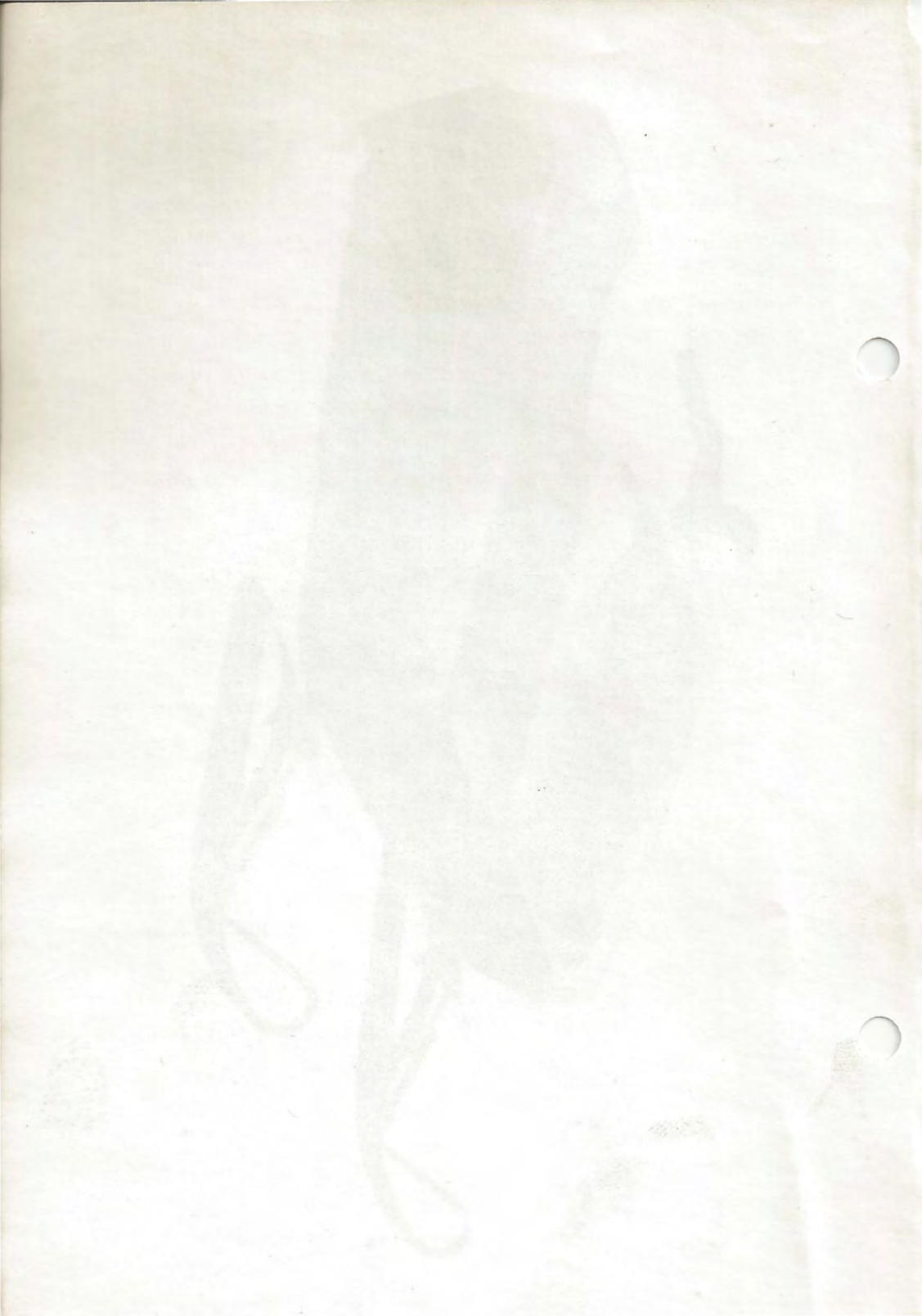
Polaris®

1973

TX starfire

OWNERS TECHNICAL MANUAL

$3.50



INTRODUCTION

The following pages of this manual cover one of the most sophisticated high performance snowmobiles on the market today. The 1973 TX Starfire snowmobile — — — "a finely tuned, quality performance machine that is backed by a heritage of leadership which is unique in the industry."

The 1973 TX Starfire and this manual are the results of the Polaris Race Team joining forces with the newly formed "Polaris Competitive Snowmobile Engineering Department".

This manual covers not only technical and service information but a certain amount of theory related to the contents enclosed. All information and specifications are printed to the best of our knowledge at this time. "Changes and adjustments usually are required after meeting our competition and to suit various track conditions" so there can and will be some changes to this manual. To enable us to send this new information to you it is essential that the tear-out card in the back of this manual be filled out in full and mailed to Polaris.

Good luck and successful racing to all of you.

Competitive Snowmobile Eng. Dept.
POLARIS
A Textron Company
Roseau, Minnesota 56751

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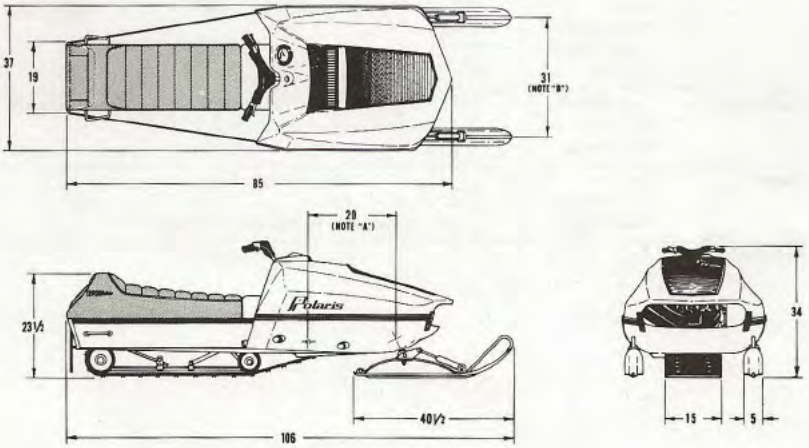
GENERAL DIMENSIONS

Below are the general dimensions of the 1973 TX Starfire. You will note that the styling and some important dimensions have changed. These changes were made to further improve the handling characteristics of this machine.

As compared to the 1972 Polaris TX Starfire the '73 chassis is 6" longer (Note 'A'). This is required for improved turning and handling. The ski stance for '73 is 3" wider for better stability (Note 'B') and more precise steering control on tight corners.



SPECIFICATIONS

The specifications on this page are very general. More detailed specifications will be covered under each separate item.

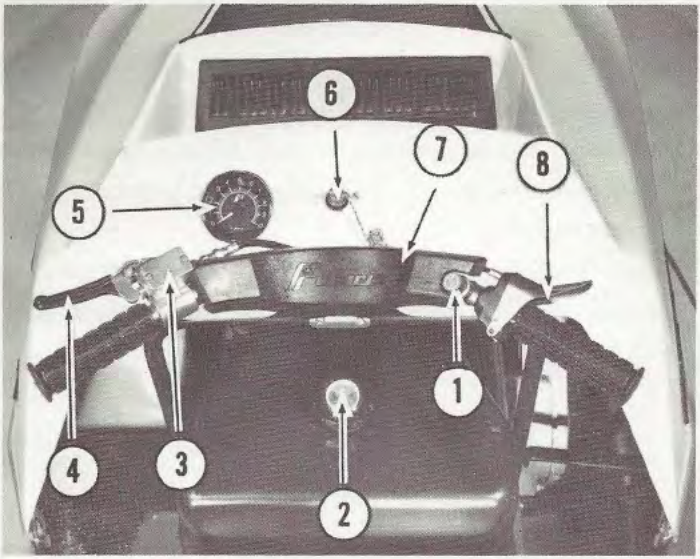
ITEM		294	335	439	649
TX Starflame Engine	Number of Cylinders	2	2	3	3
	Bore	58mm	62mm	58mm	67.75mm
	Stroke	55.6mm	55.6mm	55.5mm	60mm
	Carburetor	Mikuni VM34	Mikuni VM36	Keihin RD38	Keihin RD50
	Displacement	293.79cc	335.7cc	439.9cc	648.8cc
	Material	Aircraft Aluminum			
Chassis	Overall Length	106"	106"	106"	106"
	Overall Width	37"	37"	37"	37"
	Overall Height	34"	34"	34"	34"
	Weight				
Track	Track Width	15"	15"	15"	15"
	Track Material	Rubber with machine riveted cleats or molded rubber			
	Standard gear ratio	13 - 35	16 - 39	16 - 35	17 - 35
Ignition	Type	Kokusan Capacitor Discharge			
	Timing Specs (5000 RPM)	3.5mmBTDC 26°	3.5mmBTDC 26°	3.5mmBTDC 26°	3.75mmBTDC 26°
	*Spark Plugs (Champion)	N57	N57	N57	N57
	Plug Gap	.018"	.018"	.018"	.018"
Fuel System	Tank Capacity	3.5 U.S. Gal.	3.5 U.S. Gal.	3.5 U.S. Gal.	3.5 U.S. Gal.
	Fuel Type	Premium, not less than 98 octane			
	Mixing Ratio	16 : 1 Four gallons to one quart			
Brakes	Type	Hydraulic Disc Brakes			
	Disc Diameter	7¾"	7¾"	7¾"	7¾"
	Fluid Type	Automotive Hydraulic Brake Fluid			
Suspension	Type	Equaliberator Slide Rail			

*Machines come equipped from factory with Champion N59G Spark plugs. Use these plugs for break-in ONLY. After break-in, install N57 Champion Spark Plugs.

CONTROLS AND INSTRUMENTS

The controls and instruments on your 1973 TX Starfire are located in the position we feel is most convenient. We do recommend, however, that each person relocate his or her throttle and brake levers to positions better suiting the individual's driving style for maximum control and safety.

WARNING: The brake lever is part of the master cylinder assembly and will not function properly if rotated more than 10° up or down from the factory assembly position.



1. **Shut-off Switch**
2. **Gas Cap**
3. **Master Cylinder**
4. **Brake Control**
5. **Tachometer**
6. **Tether Switch**
7. **Handle Bar Padding**
8. **Throttle Control**

BRAKES

As performance and the new design are at the ultimate on the '73 TX Starfire, it was necessary to incorporate a different hydraulic brake system. This is the Kelsey Hayes caliper system with a 7 3/4" diameter disc and the standard Polaris master cylinder.

This system is very simple, but does need to be inspected periodically.

Before each race, we strongly recommend that the following be inspected:

1. Check brake hoses and fittings for signs of abrasion and leakage.
2. Check fluid level in master cylinder. If low, use ONLY an automotive type hydraulic disc brake fluid. This is available from automotive supply houses or from Polaris. Do not use hydraulic oil, mineral oil, aviation fluids, or any red fluids.
3. Check brake handle for a solid 'squeeze'. If action feels spongy, air has possibly entered the system and the system will have to be bled.

Bleeding the Hydraulic Brake System

To bleed the system, the following method should be followed.

1. Remove master cylinder reservoir cover and fill to top lip of reservoir. Refer to Fig. 1, Item A.
2. Slip rubber tube over ball of top bleeder valve to direct fluid away from painted surfaces. Refer to Fig. 2, Item A.
3. Squeeze brake lever (slowly) a full stroke and hold; to release air through tube, unscrew top bleeder valve 3/4 turn. Close bleeder valve, then release brake lever. Repeat above procedure until fluid flows from bleeder valve in a solid stream that is free of air. Check master cylinder reservoir periodically to make sure that it contains fluid.

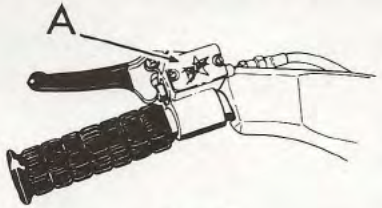


Fig. 1

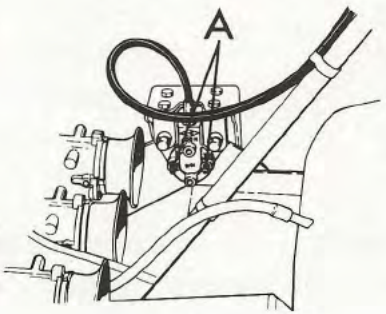


Fig. 2

GEARING

The selection of the proper chain sprocket ratios are essential to achieve maximum performance. Track condition, snow conditions, temperatures, weather, altitude, driver weight, etc. are some of the factors which must be considered in the selection of the proper ratio.

Your 1973 TX Starfire performance machine comes equipped with the following sprocket ratios:

Machine	294	335	440	650
Gears	13-35	16-39	16-35	17-35
Chain pitch				

Optional sprockets are as follows:

Number of teeth	Polaris Part Number
12	3221020
13	3221012
14	3221023
15	3221008
16	3221021
17	3221009
19	3221010
21	3222008
23	3222017
35	3222021
39	3222026
41	3222025

The following sprocket to gear ratio chart will be a great benefit to you when selecting the proper combination.

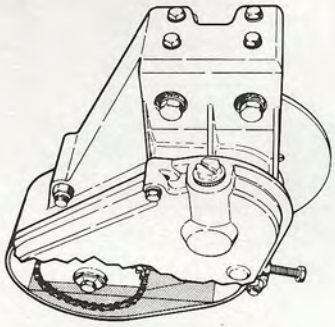
GEARING

Sprocket Combination	Ratio	Chain Pitch	Chain Part Number
23 - 35	1.52	66	3224020
21 - 35	1.67	64	3224019
23 - 39	1.70	68	3224021
23 - 41	1.78	68	3224021
19 - 35	1.84	64	3224019
21 - 39	1.86	66	3224020
21 - 41	1.95	68	3224021
17 - 35 (650)	2.06	62	3224018
19 - 39	2.05	66	3224020
19 - 41	2.16	66	3224020
16 - 35 (440)	2.19	62	3224018
17 - 39	2.30	64	3224019
15 - 35	2.32	62	3224018
17 - 41	2.41	66	3224020
16 - 39 (335)	2.42	64	3224019
14 - 35	2.50	62	3224018
16 - 41	2.56	66	3224020
15 - 39	2.60	64	3224019
13 - 35 (294)	2.70	60	3224017
15 - 41	2.73	66	3224020
14 - 39	2.79	64	3224019
12 - 35	2.91	60	3224017
14 - 41	2.93	64	3224019
13 - 39	3.00	64	3224019
13 - 41	3.18	64	3224019
12 - 39	3.25	62	3224018
12 - 41	3.42	64	3224019

Higher ↑ ↓ Lower

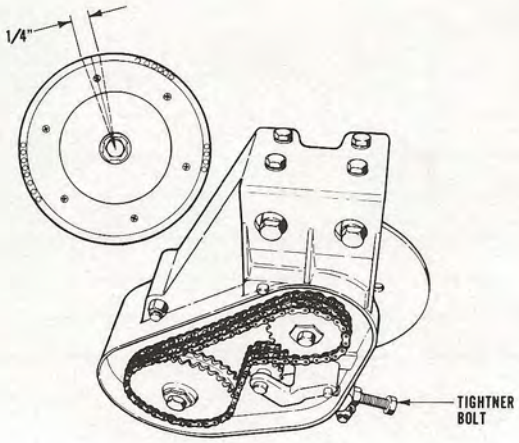
CHAINCASE OIL LEVEL

The drive chain within this model is constantly immersed in oil. Maintain oil level with No. 10 weight non-detergent engine oil. We recommend that chaincase oil be checked on a weekly basis. The proper amount of oil is ½ pint (237cc) in an empty case.



DRIVE CHAIN TENSION

To maintain lasting chain and sprocket life the drive chain tension is very important. Chain tension should be checked on a weekly basis. The proper tension is ¼" free play at driven sheave rim (see diagram). To tighten chain loosen lock nut and turn tightner bolt clockwise and lock. To loosen reverse above procedure.

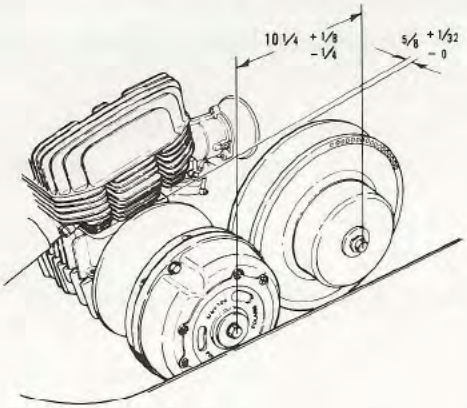


CLUTCH ALIGNMENT AND CENTER DISTANCE

Due to the lower center of gravity location of the engine the center distance between the center of the crankshaft and the center of the jackshaft is not adjustable. Should the distance change, it will be necessary to inspect the mounts and mounting bolts for proper tightness, distortion, or breakage.

The proper center distance is $10\frac{1}{4}''$ $^{+1/8''}_{-1/4''}$.

The sheave offset is $5/8''$ $^{+1/32''}_{-0''}$. This is adjusted by either adding or removing the spacer washers from behind the driven clutch.



After alignment, you should very carefully start the engine, accelerate the machine to get the belt to the top of the drive clutch and make certain the belt is running in a straight line. Clutch center distance and alignment should be checked weekly or immediately after a belt is replaced.

WARNING: Do not rev engine above level required to get belt to top of drive clutch when in unloaded condition (approximately 7500 RPM). Stay clear of all moving parts.

STEERING

Your 1973 TX Starfire performance snowmobile comes equipped with carbide ski skags for more precise high speed handling. These new skags exert a greater amount of force not only on the skag itself but also on the entire steering assembly. We recommend that to achieve maximum life from the skag that you tack weld this skag to the ski board in addition to the bolts.

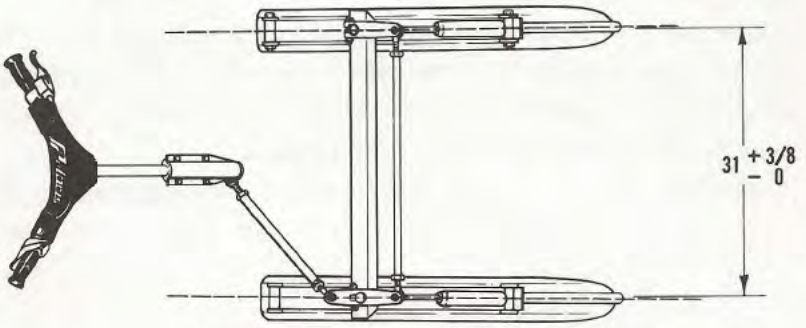
For your own safety and reliability, it is important that weekly all nuts, bolts, and tie rod ends be checked for looseness or stress damage.

Ski tow-in should be checked at the same time. Skis should be parallel when in the straight ahead position to each other to 3/8" toe-out.

WARNING: Never operate your 1973 Starfire with skis toed-in or your 'Polaris may set you free.'

If adjustment is required:

1. Release tie rod end locknuts.
2. Rotate tie rod until alignment is correct.
3. Tighten locknuts.
4. In the event that any of these items are damaged or overstressed, we recommend replacement of complete tie rod and rod end bearings in sets.



TRACKS AND STUDDING

Your 1973 TX Starfire performance snowmobile will come equipped with either the performance cleated track or the long distance molded rubber track, as ordered.

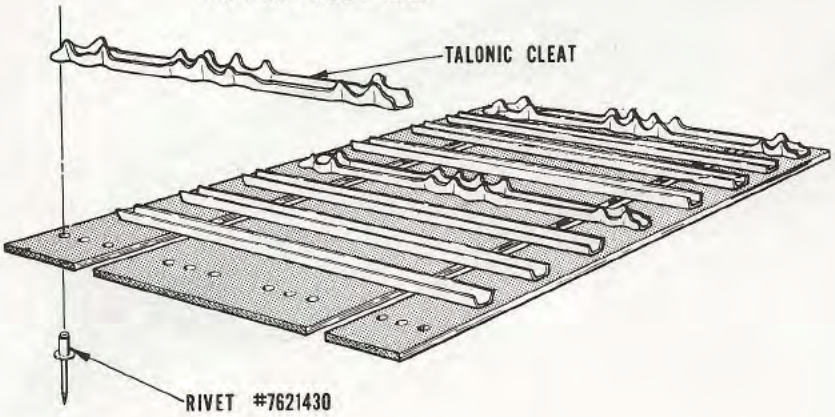
The performance cleated track is equipped with nine (9) 'Talonic Cleats', eighteen (18) Guide Cleats and ten (10) Standard Cleats.

Ice studs are not necessary.

Although the nine (9) Talonic Cleats are sufficient for most conditions, it will be necessary to add or remove some of these cleats depending on the track and conditions you are running on.

IMPORTANT!! After every day of racing check track material, cleats, and rivets for damage or breakage; replacing when necessary.

WARNING: The rivets used for holding on the cleats on Starfire model are of a different alloy than those used on all other Polaris models. It is essential that when installing new rivets to use the ones specified for the TX Starfire. These are available from Polaris by ordering part number 7621430.



TRACKS AND STUDDING (Con't.)

The long distance molded rubber track is a proven track for your long distance endurance races and is equally good on the oval.

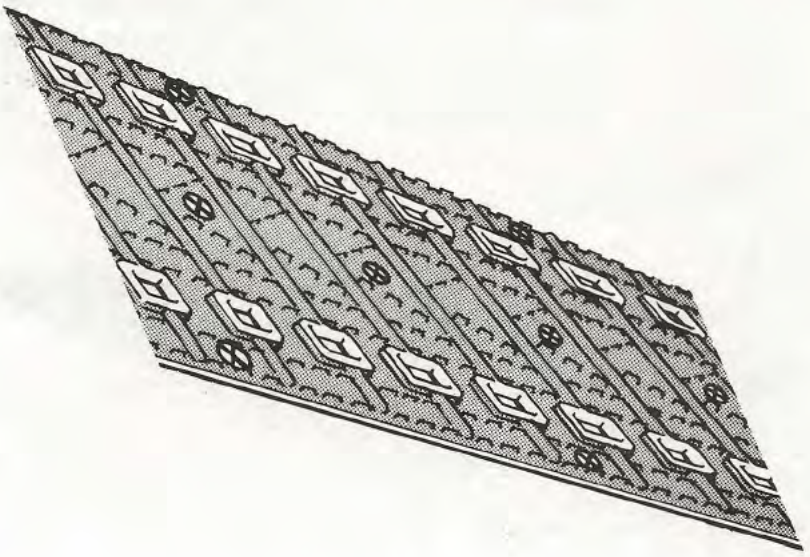
This track comes without ice studs installed because many people have their own ideas of which stud is the best. However, we do recommend the carbide tipped ice stud available from:

Special Sports Products Corporation
1573 Pinecrest Drive
Cario, Michigan 48723

Roetin Industries
24 Saginaw Drive
Rochester, New York 14623

and many other sources.

The recommended pattern for studding this track is shown in the diagram below.



TRACK ALIGNMENT AND TENSION (Both Tracks)

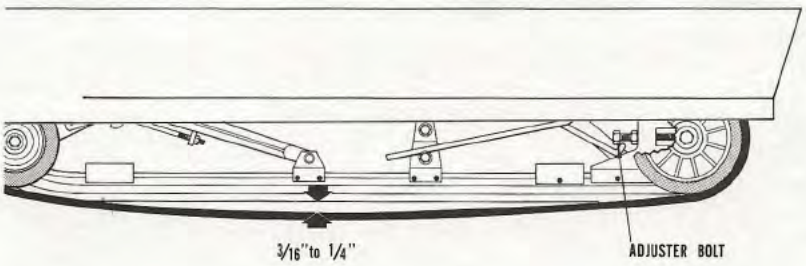
Proper track tension must be maintained to attain maximum performance from your TX Starfire machine. If the track is too loose, it will have a tendency to chatter as the cleats or studs scrape the inside top of the tunnel. If it is too tight, a great amount of pressure will be applied to the slide rail wear bars, resulting in friction drag and loss of performance.

Improper alignment will cause the track to run against one side of the slide rail or the other causing dragging action and also resulting in poor performance.

The proper tension is accomplished by the following:

1. Lift rear of machine and support it off the ground.
2. Allow the slide rail to apply pressure on track.
3. Track should have 3/16" to 1/4" of gap between track and lowest point of slide rail at midpoint of the track.
4. Adjust to proper tension by either loosening or tightening the adjuster bolts.

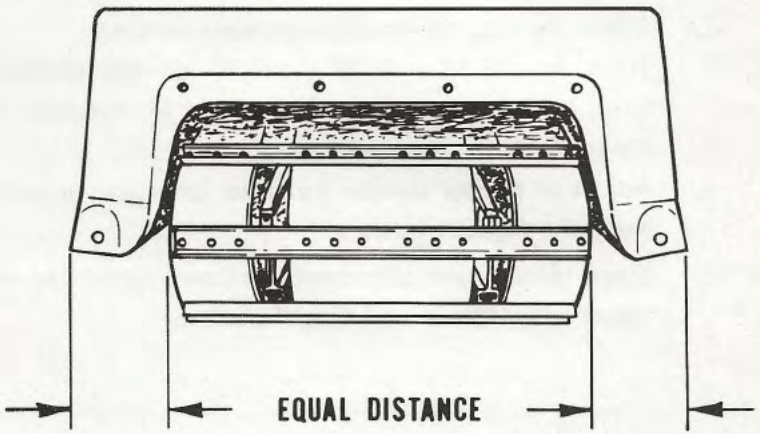
NOTE: Track tension and alignment are inter-related. Do not adjust one without adjusting the other.



TRACK ALIGNMENT

After track tension has been corrected, pull track through a couple of revolutions. Check to see that track is well-centered between tunnel and slide rail. To adjust, loosen lock nut and tighten adjuster bolt on side where track is closest to frame. Tighten lock nut and recheck alignment.

WARNING: Always stay clear of moving parts when performing such checks and adjustments.



NOTES

TRACK REMOVAL

Your 1973 TX Starfire is equipped with a quick change front drive shaft. This unique system was developed for two very important reasons:

1. It is extremely fast to change tracks . . . approximately ten minutes from start to finish.
2. The chaincase, gearing, and driven clutch do not have to be removed. Without having to remove any of these items, your clutch alignment and center distance will not change.

To remove track: (See opposite page)

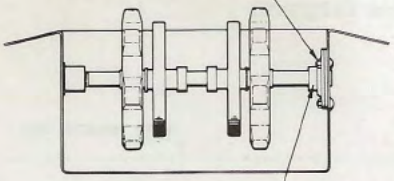
NOTE: Leave chaincase as is! It is not necessary to remove cover, chain or gears.

1. Remove slide rail.
2. Loosen front drive shaft bearing lock collar.
3. Loosen only the bottom two (2) bearing flangette supporting bolts (do not remove).
4. Slide front shaft from splines in stationary hub mounted to the chaincase.
5. Pivot front drive shaft and bearing in flangette.
6. Slide front shaft from bearing and remove shaft and track.
7. To reinstall, reverse the above procedure.
8. Check track alignment and tension.

NOTE: When tightening bearing lock collar, tighten with the rotation of the front drive shaft.

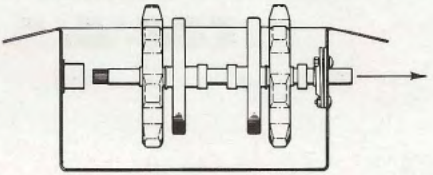
TRACK REMOVAL (Con't.)

3. LOOSEN BOTTOM SUPPORT BOLTS

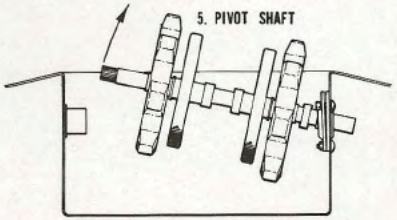


2. LOOSEN LOCK COLLAR

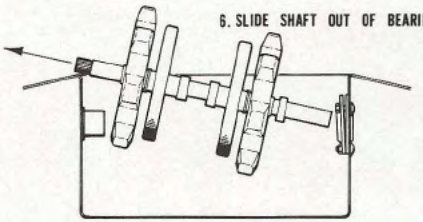
4. SLIDE SHAFT INTO BEARING



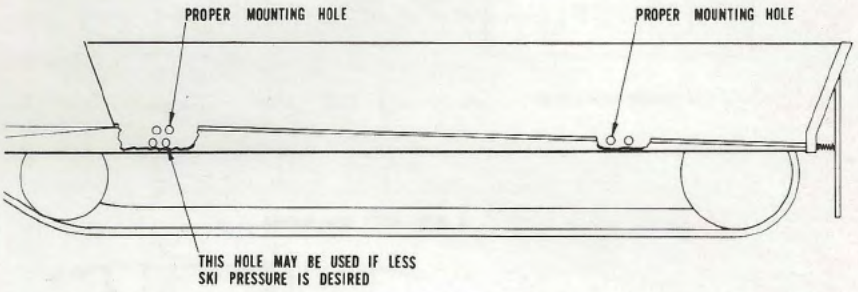
5. PIVOT SHAFT



6. SLIDE SHAFT OUT OF BEARING



When reinstalling slide rail, be certain that you use the proper mounting holes in the tunnel. (See diagram)

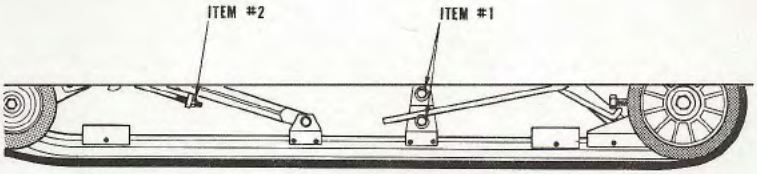


NOTES

SUSPENSION

The 1973 TX Starfire is equipped with a redesigned slide rail system. This suspension is basically the same as used on other Polaris models. There are two (2) major adjustments on this system. They are as follows:

1. Rear springs have two (2) adjustments for driver weight. For drivers between 100 - 160 pounds, put the springs in the lowest position; for drivers 160 pounds and over, put the springs in the top position (refer to item no. 1).
2. Front springs are adjustable by tightening or loosening the adjustment nuts on the springs. Adjust these for track or surface condition by applying or decreasing the amount of pressure on the front torque arm (refer to item no. 2).



Before attending your first race, we suggest that you try all adjustments and different positions to attain the best ride and handling characteristics for your style of riding.

Slide rails should be visually inspected weekly for worn or damaged parts; if worn or damaged, they must be replaced prior to continued use.

WARNING: Never operate machine on gravel, dirt, or glare ice without snow for long periods of time, as it is damaging to the slide rail and track assemblies.

NOTES:

DRIVE BELT

The drive belt is used to transfer power from the engine to the track through the drive and driven clutches. A great amount of torque and surface speed are put through the belt.

Before each and every race or heat race, remove belt and inspect for distortion, wear, or fatigue. If it is bad, replace with a new belt.

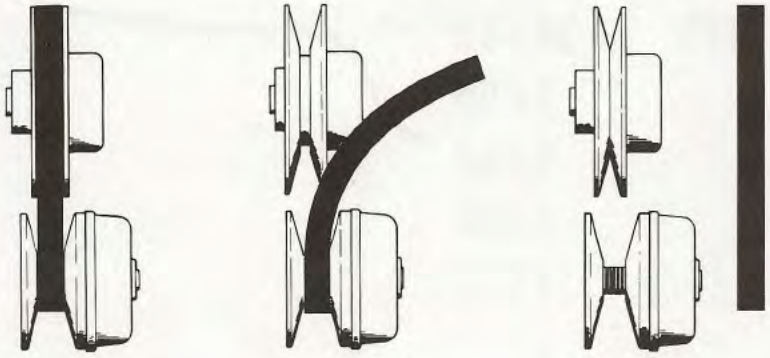
NOTE: Drive belts must be kept free of dirt, grease, oil, and moisture both when in use and in storage.

BELT REMOVAL AND INSTALLATION

(See Diagram)

1. With hood off, open the driven sheave by pushing and twisting.
2. Pull bottom of belt in toward inside of driven pulley. Slip loose belt over top edge of sheave.
3. Remove old belt from drive sheave.
4. To install new belt, reverse procedure, being careful not to damage belt and keeping it free of moisture, dirt, etc.

WARNING: Never start or run engine with belt removed.



DRIVE CLUTCH

THE DRIVE CLUTCH ON YOUR 1973 TX STARFIRE IS WITHOUT A DOUBT THE SECOND MOST IMPORTANT ITEM ON YOUR MACHINE AFTER THE ENGINE. It is like the brain in the human body – – if the human brain is not functioning properly, the body is not working properly. The clutch is the same. If it doesn't work properly, neither does your machine.

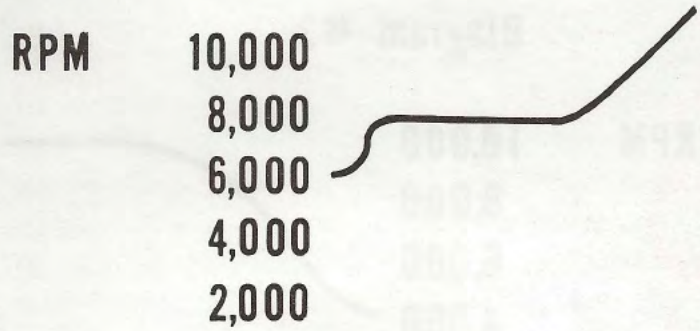
This clutch is an RPM and torque sensing unit designed to transfer the maximum amount of horsepower from the engine to the ground. This is accomplished by weights and a spring inside the unit reacting to overcome the centrifugal force applied to it from the engine.

The spring and weights work in combination. The spring resists the force of the weights mainly for engagement but assisting through the complete shift pattern. If the weights are too light (not heavy enough), the clutch will give you a 'fair' engagement. Immediately the engine will obtain very high RPM, but the belt will not go into high gear (top of the clutch). (See diagram no. 1).

Diagram #1

If the weights are too heavy (too much weight), you will have a good engagement, the engine RPM's will be low and drive the clutch into high gear; then the RPM's will gradually increase. (See diagram no. 2).

Diagram #2



NOTES

If weights and spring are matched properly, the engagement speed will be correct and engine RPM will immediately go into desired RPM and stay there on both up shifting and down shifting. (See diagram no. 3).

Diagram #3

NOTE: It is essential that the drive clutch be disassembled weekly and cleaned. Lubricate all moving parts with a light coat of machine oil.

NOTE: Specification sheet on page 31 for proper RPM setting for spring and weights.

CLUTCH SPECIFICATIONS

Clutch	294	335	440	650
Part Number	1321215	1321216	1321217	1321218
Springs				
Part Number	7041036	7041036	7041036	7041036
Spring dia. (wire size)	.170"	.170"	.170"	.170"
Spring I. D. (color)		Dayglow Pink		
Weights				
Part Number	5630067	5630091	5630065	5630066
Weight in grams	34.5	36	40	44
Weight I. D. (Letter identification)	L	R	J	K
Engagement Speed RPM	6,000-7,000	6,000-7,000	6,000-7,000	6,000-7,00(
Maximum Horsepower				
(RPM where clutch should run)	9,000*	9,000*	9,000*	9,000*
Optional Weights				
Part Number	5630090	5630089	5630068	5630064
Weight of Weight in grams	Q = 38g	P = 42g	M = 47g	H = 50g
	5630096			5630080
	T = 32g			N = 54g
Optional Springs	.179"	.179"	.192"	.192"
Part Number	7041040		7041037	7041037
	Dayglow Orange		Dayglow Yellow	

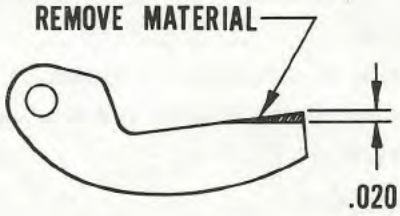
NOTE: Weights and springs shown above may have to be changed from standard production depending on geographical area, weather, track conditions, or if engine is altered from original equipment.

Machines running at elevations in excess of 6,500 feet above sea level will most likely have to use next lighter weight than original equipment.

* With engine warmed up

TROUBLE SHOOTING – DRIVE CLUTCH

Problem	Probable Cause and Fix
Clutch engagement too low	Spring has lost its tension Check height with new spring, replace if necessary
Clutch engagement too high	Spring too heavy - replace with lighter dia. spring OR Moving surfaces dirty - clean and oil
Clutch weight too heavy or RPM too low	Replace weight with next lighter weight Check engine over for possible loss of horsepower Check clutch rollers or weights for possible seizure
Clutch weight too light or RPM too high	Replace with next heavier weight
Grease, oil, or rubber on sheaves	Find cause and sand sheaves with No. 220 grit sandpaper
Lightest weight too heavy or no weight available between the two weights	Use the heaviest weight tried and trim as in diagram below. Trim in .020" graduations at a time. **NOTE:** When grinding weights be sure that when finished all three weights weigh the same $\pm$ .2 grams.



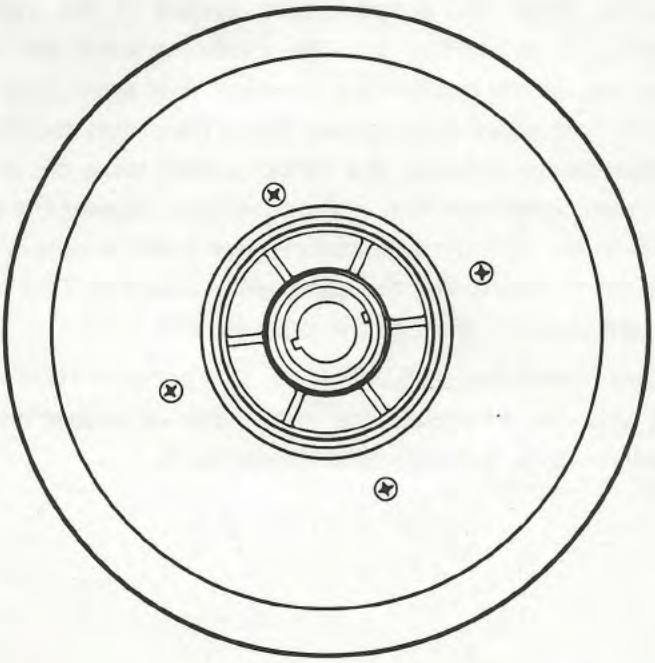
DRIVEN CLUTCH

The driven clutch for the 1973 TX Starfire has been completely redesigned and tested.

It is made from aluminum alloy die casting for better heat transfer from the belt, better balance, and less maintenance.

As stated above, this clutch is relatively maintenance free. We suggest visual inspection weekly. Lubrication is necessary between the helix hub and the stationary shaft on a weekly basis. Recommended lube is either a light coating of grease or anti-seize compound.

Correct tension of the driven clutch spring is 1/3 turn wind-up (counter-clockwise).



TX STARFLAME ENGINES

Twin Cylinder		Three Cylinder	
EC 29PR	294cc	EC 43PR	439cc
EC 34PR	335cc	EC 65PR	649cc

Your Polaris TX Starfire snowmobile is equipped with a dependable, high-performance TX Starflame fully modified two-cycle engine. Treat it right . . . give it reasonable care. The first step is to have a basic comprehension of the mechanics involved in its operation. Understanding your two-cycle engine and how it functions will enable you to better maintain your engine, resulting in longer and better performance and life at less cost to you.

A basic component of the TX Starflame two-cycle engine is the piston. When the piston moves upward in the cylinder (1st stroke), it draws fuel into the crankcase while also compressing fuel in the combustion chamber. The spark plug then ignites the fuel, which expands and forces the piston downward. The down-stroke provides the power which turns the crankshaft. It also compresses fuel in the crankcase, exposes the transfer ports in the cylinder wall and releases a new supply of fuel through the ports and into the combustion chamber. This forces the burned gases out through the exhaust ports.

When you realize that at 6,000 RPM, this happens 100 times a second, you can appreciate the importance of proper lubrication, fuel mixture, and carburetor adjustments.

Oil provides the only lubrication your engine gets. Keep in mind these recommendations:

1. Use a good grade of both oil and gasoline . . . gasoline not less than 98% octane.
2. Always mix them in proper proportions, 16:1 - - thoroughly - - and in a clean container.
3. Keep surplus fuel tightly capped to prevent evaporation, loss of volatility and power.

Too little oil means inadequate lubrication; too much oil means spark plug fouling, rapid carbonization, and over-heated pistons, all which may lead to engine damage and costly repairs.

The carburetor feeds the gas-oil mixture to the engine, mixing the fuel and air to obtain the correct volatile mixture, thus providing fuel for combustion, the lubricant, and a coolant for internal surfaces.

NOTES:

TX STARFLAME ENGINE SPECIFICATIONS

	EC29 PR 295cc	EC34 PR 340cc	EC43 PR 440cc	EC65 PR 650cc
Number of cylinders	2	2	3	3
Bore	58 mm	62 mm	58 mm	67.75 mm
Stroke	55.6 mm	55.6 mm	55.5 mm	60.0 mm
Displacement				
Cubic Centimeters	293.79 cc	335.7 cc	439.9 cc	648.8 cc
Cubic Inches	17.941 CI	20.504 CI	26.911 CI	39.631 CI
Compression Ratio – Effective	7.1 : 1	7.0 : 1	7.1 : 1	6.35 : 1
Cylinder Head Volume CC	15.5 cc	18.5 cc	15.5 cc	22.75 cc
Connecting Rod Material	Chromium moly steel			
Connecting Rod Brg. Type	Needle Bearing			
Cylinder Material	Large fin aluminum casting w/chrome liner			
Number of Main Bearings	5	5	7	7
Type of Main Bearings	Ball	Ball	Ball	Ball
Piston Type	High silicone aluminum die-cast			
Piston Clearance (Max.)	.005"	.0055"	.005"	.006"
Piston Ring Type	One Plain Type Ring Per Cylinder			
Ring Material	Steel			
Ring end gap (Max.)	.015"	.018"	.015"	.021"
Port Heights (Dimensions when port begins to open)				
Exhaust	28.6 mm	29.0 mm	28.6 mm	31.0 mm
Intake	91.8 mm	91.8 mm	91.8 mm	99.0 mm
Transfers	43.0 mm	43.0 mm	43.0 mm	47.0 mm
Port Widths (Measured in Circumference of Cylinder)				
Exhaust	37.0 mm	39.6 mm	37.0 mm	42.0 mm
Cooling	Free Air	Free Air	Free Air	Free Air

TX STARFLAME ENGINE
GENERAL INFORMATION AND MAINTENANCE

The TX Starflame engine for '73 has been completely re-designed to provide a 'winning' amount of horsepower and sustain the stresses created by competitive use. It is all new from the large fins on the cylinder head, cylinder and crank-case to chrome bore cylinders and tougher crankshaft with either 5 or 7 ball type bearings (Note specification sheet). The goal we set for ourselves was to get 160 Hp per liter and we did it.

Your TX Starflame engine is a completely modified engine and should be treated as such. The following items should be followed if you expect to receive maximum dependability and power:

1. Break-in, new engines – – We strongly recommend a break-in period of 30 minutes operating time. During the first 15 minutes, maximum throttle should not exceed 4,000 RPM with no load. The second 15 minute break-in period should not exceed 7,000 RPM (1/4 throttle). During this break-in time, use N59G spark plugs. After break-in, use Champion N57 spark plugs.

2. Use a good grade air-cooled two cycle engine oil and premium gas of not less than 98% octane mixed 16 : 1 (one quart of oil to four gallons of gas).

3. After one to two hours of operating cylinder head retaining nuts should be torqued to 13 ft. lbs. with engine COLD and weekly thereafter. (Note: refer to torque data, page 40.)

4. Keep engine and engine compartment clean. Engines with dirt, grease, and oil coating will not dissipate heat properly. A clean engine and engine compartment will also aid in the location of a problem if it should arise.

5. Engines should be checked over weekly. This includes: check all nuts and bolts, pull exhaust pipes and check the piston rings for tension and the piston for possible seizure.

6. Piston rings – Every four to five weeks or every 2½ to 3 hours, we suggest that you install new piston rings. Do not hone the 1973 Starflame cylinders, as you will damage the chrome liner. A break-in period of 10-15 minutes should be followed as per item no. 1 after re-ringing.

7. Engine overhaul – The TX Starfire engines are very simple to dismantle and reassemble. The only special tools that are necessary are:

A. Piston pin puller – Part No. 2870202

B. Clutch puller – Part No. 2870130

C. Flywheel puller – Part No. 2870159

D. Pocket knife

NOTES:

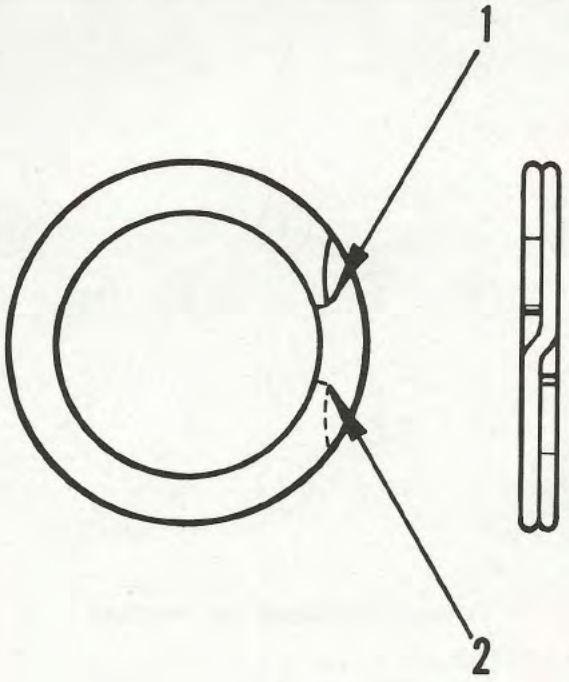
The pocket knife is to remove the new 'Spirolox' wrist pin retainer (see diagram).

To remove the 'Spirolox', take a suitable pocket knife blade and pry out on the lip (point no. 1) and unwind lock from piston. To replace, put (point no. 2) into snap ring groove and spiral into pin bore ring groove.

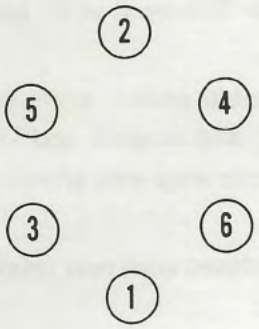
NOTE: These retainers should be replaced with new retainers after they have been removed.

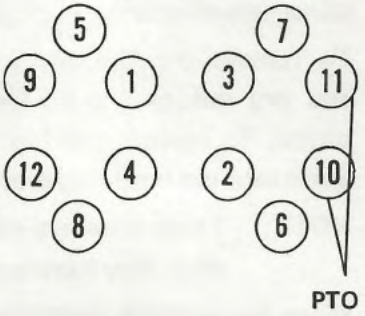
When reassembling crankcase halves, be certain that both halves are completely clean and apply a thin coat of sealer.

8. Ignition timing – see ignition section.



TX STARFLAME TORQUE PATTERNS



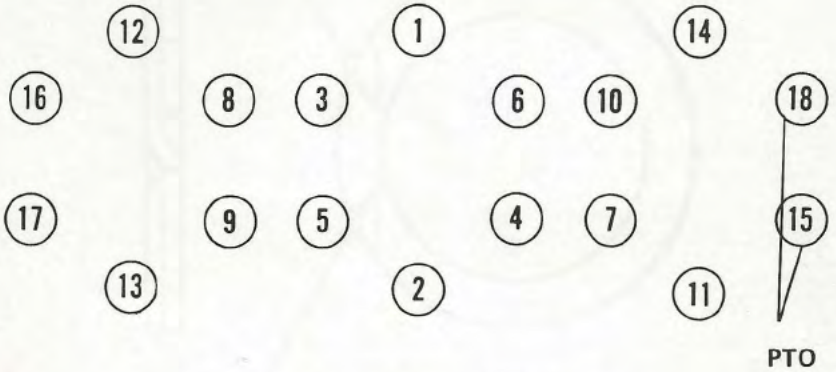


CYLINDER HEAD

14 – 17 Ft. Lbs. on new head gasket
13 – 15 Ft. Lbs. on used head gasket

TWIN CYLINDER CRANKCASE

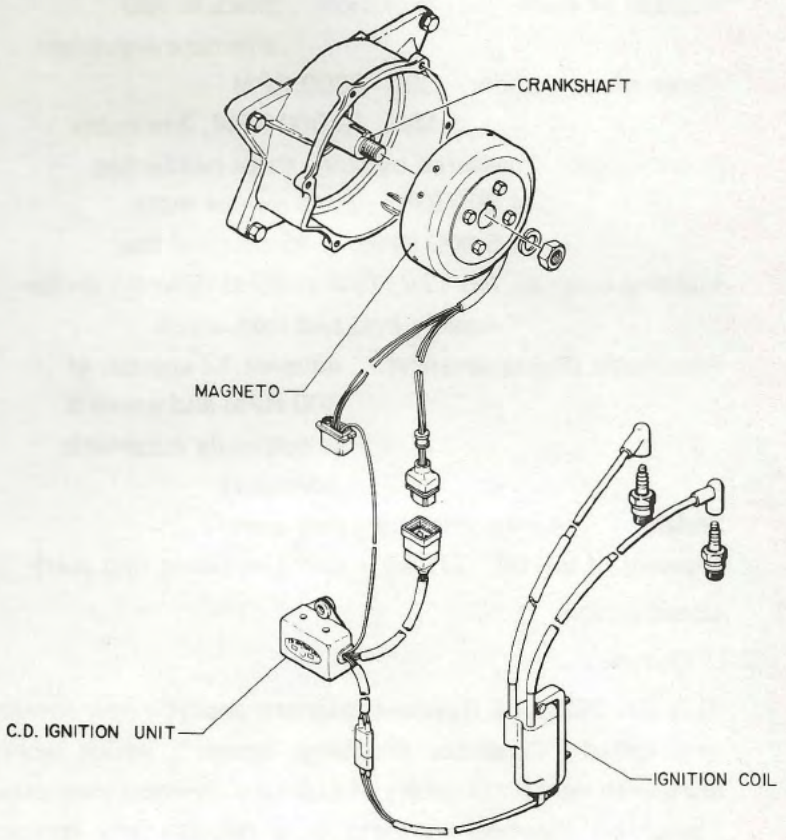
14 – 17 Ft. Lbs.
24 – 28 Ft. Lbs. – PTO



THREE CYLINDER CRANKCASE

14 – 17 Ft. Lbs.
24 – 28 Ft. Lbs. – PTO

TWIN CYLINDER IGNITION



KOKUSAN–DENKI BREAKERLESS FLYWHEEL MAGNETO TYPE GK 352

1. Specification

Rotation: clockwise

Number of sparks per revolution: twice in 180° alternate sequences

Range of revolution: 300 - 8000 RPM
Max. 10,000 RPM, 3 minutes

Spark length: measured by using three needle gap
at 300 RPM . . . . 9 mm or more
at 5,000 RPM . . 15 mm and less

Lighting output: AC 12V, 75W at 4500 RPM (to divide equally into two lead wires)

Automatic timing advancer: advance 12° approx. at 300 RPM and onward (electrically automatic advancer)

Weight: 4.5 kg (including ring gear)

Moment of inertia: 219 kg – cm^2 (including ring gear)

2. Construction

2.1 Outline

This GK 352 type flywheel magneto applys a new control unit called "Capacitor Discharge Igniter", which works alike with contact breakers of ordinary flywheel magnetos. Thus, this flywheel magneto does not use any contact breakers and conventional condensers.

GK 352 works as electric power source for said CDI unit. Hundreds voltage generated by it is stored in a primary condenser and abruptly discharged to a primary coil of an ignition coil in a timed relation with an engine operation. Then, a secondary coil generates high voltage electricity for igniting gaseous air.

2.2 Flywheel

The flywheel is of steel plate press-formed into a bowl shape. Inside are BaFerrite magnets with coesive power being fixed by screws and adhesive plastics.

2.3 Stator Plate

On an aluminum die cast alloy plate are screwed face to face an exciting coil and a pulser coil in two layers and a lighting coil. The exciting coil generates electricity to charge it to the primary condenser and the pulser coil sends signal voltage to CDI unit at the time to spark in engine operation, thereby the ignition coil generates high voltage.

2.4 CDI Unit

CDI unit has an outer-appearance as shown in drawing. In the steel case are incorporated diodes and thyristers, etc. and to provide a shock proof construction the whole parts are molded with polyester resin.

2.5 Ignition Coil

This ignition coil is of instantaneous sparking system and is also molded with polyester resin for proving wet-proof and against breakdown construction. Two ends of a secondary coil are led outward.

3. Mounting and Dismounting

3.1 Mounting

(1) To install the stator onto an engine body be careful not to leave any dust or iron chips between the fitting surfaces of the stator and the stator holding surfaces of engine. Then position the fitting screw holes right in the center of two elongated holes of the stator and then screw.

(2) Next fit the flywheel to the engine shaft. But strongly magnetized, the flywheel is apt to cling iron chips and scraps so be sure no chips are clinging to it and clean the shaft and tapered hole of the flywheel.

(3) To screw the flywheel to the shaft, screw it with stipulated screw torque 60 ft. lbs.

(4) Mounting of CDI unit and Ignition coil

Fit the CDI unit and ignition coil at prescribed position. Then checking the color of lead wires to connect, connect the couplers. When CDI unit and ignition coil are not connected firmly it is likely to damage the unit. So do not start the engine leaving the unit disconnected.

(5) Checking of Sparking Time

Since this igniter is of breakerless system, sparking time rarely goes out of order. But, if necessary, use a strobe light for checking. If the timing mark of a fan and the upper timing mark of the fan cover rear constitute a line a 7,000 RPM, timing is in well adjusted condition or 3.5 mm (26°) BTDC at 5,000 RPM. When sparking angular is off the prescribed degree, measure the off angle and slide the stator equal degree by using the elongated holes. Then check it again.

3.2 Dismount

(1) To remove the flywheel from the shaft unscrew the hexagon nut. In this case, however, use a specified detaching tool and do not force open by a driver or knock with a hammer. Use Polaris flywheel puller No. 2870159.

4. Maintenance

Normal operation of an engine indicates that sparks obtained from magneto is excellent and spark timing is

also remained in normal condition. So, there is no necessity to conduct any adjusting work on the magneto if care is given to the following points:

4.1 Removing of dust and oil

4.2 Checking of connections of leads and couplers

4.3 Checking of screw loosening

5. Inspection and Overhaul

5.1 Flywheel

In ordinary operation no repairs are needed.

5.2 Stator

In ordinary operation no repairs are needed. But when engines are out of order or do not run or when a secondary coil does not generate high voltage check the following points:

(1) Exciting Coil

Using a tester (Ohm meter) check the continuity between coil plate and lead wire (black). If resistance measures 23 ohms it is normal.

(2) Pulser Coil

Using a tester check insulation resistance between coil plate and a lead wire (brown). If resistance measures ∞ , it is in normal condition. Next check continuity between lead wire (brown) and lead wire (plural – black and white). Normal resistance is 53 ohms.

(3) Lighting Coil

Breaking down of coils is not likely to occur so check the state of soldering and couplers. Test continuity between the stater and the lead wire (yellow). Normal resistance is 0.35 to 0.45 ohms.

KOKUSAN–DENKI BREAKERLESS FLYWHEEL MAGNETO TYPE GK 352 (Con't.)

5.3 Ignition Coil

Wipe off dust and oil with care. Check breaking down of primary coil and secondary coil by using an ohm tester. Normal primary resistance is 0.36 ohms and secondary resistance is 1100 ohms.

5.4 CDI Unit

Clean with care and check the following points with tester:

(1) Resistance between case and lead wire (white) should be ∞.

(2) When connected lead wire (white) to (+) terminal of tester and lead wire (brown) to (–) terminal electricity must flow.

(3) When connected in contrast with the above electricity must not flow.

(4) Next check lead wire (black) and lead wire (white) by (+) (–) of tester. The resistance must be 200M ohms or more.

(5) When sensitivity of the tester is raised to the utmost degree connect lead wire (black) to (+) and lead wire (orange) to (–). In this case dial of the tester must swing once and must return to its place.

NOTE: The tester to be used for the above mentioned must be for 3V.

NOTES

TROUBLE SHOOTING – TWIN CYLINDER IGNITION

PROBLEM			CHECK
NO SPARK	1.	Connection	1. Check each coupler
	2.	Stop switch	1. Inferior insulation of stop switch 2. Short circuit of lead wire
	3.	Ignition coil	1. Disconnection of primary winding 2. Short circuit of primary winding 3. Disconnection of secondary winding 4. Short circuit of secondary winding (In 3 & 4 normal resistance to be 1100 ohms)
	4.	Flywheel magneto	1. Breaking of exciter coil (normally 250 ohms between plate and black lead) 2. Short circuit of exciter coil 3. Breaking of pulser coil (normally 65 ohms between black lead and brown-white lead) 4. Short circuit of pulser coil 5. Short circuit of breaking of lead wires
	5.	CDI Unit	1. Trouble of CDI unit 2. Breaking of lead wire

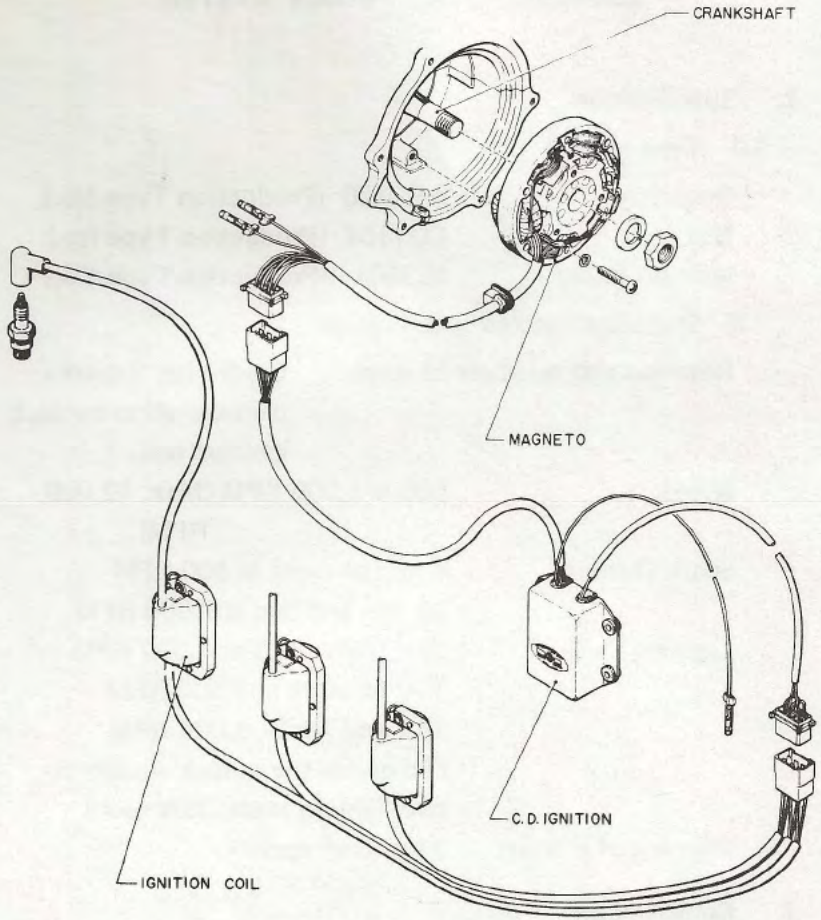
PROBLEM			CHECK
WEAK SPARK	1.	Connection	1. Clean dirt on each coupler
	2.	Stop switch	1. Inferior withstand voltage or insulation of stop switch
	3.	Ignition coil	1. Dirt on plug cap 2. Layer short of secondary winding 3. Breaking of secondary winding
	4.	Flywheel magneto	1. Breaking of exciter coil 2. Layer short of exciter coil 3. Layer short of pulser coil
	5.	CDI Unit	1. Deterioration of CDI unit
SPARKS CAN BE OBTAINED BUT IGNITION TIMING IS OUT OF ORDER	1.	Flywheel magneto	1. Breakage of key slot of crankshaft 2. Adverse magnetizing of flywheel magnets 3. Wrong connection of pulser coil
	2.	CDI Unit	1. Deterioration of CDI unit
	3.	Stop switch	1. Inferior withstand voltage
	4.	Lead wire	1. Cover of lead wire is torn

CIRCUIT CHECKING OF CDI UNIT BY TESTER (OHM METER)

CONNECTION BY COLOR OF LEAD WIRES		TO CONNECT + TERMINAL OF THE TESTER				
		BLACK STOP LEAD	WHITE GROUND LEAD	BLACK–WHITE EXCITER COIL	BROWN PULSER COIL	ORANGE IGNITION COIL
TO CONNECT – TERMINAL OF THE TESTER	BLACK		OFF	TO INDICATE ABOUT 2 OHMS	OFF	CON
	WHITE	ON		TO INDICATE ABOUT 2 OHMS	ON	CON
	BLACK-WHITE BLACK-RED	ON	OFF		OFF	CON
	BROWN	OFF	OFF	OFF		OFF
	ORANGE	CON	OFF	OFF	OFF	

NOTE: "CON" represents a characteristic of condenser – the needle of the tester swings once and returns straight. The swing of the needle shifts based on the sensitiveness of a tester in use; when the condenser is charged, the needle will not swing until it is discharged.

THREE CYLINDER IGNITION



THREE CYLINDER IGNITION
KOKUSAN–DENKI COMPANY, LTD.
MODEL NO. AR3330
CAPACITOR DISCHARGE SYSTEM

1. Specification

1.1 Type Nos.

Generator:	AR3330 (Production Type No.)
CDI Unit:	CU1104 (Production Type No.)
Ignition Coils:	IG3501 (Production Type No.)

1.2 Characteristic and specification

Rotation and numbers of spark:	Clockwise, 3 sparks per revolution by each ignition coil.
Speed:	500 – 1,000 RPM (Max. 12,000 RPM)
Spark Output:	7 mm or more at 500 RPM 16 mm and less at 7,000 RPM
Lighting Output:	12V, 75W (AC) at 4,500 RPM 13V or more at 4,500 RPM 16V and less at 8,000 RPM (To divide the output equally to two lighting leads, 35W each)
Moment of inertia:	6 kg–cm^2 approx.

2. Construction

2.1 Introduction

In this CDI system an inner rotor magneto is used for its power source for generating electric current to charge the primary condenser until hundreds of voltage is stored. The energy stored in the condenser is discharged abruptly to primary windings of 3 ignition coils, connected in

series to generate high voltage in secondary coils at the timed relation to ignite for each cylinder of engine.

Per revolution of the rotor, 3 sparks can be obtained for each cylinder, but only one spark is used for actual ignition and the other two wasted. Such an ignition system as ours is called "Capacitor Discharge Ignition System" (in abbreviation CDI system). Accordingly this CDI eliminates contact breakers and condensers in conventional ways, in place of which this control unit named "CDI Unit" embodying thristors, diodes, condensers, and etc. therein.

2.2 Construction of Stator

The stator has six magnetic poles projecting in the inside center which are of laminated steel plates with plastic powder coating. Out of six, four pole cores are directly wound coils and two leads are led out to light two bulbs – 12V, 37.5W each. In this case, when one bulb is gone, the other can light normally.

The lighting output obtained also can be used for one bulb only of 75W by putting those two leads together. Next, onto the rest of the pole cores, the same number of exciting coils which work as the electrical power source for ignition are put and fixed by fitting plates.

Additionally, this stator is also designed to mount a coil for preventing inverse revolution of engine and an indicator for the purpose of adjusting ignition timing of the engine.

2.3 Construction of Rotor

The rotor has such an outer appearance as shown; a boss is rivet-fixed to aluminum diecast side plates, on the one

side of which three screwed holes are provided to mount a cover of recoil stater. A six pole emmit shaped cast magnet with pole pieces of laminated steel on its surfaces is fixed securely by rivetting between both of the aluminum side plates.

2.4 Construction of CDI Unit

The outer appearance of the CDI unit is shown in the drawing; a steel case has two flanges for mounting by each two holes with grommets. Inside is a plate with printed circuit providing CDI circuit and an inverse revolution preventing circuit on it. The former circuit comprises of a charge storing condenser and semi-conductor parts such as voltage rectifying diodes and thyristors etc. The latter works not to supply sparks by dissolving signal voltages when the engine operates in the inverse direction. The parts are molded together with polyester resin in the steel case for providing para-shock construction.

Furthermore, as this CDI unit is intended for three cylinder engines, even if one plug of the three is off, this can run the engine in normal condition. However, to keep the engine running under this circumstance it will exert vicious effect to the endurance of the ignition coils because the highest voltage of coils will be produced between the coil terminals. Therefore, in order to prevent this, the CDI unit protects the coils by all of the three coils stopping instantaneously the supply of sparks. When the generated voltage from such coils can not be discharged anywhere in the consequence that one plug cap is off at the engine speed of more than 3,000 RPM. And then, when spark discharge is stopped and engine speed is down, the thyristors will work again to operate normally. In the

case that the engine runs with two cylinders out of three due to troubles of engine itself, either the high tension lead of the idle cylinder will short circuit or with the rest two cylinders engine will operate normally if all the plug caps are kept fixed.

2.5 Ignition Coil

The ignition coils have such an outer appearance as shown in the drawing; the coil has closed iron core; wound coils are impregnated by epoxy resin and molded tightly by thermo plasticity resin. These three coils are connected by their primary coils through couplers in series.

3. Mounting and Dismounting of Generator

3.1 Mounting

(1) To mount the stator on an engine, confirm that any dust and/or chips are not left on the surfaces to be set together, and give care that the coils are not damaged. Next, mount the stator on the engine and fix it firmly by three screws. When inserting screws, avoid to force leads and/or coils shift or slide aside by using a driver and etc.

(2) In mounting the rotor, remove anti-rust oil coated on its surfaces and clean the shaft with a dry cloth. Next put on the rotor to the engine shaft and screw it firmly with torque of 60 ft. lbs.

(3) Mounting of CDI unit and ignition coil

CDI unit and ignition coil should be mounted at the well ventilated places with environmental temperature below 60°C.

(4) Connecting of Lead Wires

Couplers are provided for connecting each lead wire, so connect them firmly, confirming colors of each lead. If any leads are left unconnected or off in operation, it may damage the CDI unit.

(5) Confirmation of ignition timing

Since this ignition system is of breakerless system, the ignition timing will hardly vary. But to confirm it, use a stroboscope. When the mark of rotor concides with that of indicator at the engine speed of 7,000 RPM and under the day time load condition, it shows ignition timing is normal or 3.75 mm BTDC or 26° BTDC. Use a strobe light with verified reliability for it is occasional that a low intelligence strobe light shows the timing retarded, as it has retarded radiation itself.

3.2 Dismounting

(1) To dismount this ignition system, pull out the rotor first. Draw out hexagon nuts and then pull out the rotor by a pull-out tool using three screw holes for fitting recoil starter on the surface of the rotor's side plate. Use rotor removal tool No. 2870159.

(2) After pulling out the rotor, loosen the screws with which stator is mounted to engine and also pull out the stator by hand. Be sure not to force it out with a driver and/or a hammer.

4. Maintenance and Repair

In ordinary operation of the CDI system no repair or maintenance work is required. However, dust, oil and/or muddy water is undesirable so clean them if covered. Next check to see if there is any loosening of screws and the connection of each lead and coupler.

4.1 Checking at the time of out of order

If engine does not start or does not run in good condition and if checking is required to confirm whether or not each part is normal check the following:

(1) Lighting Coil

Check continuity of coils to the stator (ground potential) and the lead wire (yellow) by a circuit tester. If resistance is read about 0.75 ohms it shows coils are normal.

(2) Exciter Coil I

If the tester shows that the exciter coil has resistance about 470 OHMS between the stator and the lead wire (red) it is normal.

(3) Exciter Coil II (Pulser Coil)

If the tester shows resistance 20-22 ohms between lead wire (green) and the lead wire (blue) and if it is ∞ between the stator and the lead wire (either green or blue) it is normal.

4.2 Ignition Coil

(1) Using the tester, check if there is breakdown of a primary coil and secondary coil. It is normal if the primary resistance is 0.7 Ohms and the secondary is 12K ohms.

4.3 CDI unit

In general, the checking of CDI units is not easy and it is desirable to use a unit tester. But if it cannot be available check it as per the following as a preliminary method:

(1) If resistance shown between the unit case and each lead wire is ∞.

(2) If a pointer of tester moves when connected between the lead wire (black) and the plus terminal of tester and

between the lead wire (white) and minus terminal of the tester.

(3) If resistance is ∞ when connected inversely to the above, the lead wire (black) to the minus of the tester and the lead wire (white) to the plus side.

(4) If resistance is 1—10M ohm when connected the lead wire (black with white stripes) to the plus, and the lead wire (red) and (white) to the minus.

(5) If resistance is 10M ohm or more when connected lead wire (black with white stripes) to the plus, and the lead wire (black) to the minus.

(6) If a pointer of tester swings once and then resets when connected the lead wire (black with white stripe) to the plus, and the lead wire (orange) to the minus.

(7) If current flows when connected the lead wire (green) to the plus, and the lead wire (blue) to the minus.

(8) If resistance is ∞ when inversely connected to the above: the lead wire (green) to the minus, and the lead wire (blue) to the plus.

When it is confirmed that the unit satisfies all of the above checking items, it shows that the unit is in normal condition. Next, clean dust of couplers and check its condition. (In the above checking instructions, the plus side of the tester means the anode poles of dry cells included therein.

5. Precautions in Operation

5.1 At engine starting

Before starting engine, check connections of each coupler and loosening of each screw and also lead wires if not short circuit to the generator body.

5.2 When couplers are off or lead wires short circuit in operation, the following troubles are likely to occur:

(1) Off of the couplers between the generator and the CDI unit — — — If all of the couplers are off instantaneously, there would be no trouble. However, the coupler of pulser lead be off first and then exciter lead gets off, the main thyristor would be damaged due to overvoltage.

(2) Off of coupler between the CDI unit and ignition coils — — — damage of the main thyristor due to overvoltage.

(3) Short circuit of ignition leads and lead wire (orange) — — — damage of main thyristor due to overvoltage.

(4) Short circuit of lead wire (white) — — — deterioration of main thyristor due to overvoltage.

(5) Short circuit of lead wire (red) — — — no damage, however, no spark.

(6) Off of plug caps from plugs in operation — — — no damage, however, no spark.

5.3 To stop an engine operation

To stop an engine operation, stop it by the stop lead. To pull out couplers and/or plug caps in operation of engine will cause such troubles above mentioned.

6. Other Precautions

6.1 Measuring of Characteristics of the Ignition System

When measuring characteristics of the ignition system by using a motor, there would not be any troubles if the generator runs in regular direction and each connected portion is normal. However, to measure the spark output in inverse revolution, be sure not to raise its speed over 500 RPM. Since this unit has applied a circuit which dissolves only ignition signals in inverse revolution not to supply spark in such occasion, it may cause charging voltage of primary condenser too high value at high speed operation. When spark lengths are measured by three needle gap, set the gap length 1 mm except to use testing coils.

NOTES

NOTES

TROUBLE SHOOTING OF THREE CYLINDER IGNITION SYSTEMS

PROBLEM		CHECK	
NO SPARK	1. Connection	1. Check each coupler	
	2. Stop switch	1. Inferior insulation of stop switch	
		2. Short circuit of lead wire	
	3. Ignition coil	1. Breaking of primary winding	0.7 Ω
		2. Short circuit of primary winding	
		3. Breaking of secondary winding	11,850 Ω
		4. Short circuit of secondary winding	
	4. Magneto	1. Breaking of exciter coil	440 Ω
		2. Short circuit of exciter coil	
		3. Breaking of pulser coil	24 Ω
		4. Short circuit of pulser coil	
		5. Short circuit of control coil	28 Ω
	5. CDI unit	1. Breaking of lead wire	
		2. Wrong circuit of CDI unit: red, white, and orange	

PROBLEM			CHECK	
WEAK SPARK	1.	Connection	1.	Clean off dirt of each coupler
	2.	Stop switch	1.	Inferior insulation of stop switch
	3.	Ignition coil	1.	Dirt on plug cap
			2.	Short circuit of primary winding
			3.	Layer short of secondary winding
			4.	Breaking of secondary winding
	4.	Magneto	1.	Breaking or layer short of exciter coil
			2.	Layer short of pulser coil
			3.	Wrong connection of reverse rotation prevention coil
	5.	CDI unit	1.	Wrong circuit of red, white & black–white
SPARK CAN BE OBTAINED BUT SPARK TIMING IS OUT OF ORDER	1.	Magneto	1.	Breakage of key slot of crankshaft
			2.	Adverse magnetizing of rotor
			3.	Wrong connection of pulser coil
	2.	CDI unit	1.	Wrong circuit of CDI unit: white, green, blue & black–white
ENGINE RUNS IN THE ADVERSE DIRECTION BUT DOES NOT STOP	1.	Magneto	1.	Breaking of adverse rotation prevention coil
			2.	Layer short of adverse rotation prevention coil
	2.	CDI unit	1.	Wrong circuit of CDI unit: blue & green

CU1117
(CU1104 TYPE) CIRCUIT CHECKING OF CDI UNIT BY TESTER

CONNECTION BY COLOR OF LEAD WIRES		TO CONNECT – TERMINAL OF THE TESTER						
		EXCITER COIL	PULSER COIL	STOP LEAD	EARTHING LEAD	PRIMARY LEAD	REVERSE ROTATION PREVENTION COIL	
		RED	WHITE	BLACK-WHITE	BLACK	ORANGE	BLUE	GREEN
+ TERMINAL OF THE TESTER TO CONNECT	RED		OFF	2 M Ω	OFF	OFF	OFF	OFF
	WHITE	OFF		OFF	200-500 Ω	OFF	ON	ON
	BLACK–WHITE	ON	OFF		ON	CON	OFF	ON
	BLACK	OFF	OFF	OFF		OFF	OFF	ON
	ORANGE	CON	OFF	CON	CON		OFF	CON
	BLUE	OFF	OFF	OFF	200-500 Ω	OFF		ON
	GREEN	OFF	OFF	OFF	OFF	OFF	OFF	

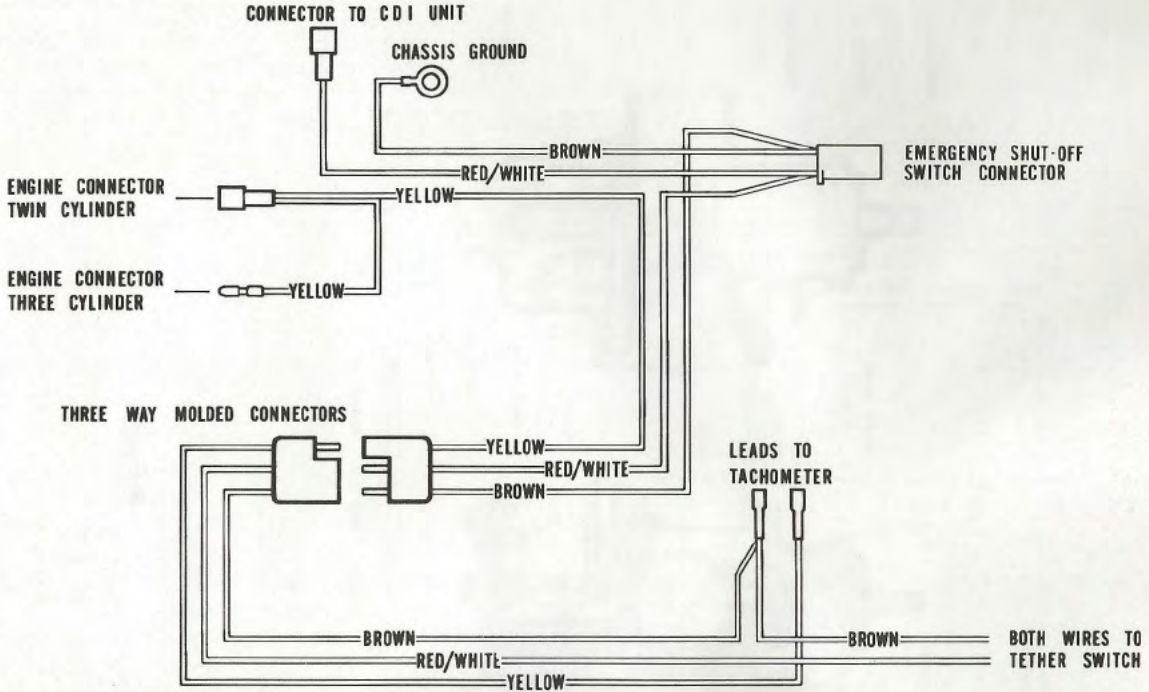
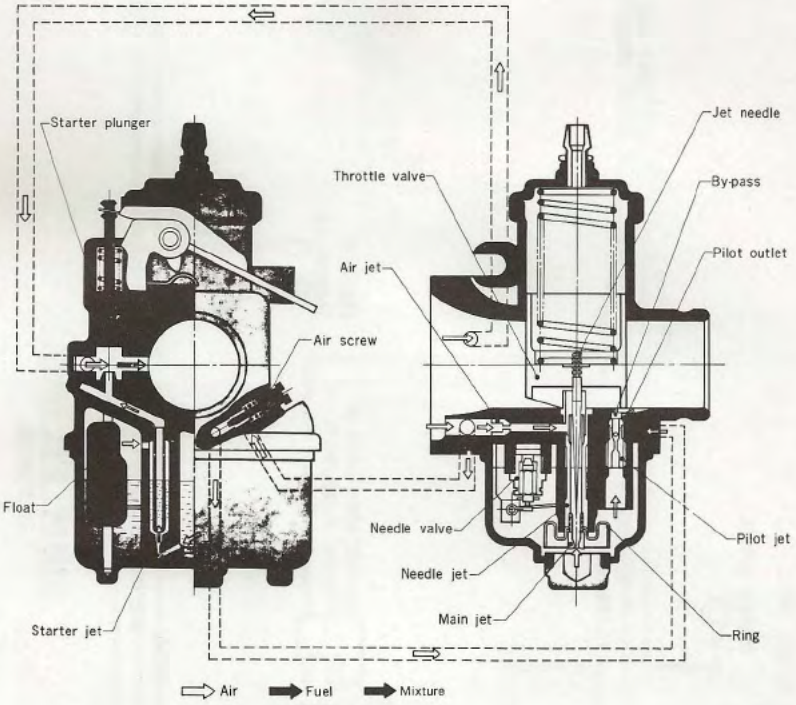


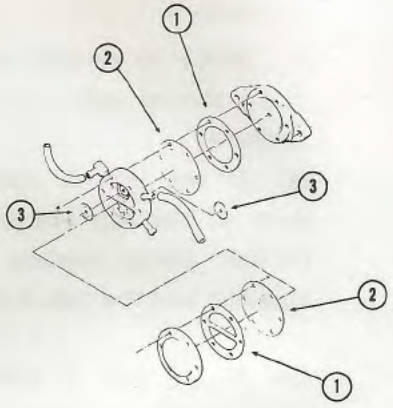
DIAGRAM - WIRE HARNESS

TX STARFIRE

MIKUNI CARBURETORS AND FUEL PUMPS



FUEL PUMP



1. Gasket
2. Diaphram
3. Valve

Troubles in this pump show themselves in a reduction of discharge volume due to the reduction of both discharge and intake pressure.

Causes of trouble	Corrections
1. Loose attachment of the inlet valve and the outlet valve, or the damage or wear of the valve spring.	1. Replacement of the pump assembly.
2. Damage of the diaphragm or the membrane.	2. Replacement with a new one. (When reassembled, the gasket and the gasket cap also should be replaced at the same time.
3. Leak of wave motion pressure.	3. Check all joints of passage of the wave motion from the crank chamber to the bottom body.
4. Leak of fuel due to poor piping.	4. Check the fuel pipe and the elbow on the sides of intake and discharge.

Causes of trouble	Corrections
5. Other leaks.	5. Make an air-tight test. The pump should hold 11 P.S.I. of pressure. (a) If the leak is due to the joint of the top body and the bottom body, replace the diaphragm and the gasket with new ones. (b) If the leak is due to the joint of the top body and the cap, replace the membrane and cap gasket with new ones.
6. Presence of dust and impurities.	6. Check the inlet valve and the outlet valve.
7. Clog of the filter.	7. Clean at regular intervals.

NOTES:

The Mikuni carburetor has varying operations depending upon varying driving conditions. It is constructed with the float system, the pilot system, the main system, and the starter system (initial starting device).

FLOAT SYSTEM

The float system is designed to maintain a constant height of gasoline during operation.

When the fuel flowing from the fuel pump into the float chamber through the needle valve reaches the constant fuel level, the float rises. When the buoyancy of the float and the fuel pressure of the fuel pump balance, the needle valve sticks fast to the needle seat, preventing further delivery of gasoline, thereby holding the standard level of gasoline.

The standard level of gasoline is set at below 30 m/m $\pm$ 1 from the center of the main bore.

STARTER SYSTEM

The starter system is designed to make the engine start quickly in cold weather. It is constructed with functional parts such as a starter jet, a starter emulsion tube, and a starter plunger, etc.

When the engine starts with the throttle valve closed and the starter plunger wide open, the intake negative pressure of the engine works on the fuel nozzle. By this negative pressure, the fuel is measured by the starter jet, mixed with air in the starter emulsion tube, absorbed into the plunger chamber, mixed again with air from the starter air inlet, made the most suitable concentration of fuel-air mixture for initial starting, and delivered to the engine through the fuel nozzle.

In this starter system, you can be sure of initial starting without any skill of operation, since both fuel and air are measured and the constant fuel-air mixture ratio is always correct.

PILOT SYSTEM

The pilot system is designed to deliver gasoline during idling and low-speed driving.

Fuel for idling is measured by the pilot jet, mixed with the air, regulated with the air screw, mixed again with the air from the by-pass, and delivered to the engine through the pilot outlet. The concentration of fuel-air mixture for idling is determined by the air screw. When the air screw is closed, the amount of air is reduced and the fuel-air mixture is enriched. When the air screw is opened, the amount of air increases and the fuel-air mixture is lean.

When the throttle valve opens slightly during low speed driving, gasoline injects through the by-pass in addition to the fuel-air mixture from the pilot outlet to secure smooth operation of the engine. When the throttle valve opens wider, approximately above 1/8 of the diameter of the main bore, gasoline injects through the needle jet. The adjustment of the time and amount of injection from the needle jet is chiefly performed by the cutaway furnished on the side of the air cleaner of the throttle valve.

MAIN SYSTEM

The main system is designed for delivering fuel between low speed driving and high speed driving.

The fuel during the low speed driving is delivered from the pilot system and the main system. During intermediate speed driving (the opening of the throttle valve is above 1/4), the fuel is largely delivered from the main system. The fuel during intermediate speed driving flows into the needle jet through the main jet and mixes with the air measured by the air-jet to make a fine spray of fuel-air mixture of good quality.

The point of the jet needle is tapered to adjust the flow of fuel-air mixture in accordance with the opening of the throttle valve. During high speed driving (the opening of the throttle valve is above 3/4), the fuel is measured by the main jet and mixed with the air measured by the air jet to make a fine spray of fuel-air mixture of good quality for delivery to the engine.

ADJUSTMENTS

When the engine has dual carburetors, it is the prerequisite for full engine performance to maintain the equal operation of each carburetor. The following items should be followed cautiously and accurately.

ADJUSTMENT OF THROTTLE CABLE

With your eye or plug gauge, adjust the opening of each throttle valve with the throttle cable attached and the throttle open. With your eye, you can adjust accurately by matching the corner of the cutaway of the throttle valve with the upper surface of the main bore. After adjustment, be sure to fasten the cable adjuster lock nuts as well as the starter wire.

ADJUSTMENT OF IDLING AND SYNCHRONIZATION

(a) Set the air screw of each carburetor at the standard return number and then fasten the throttle stop screw of each carburetor evenly, setting the number at about 1,000 RPM which is a little higher than normal idling speed.

(b) Warm up the engine completely.

(c) Find out and set the position where the number of RPMs of the engine becomes maximum by opening or closing the air screws one by one about 1/2 each time. In this case, be sure to use a tachometer.

(d) Return each screw of the throttle valve evenly and set at the normal number of rotations of idling.

(e) Find out and set the position once more where engine rotation becomes maximum by opening or closing the air screws one by one about 1/16 each time.

(f) If the number of rotations has changed in the adjustment mentioned in paragraph (e), set once more at the normal number of rotations of idling by means of each throttle stop screw.

(g) Remove the plug cap of each cylinder and check whether the down percentage in the number of rotations of the engine is constant or not at that time. If not, return the throttle stop screw on the side where the down percentage is larger and adjust so as to make the down percentage constant.

(h) In the last step, operate for 5-10 minutes by idling. If the rotations of the engine are normal during that time, the adjustment is complete. If abnormal, remove the ignition plug and check the condition of combustion. If the combustion seems to be somewhat over, return the air screw, and if somewhat under, fasten the air screw.

ADJUSTMENT IN ACCORDANCE WITH THE ALTITUDE AND THE TEMPERATURE

The density of the air varies according to the altitude and the temperature. It is necessary that the delivery of the fuel in the carburetor should be changed according to the change of the density of the air.

INITIAL STARTING

For initial starting in cold weather, start the engine with the choke full open. On this occasion, it is necessary to be careful not to open the throttle valve. If you open the throttle valve, the negative pressure working for the injection of the fuel for

the starter drops and the intake of the fuel becomes weak. When the engine has started, warm up the engine with the choke engaged. After warm up, return choke to normal position. When starting an engine that is already warm, activate throttle slightly (about 1/3).

OVERHAUL SERVICE

As you may have understood by the preceding explanations, a carburetor has little mechanical functions, and troubles are mostly due to the wear of parts and the clog by dirt and dust. In overhaul service, use gasoline for washing out and blow dry with an air compressor. Observe the following instructions.

STARTER SYSTEM

(a) The starter jet is driven into the float chamber body. Jets should never be cleaned by drills or wire.

(b) Be careful in handling the starter plunger, since scratches on the circumference cause malfunctioning and scratches on the base prevent a tight seal which may cause a fuel leak while driving.

(c) Since a damaged or worn rubber cap of the starter allows the invasion of water from outside, replace it with a new one.

PILOT SYSTEM

(a) Be sure to use proper tools for overhauling the pilot jet, and be careful not to make scratches. Wash out in gasoline and blow dry with an air compressor.

(b) If the taper of the air screw is disfigured or worn, replace it with a new one.

(c) When the pilot jet and the air screw are disassembled, carefully clean the passages on the side of the body (the pilot outlet and the by-pass, etc.).

MAIN SYSTEM

(a) Be sure to use proper tools for disassembling the main jet and the needle jet, and be careful not to make scratches when reassembling. (Excessive tightening is a cause of disfigure or damage.)

FLOAT SYSTEM

(a) Be careful not to bend the float guide pin in handling. If bent, the pin causes malfunctioning of the float.

(b) The needle valve can be disassembled into the valve seat and the float valve. When it is replaced because of wear or scratches, use the complete needle valve assembly.

(c) Every time overhaul is performed, replace the float chamber packing with a new one.

DISORDER AND ADJUSTMENT

A carburetor is a vessel with a lot of precision jets and a constant fuel level. It is so constructed that when the negative pressure of intake of the engine functions, proper concentration of fuel-air mixture is obtained for the operation of the engine.

Accordingly, except for the mechanical disorders, most carburetor problems are caused by an abnormal concentration of the fuel-air mixture due to accumulated dirt and dust and wear of parts.

Disorders of the engine due to an abnormal fuel-air mixture are as follows:

When the fuel-air mixture is too rich:

(1) The rotations sound overwrapped and intermittent.
(2) When the choke is opened, the condition worsens.
(3) When the engine is warmed up, the condition worsens.
(4) The ignition plug becomes dark and dusty.
(5) Exhaust gas is rich.

When the fuel-air mixture is too lean:

(1) The engine is over-heated.
(2) When the choke is opened, the condition becomes better.
(3) Acceleration is poor.
(4) The ignition plug is burnt.
(5) Rotations are irregular.
(6) Exhaust gas is lean.

Our carburetor is so constructed that the parts to adjust vary according to the degree of throttle opening. After having checked whether the cause of disorder is due to an over-rich mixture or to over-lean mixture, confirm what parts must be adjusted for a specific throttle opening.

The relation between the degree of the opening of the throttle valve and the functional systems and the parts to adjust is as follows:

Throttle Valve				
Degree of Opening	0 – 1/8	1/8 – 1/4	1/4 – 3/4	3/4 – Full Open
Functional System	Pilot System	Pilot System Main System	Main System	Main System
Parts to Adjust	Air Screw	Throttle Valve Air Screw	Jet Needle	Main Jet

When the condition of disorder and the degree of opening have been confirmed, first check and clean the functional systems and then adjust the parts in question.

DEGREE OF OPENING: 0 – 1/8, air screw

When the opening is closed, the amount of air reduces and the fuel-air mixture becomes rich.

When the opening is opened, the amount of air increases and the fuel-air mixture becomes lean.

DEGREE OF OPENING: 1/8 – 1/4, air screw, throttle valve

When the cutaway of the throttle valve is made larger, the negative pressure which works on the needle jet reduces, and the fuel-air mixture becomes lean.

When the cutaway of the throttle valve is made smaller, the negative pressure which works on the needle jet becomes rich. The cutaways are prepared at intervals of 0.5 m/m alternately.

(Note) The adjustment of the opening can be made either by the throttle valve or the air screw. However, so far as the idling is not in disorder, make adjustment by the air screw.

DEGREE OF OPENING: 1/4 – 3/4, jet needle

The jet needle has 5 levels of groove. When the grip goes upward (2nd & 1st levels) the space between the jet needle and the needle jet becomes smaller and the fuel-air mixture becomes lean.

When the grip goes downward, the space between the jet needle and the needle jet becomes larger and the fuel-air mixture becomes rich.

DEGREE OF OPENING: 3/4 – full open, main jet

When the larger number is used, the fuel-air mixture becomes rich. When the smaller number is used, the fuel-air mixture becomes lean.

CHECK AND ADJUSTMENT OF THE FLOAT SYSTEM

The overflow during driving or operation of the engine could be caused by a loose attachment due to worn needle valves, the clog of dirt and dust, and the malfunctioning of the float, etc.

Needle Valve – Worn.

Spring is damaged or worn – replace with a new one.

Spring seat is worn or scratched.

Clogged with dirt and dust – cleaning.

Float – Malfunctioning due to bent guide pin – adjustment.

Float Arm – Malfunctioning due to clog — adjustment.

Over-height of the fuel level.

Remove the float chamber and measure the height from the level of the float chamber packing to the float arm when the mixing body is placed upside down and the float chamber packing is removed. Make adjustment so that the height is within 22.5 – 23.0 m/m.

NOTES:

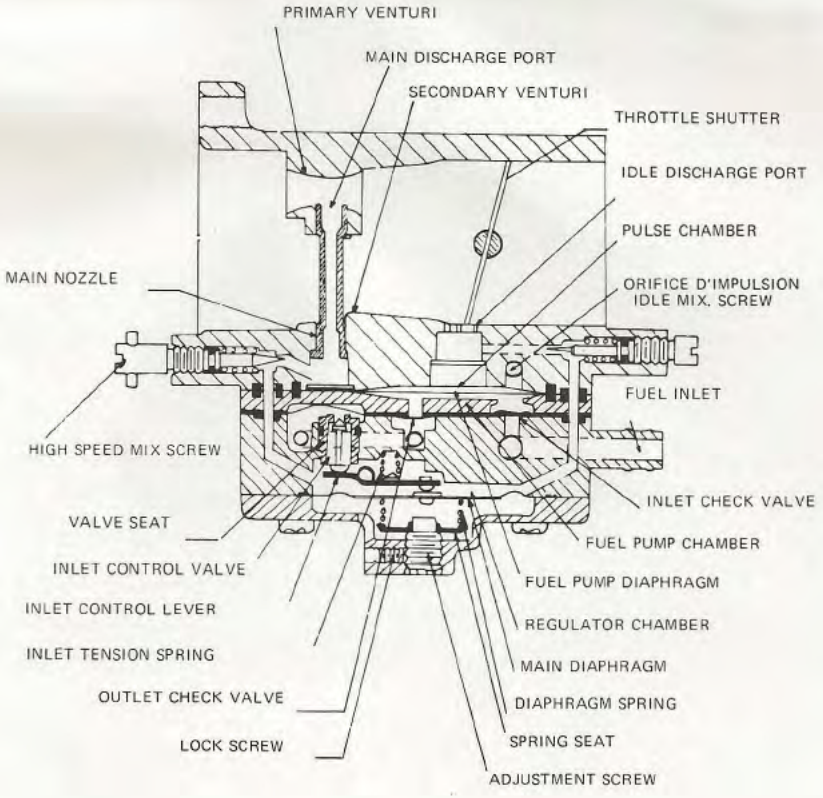
KEIHIN CARBURETORS

SCHEMATIC VIEW

Your 1973 TX Starfire 439 and 650 machines will be equipped with Keihin carburetors. The 439 with model RD38, and the 650 with model RD50.

Each of these carburetors has been calibrated and adjusted for its given engine size.

The following service and trouble shooting information will be a great benefit to you.



As improper adjusting or servicing could result in poor engine performance, it is very important that the correct procedure be followed when cleaning, checking or replacing worn or damaged parts.

Before opening the carburetor consult the trouble shooting chart.

Always use genuine Keihin replacement parts.

OVERHAUL

1. DISMANTLING AND CHECKING OF THE PUMP SECTION:

a) Loosen the six screws and remove the pump section from the main body.

b) Check the pump diaphragm. As the pump diaphragm is made of thin stainless steel, it should be handled with care. Replace, if damaged or deformed.

c) Check the gasket between the pump and mixing body and also the gasket inside the pump body. Replace if necessary.

d) Check the "O" ring in the mixing body and pump body and replace, if necessary.

e) Check and replace the check valve if damaged or worn. Caution should be used not to pull or roll the check valve as this part is made of extra thin synthetic rubber material.

f) Check if the surface of the brass valve seats is smooth. Replace pump body if necessary as the valve seats are bonded into the pump body.

g) Check the regulator diaphragm being careful not to pull or roll it. Replace, if broken.

2. CHECKING OF THE REGULATOR CHAMBER:

a) Confirm that the top of the inlet control lever is adjusted properly so as to be flush with the floor of the regulator chamber.

b) If the inlet valve does not close or function properly (sticking or not seating well), dismantle by removing the small screw taking care not to lose the inlet tension spring when removing the lever.

c) Check if the tip of the valve and the inner surface of the valve seat are smooth.

d) Replacement of valve and valve seat:

1. Only if the tip of the valve is damaged replace this part only.

2. If both valve and seat are damaged, replace the old valve seat using a flat punch.

3. According to the condition of the regulator chamber, install either a standard or one of the two sizes of oversize seats available but always use a flat punch so as not to damage the inside part of the new seat.

e) Check the inlet control lever and pin and replace if necessary.

3. DIAPHRAGM SPRING:

Check, and replace, if deformed.

4. MIXING BODY

a) Remove both idle and high speed mixture screws.

b) Check the tapered ends of both screws and the orifices of the body.

c) Replace if the ends of the screws are damaged or the orifices are deformed.

d) Remove the cover of the idle by-pass port by removing the two small screws. Then check for blocking of the by-pass port. Air pressure should be used to blow out any dirt. Never use a wire or drill so as not to damage the orifice.

5. RE-ASSEMBLING:

a) Re-assembly while being careful that all the fuel passages

through the gaskets, pump diaphragm, pump body and mixing chamber coincide.

b) Make sure that the check valve is correctly positioned in the pump body (in line with the valve seats).

c) Make sure that the inlet tension and diaphragm springs are correctly positioned.

d) Replace the six screws which fix the pump section to the main body.

e) Secure counterpoint screw one by one to prevent deforming the pump cover.

6. ADJUSTMENTS:

Four separate adjustments are required following the above overhaul procedure.

a) FUEL LEVEL.

b) IDLE MIXTURE SCREW.

c) IDLE SPEED SCREW.

d) HIGH SPEED MIXTURE SCREW.

a) FUEL LEVEL:

Install fuel level checking parts and start the engine.

Loosen lock screw and turn the adjustment screw. (See figure) Fuel level in vinyl tube must come in line with underneath fringe of the mixing body. Fuel level in vinyl tube must come in line with underneath fringe of the pump body (and not the pump body ass'y.)

Secure the adjustment screw by the lock screw. Do not overtighten so as not to damage the adjustment screw.

b) IDLE MIXTURE SCREW:

Adjust the idle mixture screw until smooth engine running is obtained.

Clockwise turning results leaner mixture, counter-clockwise turning results richer mixture.

Normal adjustment is approximately 1-1/4 turn counter-clock wise from a full closed position.

c) IDLE SPEED SCREW:

Adjust idle speed as per engine manufacturer specifications.

d) HIGH SPEED MIXTURE SCREW:

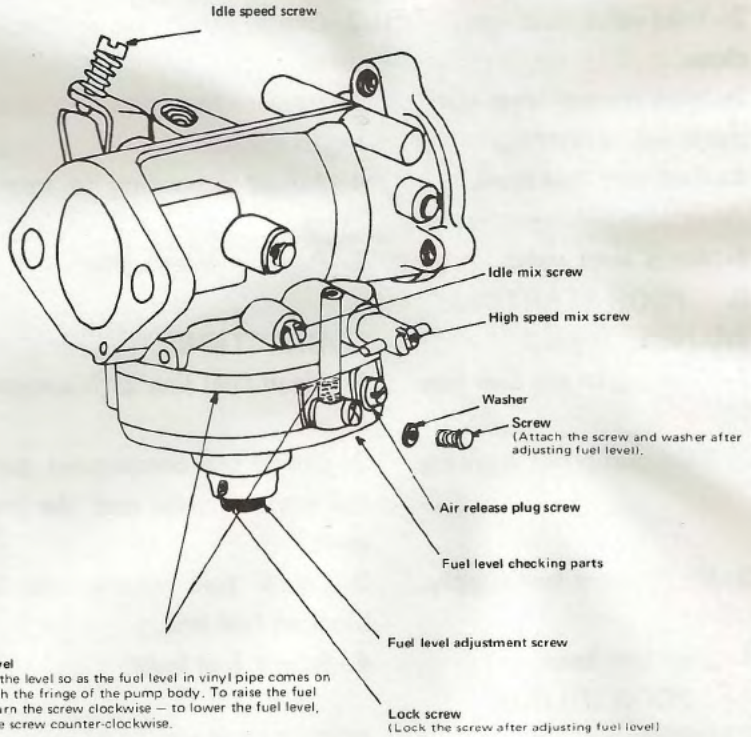
Adjust high speed mixture screw so as to reach maximum revolution.

This adjustment should be made with throttle valve fully opened and normal load for the engine.

Normal adjustment is approximately 1 turn counter-clockwise from a fully closed position.

NOTES

FLOAT LEVEL



Fuel level
Adjust the level so as the fuel level in vinyl pipe comes on line with the fringe of the pump body. To raise the fuel level, turn the screw clockwise — to lower the fuel level, turn the screw counter-clockwise.

TROUBLE SHOOTING

KEIHIN RD38 AND RD50

A. OVERFLOW:

CAUSES	CORRECTIONS
1—Dirty inlet valve.	1—Remove valve, clean and/or replace.
2—Inlet valve does not close.	2—Check valve seat and replace valve.
3—Inlet control lever not operating smoothly.	3—Replace lever or adjust according to instructions.
4—Incorrect fuel level.	4—Adjust according to instructions.
5—Worn inlet valve	5—Replace inlet valve.

B. POOR STARTING:

CAUSES	CORRECTIONS
1—Choking in the fuel line.	1—Clean fuel line with compressed air.
2—Fuel pump not working.	2—Check the component parts, the impulse tube and the check valve.
3—Insufficient fuel supply.	3—Check fuel supply and for blocked fuel line.
4—Low fuel level.	4—Adjust fuel level.

C. POOR IDLING:

CAUSES	CORRECTIONS
1—Incorrect adjustment.	1—Adjust idle mixture and speed screws, and check fuel level.
2—Incorrect level of inlet control lever.	2—Adjust inlet control lever flush with the floor of the regulator chamber.
3—Insufficient pumping.	3—Check pump and component parts, impulse tube and orifice.

D. POOR HIGH SPEED PERFORMANCE:

CAUSES	CORRECTIONS
1—Poor adjustment.	1—Adjust high speed mixture screws.
2—Insufficient fuel supply.	2—Release air by loosening screw plug with engine idling.
3—Choking in the fuel line.	3—Check and clean fuel line.
4—Blocked fuel filter.	4—Replace fuel filter.
5—Incorrect fuel level.	5—Adjust fuel level.

IMPORTANT

a) To obtain constant performance, the carburetor should be cleaned and checked at reasonable intervals.

b) Dust or dirty parts are the usual causes of carburetor troubles.

c) Never use solvents which can damage the synthetic rubber parts of the carburetor.

d) It is recommended to use gasoline for cleaning.

e) The use of a high quality filter is necessary to insure proper operation.

NOTES

WARRANTY

Although the TX Starfire is subject to a stringent Polaris quality control program to insure maximum dependability, Polaris, A Textron Company, will not warranty any snowmobile used for racing or competitive use, including the 1973 TX Starfire high performance snowmobile.

SAFETY

Your 1973 TX Starfire Racer is designed and built for competition use. It does not conform to ISIA and many state laws and standards governing noise and lighting. Do not operate this machine for any other purpose than in sanctioned competition events.

When operating this machine familiarize yourself with it before any full throttle runs. Get the feel of the braking system and always connect the cord for the tether stop switch to yourself before starting.

Always wear protective clothing when operating your TX Starfire. We recommend that you wear the following:

1. Full coverage approved helmet
2. Goggles
3. Ankle high leather topped boots
4. Knee and shin pads
5. Shoulder and rib pads
6. Hearing plugs (earplugs)

NOTES

1973 TX Starfire Owners Registration

(Please Print)

Name: _____

Street Address: _____ Telephone No. _____

City: _____ State: _____ Zip Code: _____

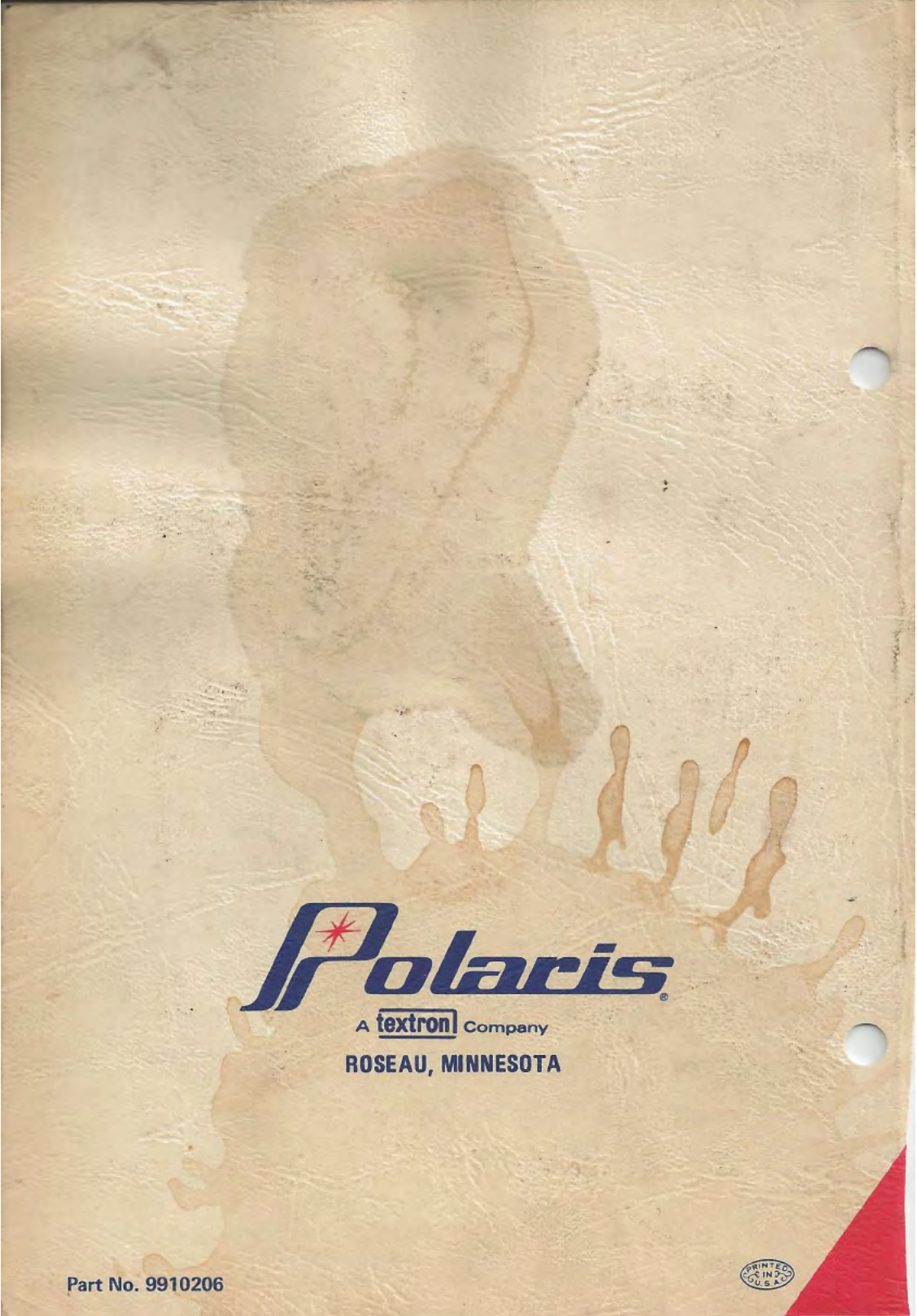
TX Starfire Serial Number: _____

TX Starflame Engine Number: _____

Dealer's Name: _____

City: _____ State: _____ Zip Code: _____

Polaris Distributor: _____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