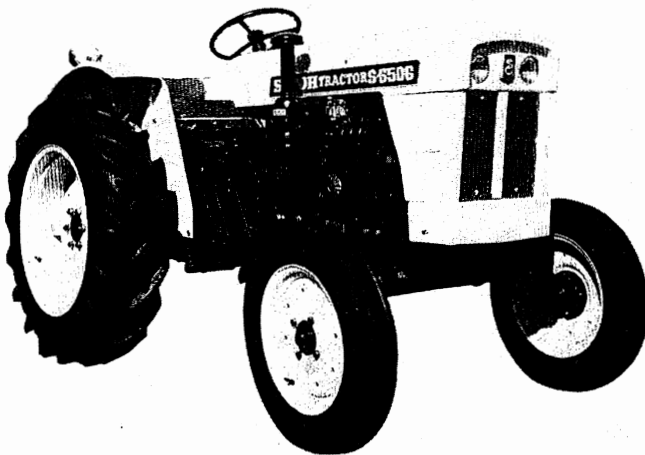


SATOH TRACTOR

S-650G

with 4-cylinder PB Gasoline Engine

INSTRUCTION BOOK



SATOH AGRICULTURAL MACHINE MFG. CO., LTD.

KINSAN BLDG. NO. 5, 4-CHOME NIHONBASHI-MUROMACHI
TOKYO JAPAN

INTRODUCTION

Equipped with a high-powered four-cylinder gasoline engine, SATOH S-650G tractor does an extensive range of farming jobs. Because it is incorporated SATOH's latest technological innovation as well as many years of research and experience in manufacturing farm tractors, its outstanding performance and high efficiency have been already recognized through many severest tests.

Every piece of the tractor S-650G is made of the selected quality materials and by the world's most advanced machine tools. It also combines SATOH's highest standards of design and workmanship, therefore, both longer service life and versatility are secured.

However, to work out these potentialities, the operator's cooperation is a must. For this reason, not only must he perform daily check and periodical service, but also he must strictly follow the instructions given in this manual. These instructions can be followed even by a novice, however, in order to get easier and quicker operations, an operator is requested to have a full knowledge of the service procedures and a skilled level of techniques. Once the operator is fully acquainted with the technical informations described in this manual, he will become a qualified mechanic.

Prior to the use of this new tractor, be sure to read "Operation" and "Periodical Service" in this manual. It is desired that an operator keeps this manual on hand so that he can look into it whenever necessary.

For further questions, apply to your nearest **SATOH** dealer, giving the **SERIAL** and **ENGINE NUMBER** of your tractor.

CONTENTS

	Page
Precautions with a New Tractor	1
50-hours Service	1
External View and Nomenclature of each Part	2

SECTION 1. OPERATION

Starting and Stopping the Engine	5
Controls	6
1. Oil Pressure Warning Lamp	6
2. Battery Charge Warning Lamp	6
3. Water Temperature Warning Lamp	7
4. Lighting Switch and Flood Light	7
5. Tractor Meter	7
6. Throttle Lever	8
7. Clutch	8
8. Brake	8
9. 6-speed Transmission Gear	9
10. Seat	10
11. Differential Lock	10
12. P.T.O. Operation	11
13. Tread Adjustments	12
14. Ballast Weights	14
15. Tire Pressure	14
16. Installing the 3-point Linkage	14
17. Hydraulic System	15
17-1. Features	15
17-2. Mechanism and Operation of Hydraulic System	16
18. Draw-bar	18

SECTION 2. REGULAR MAINTENANCE

1. Service	19
1-1. Daily Inspection.	20
1-2. A Service	20
1-3. B Service	24
1-4. C Service	25
1-5. D Service	25
1-6. E Service	25
2. Recommended Lubricants	26
3. Greasing Diagram	27

SECTION 3. SERVICE INFORMATION

1. Caution Under Cold Climate	28
2. Carburetor and Fuel Pump	29
3. Governor	29
4. Valve Clearance	29
5. Engine Oil	30
6. Cooling System	30
7. Tightening Cylinder Head Bolts	30
8. Air Cleaner	31
9. Battery	31
10. Alternator	31
11. Starting Motor	32
12. Fan and Governor Belts	32
13. Fuse	33
14. Brake Adjustment	33
15. Clutch Adjustment	34
16. Center Beam and Front Hub	34
17. Electrical Wiring Chart	35

SECTION 4. SPECIFICATION AND DATA

Engine	36
Cooling System	36
Fuel Equipment	36
Lubrication System	36
Electrical System	36
Engine Performance Curves	37
Capacities	38
Dimensions	38
Performance	38
Power Lift	38
Clutch	38
Brakes	39
P.T.O.	39
Tread Adjustment	39
3-point Linkage	39
Wheel Equipment	39
Travel Speeds	40

PRECAUTIONS WITH A NEW TRACTOR

All component including the engine is subject to rigorous checks during factory assembly. It is advisable that a new tractor should be used with special care. For the first 25 ~ 50 hours, it should not be operated for heavy duty work. If circumstances require the tractor to operate with heavy load, the gear should be one stage lower than requested.

50-HOURS SERVICE

After first 50-hours of operation, the following points should be serviced.

- (1) Replace the engine oil and the oil filter.
- (2) Replace the *transmission* oil.
- (3) Retighten the cylinder head bolts and adjust the valve clearance.
- (4) Retighten all bolts, nuts and screws.
- (5) Check and adjust the fan and governor belts.
- (6) Check the wheels for tire pressure and tire condition.

This 50-hours Service must be performed without fail because it is essential in order to keep the tractor always in the top condition.

EXTERNAL VIEW AND NOMENCLATURE OF EACH PART

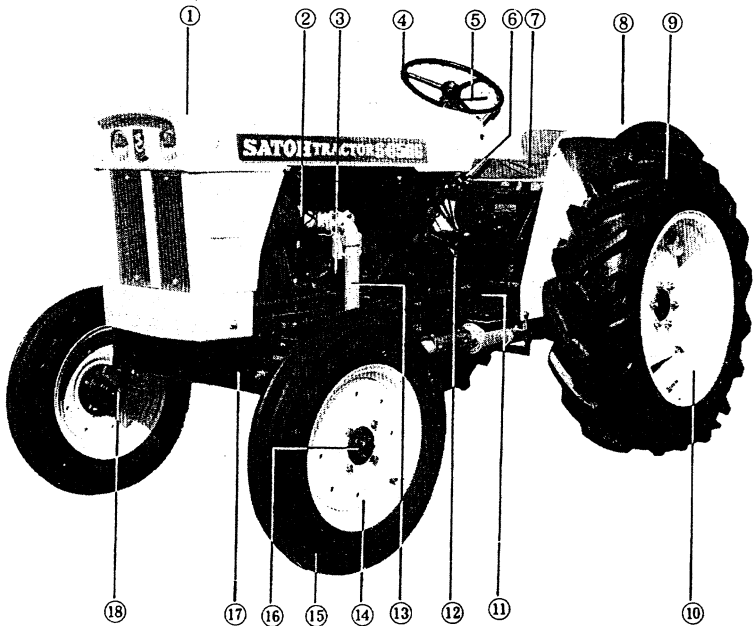


Fig. 1

No.	Part Name	No.	Part Name
1	Bonnet	10	Rim
2	Alternator	11	Clutch pedal
3	Starting motor	12	Pitman arm
4	Steering wheel	13	Silencer pipe
5	Throttle lever	14	Front wheel
6	Selector lever	15	Front tire
7	Seat	16	Hub cap
8	Rear Fender	17	Center beam
9	Rear tire (standard 11. 2/10-24)	18	King pin

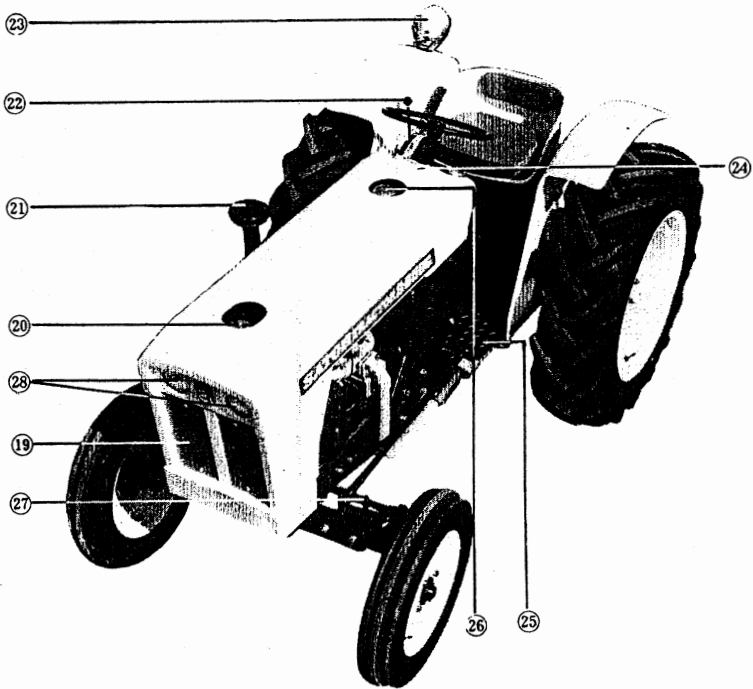


Fig. 2

No.	Part Name	No.	Part Name
19	Louver	24	Instrument panel
20	Filler cap	25	Step
21	Air cleaner	26	Fuel cap
22	Control lever	27	Steering lever
23	Flood light	28	Head lamp

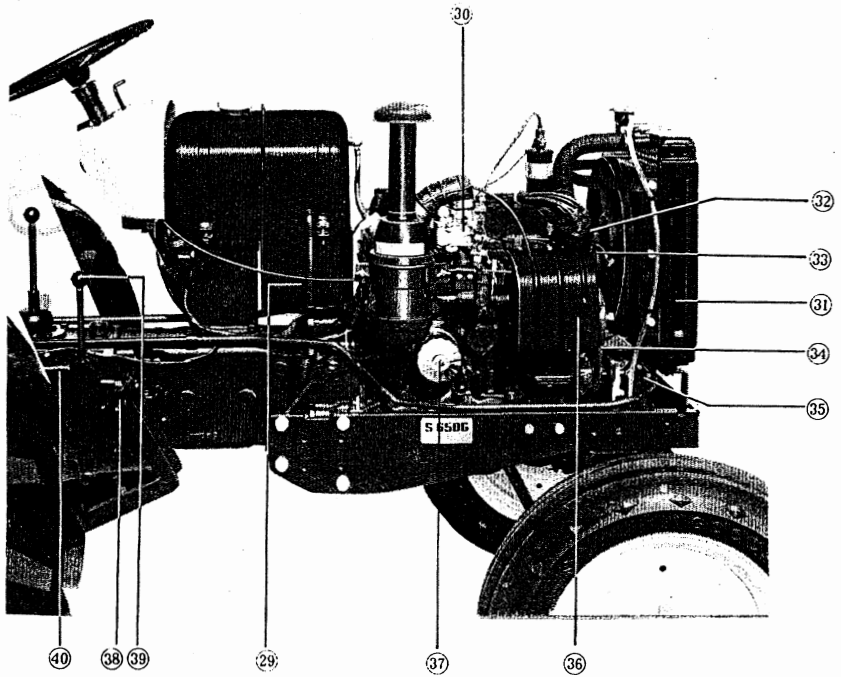


Fig. 3

No.	Part Name	No.	Part Name
29	Level gauge	35	Hydraulic pump
30	Carburetor	36	Governor
31	Radiator	37	Oil filter
32	Distributor	38	Brake pedal
33	Fan belt	39	Range lever
34	Governor belt	40	Safety starter switch

SECTION 1. OPERATION

STARTING AND STOPPING THE ENGINE

Before starting the engine, be sure to check the engine oil, cooling water, transmission oil and hydraulic oil for quantity, in addition the daily check specified in 1-1 of SECTION 2.

- (1) The engine is provided with a safety switch, so that the starter will not run excepting when the range lever is in "NEUTRAL". Accordingly, when starting the engine, place range lever in "NEUTRAL".
- (2) Set the starter switch to "ON", and confirm the oil pressure warning lamp, battery charge warning lamp, and water temperature warning lamp. Turn the starter switch to "START", then, the engine will start to run. After the engine has been started, keep off your hand from the starter switch.

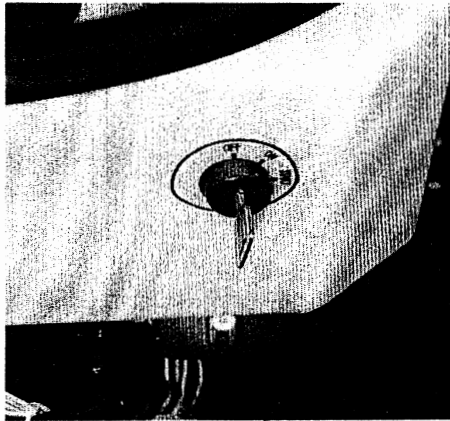


Fig. 4

- (3) Avoid turning the starting motor for 15 consecutive seconds or more.
- (4) Under the cold climate, disengage the clutch by fully depressing the pedal, then, fully pull out the choke button. Start the engine with the throttle lever in the idle running speed. After the engine started, release the clutch pedal and slowly push in the choke lever while observing the engine condition. When the engine started to run smoothly, keep the engine under idle running for warming-up.
- (5) To stop the engine, turn the throttle lever to the "SLOW" (idle running) position, and set the starter switch to "OFF". After stopping, be sure to remove the main switch key.

CONTROLS

In case the starter switch turns off under the high speed running of the engine, it will be caused to have a trouble of "DIESELING". Control System of the engine and tractor are as shown in Figs. 7 through 12.

1. OIL PRESSURE WARNING LAMP

When the starter switch is set to "ON", the oil pressure warning lamp is turned on. Always the lamp should be watched, because it indicates whether the engine is properly lubricated. Normally, after the engine started, the lamp is turned off. If the lamp keeps to light on during operation, the engine oil may be insufficient or the oil pressure switch is faulty. Stop the operation, and check quantity of the oil and the oil pressure switch condition.

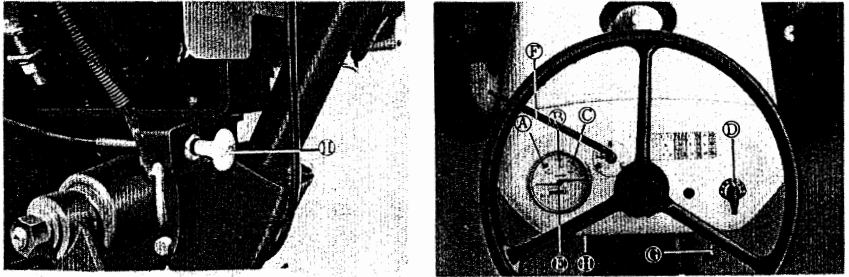


Fig. 5 Instrument Panel and Control System Indicator
Instrument

- (A) Oil Pressure Warning Lamp
- (B) Battery Charge Warning Lamp
- (C) Water Temperature Warning Lamp
- (D) Lighting Switch
- (E) Tractor Meter
- (F) Throttle Lever
- (G) Starter Switch
- (H) Choke wire

2. BATTERY CHARGE WARNING LAMP

When the starter switch is turned to "ON", the lamp is turned on. After starting the operation, the lamp is turned off. The lamp indicates whether the battery is being correctly charged. If the lamp lights on during operation, the fan belt may be slipping or damaged, or the charging circuit is faulty. Stop the operation immediately, and check the possible cause.

3. WATER TEMPERATURE WARNING LAMP

Dust accumulations will adversely affect the radiation efficiency of the radiator. If the water temperature in the radiator exceeds 212°F (100°C) or if the water in the radiator is insufficient, the lamp is turned on. Immediately stop the engine and make it cool. Then check the radiator for dust and water. If necessary, clean the radiator or feed the water.

4. LIGHTING SWITCH AND FLOOD LIGHT

- 0 — Lights are off.
- 1 — Headlight is on.
- 2 — Headlight is dimmed and directed downward.

The switch for the implement light is incorporated in the light itself.

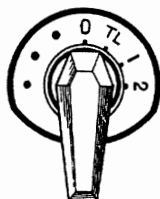


Fig. 6 Lighting Switch

5. TRACTOR METER

The calibration along the lower rim of the meter shows travelling speeds (mph) at the 6th forward gear. The figure in the center of the meter shows the accumulated hours of tractor running with engine revolution at 2,800 rpm. Periodical checks are based on the accumulated hours in this meter.

The upper calibration indicates the engine rpm, and the red line (2,800 rpm) shows that when the P.T.O. gear is in "1st", the P.T.O. shaft rotates at 540 rpm and with the P.T.O. gear in "2nd", the shaft rotates at 1,092 rpm.

The left one of the three lamps arranged along the upper rim is the oil pressure warning lamp, the center is for the battery charge warning lamp, and the right is for the water temperature warning lamp.

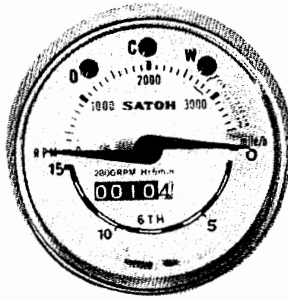


Fig. 7 Tractor Meter

6. THROTTLE LEVER

When the throttle lever is pulled forward, the engine speed reaches the maximum. The speed range controlled by the lever is 700 to 3,150 rpm (with no load). When the P.T.O. gear is shifted to "1st" at 2,800 rpm, the P.T.O. shaft rotates at 540 rpm.

7. CLUTCH

When the clutch pedal is operated, it is essential to avoid the operation of a half-engaged clutch as maximum as possible. It is requested to make the engine speed lower. The life of the clutch depends entirely on the operating habit of the user. The clutch is combined with the P.T.O. operation.

8. BRAKE

To stop the tractor running, first make the engine speed lower. Then depress the clutch pedal with the left foot, and engage the brake with the right foot.

Note: While travelling on roads, be sure to link the both right and left brake pedals. When parking, depress the brake pedal and lock the pedal with side brake lever.

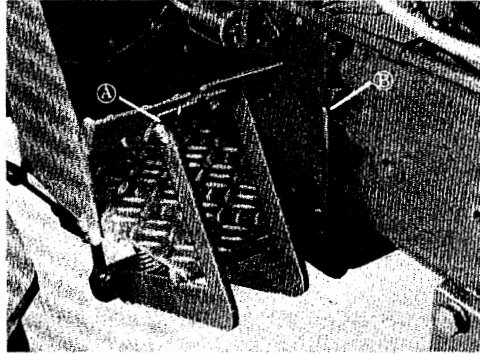


Fig. 8 Brake Pedal

(A) Looking Plate
(B) Side Brake Lever

9. 6-SPEED TRANSMISSION

GEAR

The lever located exactly in front of the seat is the selector lever. This lever is used for shifting the gears to 1st, 2nd and 3rd for forward and 1st for reverse. The lever on the right side is used for changing the speed range from High to Low and vice versa. Thus a total of 6 for forward and 2 for reverse speeds are at your option.

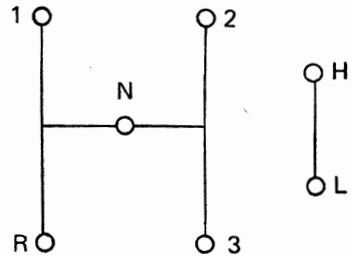


Fig. 9 6-Speed Gear Position

Running Position		F1	F2	F3	F4	F5	F6	R1	R2
Lever Position	Range Selector	L		H		L	H	L	H
	Selector	1	2	1	2	3	3	R	R

10. SEAT

The operator's seat can be adjusted in the range of 1.77 in. (45 mm) both for front and rear directions so that the operator can have the most suitable posture.

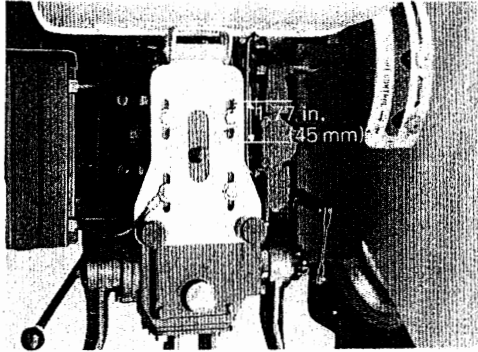


Fig. 10 Seat

11. DIFFERENTIAL LOCK

The differential lock is a device for making the rear wheels at the same speed so that either of the left or right wheel will not slip.

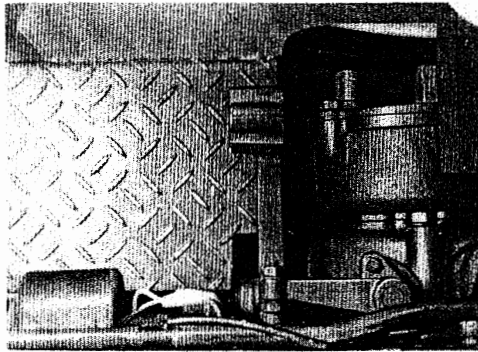


Fig. 11 Differential Lock

How to engage the differential lock:

To engage the differential lock, stop the tractor running before start to slip or slow down the tractor speed, then, depress the pedal by the right heel. Faulty engagement at one time depressing is requested the same operation repeatedly with harder depressing. If either of the left or right wheel has already begun slipping; turn the throttle lever to the idle running or disengage the clutch, then, depress the differential lock pedal. Make sure that the pedal is fully depressed. As far as the pedal is depressed, the lock is in effect.

How to release the differential lock:

Immediately after the right foot is moved off the pedal, the differential lock is automatically released by force of the spring. However, it must be remembered that the lock may not be released under special conditions. In this case, the right and left brake pedals should be quickly and alternatively depressed, then, the differential lock will be set free. If the same occurs while plowing, the brake pedal of the land wheel side should be applied. The lock will be let out. When the both right and left brakes are linked for towing a trailer, operation of the steering handle to right and left allows the lock becoming free. When the tractor is stopped with the differential lock applied, reverse running with a jerk can release the lock.

Note: Avoid using the differential lock when operating the tractor at high speed or running on a road.

12. P.T.O. OPERATION

The P.T.O. shaft speed is as shown in Fig. 12.

When the P.T.O. driven implement is used, the following instructions should be observed:

P.T.O shaft speed (engine 2800 r.p.m.)	1092 r.p.m.	540 r.p.m.
Lever position		

Fig. 12 P.T.O. Lever Position

- When any implement is mounted on the tractor, care should be taken so that the universal joint will not form an angle more than the limit (normally 15°).
- When the P.T.O. is under an impact load, correctly adjust the slide clutch on the implement side so that no over load will be given.
- To reduce the thrust load to the P.T.O. driven shaft as maximum as possible, it is advisable that the test operation with an implement but without any load is requested.
- Thoroughly apply lubricants to the P.T.O. driven shaft.
- Avoid using a square-shaped driven shaft as much as possible.
- Special care should be given to the yoke position so that the driven shaft is well balanced.



Fig. 13

13. TREAD ADJUSTMENTS

The tread of the front and the rear wheels can be freely adjusted according to the type of operation.

A. Adjusting the tread of the front wheels

The tread can be adjusted to the following four ways; viz. 40.9 in. (1,040 mm), 44.9 in. (1,140 mm), 48.8 in. (1,240 mm) and 52.8 in. (1,341 mm). To adjust the tread, first jack up the front part of the tractor, and align the setting hole of the center beam with that of the beam extension.

After this adjustment, the tie rod should also be adjusted according to the tread requested.

(Do note that when adjustment of 50.2 in. (1,321 mm) tread is requested, the front wheels of the right and left side should be replaced as one side to the other.)

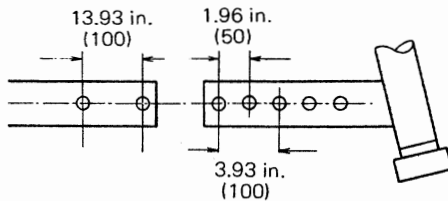


Fig. 14 Adjusting the Tread of the Front Wheels

A-1. Steering angle adjustment

The front wheel tread is required to be adjusted according to the type of operation. With tread adjustment, the steering angle must be adjusted by means of the drag link.

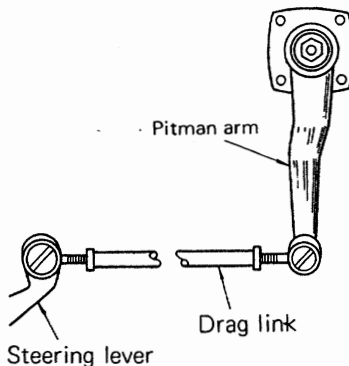


Fig. 15 Steering Angle Adjustments

Adjustment should be made in the following manner. The maximum steering angle is 53° when inside of both right and left wheels are measured. Turn the steering wheel to both right or left with the maximum angle, and loosen the drag link lock nut and turn the drag link so that the rear end of the inner wheel steering lever comes contact with the stopper. When the wider tread is required the drag link becomes longer while the narrower tread makes the tube shorter.

B. Rear wheel tread adjustment

To adjust the rear wheel tread, jack up the rear wheels. Select the tread required for operation by means of turning the rim inside out or replace the tires of the right and left as one side to the other. Fig. 16 shows adjustment of the rear wheel tread.

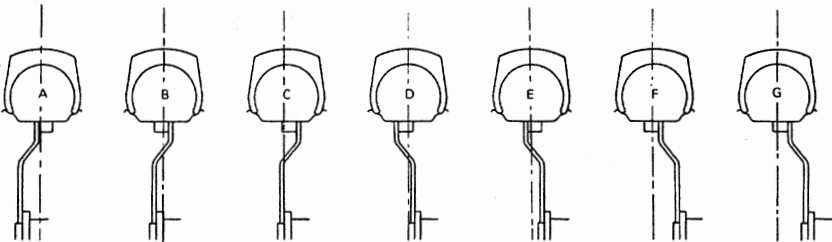


Fig. 16 Rear Wheel Tread Adjustments

Distance between tire center lines

A	B	C	D	E	F	G
40 in.	42.1 in.	43.8 in.	46.2 in.	47.9 in.	50 in.	51.7 in.
(1,017 m/m)	(1,069 m/m)	(1,113 m/m)	(1,173 m/m)	(1,217 m/m)	(1,269 m/m)	(1,313 m/m)

B-1. Installation of the rear wheels

Make sure that the rear tires should be installed so as to form the letter of "V" as viewed from the tractor front side.



Fig. 17

14. BALLAST WEIGHTS

Tire slipping will not only damage the tire, but also waste the fuel. If heavier traction force is needed, the ballast weight should be attached to each wheel, or water can be fed into the tire tubes in combination with the ballast weights. In this case, if atmospheric temperature tends to be below the freezing point an anti-freezing solution should be added to the water.

Front wheel added	40 lbs x 4 (18 kg x 4)
Rear wheel added	77 lbs x 4 (35 kg x 4)

To feed the water into tire tubes, the valve **TR218A**, manufactured by Nippon Goodyear K.K. is used.

15. TIRE PRESSURE

Tire pressure should be frequently checked. Incorrect tire pressure, either too high or too low, will result in the quick wear of the tire. It is advisable that tire pressure should be checked at least once a week. When water ballast is put into the tubes, further frequent check is required.

AG TIRE	Front tire (500—15)	36.93 lbs/in ² (2.6 kg/cm ²)
	Rear tire (11.2/10—24)	16 lbs/in ² (1.13 kg/cm ²)
ESTATE TIRE	Front tire (5.90—15)	27.9 lbs/in ² (1.97 kg/cm ²)
	Rear tire (11.2/10—24)	17.7 lbs/in ² (1.25 kg/cm ²)

16. INSTALLING THE 3-POINT LINKAGE

The 3-point linkage is designed for implements under Category I.

- The top link length can be adjusted in the range from 16.53 in. (420 mm) to 24.4 in. (620 mm). The bracket which is to be mounted on the tractor side, has two holes (upper and lower). These holes should be used according to the type of operation.
- The lift rod (leveling lever) can be adjusted in the range from 12.598 in. (320 mm) to 18.503 in. (470 mm).

Note: It should be avoided to draw an implement by installing the linkage draw-bar on the lower link.

When it is requested to draw an implement, the lower link should be always kept in horizontal position.

17. HYDRAULIC SYSTEM

The SATOH tractor's hydraulic system is equipped with Height Control mechanism, thus providing easier operation. In addition, it has the following features.

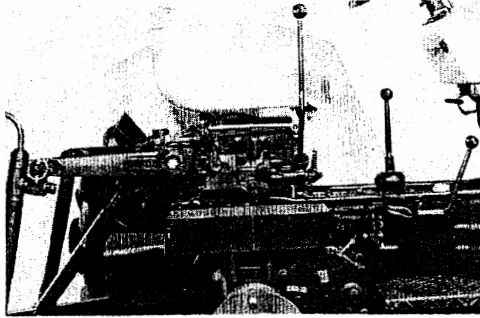


Fig. 18 Hydraulic Unit

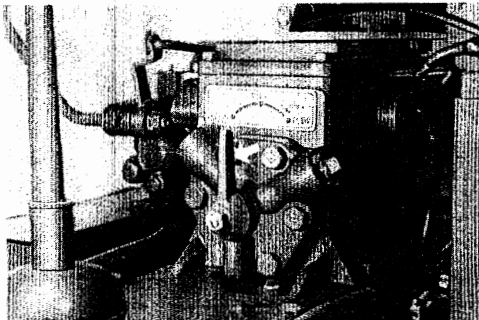


Fig. 19 Adjusting Lever

17-1. Features

- A. "Lift", "Hold", "Height", and "Lower" can be controlled by one control lever.
- B. The operational position of an implement can be controlled by the control lever.
- C. An automatic neutral device is incorporated so that an implement can readily be raised and lowered by the control lever.
- D. Although each valve is not replaceable, spool valves and sleeves are made of the same material and their durability has been greatly improved.
- E. The hydraulic pump is directly connected to the engine, therefore, the pump operates independently from the clutch operation..
- F. Employment of the flow control valve has made it possible to control the lowering speed of an implement. Further, an implement can be stopped or locked at any desired position.

- G. The hydraulic system has improved its performance and durability by the use of an exclusive oil.
- H. External hydraulic valve (optional equipment) provides availability of hydraulically driven implements, such as front loader, dump trailer, hydraulic mower, etc.

17-2. Mechanism and Operation of Hydraulic System

To operate the SATOH tractor correctly, a good knowledge of the operation of each hydraulic mechanism is requested.

A. Control lever

When the control lever is pulled toward the rear of the tractor, the hydraulic lift arm moves up, and pushed toward the front, lowers the lift arm. Accordingly, an implement can be held at a desired height according to the type of implements.

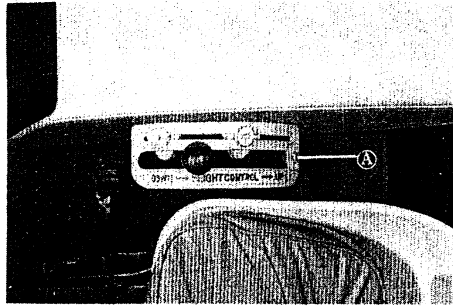


Fig. 20 Control Lever

Note: When the control lever placed in "UP", the lever stopper (see Fig. 20 A) has been set according to each tractor. Make no attempt to change the stopper position at your option. If the stopper position had been shifted carelessly, the hydraulic pump will be given an over load. Consult the nearest dealer for correction of the stopper position.

B. Hand nut

Two hand nuts are provided, which are to be used when the same type operation is repeatedly performed.

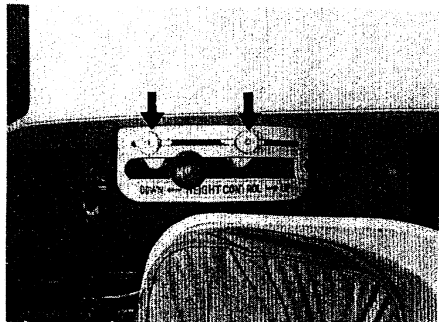


Fig. 21

C. Adjusting lever

As shown in Fig. 22, the adjusting lever can be used at three positions. The adjusting lever regulates the oil flow; that is, when an implement is heavy, the oil flow is reduced, and when light, the oil flow is increased, thereby, controlling the lowering speed of an implement.

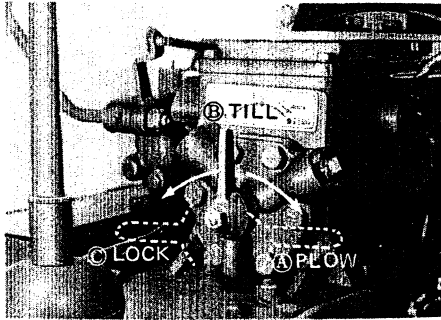


Fig. 22

The position A is used when an implement is requested quick lowering such as plow, etc.

The position B is used when the P.T.O. is in use. Particularly, it is the most suitable when the rotary tiller with rotating blades starts to cultivate with the minimum shock.

The position C is used for locking the oil returning from the ram cylinder, thereby, lock lowering of the lift arm. It is also usable as a safety device when the tractor moves for hours with an implement or when it is serviced with an implement mounted.

D. External Hydraulic Valve (Optional Equipment)

The external hydraulic valve is operated by the control lever. A special valve is provided in order to allow the oil to flow from the ram cylinder to the cylinder of an implement.

E. Note on hydraulic oil replacement.

When replacing the hydraulic oil, remove the strainer as shown in Fig. 23 and clean it. Then feed the oil.

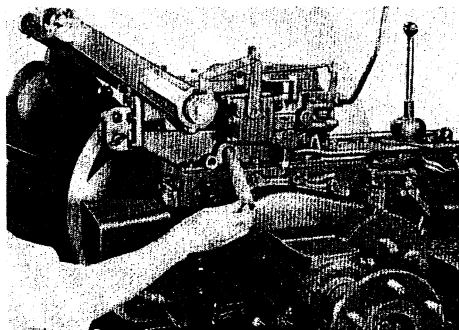


Fig. 23 Strainer

18. DRAW-BAR

The S-650G is equipped with the modified swinging draw-bar as standard, which is useful in towing a heavy duty implement.

SECTION 2. REGULAR MAINTENANCE

Periodical inspection is indispensable for the tractor in order to keep it always in the top condition.

If any tractor is not correctly serviced, its performance and reliability will be greatly reduced and unexpected repairs are often required, costing more than the expense for periodical inspection in the long run.

The SATOH tractor requires a very simple service, which is divided into daily care, greasing and periodical care. The periodical care is further divided into the five stages; A, B, C, D and E services. These services are performed according to the length of the time of operation as shown in the following service chart.

This service chart is based on the normal operating conditions, therefore, if the tractor has been in operation in an exceptionally dusty or muddy place, greasing and air cleaner check should be given twice a day. The hydraulic oil should be drained while it is warm; for instance, right after operation. The oil can be drained faster than when it is cool.

Note: To keep the tractor clean is the most important. The grease nipple should be cleaned before it is filled with grease. The oil pan plug and the filler cap should be wiped off of dust before they are removed. All tools and instruments used for the engine, transmission and fuel tank should also be kept clean. Even a fine dust in the fuel system may cause troubles and power loss.

It is advisable that all service jobs are performed indoors as much as possible.

1. SERVICE

Service should be given according to the service schedule. The service schedule is applicable to the tractor which has been operated under normal working condition. If it has been operating in muddy place, frequent greasing is needed. If the tractor has been at the stationary works in a dusty place, the air cleaner and fuel filter should be frequently cleaned or replaced.

SERVICE CHART SCHEDULE

Hours of operation	Service				
	A	B	C	D	E
50 hrs (25-50 hrs for brand new tractor)	○				
100 hrs	○	○			
200 hrs	○	○	○		
300 hrs	○	○	○	○	
600 hrs	○	○	○	○	○

- * After 600 hours of operation, service should be repeated in the order of A, B, C, D and E.
- * A brand new tractor should be serviced according to the 50 hrs' Service.

1-1. Daily Inspection

- A. Inspection: Check the oil, cooling water and fuel for leakage.
 - B. Oil: Check the engine oil, transmission oil, governor oil and hydraulic oil for the oil level, and if needed, refill oil.
 - C. Fuel: Feed the fuel so that the fuel level is 1.57 in. (4 cm) below the tank fuel inlet.
 - D. Air cleaner: If the tractor is operated in a dusty place, the air cleaner's oil bath should be cleaned and refilled with the engine oil up to a specific level. (Fig. 24)
 - E. Greasing: If the tractor is operated in a dusty or humid place, the king pin and front axle center pin should be frequently greased.
- Note: Before greasing, the grease nipples should be cleaned.

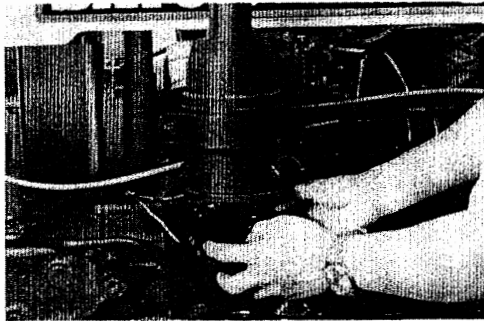


Fig. 24 Air Cleaner

1-2. "A" Service

(Generally, every 50 hours of operation. If necessary, increase the frequency of service.)

- A. Air cleaner: Clean the air cleaner's oil bath, and refill with new oil. Check the pre-cleaner for dirtiness.

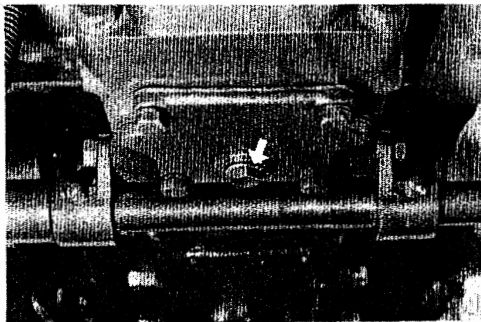


Fig. 25 Transmission Oil Drain Plug

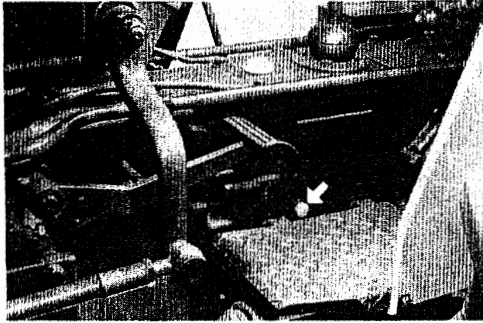


Fig. 26 Transmission Oil gauge

- B. Transmission case and governor: If the transmission and governor oil level are found low, add the oil up to the oil gauge mark. In the case of a new tractor, replace the oil, thereafter, replacement is required every 600 hours of operation.
- C. Controls: Apply the new engine oil to the moving part of controls. However, when the tractor is used in a dry, dusty place, avoid oiling to these controls.
- D. Brake: Adjust both right and left brakes so that they are effected evenly and the same amount of the pedal free-play when they are linked. (See "Brake Adjustment" in Section 3.)
- E. Clutch lever: Check for pedal free-play. If the free-play is not correct, adjust it to 1.57 in. (40 mm).
- F. Cooling water: If the cooling water in the radiator is found insufficient, add the water so that the water level becomes 0.98 in. (25 mm) below the level of water inlet. If the radiator has a high pressure, loosen the cap as much slowly as possible.
- G. Battery: If the battery liquid level is found low, add distilled water so that the liquid level becomes right over the plates. Dry the battery top surface, and make sure that the cap vent is not clogged. When the tractor is used in a dry, hot area, the battery should be checked frequently.
- H. Tires: Check for tire pressure, and if necessary, correct the pressure. (See "Tire Pressure" in Section 1.)
- I. Wheels: When the new nuts are used, they should be checked and retightened every day for the first 50 hours of operation.
- J. Engine oil: The engine oil should be replaced while it is warm. (This is applicable only to a brand new tractor.) Thereafter, replacement is needed every 100 hours of operation.

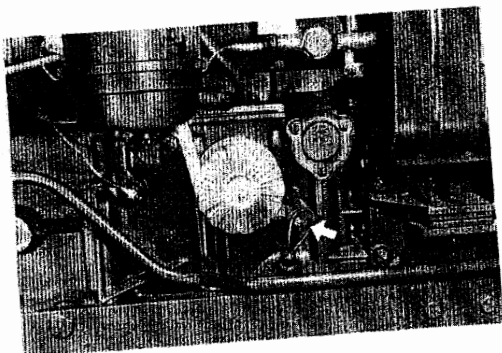


Fig. 27 Oil Lever Gauge

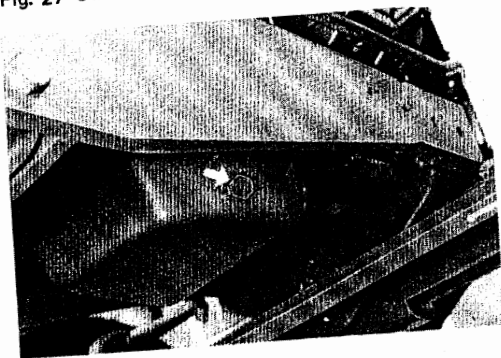


Fig. 28 Oil Pan Plug

- K. Oil filter: The filter is of the cartridge type. Replacement is required to be made as an unit.
(This replacement is applicable only to a brand new tractor.)
Thereafter, replacement is needed every 300 hours of operation.

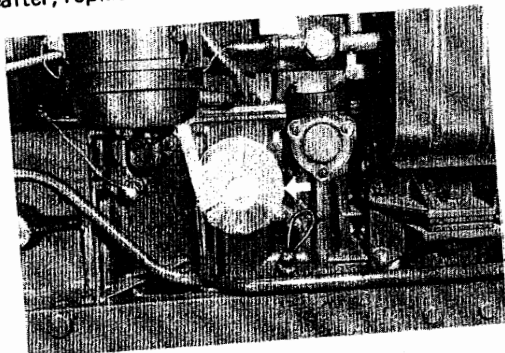


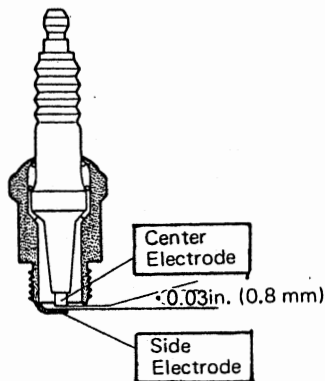
Fig. 29 Oil Filter

Note:

1. Slightly smear the oil on the seal surface prior to installation.
 2. Screw the cartridge into the case. When the seal surface comes to contact, screw in the cartridge about 2/3 turn by hand. (Tightening torque: 7 ~ 11 ft-lb)
 3. After installation, start the engine and make sure that no oil leaks through the seal surface.
- L. Cleaning spark plug: When cleaning the spark plug, it is better to use the plug cleaner. If not available, remove the carbon by means of a needle or wire, and wash with gasoline and the like. Fully dry it up prior to reinstallation.

The gap between the electrodes should be 0.03 in. (0.8 mm). If the electrodes are found excessively worn, replace the plug with a new one.

Recommendable spark plug: NGK B6E The spark plug should be checked and cleaned every 300 hours of operation. If necessary, replace it.



Points Gap AT 17

Fig. 30 Cleaning the Spark Plug

- M. Valve clearance: Retighten the cylinder head set bolts, then, adjust the valve clearance. (See "Valve Clearance" in Section 3.)
- N. Fan and governor belts: Slack of the fan and governor belts should be properly maintained. The correct slack is 0.8 ~ 0.9 in. (10 ~ 13 mm), when press the belts with the pressure of 22 lb (10 kgs).
- O. Replacement of hydraulic oil: The quality of hydraulic oil has a determining factor in affecting the performance of the hydraulic system. The specified oil should be fed with a correct amount in the hydraulic lift case so that the oil level will be at the center of the oil gauge (Gauge Plug).

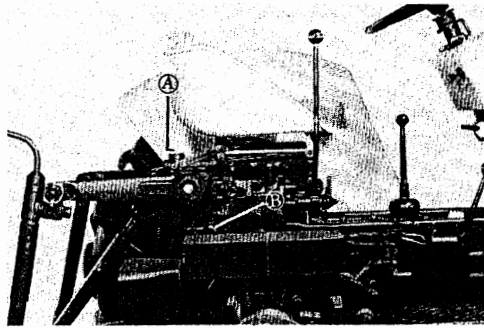


Fig. 31 (A) Plug
(B) Magnet Plug

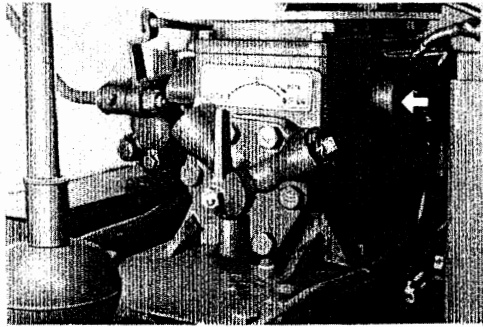


Fig. 32 Gauge Plug

P. Retightening bolts and nuts: As all moving parts, as well as bolts and nuts, become tame, retighten all bolts and nuts.

1-3. "B" Service (Every 100 hours of operation)

"B" service is carried out, along with the daily check and "A" service. However, the following items may be excluded out of "A" service.

- (1) Oil filter replacement
- (2) Hydraulic oil replacement
- (3) Transmission oil replacement
- (4) Valve clearance adjustment

1-4. "C" Service (Every 200 hours of operation)

"C" service should be performed, along with the daily check, "A" and "B" services. However, the following items may be excluded out of "A" service.

- (1) Oil filter replacement
- (2) Valve clearance adjustments
- (3) Transmission oil replacement

Note: The hydraulic oil should preferably be replaced every 100 hours of operation. Being costlier, the oil should be replaced when it shows deterioration.

1-5. "D" Service (Every 300 hours of operation)

"D" service should be performed, along with the daily care, "A", "B" and "C" services. However, out of the "A" service, the following item should be excluded.

- (1) Transmission oil replacement

- A. Gasoline filter replacement: To replace the fuel strainer, disconnect the pipe at the inlet side and remove the filter from the clamp. Make sure that after reinstallation, the strainer faces a correct direction.

Note: Particular care should be taken against fire. Make sure that no fuel is leaking out of the pipe connection.



Fig. 33 Fuel Strainer

1-6. "E" Service

"E" service should be performed along with the daily care "A", "B", "C" and "D" services, in addition, the following item should be carried out.

- A. Check whether the front hub bearing is sufficiently greased, and also check for preload.

B. The steering box is completely sealed. Therefore, the oil in the steering box should be replaced when the clutch assembly or transmission is disassembled.

2. RECOMMENDED LUBRICANTS

Application	Air Temp	A.P.I. Classification	Grade	Mobil 	Esso 	Shell 	Gulf 
Engine, Air Cleaner, and Governor	Below 20°F (-7°C)	MS DG DM	Multigrade SAE 10W	Mobiloil 10W Mobiloil Special Mobiloil Super 10W-40	Esso Motor Oil 10W Esso Extra Motor Oil 5W-20	Shell X-100 10W Shell Multigrade 10W-30	Gulflube Motor Oil HD 10W Gulfpride Multi G 10W-40
	20°F to 90°F (-7°C to 32°C)	MS DG DM	Multigrade SAE 10W 20W 20 30	Mobiloil 20-20W Mobiloil 30 Mobiloil Special Mobiloil Super 10W-40	Esso Motor Oil 20W Esso Motor Oil 20W-30 Esso Extra Motor Oil 10W-30	Shell X-100 20W Shell Multigrade 10W-30	Gulflube Motor Oil HD 30 Gulfpride Multi G 10W-40
	Above 90°F (32°F)	MS DG DM	Multigrade SAE 40	Mobiloil 40 Mobiloil Super 10W-40	Esso Motor Oil 40 Esso Extra Motor Oil 20W-40, 30-40	Shell X-100 40 Shell Multigrade 20-40	Gulflube Motor Oil HD 40 Gulfpride Multi G 10W-40
Transmission and Steering Box	Below 20°F (-7°C)	GL-4 GL-5	SAE 80	Mobilube C80	Esso Gear Oil GP80	Shell Spirax 80EP Shell Spirax HD80	Gulf Multipurpose Gear Lubricant 80
	20°F to 90°F (-7°C to 32°C)	GL-4 GL-5	SAE 90	Mobilube C90	Esso Gear Oil GP90	Shell Spirax 90EP Shell Spirax HD 90	Gulf Multipurpose Gear Lubricant 90
	Above 90°F (32°C)	GL-4 GL-5	SAE 90 SAE 140	Mobilube C140	Esso Gear Oil GP140	Shell Spirax 140EP Shell Spirax HD 140	Gulf Multipurpose Gear Lubricant 140
Hydraulic System	Below -14°F (10°C)	Hydraulic Oil equivalent to SAE 10W		Mobil DTE 23 Mobil A.T.F.	Nuto H44 Esso A.T.F.	Shell Tellus Oil 27 Shell A.T.F. Dexron	Gulf Harmony 44 Gulf A.T.F.
	Above -14°F (10°C)	Hydraulic Oil equivalent to SAE 20		Mobil DTE 26 Mobil A.T.F.	Nuto H54 Esso A.T.F.	Shell Tellus Oil 33 Shell A.T.F. Dexron	Gulf Harmony 53 Gulf A.T.F.

3. GREASING DIAGRAM

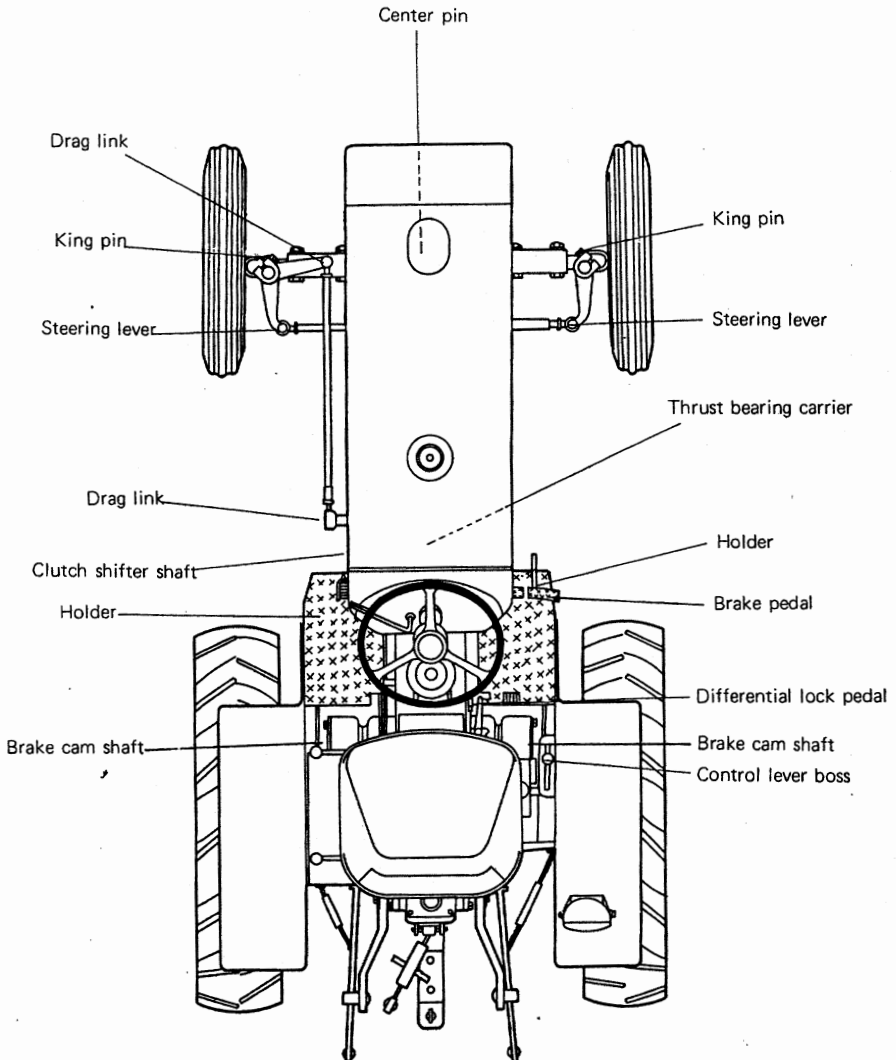


Fig. 34

SECTION 3. SERVICE INFORMATION

This chapter deals with the technical information required for the operator with respect to the daily care and adjustment.

(When removing the cap lug or the cover, be sure to clean it of dust so that no dust will enter into the tractor.)

1. CAUTION UNDER COLD CLIMATE

When the tractor is requested for storing for a long time, drain the water from the radiator and cylinder block, or used an antifreezing solution.

To completely drain the water, remove the radiator cap.

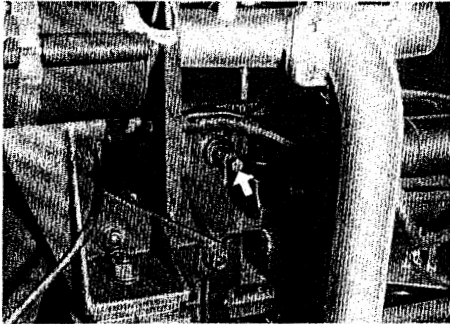


Fig. 35 Cylinder Block Drain Plug

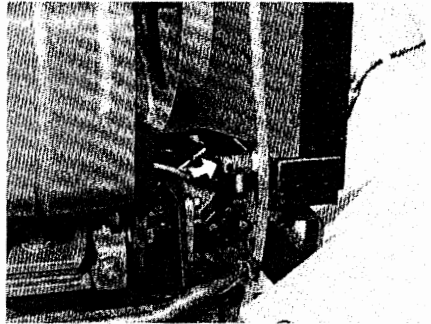


Fig. 36 Radiator Drain Plug

1-1. Antifreezing Solution

When an antifreezing solution is added to the engine cooling water, the following instructions should be observed. Otherwise, corrosion may develop in the cylinder block.

- (1) Make sure that the antifreezing solution is specified as "for aluminum engines".
- (2) Before adding the antifreezing solution, thoroughly wash the cooling system with a detergent.
- (3) The water to be added to the antifreeze must be clean soft water.
- (4) To refilling with the cooling water, be sure to use the mixture of water and antifreeze.
- (5) Never use the same water/antifreeze mixture repeatedly. After draining, be sure to completely wash the inside of the cooling system and refill with clean cooling water.
- (6) Make sure that no water leaks through hose joints and cylinder head gaskets, then, add a new antifreeze.

Do not use the same antifreeze-contained cooling water for more than two years, even if it is specified as "Permanent Anti-Freeze".

2. CARBURETOR AND FUEL PUMP

The carburetor is the type of Stromberg Model 210028-061. Do not attempt to disassemble by yourself. Overhauling should be done by your SATOH dealer.

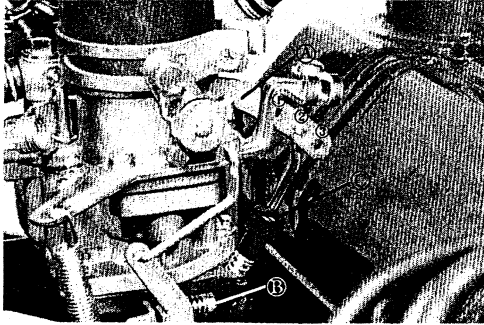


Fig. 37 Carburetor

Referring to Fig. 37, the A has three positions to be adjusted, viz. 1, 2 and 3, which are to be shifted according to atmospheric temperature and pressure. When shifting from 1 to 3, the greater injection amount can be obtained.

The B represents the throttle adjusting screw, and the C shows the idle adjusting screw.

The float level is 1.85 in. (47 mm) when the float is down, and 0.157 in. (9.0 mm) when it is up. However, it is advisable that any carburetor trouble should be corrected by your SATOH dealer.

In general, the fuel pump needs no disassembling. When replacing the gasoline filter, remove the cover and clean the housing (inside) of dust. When the fuel pump is found defective, the possible cause will be a faulty diaphragm or valve in most cases, thus, consult your SATOH dealer.

3. GOVERNOR

There are three parts on the governor where completely sealed. These sealings should never be removed.

4. VALVE CLEARANCE

The correct valve clearance should read 0.010 in. (0.25 mm) for both intake and exhaust valves, while the engine is warm.

Measurement procedure should be as shown in Fig. 38. Insert the thickness gauge C between the rocker arm end and the valve stem end, and loosen the lock nut B. Then adjust the valve clearance by screwing in or out the adjust screw A.

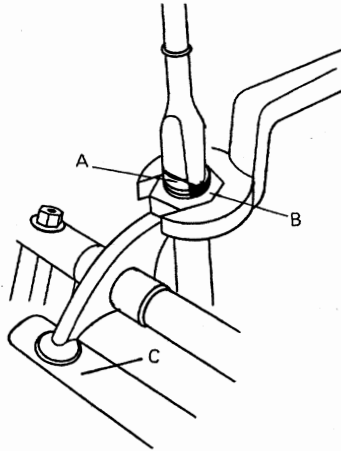


Fig. 38 Valve Clearance Setting

When tightening the lock nut, care should be taken so that the adjusting screw will not turn together with the nut. To prevent turning of the adjust screw, hold it with a screw driver.

5. ENGINE OIL

When the oil pan is drained through the drain plug hole, keep the tractor in a horizontal position. Draining should be done while the engine is warm. Keep the oil drain plug removed for about five minutes, and the oil will be completely let out. Refill with the recommended oil so that the oil level will reach the safety mark on the oil level gauge.

Special care should be exercised so that no dust will enter into the engine. Before remove the oil filler cap, be sure to clean it and its surrounding area of dust.

The oil feeder must be also clean. When it is used, clean the top and outlet of oil. To feed the oil, use a funnel with a filtering sieve.

6. COOLING SYSTEM

The cooling water must be always clean and soft water, except when using an antifreezer or anticorrosive agent. Make sure that the hose joint is fully tightened and no water leaks.

7. TIGHTENING CYLINDER HEAD BOLTS

The cylinder head bolts should be tightened in the order as shown in Fig. 39. Tightening torque should read between 47 ~ 51 ft-lb (6.5 ~ 7.0 m-kgr). It is advisable that a torque wrench be used. After tightening the bolts, check for valve clearance.

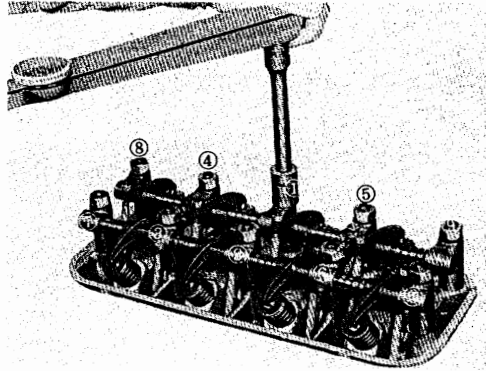


Fig. 39 Cylinder Head Bolt Tightening Order

8. AIR CLEANER

The air cleaner is designed for supplying the large amount of clean, fresh air. The oil reservoir is removable and the oil filter is washable.

Care should be taken so that the sediment on the oil bath will not be more than 0.23 in. (6 mm) thick and the element (fine-mesh) will not be clogged with dust and dirt. The air cleaner oil filter should frequently be washed; otherwise, the engine will be worn faster and fuel consumption will increase.

The air cleaner used in a dusty place should be cleaned several times per day.

9. BATTERY

Under hot climate, the battery electrolyte should be checked frequently. The electrolyte level must be about 0.51 ~ 0.59 in. (12 ~ 15 mm) above the plates, and the top surface of the battery must be kept clean and dry.

Be sure that the cap vent hole is not clogged. If the specific gravity of the electrolyte is found below 1.25, the battery should be recharged.

10. ALTERNATOR

The generator is of the alternator type, and the ground polarity is negative. Special care should be taken as to wiring, accordingly. The alternator is of the oil-less type.

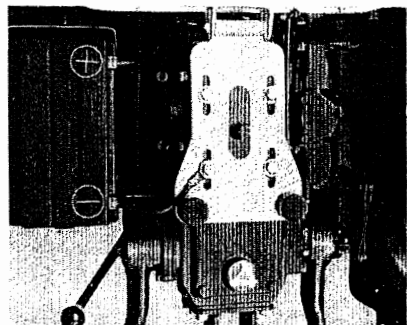


Fig. 40 Negative Ground Polarity

11. STARTING MOTOR

The starting motor should be periodically checked by your SATOH dealer. If the starting is difficult, it may be due to the insufficient capacity of the battery.

Check the battery for capacity and recharge if necessary. Also, it is requested to check the fan belt of its tension. If this does not cure the starting difficulty, the carbon brushes or magnetic switch may be defective. Consult your SATOH dealer.

There will be also a possibility that a sufficient amount of the current flow required to start the starting motor, is not available, even if the light goes on brightly. In this case, the battery terminals may possibly be loosened or the regulator is faulty. Avoid trying hard to run the starting motor when starting is difficult, otherwise, the starting motor or the battery will be damaged. Consult your SATOH dealer.

12. FAN AND GOVERNOR BELTS

Keep correct tension of the fan and governor belts. The correct slack of the fan belt is 0.40 ~ 0.51 in./22.05 lbs. (10 ~ 13 mm/10 kg) in the drive direction when press the belt by the pressure of 22.05 lbs. (10 kgs), and the same of the governor belt is 0.55 ~ 0.67 in./22.05 lbs. (14 ~ 17 mm/10 kg). Adjustment can be done by shifting the alternator (C) and the governor tension pulley (F) in the direction of the arrow. (Fig. 41)

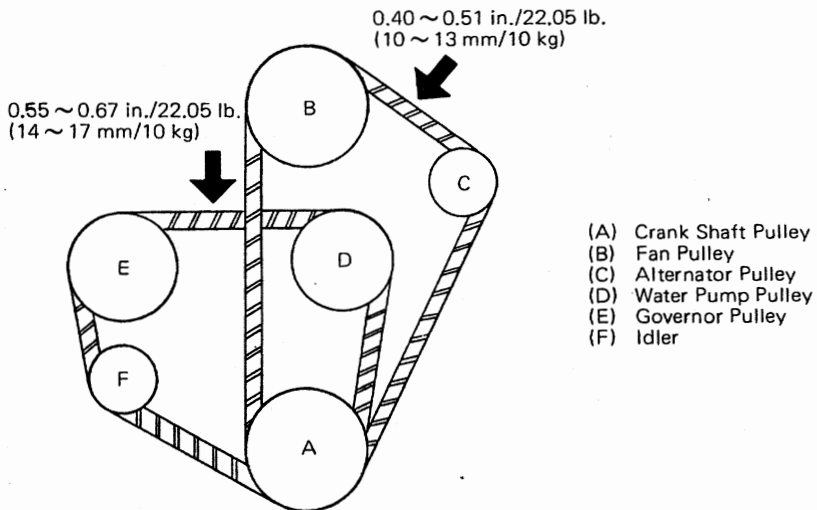


Fig. 41 Belt Adjustment

13. FUSE

Fuses are installed on the wiring inside the instrument panel, including 10-A fuses for the pilots of the water temperature warning lamp, battery charge warning lamp and oil pressure warning lamp incorporated in the tractor meter, and two 10-A fuses (in a fuse holder) for the light switch. If any fuse is burned out, check for the cause before replacement.

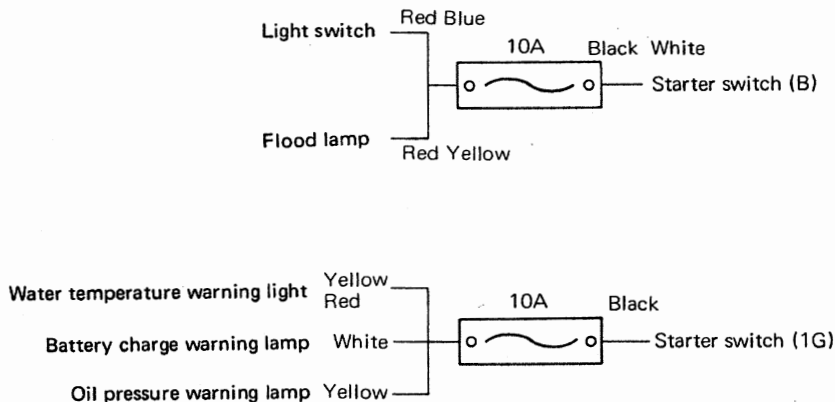


Fig. 42

14. BRAKE ADJUSTMENT

The brakes, both for right and left, are independent of each other. If the tractor frequently makes a right turn in operating (particularly in plowing), the right side brake lining wears more than the left. For adjustment, link both right and left brake pedals and adjust the adjusting rods so that they are effected evenly. The pedal free-play (free-pedal amount and travel amount) should be 1.57 in. (40 mm) as shown in Fig. 43.

Note: When the tractor runs on roads, both brakes should be linked.

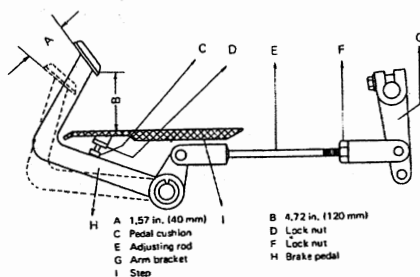


Fig. 43

15. CLUTCH ADJUSTMENT

The clutch pedal free-play should be 1.57 in. (40 mm) at A as shown in Fig. 44. The free-play is very important to keep the correct free travel of the clutch release thrust bearing.

The pedal free-play is locked by one turn unscrewing the adjusting bolt B from the position where the bolt is contacted with the pedal hanger D, after depressing the pedal.

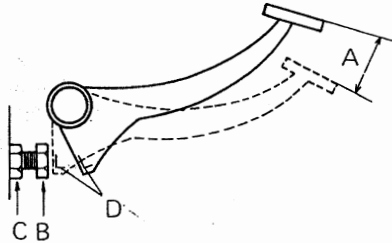


Fig. 44 Clutch Pedal

16. CENTER BEAM AND FRONT HUB

The center beam pin is always loaded, therefore, the A portion as shown in Fig. 45 should be greased. For other greasing, refer to *Greasing Chart of SECTION 2 REGULAR MAINTENANCE*. If the front axle shows excessive wear because of lack of periodical greasing, consult your SATOH dealer.

The front hub is greased when the tractor is assembled in the factory, and the preload of the bearing is also set at the same time. Every 500 hours of operation, they should be checked. If necessary, the grease should be replaced and the preload be readjusted. To adjust the preload, screw in the slotted nut up to a slightly seated position, then, screw out by $1/8 \sim 1/16$ turn. Lock it with a cotter pin.

Note: For this adjustment, jack up the front wheels.

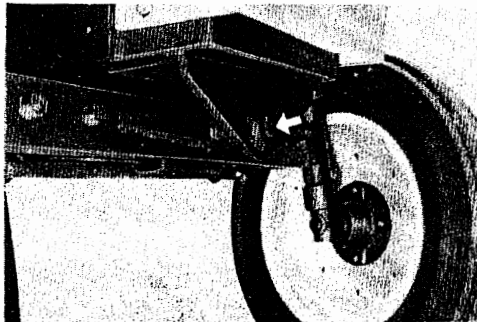
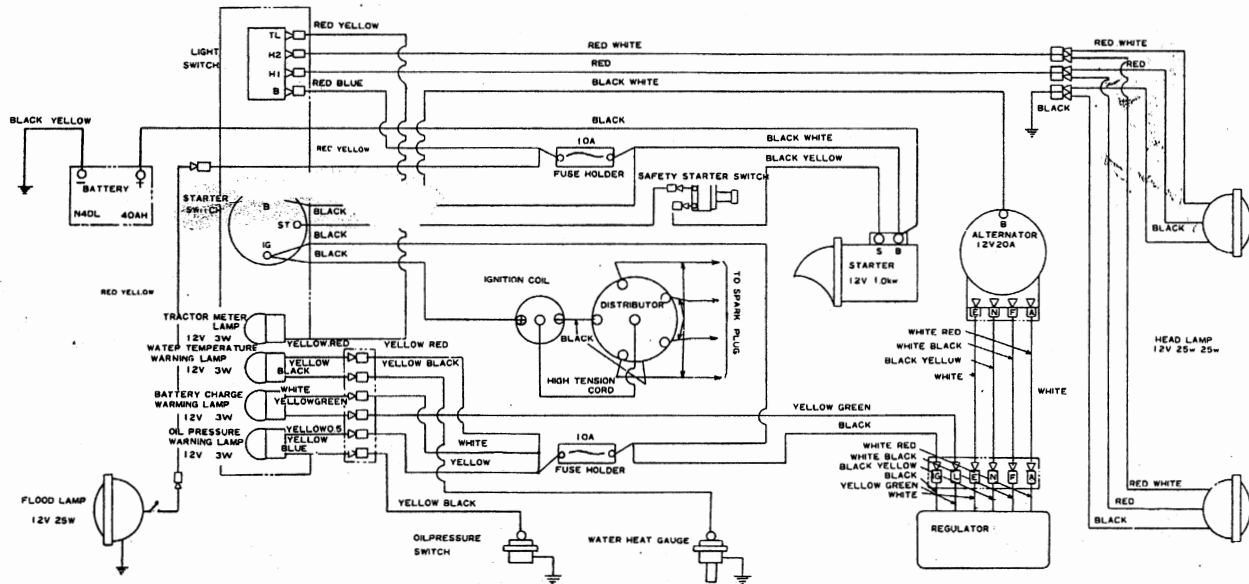


Fig. 45 Center beam Pin

17. ELECTRICAL WIRING CHART

Fig. 46



SECTION 4. SPECIFICATION AND DATA

ENGINE

Type	P.B.
Number of cylinders	4
Cylinder arrangement	In series
Piston displacement	60.2 in ³ (987 cc)
Bore and stroke	2.6772 x 2.6772 in. (68 x 68 mm)
Rated r.p.m.	2,800 r.p.m.
Maximum r.p.m.	3,150 r.p.m.
Rated power	23 PS/2,800 r.p.m.
Maximum power	25 PS/2,800 r.p.m.
Maximum torque	46.9 ft-lb/2,200 r.p.m. 6.5 kg-m/2,200 r.p.m.
Compression ratio	8.6 : 1
Compression pressure	145 lb/in ² (10.2 kg/cm ²)
Ignition order	1, 3, 4, 2
Valve position	Overhead valve system
Weight	258 lbs (117 kg)
Valve clearance	Intake 0.010 in. (0.25 mm) Exhaust 0.010 in. (0.25 mm)

COOLING SYSTEM

Thermostat type	Wax type
Water pump type	Geared wing pump
Temperature at which thermostat begins to open	180°F (82°C)
Temperature at which thermostat is fully opened	203°F (95°C)

FUEL EQUIPMENT

Fuel	Gasoline
Fuel pump	Mechanical diaphragm type
Fuel filter	Cartridge filter
Carburetor	Model 210028 - 061

LUBRICATION SYSTEM

Oil pump	Trochoid gear
Filter	Cartridge filter

ELECTRICAL SYSTEM

Generator	Alternator type (AC)
Battery	12V, 40AH
Starting motor	Model 28000-267-0
Starting motor output	12V/1.0kW

ENGINE PERFORMANCE CURVES

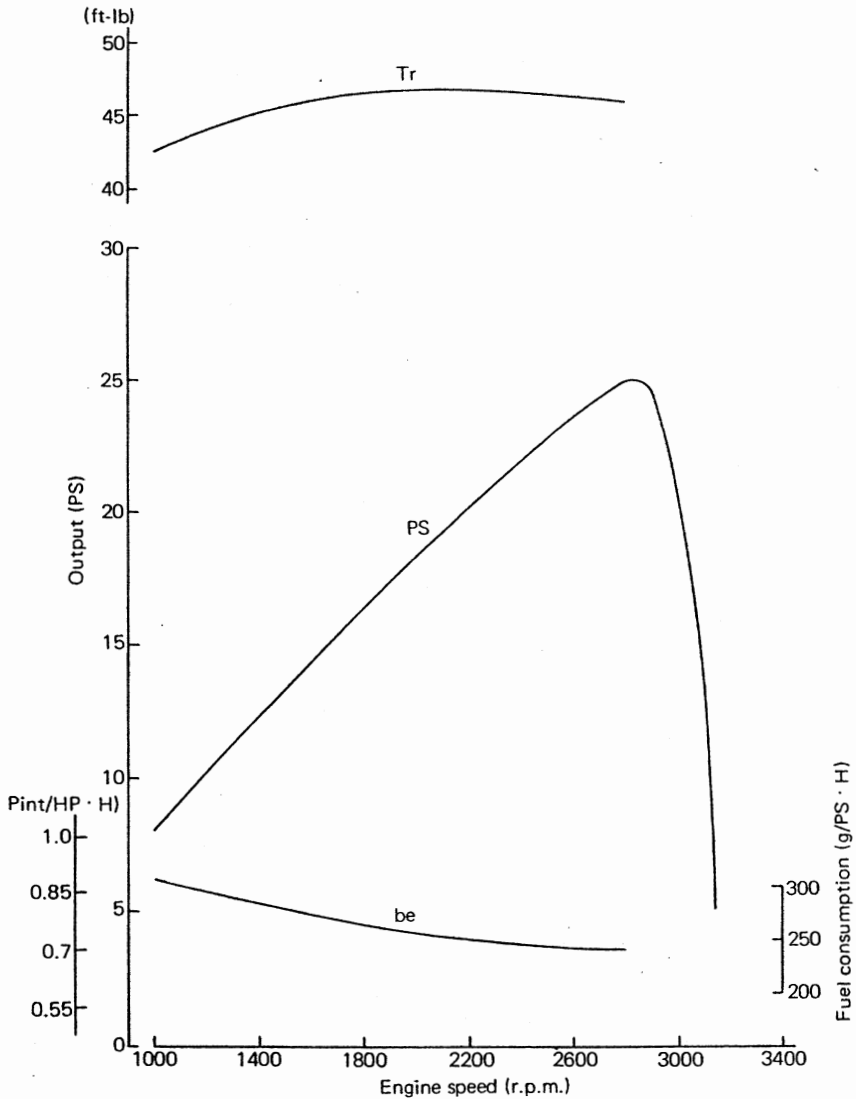


Fig. 47 Engine performance curves

CAPACITIES (APPROXIMATE INITIAL FILL)

Cooling system	1.85 gsl.	7 ℓ
Air cleaner oil bath	0.44 pt	0.25 ℓ
Engine lubricating oil	5.28 pt	3 ℓ
Governor oil	0.0704 pt	0.04 ℓ
Transmission oil	4.49 gal.	17 ℓ
Steering oil	0.704 pt	0.4 ℓ
Hydraulic oil	6.16 pt	3.5 ℓ
Fuel	9.5 gal.	36 ℓ

DIMENSIONS ON STANDARD TYPE

Overall length	94.88 in.	(2,410 mm)
Height up to steering handle	54.72 in.	(1,390 mm)
Overall width — standard	52.87 in.	(1,343 mm)
Wheelbase	60.43 in.	(1,535 mm)
Ground clearance under front axle	14.69 in.	(373 mm)
Ground clearance under draw-bar frame	13.59 in.	(354 mm)
Weight — with oil fuel, etc.		
— total	2,105 lb.	(955 kg)
— rear axle	1,389 lb.	(630 kg)
— front axle	716 lb.	(325 kg)
Turning radius — without brakes	102.4 in.	(2,600 mm)
— with brakes	90.6 in.	(2,300 mm)

PERFORMANCE

Maximum P.T.O. horsepower	22.7 HP	(23 PS)
P.T.O.—rated P.T.O. horsepower	21.7 HP	(22 PS)
Maximum draw-bar pull	1,430 lb.	(650 kg)

POWER LIFT

Type of hydraulic pump	Gear type	
Maximum operating pressure	1,777.5 lb/in ²	(125 kg/cm ²)
Maximum lift power at the lower link	1,102.5 lb	(500 kg)
Output of pump	5.2 gal/min	(19 ℓ/min)
	1,500 r.p.m.	Engine

CLUTCH

Type	Dry single disc	
Clutch diameter	7.25 in.	(184.2 φmm)
Clutch area		

TRAVEL SPEEDS ON 11.2 / 10 – 24 TIRES

Speed	Selector Lever Positions	Engine Speed at 2,800 r.p.m. 11.2/10–24 Tires		Rear Wheel
		mile/h	km/h	r.p.m.
1	L1	0.853	1.37	6.64
2	L2	1.220	1.96	9.49
3	H1	1.636	2.63	12.73
4	H2	2.337	3.76	18.10
5	L3	4.620	7.43	35.94
6	H3	8.843	14.23	68.80
R1	LR	1.607	2.59	12.50
R2	HR	3.076	4.95	23.93