycle Super Plug (HAN3011) is a standard replacement to use in these engines.

3. To select the correct propeller, refer to the "Propeller Selection" chart on page 14 of this manual. Remember to balance the propeller prior to use.

4. Ensure that the high-speed needle valve (85) is opened (turned counterclockwise) five full turns. This guarantees a very rich setting

Do **not** adjust the low-speed needle valve (89) at this time.

5. The use of a tachometer (HAN156) is highly recommended since the adjustment of a 4-cycle engine, while similar to that of a 2-cycle engine, is more difficult to "set by ear," making it much easier to damage the engine by "over-leaning."

Starting The Engine

1. Make sure the glow plug(s) is/are installed and tightened.

2. Be sure the propeller is properly secured. The use of an anti-loosening nut, or "jam nut," is encouraged on 4-cycle engines.

3. Make sure that the fuel tank line(s) are properly connected. The fuel pickup line should be connected to the carburetor spray bar (84), and the vent line should be connected to the pressure nipple on the muffler. The proper "plumbing" of the lines is extremely important to the performance of any engine. Saito™ recommends the tank be mounted approximately 5mm lower than the carburetor center.

4. Be certain that the muffler is installed properly by oiling the threads prior to inserting the muffler into the cylinder head and that the pressure line is properly connected.

5. Fill the fuel tank.

6. Prime the engine:

- Check to make sure the glow plug is **not** connected to the heat source (glow plug clip/locking socket)
- Open the throttle fully
- Rotate the propeller in a counter-clockwise direction 5 to 6 times while plugging the end of the muffler with your finger to draw fuel into the carburetor.

Note: Saito single cylinder engines are now manufactured without the choke valve (92). Due to the excellent fuel draw characteristics of the Saito engines, the use of the choke was determined not to be necessary.

7. Start the engine:

- Turn through the prop 2 to 3 times slowly to ensure that the engine is not hydro-locked (see note below).

Note: When using an electric starter, care should be taken to be sure the engine does not become "hydro-locked" (flooded with fuel). While the electric starter will turn the engine over, it may damage the connecting rod or other components. If the engine becomes hydro-locked, simply remove the glow plug and turn the engine over a few times with the "start stick" or electric starter. The excess fuel will be forced to exit the engine via the cylinder head.

- Close throttle to 1/4 – 1/3 open position.
- Rotate propeller clockwise until it is against the compression stroke.

- Connect the heating source to the glow plug.
- Using either the "Start Stick (HAN113)" or electric starter, spin the propeller until the engine is running.

Note: A very common error is to remove the glow plug igniter too early. It is suggested that the igniter be left attached until after the engine has been run up and the high-speed needle valve has been properly adjusted.

8. Initial break-in:

Do not exceed 4,000 rpm for the first 10 minutes of operation. This allows all parts to mate properly with good lubrication.

Note: Due to the excessively "rich" mixture setting, it may be necessary to leave the heat source attached to the glow plug.

Subsequent runs may be made while slightly leaning out the mixture with each tank full of fuel. Forty minutes is considered sufficient time for normal break-in prior to the first flight.

9. After break-in:

If a test stand was used for the break-in procedure, the engine may now be mounted in the aircraft using a high-quality motor mount such as those available from Saito™ specifically or for Saito engines.
The idle needle valve (89) may now be refined. Please refer to the "Carburetor Adjustments" section shown below for information on how to do so.

The valves may also be checked at this time. Refer to the "Engine Maintenance" section on page 8–9 for information on the valve/tappet adjustments.

The use of a tachometer is encouraged for setting the high-speed needle valve (85) prior to flight. The peak rpm should be obtained and then reduced by approximately 200 – 300 rpm by turning the high-speed needle valve counter-clockwise (richen). Each engine's peak rpm can be found on the "Propeller Chart" on page 14. Over-revving of a 4-stroke engine can cause internal damage to the engine.

Carburetor Adjustments for Two-Needle Carburetors

The low-speed, or idle needle valve (89), is preadjusted at the factory for best performance during break-in. After break-in it may be necessary to "fine tune" the low speed adjustment using the following procedure:

1. Start the engine and let it warm up prior to attempting any adjustments.

2. Close the throttle slowly and adjust the low speed setting by rotating the idle needle valve (89) clockwise to lean the mixture and counterclockwise to richen the mixture.

Note: The fuel mixture is too rich if, when opening the throttle rapidly, the engine emits white smoke and "stutters" or "stumbles." Correct this by rotating the idle needle valve clockwise 1/4 to 1/2 turn at a time until the engine transitions smoothly without hesitation upon opening the throttle rapidly.

The fuel mixture may be too lean if the engine stops at the lowest idle position, or when the throttle is rapidly opened from idle. Attempt to correct this by rotating the idle needle valve counter-clockwise 1/4 to 1/2 turn at a time until the engine transitions smoothly without hesitation upon opening the throttle rapidly. If the situation is not rectified by counterclockwise rotations of the idle needle valve, turn the idle needle valve clockwise in 1/4 to 1/2 turn increments.

3. After obtaining the proper idle setting, the low rpm setting may be made through the positioning of the throttle adjustment screw, if applicable. If not, adjust the idle setting via the throttle trim of your transmitter.

Normal Engine Operation

If break-in was accomplished on a test bench, your engine may be mounted to the aircraft and flown. The initial flight should be performed with the engine adjusted for a rich fuel mixture.

1. Your Saito™ engine should be securely mounted to the aircraft. There are many motor mounts available; however, a high-quality metal mount, such as those manufactured by Saito exclusively for Saito engines, is considered to be the best.

2. General operating procedures that will ensure long engine life are:

- Do not operate the engine with a "lean" mixture.
- Regularly check all screws and nuts on both the engine and muffler.
- After 1 to 2 hours of operation, valve adjustment may be necessary. Adjust the valves as shown in the "Engine Maintenance" section.
- The Saito engines are equipped with a breather nipple (19). It is recommended that a length of silicone tubing be attached to this crankcase breather nipple (19) and routed away from the engine compartment so the excess oil can be expelled outside of the aircraft.

Engine Maintenance

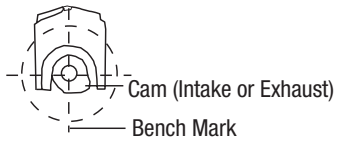
Do not needlessly dismantle your Saito™ single cylinder engine.

If you must disassemble your single cylinder engine, please refer to the following steps. Remember, a qualified individual should do disassembly.

1. Cylinder screws should be loosened in a criss-cross pattern.

2. Assemble the cam gear lining up the timing mark at the "6 o'clock" position. The crankshaft must be positioned at the "12 o'clock" or "top dead center" (TDC) position (refer to Figure 1 below).

Figure 1



3. Reassemble the piston, rod, rocker arm, pins, pushrod, tappet, etc. in their original positions. Engine parts are mated after running the engine and they must be reassembled as close as possible to their original position.

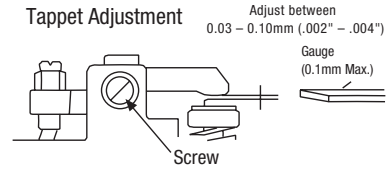
4. Assemble the engine, reversing the criss-cross pattern used in the disassembly. Prior to tightening each of the screws, apply a drop of oil to prevent thread damage.
Normal engine maintenance, such as adjusting the valves or carburetor maintenance, is permissible without voiding the warranty. **If you have any questions concerning maintenance procedures, please contact the Saito Service Center at (217) 355-9511.** Our technicians will be happy to advise you on maintenance issues.

Valve/Tappet Gap Adjustment

After approximately one hour of operation, tappet gap adjustment may be necessary. When you check the valves, lubricate the moveable parts. Also make sure the screw is in tight before making adjustments to valves. Adjust the valves to a clearance of .03mm to .10mm (.002" – .004") using the supplied gauge. The valves must be adjusted with the engine cold due to thermal expansion.

Note: Valves must be in the compression stroke or closed position as shown in Figure 2 below. When adjustment is completed, make sure you tighten the lock nut.

Figure 2

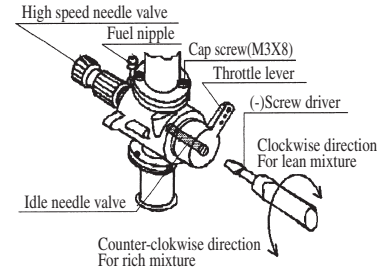


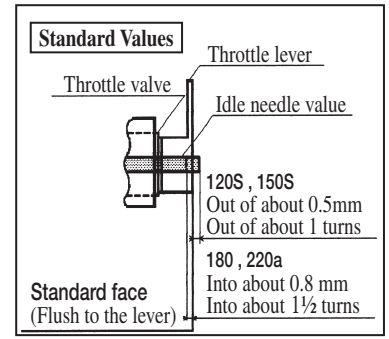
Carburetor Maintenance

Should you experience difficulty with the carburetor of your engine:

1. Remove the high-speed needle (85) and flush out the spray bar with clean fuel. Replace the high-speed needle and follow the instructions in the Carburetor Adjustment section.

2. Factory settings for the idle needle valve for engines 120 thru 220a are shown in the figure below.





Tips For Extended Engine Life

To add longer life to your Saito™ engine the following recommendations are made:

1. Use a high-quality fuel containing 20% lubricants.

2. Use recommended glow plugs.

3. Use the proper propeller size and balance the propeller prior to use.

4. Use a tachometer for precise engine adjustments.

5. Use an "after-run" oil when you're finished flying for the day. Hangar 9® After Run fuel is recommended.

6. For long-term storage, make sure there is no fuel left in the tank and the engine. Remove the glow plug(s) and apply several drops of high-quality light oil (e.g., a good quality light machine oil or Marvel Air Tool Oil) to the top of the engine, into the glow plug hole, down the pushrod tubes, and through the crankcase pressure vent breather nipple). Rotate the crankshaft several times. Store the engine in the box or on the airplane with the nose down in order to keep oil in the bearings.

Troubleshooting

Generally speaking, there are very few things that will keep today's modern glow engines from starting. To that end, make sure you're using good quality "fresh" fuel, there are good glow plugs installed, and the starting battery is charged and in good condition. Should the engine fail to start after these items are verified, refer to the troubleshooting chart on page 12.

Optional Fuel Pump System

When operating the FA-220a/GK engine with a remote fuel tank it may be necessary to use the optional fuel pump system, (SAI220a102). The fuel pump system provides additional pressure to the fuel tank from the crankcase one-way vent valve. See the installation diagram included with the pump system for the proper fuel line hook-up procedure.

For initial operation with the remote fuel tank and fuel pump system, open the pump system needle valve 2¾ turns and start the engine.

1. Begin with the pressure adjusting valve open 2¾ turns.

2. Start the engine and allow it to warm up prior to attempting any adjustments.

3. Advance the engine to full throttle.

4. Rotate the pressure adjusting valve in ¼ turn increments—first clockwise ¼ turn (rich) then rotate counterclockwise ¼ turn (lean) until the best rpm is achieved. It is important to note that the pump system has a definite response lag. This lag is approximately 2–5 seconds. With each ¼ turn change of the pressure adjusting valve, allow the engine rpm enough time to stabilize. This will prevent "chasing" of the correct setting.

5. It may be noted that the Pump Pressure needle setting will operate anywhere from 2 ½ turns open to 6 turns open. The final setting will depend largely on the specific fuel tank location and choice of propeller.

The fuel tank must not have any leaks as the pump system operates by increasing the pressure in the fuel tank. Check all connections for leakage or obstruction before initial operation with the fuel pump system. Other operation will be similar to running the engine with muffler pressure.

SYMPTOM	CAUSE	CORRECTIVE ACTION
Engine fails to start	Low voltage on starting battery	Replace/recharge the starting battery
	Bad glow plug(s)	Inspect/replace bad glow plug
	Insufficient priming	Repeat priming procedure
	"Flooded" due to excessive priming	Disconnect battery, remove the glow plugs, and rotate the propeller several times to "clear" the cylinder
Engine fires but does not run	Over-primed	Disconnect battery and rotate propeller several times to "clear" cylinder
Engine starts but slows down and then stops	Mixture too rich	Close high-speed needle valve 1/2 turn and start again. Repeat until engine is running smoothly.
Engine starts, speeds up, and then quits	Mixture too lean	Open high-speed needle valve 1/2 turn and start again. Repeat until engine is running smoothly.
Engine quits when starter battery is removed	Mixture too rich	Close high-speed needle valve 1/2 turn and restart
	Incorrect glow plugs	Change glow plugs
	Incorrect or bad fuel	Change fuel

In the event that none of the above procedures results in the engine running properly, contact our service department for suggestions:

Horizon Service Center
4105 Fieldstone Road
Champaign, Illinois 61822
217-355-9511 (Mon–Fri 8:00–5:00 CST)

Figure 4C

Large Single Cylinder Cross-Reference Chart

Part		M FA-120S(H)	FF FA-120SGK	CC FA-150(H)	GG FA-150GK	OO FA-180	PP FA-180GK	AD FA-220a	AE FA-220aGK
01	Cylinder Left	120S01A	120SGK01A	150H01	150S01	18001	180GK01	220a01	220aGK01
06	Piston	120S06	120S06	150S06	150S06	18006	18006	220a06	220a06
07	Piston Pin	120S07	120S07	120S07	120S07	18007	18007	220a07	220a07
08	Piston Pin Retainer	120S08	120S08	300T08	300T08	300T08	300T08	300T08	300T08
09	Piston Ring	120S09	120S09	300T09A	300T09A	18009	18009	220a09	220a09
10	Connecting Rod	120S10C	120S10C	120S10C	120S10C	18010A	18010A	220a10	220a10
14	Cylinder Screw Set	120S14	120S14	120S14	120S14	120S14	120S14	220a14	220a14
15	Crankcase	120S15B	120SGK15B	150H15A	150S15A	18015	180GK15	220a15	220aGK15
17	Rear Cover (A)	120S17A	150S17	120S17A	150S17	18017	180GK17	220a17	220aGK17
19	Breather Nipple	6519	6519	6519	6519	6519	6519	6519	6519
20	Front Ball Bearing	120S20A	120S20A	120S20A	120S20A	120S20A	120S20A	120S20A	120S20A
21	Main Ball Bearing	—	—	—	—	—	—	—	—
22	Rear Ball Bearing	120S22	120S22	120S22	120S22	120S22	120S22	120S22	120S22
23	Crankshaft	120S23B	120S23B	150S23A	150S23A	18023A	18023A	220a23	220a23
24	Pinion-Crankshaft	—	—	—	—	—	—	—	—
25	Pinion Gear-Pin	—	—	—	—	—	—	—	—
26	Collar, Crankshaft	—	—	—	—	—	—	—	—
27	Taper Collet & Drive Flange	120S27A	120S27A	120S27A	120S27A	120S27A	120S27A	300T27B	300T27B
28	Prop Washer & Nut	170R328	170R328	170R328	170R328	170R328	170R328	170R328	170R328
29	Prop Nut, Spinner	120S29	120S29	120S29	120S29	120S29	120S29	—	—
30	Prop Nut, Electric Starter	120S30	120S30	120S30	120S30	120S30	120S30	120S30	120S30
31	Crankcase Screw Set	5031	5031	5031	5031	5031	5031	5031	5031
32	Engine Gasket Set	120S32B	120S32B	150S32A	150S32A	18032A	18032A	220a32	220a32
33	Cam Gear Housing	120S33	150S33	120S33	150S33	120S33	150S33	300T33	220aGK33
35	Cam Gear (Right)	120S35	120S35	120S35	120S35	120S35	120S35	120S35	120S35
36	Cam Gear Shaft	5036A	5036A	5036A	5036A	5036A	5036A	5036A	5036A
37	Teflon/Steel Washer Set	120S37	120S37	120S37	120S37	120S37	120S37	120S37	120S37
38	Tappet (2 pc)	120S38	120S38	120S38	120S38	120S38	120S38	120S38	120S38
39	Push-rod (2 pc)	120S39	120S39	120S39	120S39	120S39	120S39	220a39	220a39
40	Push-rod Cover & Rubber Seal (Pr)	120S40	120S40	120S40	120S40	120S40	120S40	220a40	220a40
41	Rocker Arm (Pr)	120S41	120S41	120S41	120S41	120S41	120S41	120S41	120S41
42	Rocker Arm Screw & Nut (2 sets)	120S42	120S42	120S42	120S42	300T42	300T42	300T42	300T42
43	Rocker Arm Pin (2 Pc)	120S43	120S43	120S43	120S43	120S43	120S43	120S43	120S43
44	Rocker Arm Bracket (Left)	120S44	150S44	120S44	150S44	120S44	150S44	120S44	150S44
45	Rocker Arm Bracket (Right)	120S45	150S45	120S45	150S45	120S45	150S45	120S45	150S45
46	Valve (In & Out) (Pr)	120S46	120S46	120S46	120S46	18046	18046	220a46	220a46
47	Valve Spring, Keeper, Retainer (2 Sets)	120S47	120S47	120S47	120S47	120S47	120S47	120S47	120S47
48	Valve Retainer (4 Pc)	120S48	120S48	120S48	120S48	120S48	120S48	120S48	120S48
49	Rocker Arm Cover (Pr)	150S49	120S49	150S49	120S49	150S49	120S49	150S49	120S49
68	Check Valve (In & Out) (Pr)	—	—	—	—	—	—	130T68A	130T68A
69	Intake Manifold, Left	150S69A	150S69A	150S69A	150S69A	18069	18069	220a69	220a69
74	Muffler, Right	120S74D	120S74D	120S74D	120S74D	120S74D	120S74D	220a74	220a74
75	Muffler Manifold, Standard	120S75A	120S75A	120S75A	120S75A	120S75A	120S75A	220a75	220a75
79	Muffler Gasket (5 pc)	—	—	—	—	—	—	—	—
80	Muffler Nut (2 pc)	120S80	120S80	120S80	120S80	120S80	120S80	220a80	220a80
821	Carburetor-Complete, Left	120S821E	120S821E	150S821C	150S821C	180821B	180821B	180821B	180821B
822	Carburetor-Complete, Right	—	—	—	—	—	—	—	—
831	Carburetor Body Assembly, Left	120S831B	120S831B	150S831A	150S831A	180831	180831	180831	180831
84	Spray Bar Assembly	450R3D84A	450R3D84A	450R3D84A	450R3D84A	450R3D84A	450R3D84A	450R3D84A	450R3D84A
85	High Speed Needle Valve	120S85A	120S85A	120S85A	120S85A	120S85A	120S85A	120S85A	120S85A
86	High Speed Needle Valve Extension	5086	5086	5086	5086	5086	5086	5086	5086
87	Throttle Barrel Assembly	120S87A	120S87A	150S87A	150S87A	18087A	18087A	18087A	18087A
88	Throttle Lever	5088B	5088B	5088B	5088B	5088B	5088B	5088B	5088B
89	Idle Needle Valve	120S89	120S89	120S89	120S89	18089	18089	18089	18089
90	Carburetor Screw & Spring Set	120S90A	120S90A	120S90A	120S90A	120S90A	120S90A	120S90A	120S90A
91	Carburetor Gasket Set	120S91B	120S91B	150S91A	150S91A	18091	18091	220a91	220a91
92	Choke Valve Assembly	120S92	120S92	120S92	120S92	n/a	n/a	n/a	n/a
93	Intake Velocity Stack	120S93	120S93	120S93	120S93	18093	18093	18093	18093
95	Engine Mount	120S95	120S95	120S95	120S95	120S95	120S95	220a95	220a95
96	Tool Set	120S96	120S96	120S96	120S96	120S96	120S96	120S96	120S96
97	Instruction Manual	SAIMAN1L	SAIMAN1L	SAIMAN1L	SAIMAN1L	SAIMAN1L	SAIMAN1L	SAIMAN1L	SAIMAN1L
102	Fuel Pump System	—	—	—	—	—	—	—	—
109	F-1 Fuel Filter	50109	50109	50109	50109	50109	50109	50109	50109
110	Anti-Loosening Nut	170R3110	170R3110	170R3110	170R3110	170R3110	170R3110	170R3110	170R3110
111	Flexible Exhaust Pipe	120S111	120S111	120S111	120S111	120S111	120S111	—	—
112	Tuned Silencer	—	—	—	—	—	—	—	—
114	Engine Bed	—	—	—	—	—	—	—	—
116	M3 Nut for Spinner	—	—	—	—	—	—	—	—
117	M4 Nut for Spinner	120S117	120S117	120S117	120S117	120S117	120S117	120S117	120S117
118	M5 Nut for Spinner	120S118	120S118	120S118	120S118	120S118	120S118	120S118	129S118
122	Spray-bar with Internal p-2/External p-5 "0"-Ring	—	—	—	—	—	—	—	—
126	Needle Valve Stopper and Nut	120S126	120S126	120S126	120S126	120S126	120S126	120S126	120S126
135	Prop Washer/Nut/Anti-Loosening Nut	170R3135	170R3135	170R3135	170R3135	170R3135	170R3135	170R3135	170R3135
136	Intake Manifold	—	—	—	—	—	—	—	—
137	Prop Washer	—	—	—	—	—	—	—	—
145	Spray-bar with Internal p-2 "0" Ring	120S145	120S145	120S145	120S145	120S145	120S145	120S145	120S145
147	Carburetor Nipple	30S147	30S147	30S147	30S147	30S147	30S147	30S147	30S147
149	Oil Slinger	—	—	—	—	—	—	220a149	220a149

Propeller Selection

In the chart below you will find a propeller selection list. This chart will enable you to select the best propeller for initial setup of your Saito™ engine.

Remember, it is imperative to balance each propeller prior to installation onto your Saito engine. Failure to do so may cause unwanted vibration in your aircraft.

Figure 5

You will note a letter (A, B,C, etc.) stamped on the top of the motor mount. This letter identifies the production version of your engine. Should you ever need to order a part or have a question pertaining to your engine, specify this letter along with the engine type. This will allow for easier identification of your engine.

Saito Single-Cylinder Propeller Chart

NOTE: All recommendations are based on engines using APC props, Power Master 15% 2-stroke fuel, and Saito SAIP400S glow plugs.

ENGINE	SPORT	SCALE	AEROBATICS
FA-120S/120SGK 2000 – 11,000 rpm	14 x 10,15 x 8, 15 x 10 16 x 16, 16 x 8	15 x 8, 16 x 6, 16 x 8, 18 x 6	13.5 x 13.5, 14 x 10N 14 x 12
FA-150/150GK 2000 – 10,500 rpm	15 x 8, 15 x 10, 16 x 8 18 x 6, 18 x 8	16 x 8, 18 x 6, 18 x 8,	14 x 10N, 14 x 14, 15 x 10, 15 x 11
FA-180/180GK 2000 – 10,000 rpm	15 x 8, 15 x 10, 15 x 11 16 x 8, 16 x 10	16 x 8, 16 x 10, 18 x 6	14 x 13.5, 15 x 12
FA-220a/220aGK 1900 – 10,000 rpm	18 x10, 20 x 6, 20 x 8, 22 x 6	20 x 6, 20 x 8, 22 x 6	18 x 10, 20 x 6, 20 x 6W 21 x 6, 22 x 6

NOTE: Observe operating rpm ranges as excessive rpm can result in damage to the engine.

Figure 6

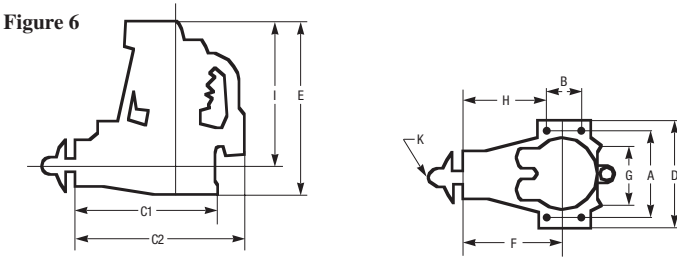


Figure 7

OUTSIDE DIMENSIONS (mm)

Items	A	B	B1	B2	C1	C2	D	E	F	G	H	I
FA-120 Special/FA-120SGK	59	24	–	–	111	138	69	132	82	45	70	111
FA-150/FA-150GK	59	24	–	–	111	138	69	134	82	45	70	112
FA-180/FA-180GK	59	24	–	–	111	138	69	135	82	45	70	113
FA-220a/FA-220aGK	64	30	–	–	116	149	75	158	85	53	70	130

Figure 8

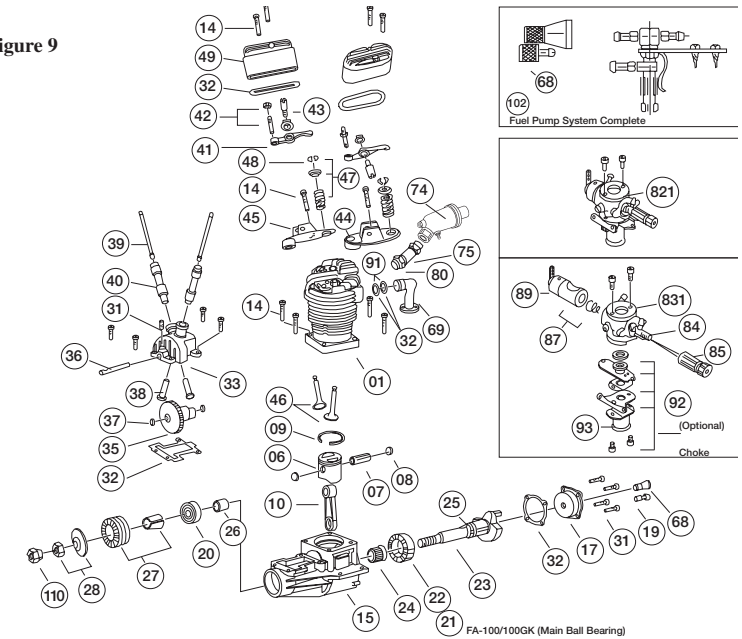
SPECIFICATIONS

Items	Disp (cc)	Bore (mm)	Stroke (mm)	Weight (g)	K (ISO)	Cylinder	HP
FA-120 Special/FA-120SGK	20.0	32.0	24.8	820	M8x1.25	– AAC	2.2
FA-150/FA-150GK	25.0	34.0	27.6	850	M8x1.25	– AAC	2.5
FA-180/FA-180GK	29.1	36.0	28.6	880	M8x1.25	– AAC	2.8
FA-220a/FA-220aGK	36.3	38.0	32.0	1100	M8x1.25	– AAC	3.5

No.	Description	Qty.
01	Cylinder (left)	1
06	Piston	1
07	Piston pin	1
08	Piston pin retainer	2
09	Piston ring	1
10	Connecting rod	1
14	Cylinder screw set	1 set
15	Crankcase	1
17	Rear cover	1
19	Breather nipple	1
20	Front bearing	1
22	Rear bearing	1
23	Crankshaft	1
24	Pinion (crankshaft)	1
25	Pinion gearpin	
26	Collar (crankshaft)	1
27	Taper collet & drive flange	1 each
28	Prop washer & nut	1 set
29	Prop nut—spinner	
30	Prop nut—electric starter	
31	Crankcase screw set	1 set
32	Engine gasket set	1 set
33	Cam gear housing	1
35	Cam gear	1
36	Cam gear shaft	1
37	Steel washer set	1 set
38	Tappet	2

No.	Description	Qty.
39	Pushrod	2
40	Pushrod cover & rubber seal	2 each
41	Rocker arm	2
42	Rocker arm screw & nut	2 each
43	Rocker arm pin	2
44	Rocker arm bracket (left)	1
45	Rocker arm bracket (right)	1
46	Valve (in & out)	2
47	Valve spring & keeper & retainer	2 each
48	Valve retainer	
49	Rocker arm cover	2
68	Checkvalve (in & out)	1 pair
69	Intake manifold	1
74	Muffler	1
75	Muffler manifold	1
77	Muffler gasket	5
80	Muffler nut	2
89	Idle needle valve	1
821	Carburetor complete	1 set
831	Carburetor body assembly	1 set
84	Spray bar assembly	
85	High speed needle valve	1
87	Throttle barrel assembly	1 set
91	Carburetor gasket set	1 set
93	Intake velocity stack	1 set
102	Fuel pump system complete	1 set
110	Anti-loosening nut	1

Figure 9



Consumer Warranty and Repair Policy

Saito™ engines are guaranteed against workmanship and manufacturing defects for a period of 3 years from the original date of purchase. This warranty is limited to the original purchaser of the engine and is not transferable. Warranty repairs will **not** cover:

- Normal engine wear
- Damage due to insufficient maintenance
- Damage related to over-revving of engine due to small prop size or unreasonable use
- Rusted bearings
- Crash damage
- Damage due to use of improper fuel and/or glow plug
- Damage due to lean runs, such as rusted bearings, seized connecting rod or piston, etc.
- Damage caused by foreign objects (dirt or broken glow plug filaments)
- Damage caused by unreasonable mounting or running conditions (dust, insufficient cooling, improper mounting, improper propeller size, or lack of balancing, etc.)
- Damage due to improper disassembly
- Modifications of any kind

If your engine needs repair, please do the following:

1. Ship your engine in its original box, freight prepaid to:

Horizon Service Center
Attn: Saito Service
4105 Fieldstone Road
Champaign, IL 61822
Phone: (217) 355-9511

Include complete name and address information inside the carton, as well as clearly writing it on the outer label/ return address area.
2. Include a note containing a brief summary of the difficulty and include the following information:

- Nitro content and brand of fuel
- Propeller size and brand used
- Type of glow plug used
- Type of engine mount
- Approximately how much running time the engine had before difficulty

Date your correspondence and be sure your name and address appear on this enclosure. Also, include a phone number where you can be reached during the business day.

Warranty Repairs

To receive warranty service, you must include your original dated sales receipt to verify your proof-of-purchase date. Providing that warranty conditions have been met, your engine will be repaired without charge.

Non-Warranty Repairs

Should your repair cost exceed 50% of the retail purchase cost, you will be provided with an estimate advising you of your options. Any return freight for non-warranty repairs will be billed to the consumer.

Please advise us of the payment method you prefer to use. The Horizon Service Center accepts VISA, MasterCard, or money orders. If you prefer to use a credit card, include your card number and expiration date.

The Consumer Warranty Registration in the back of this manual must be completely filled out and mailed to:

Horizon Service Center
Attn: Saito Warranty
4105 Fieldstone Road
Champaign, IL 61822

Please cut on dotted line.

Consumer Warranty Registration

Complete this form and mail along with your dated sales receipt (send copy, keep original for your files) within 10 days of purchase to: Horizon Service Center
Attn: Saito Warranty Dept.
4105 Fieldstone Road
Champaign, IL 61822

Engine Type _____

Date of Purchase _____

Owner's Name _____

Street Address _____

City/State/Zip _____

Daytime Phone Number _____

Purchased From:

Dealer's Name _____

Street Address _____

City/State/Zip _____

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