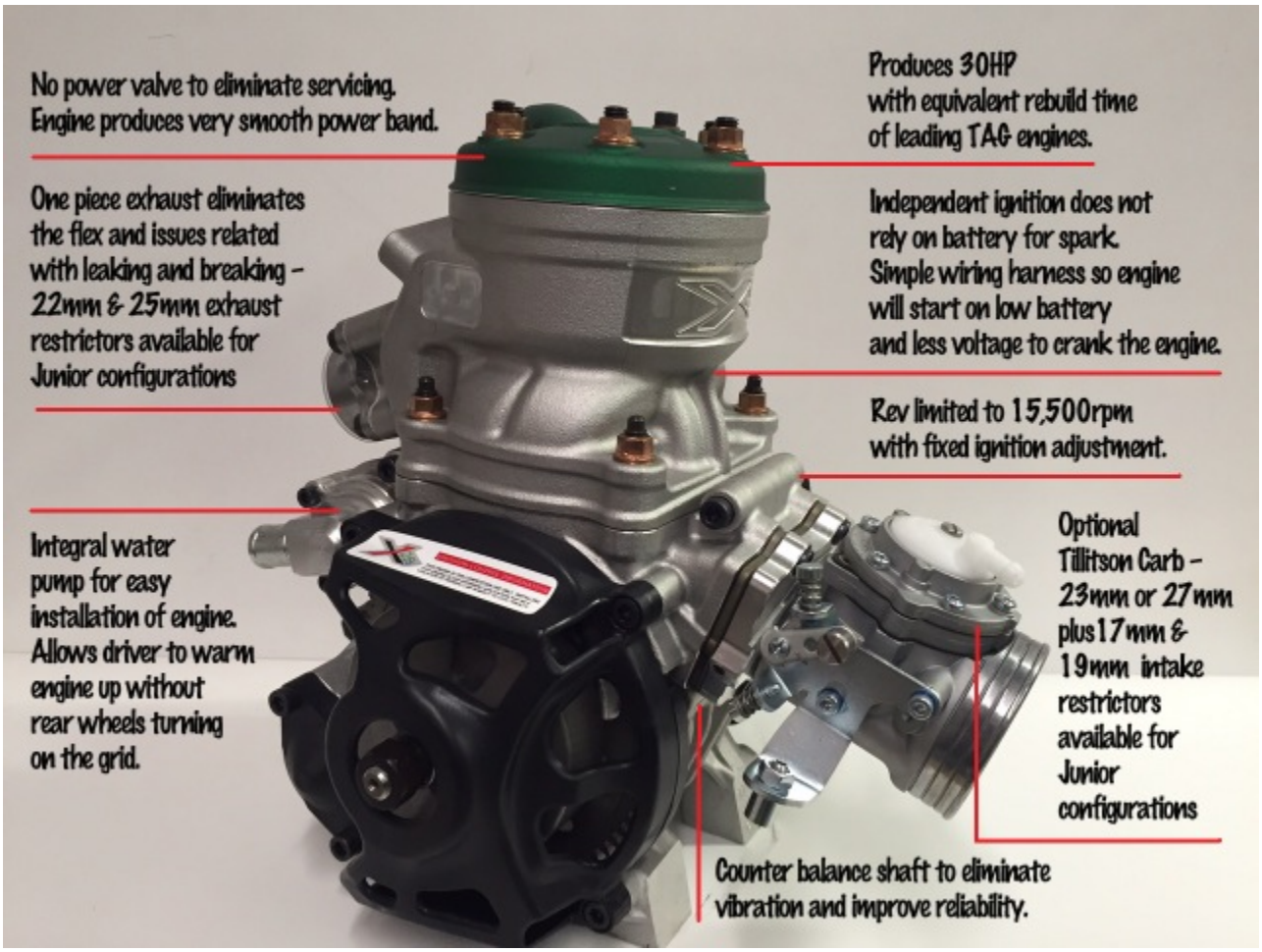
X125T - MX ENGINE



Assembly Instructions and Owner's Manual

March 2017

1. DESCRIPTION OF THE X125T TAG ENGINE

1.1 *MAIN FEATURES*

The “Italian Motors X125T-MX” has been expressly designed and tuned for kart hobby racing on closed tracks destined for this specific purpose. When designing this new engine, we have considered the technical solutions already adopted for the high performance engines, and the experience acquired with TAG engines (Touch And Go). This guarantees the highest reliability of components, when the operating limits are respected.

This engine is a 2 stroke single cylinder. The cylinder and the crankcase are cast in aluminum alloy. The pressed liner is made of centrifuged cast iron, fully machined to guarantee the best possible stability and sliding surface. The head is separated from the cylinder and secured by 6 studs. The crankshaft is built and supported by two ball-bearings. The crankshaft is made of steel alloy, hardened and tempered, as is the connecting rod, machined from billet, which runs on roller bearings. The crankcase houses a balance shaft, driven by two gears, which rotates opposite to the crankshaft thus reducing the engine vibrations.

The ignition includes a stator-rotor, the starter relay, the HT coil, a push button start and on-off button assembly, and the wiring harness which connects the whole system.

The rev limiter is controlled internally in the HT coil which prevents the engine from exceeding 15.500 RPM during use. With the on-off button in the “OUT” position, the start button activates the Bendix which engages the starter wheel assembled on the clutch.

The engine is provided with an automatic dry centrifugal clutch with low maintenance and with drum sprockets in 10, 11, 12, 13 and 16 tooth sizes.

The carburetor alternatives are 23mm or 27mm diameters, specially designed for this engine and include an integral fuel pump filter and an all position mounting capability.

The battery (12 volt - 9 ampere-hour) is a sealed, no maintenance one and is not supplied with the engine. It has to be mounted in the support box which can be easily adapted to all existing chassis.

The engine is supplied with an accessories kit which includes the radiator, the pump, water hoses and whatever necessary for the assembly on the kart. The exhaust, included in the accessories kit, is already tuned for the best possible performance.

1.2 *CHARACTERISTICS OF THE ENGINE - OPERATIONAL LIMITS*

The characteristics of the engine are the following :

- Cycle: 2 stroke
- Original cubic capacity: 123.67 cc (125cc max.)
- Original bore: 54.00 mm
- Max. theoretical bore: 54.28 mm
- Stroke: 54.00 mm
- Lubrication: Fuel / oil mix 6% (16:1)
- Induction: Reed valve in the crankcase
- Carburetors: 23mm Tillotson HL-334AB or 27mm Tillotson HW-32A
- Cooling: Water, forced by internal water pump
- Ignition: Digital/with integrated rev. limiter
- Electric start: 12 volt, 0.30 kilo watt
- Clutch: Automatic, dry, centrifugal

Operational limits:

- Maximum RPM: 15,500 with rev limiter
- Minimum water temperature: 45°C, 113°F
- Maximum water temperature: 65°C, 150°F

Caution: Do not exceed the above limits

1.3 *PACKAGE CONTENTS*

Each X125T engine is supplied with the following accessories:

Table 1-1 Package Contents

	Quantity
Exhaust System	
Exhaust Manifold	1
Exhaust Pipe (one piece)	1
Exhaust Springs	2
Intake System	
Tillotson HL334AB 23mm carburetor or Tillotson HW-32A 27mm carburetor	1
Intake Silencer	1
Electrical Equipment	
Battery 12V - 9AH	1
Battery support box and cover	1
Battery Support chassis clamps	2
Electric wiring harness	1
Spark plug - NGK BR10EG	1
Water Cooling System	
Radiator	1
Radiator cover	

	Quantity
Radiator support kit	1
Water hoses	2
Thermostat	1
Miscellaneous Equipment	
Clutch cover	1

1.4 *ACCESSORIES*

Figure 1-1 Accessories Kit

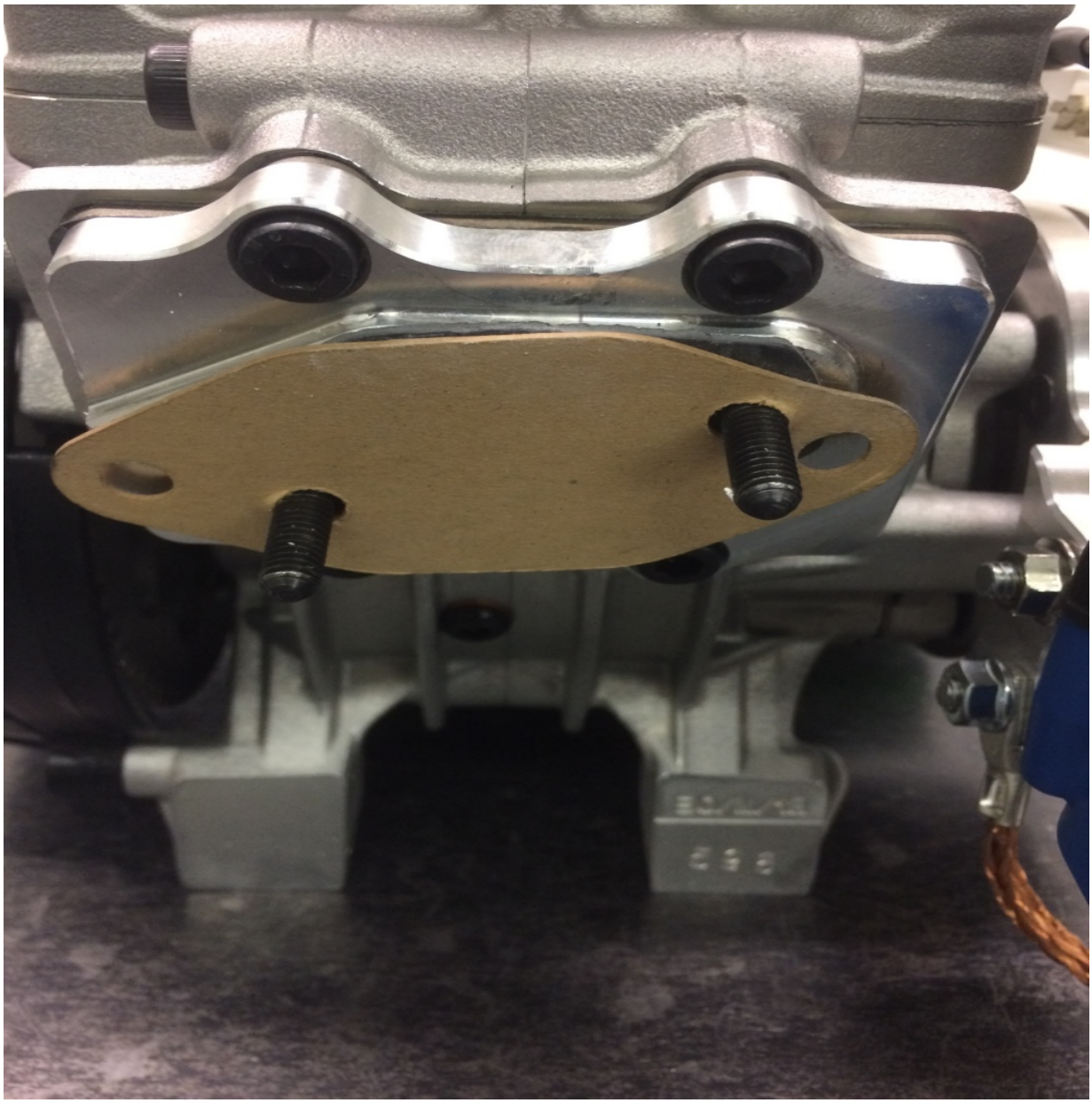
1.5 *ENGINE SERIAL NUMBER*

The official engine serial number[1] can be found stamped on the lower right part of the crankcase, next to the coil (Figure 1-2). The number normally includes 3 digits (there can be exceptions in some special cases). Other numbers stamped on the crankcase or other

[1] **Note**: When spare parts are required from your local dealer, please always refer to the engine serial number.

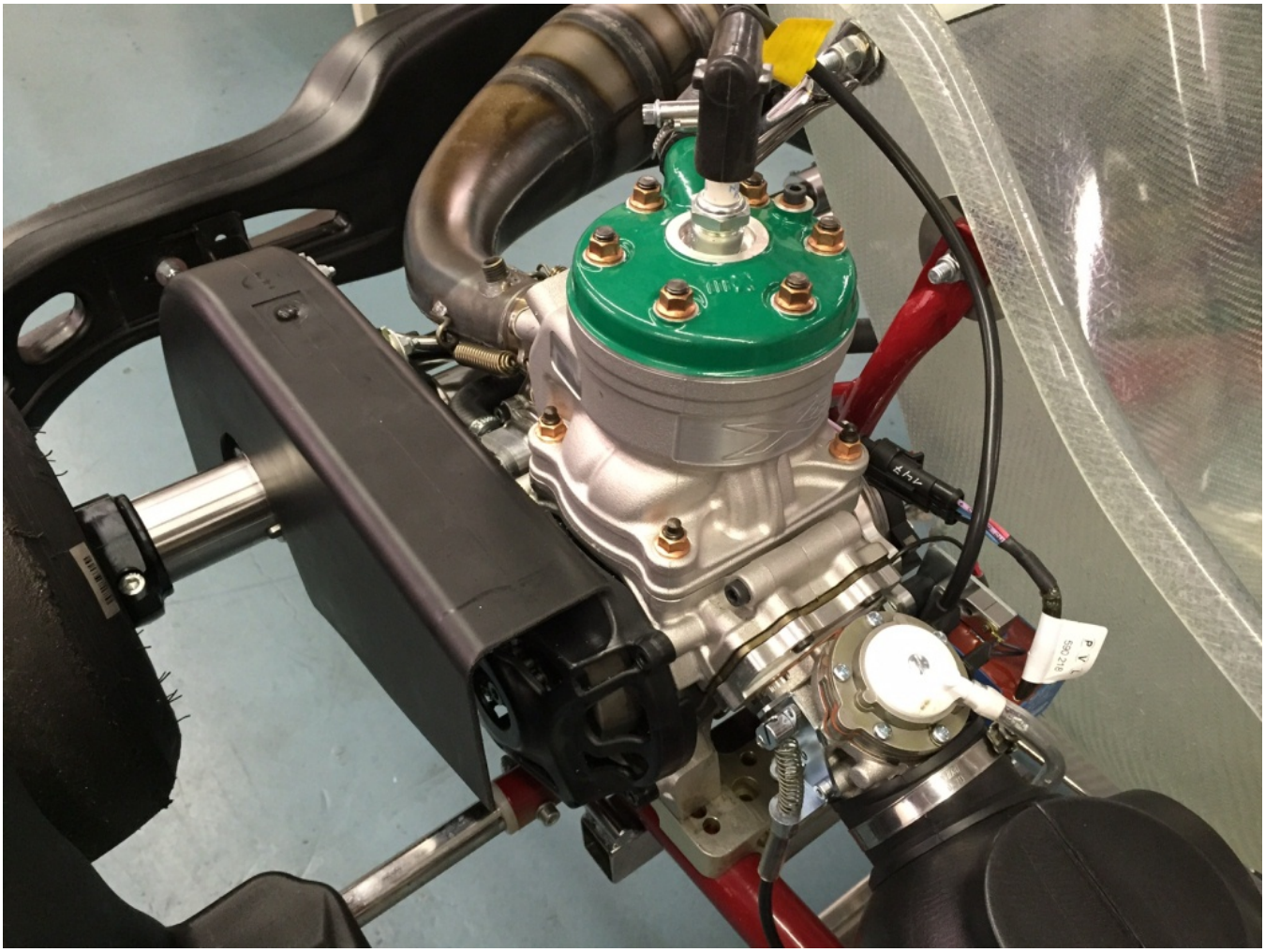
surfaces of the motor refer to various manufacturing processes and do not identify the motor.

Figure 1-2 -- Engine Serial Number



2. INSTALLATION OF THE ENGINE ON THE CHASSIS[2]

2.1 *INSTALLATION PICTURE OF THE ENGINE ON THE CHASSIS*



[2] **Note**: If the engine is supplied already assembled on the chassis, the assembler should follow these instructions. The final customer can skip this section and can start reading from section 3. Whenever the engine or a component is disassembled, always follow the instructions in this manual for proper reassembly.

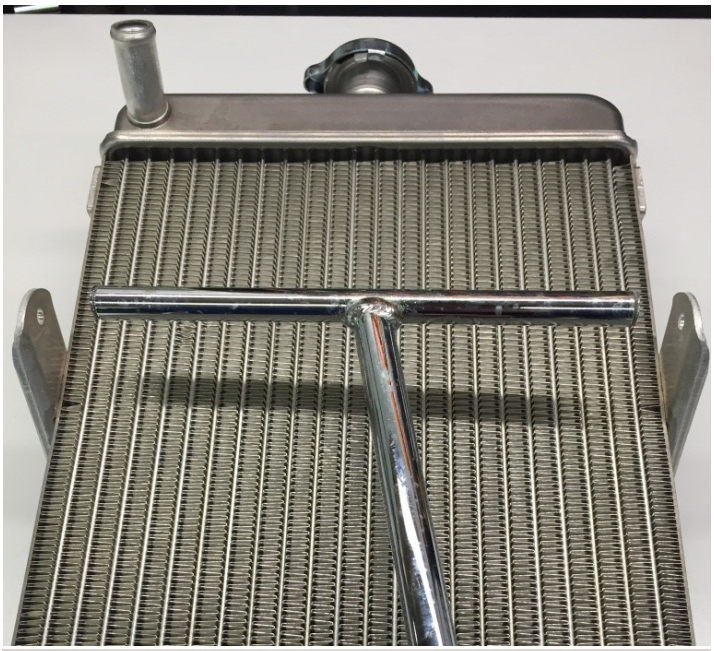
2.2 *INSTALL THE WATER COOLING+*

2.3 *SYSTEM*

2.2.1 Before installing the radiator, preassemble the following components:

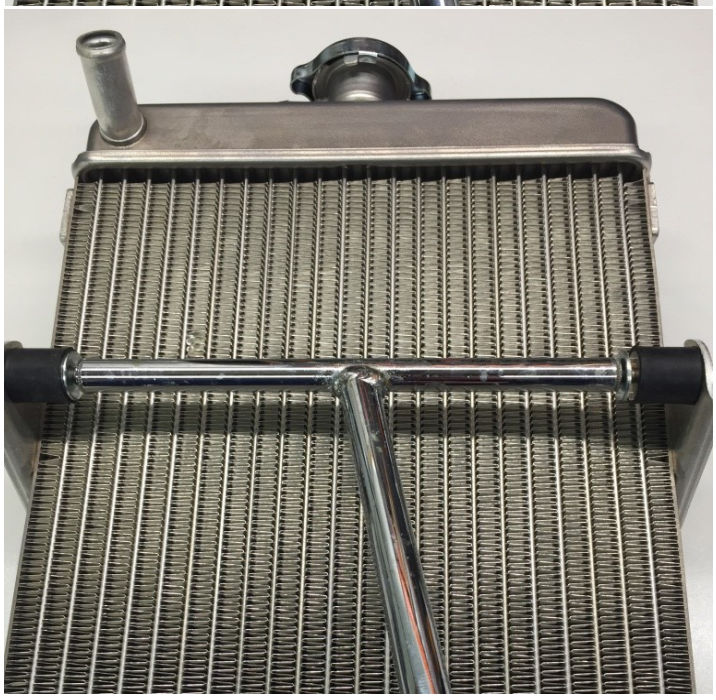
- Radiator X125T
- Support long
- Support short
- Anti vibration dampers
- M6X14 button head bolts
- M6 washers

Figure 2-2

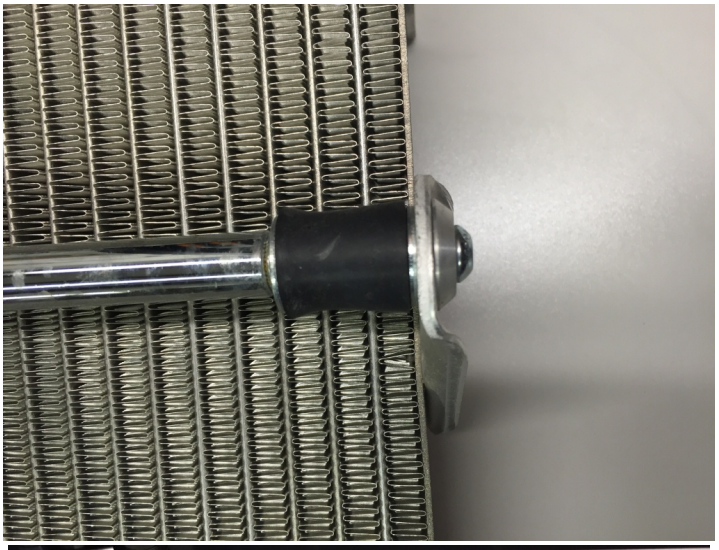


2.2.2 Install the long and short supports using the vibration dampeners, the M6 washers and the M6X14 button head bolts

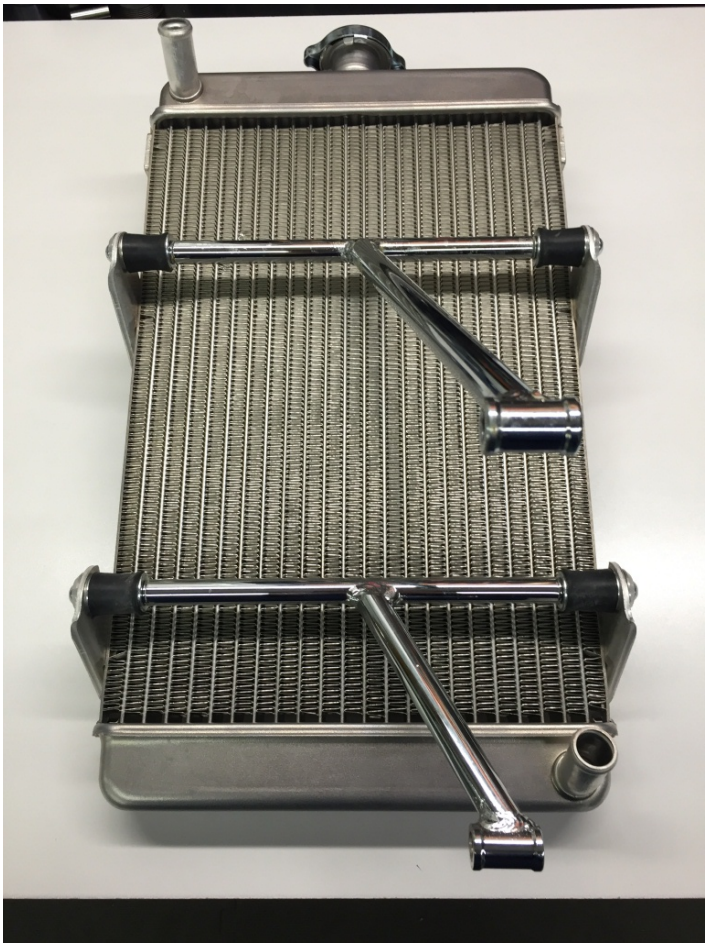
Figures 2-3 to 2-5



2.2.3 Figure 2-4



2.2.4 Figure 2-5

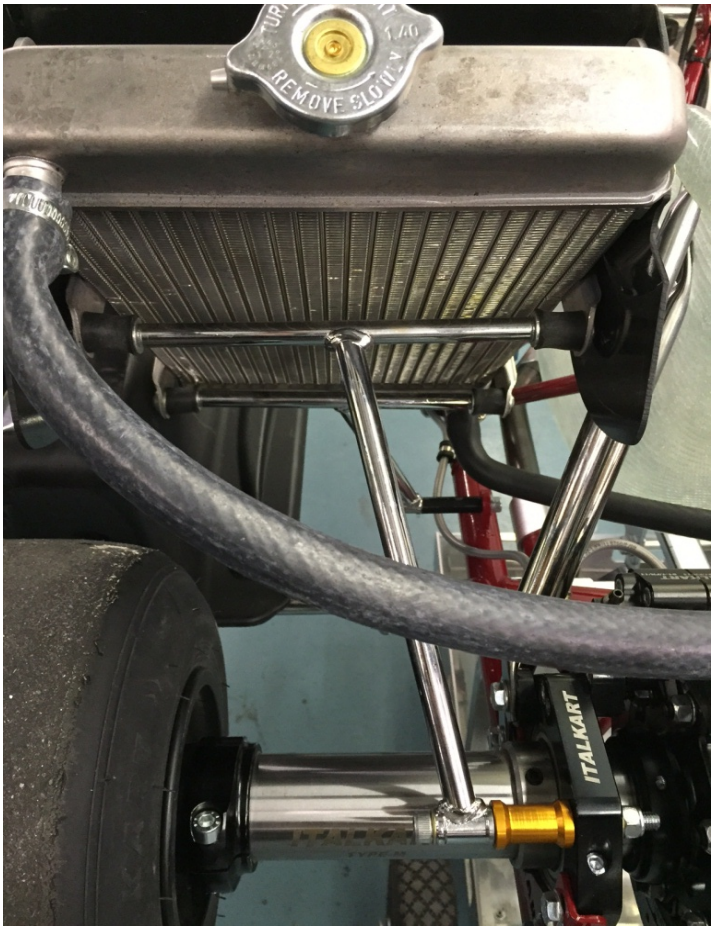


2.2.5 Install the radiator assembly on the chassis.

Attach the upper (long) support to the bearing cassette with the M8X50 bolt, M8 nylock nut and 2 M8 washers.

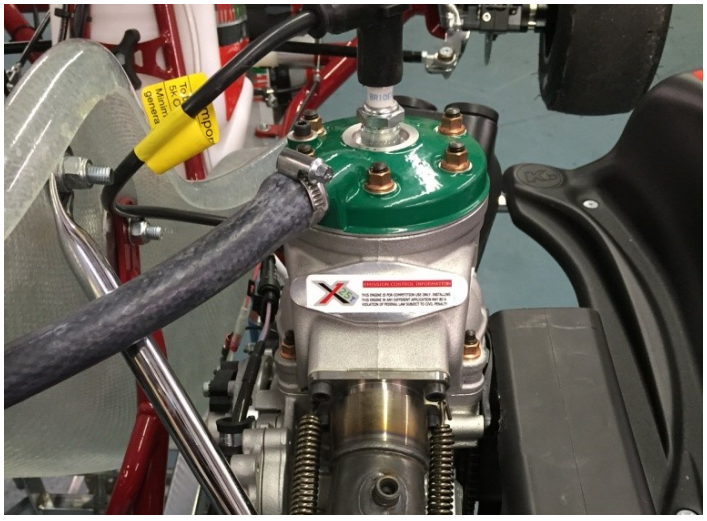
Attach one of the water system hoses to the top of the radiator on the inlet pipe.

Figure 2-6



2.2.6 Attach the other end of one of the water system hoses to the water outlet on the cylinder head.

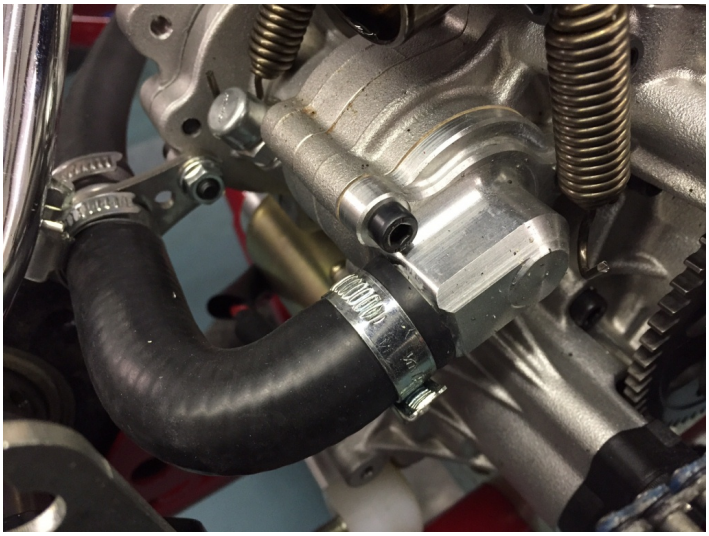
Figure 2-7



2.2.7 Install the other water system hose onto the water pump inlet.

Connect the other water system hose to the bottom connection on the radiator.

Figure 2-8



2.2.8 Attach the radiator shield to the top of the radiator using:

- M6X25 flathead allen bolt (2)
- M6 countersunk spring (2)
- M6 rubber dampener (2)
- M6 washer (2)
- M6 nylock nut (2)

Figures 2-8 and 2-9

2.2.9 Figure 2-9

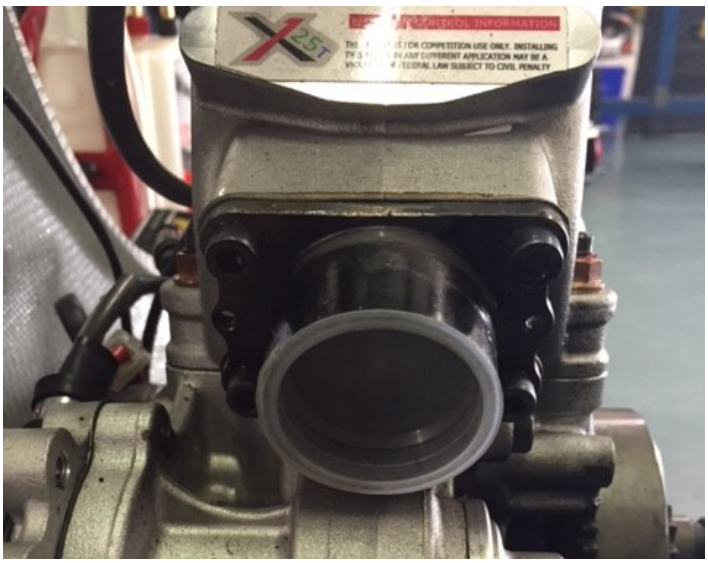
Before starting the engine follow these recommendations

- Unscrew the cap on the radiator and loosen the breather plug on the engine head.
- Fill the radiator until the water comes out from the plug (there is no air in the system now) and the radiator is completely filled. Tighten the cap (the system contains approximately 1 liter of water).
- It is advisable to put a catch can to recover water from the breather on the cap in case of boiling water.
- After the engine is broken in, check the water level in the radiator and top up if necessary.
- After a long period of inactivity, drain the water from the cooling system by removing the hoses and emptying the water circuit to avoid damage to the engine or parts due to freezing temperatures.

2.4 *EXHAUST MANIFOLD ASSEMBLY*

2.3.1 Remove the plastic plug from the exhaust manifold.

Figure 2-10

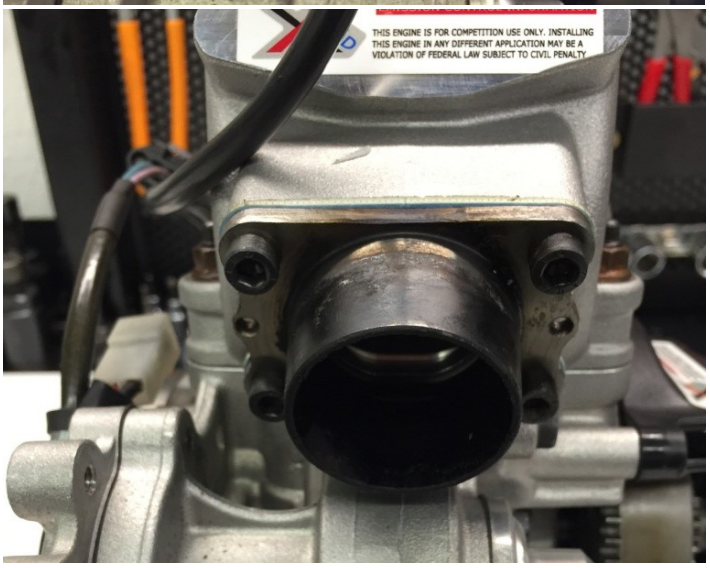


2.3.2 Make sure the exhaust gasket is installed behind the exhaust manifold.

Install the four M6X16 allen bolts

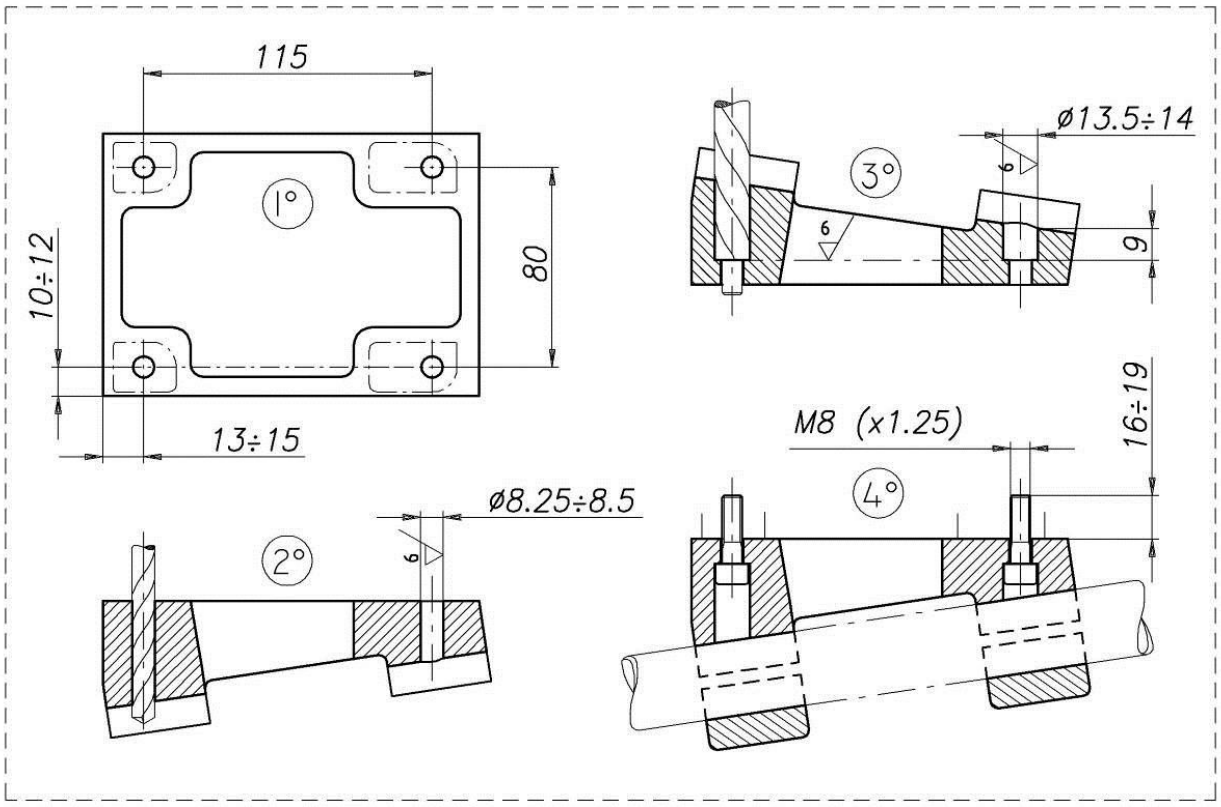
Torque at 8 - 10 nm (70 - 90 in-lb)

Figure 2-11



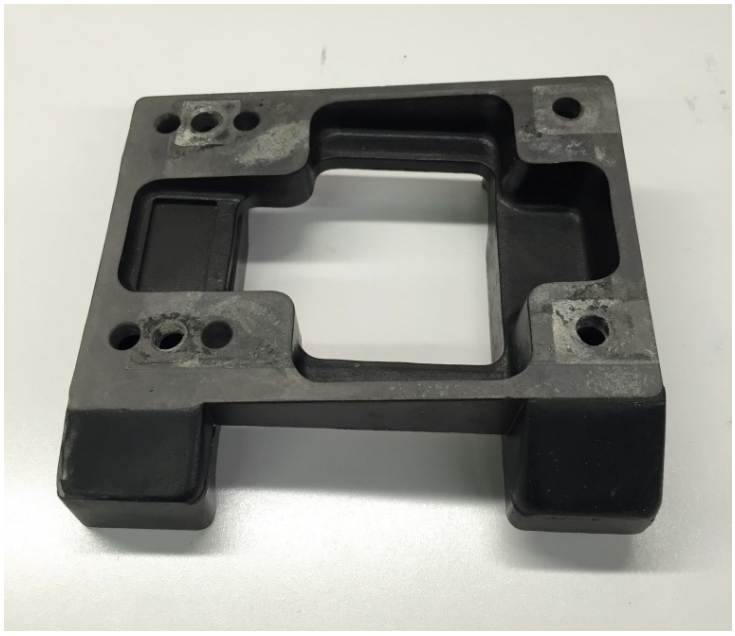
2.5 *PREPARATION AND INSTALLATION OF THE MOTOR MOUNT*

Figure 2-12 - Drill holes in the motor mount (8.25 - 8.5 mm)[3]



2.4.1 Select a mount with the dimensions indicated in Figure 2-12 above.

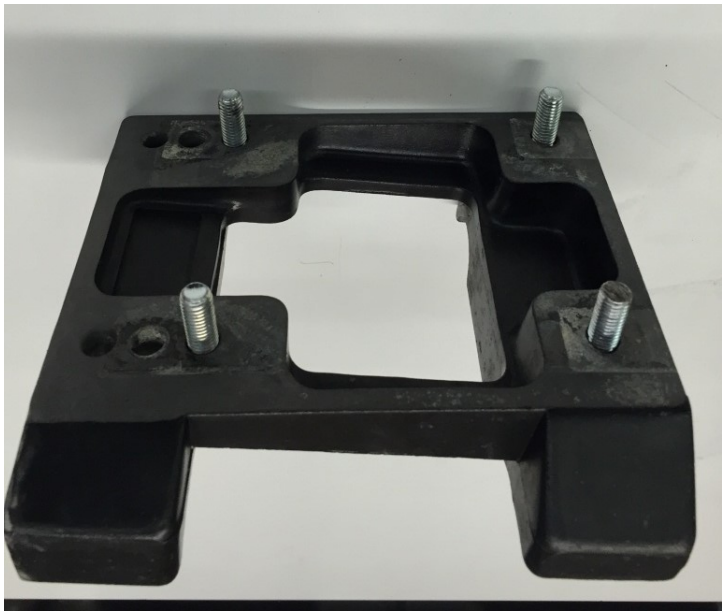
Figure 2-13



[3] **Note**: All dimensions in millimetres

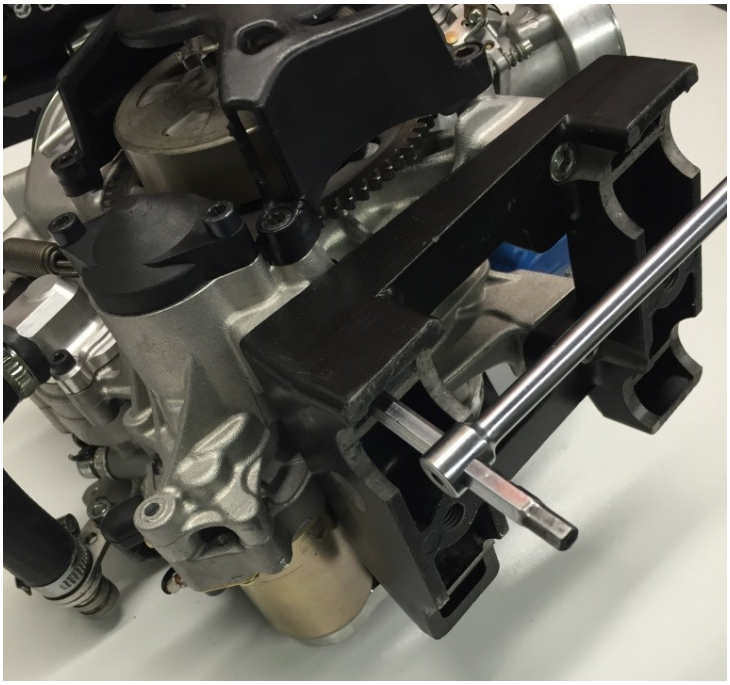
2.4.2 Install the motor mount, make sure to use the M8 allen bolts long enough to engage fully in the base feet a threaded length of 16 to 19mm, i.e. the bolts should protrude from the motor mount 16 to 19mm.

Figure 2-14



2.4.3 Torque the 4 X M8 allen bolts to 22 - 24 nm (190 - 210 in-lb)

Figure 2-15

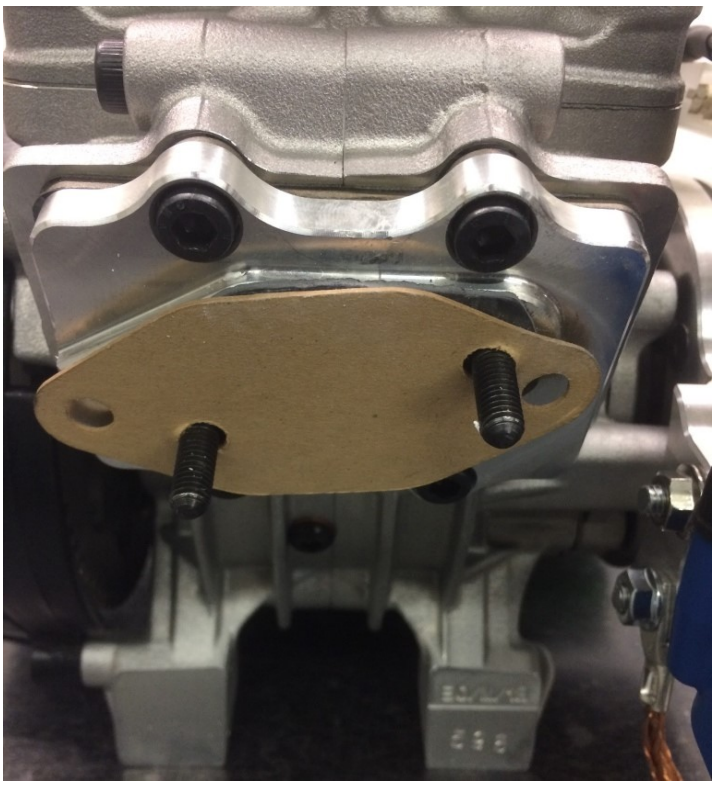


2.6 *INSTALL THE CARBURETOR*

2.5.1 Remove the paper cover from the inlet manifold.

Make sure that the pressure hole in the gasket is not plugged. When replacing the carb gasket always make sure that the gasket is installed so that the hole in the gasket matches with the two pressure holes in the carb and the reed cage. Otherwise the carb won't pump and the engine won't start.

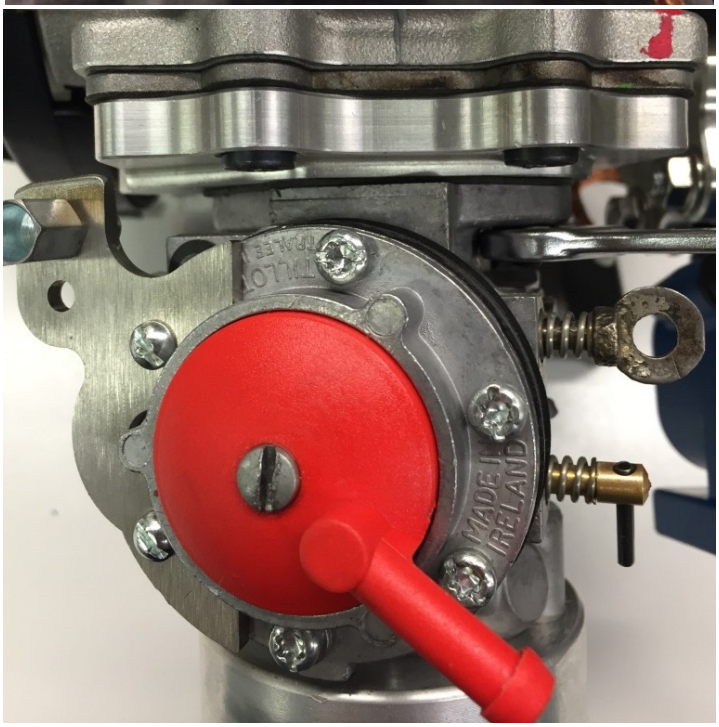
Figure 2-16



2.5.2 Install the two M6 carb nuts and two washers.

Torque to 6 - 10 nm (50 - 90 in-lb)

Figure 2-17



2.5.3 Fill the fuel line with fuel from the tank and connect the fuel line to the fuel pump.

Figure 2-18

2.7 *INSTALL THE ENGINE IN THE CHASSIS*

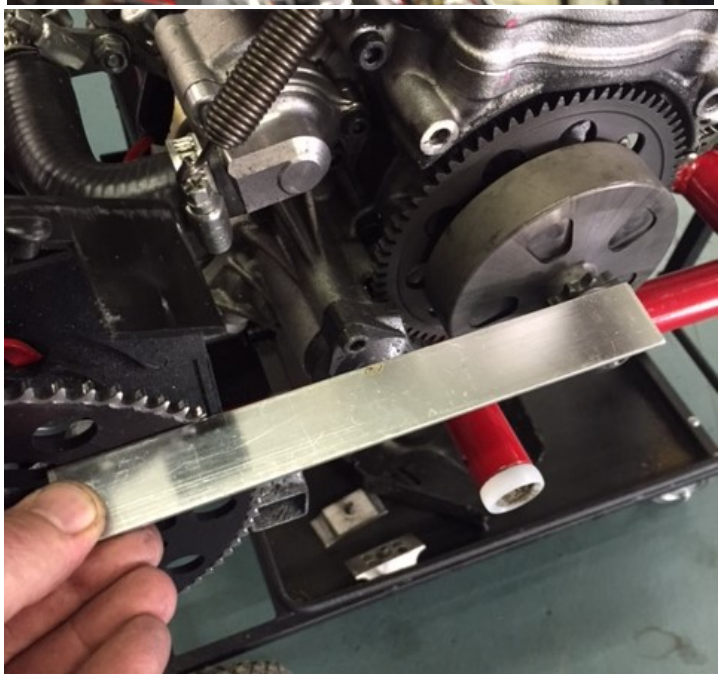
2.6.1 Place the engine with motor mount onto the frame rails and tighten the motor mount with the two butterfly clamps using the M10 allen bolts supplied with the motor mount.

Never fully torque the butterfly clamps until the chain is installed and properly aligned.

Figure 2-19

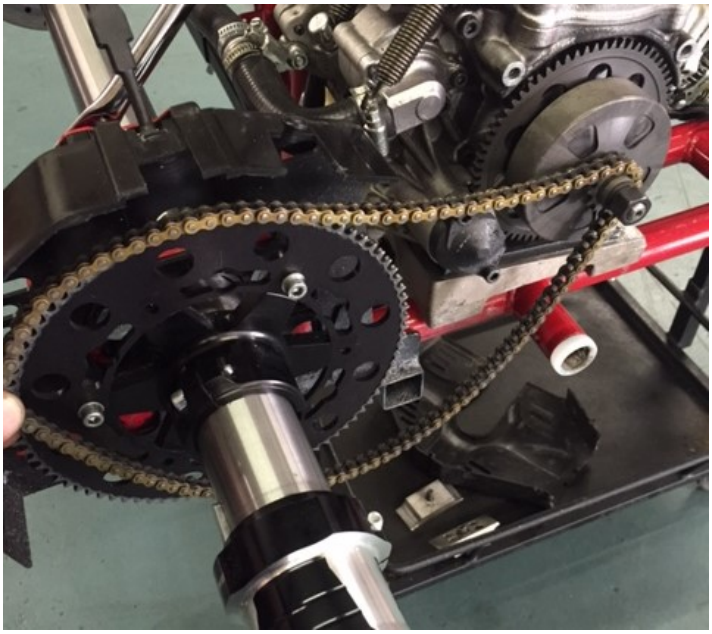
2.6.2 Check the alignment of the engine sprocket and the axle sprocket with a straight edge.

Figure 2-20



2.6.3 Install the #219 pitch chain.

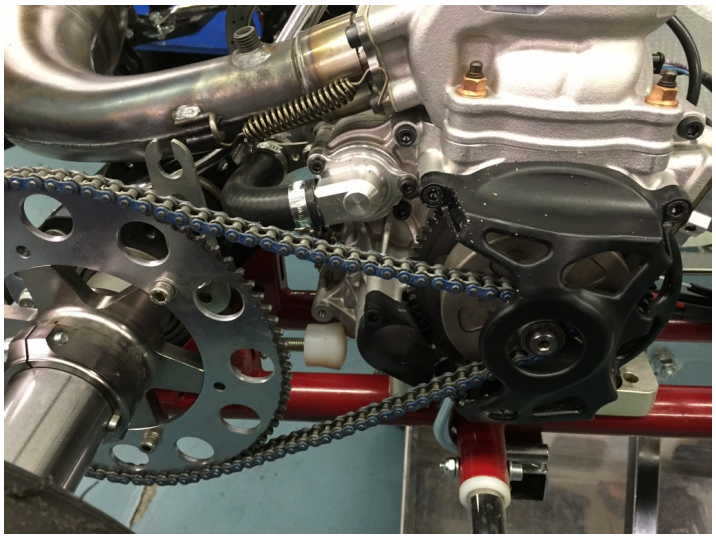
Figure 2-21



2.6.4 Move the engine forward on the frame rails until the chain is the desired tension. The chain play should be approximately 15mm measured as shown.

Torque the butterfly clamp screws to 22 - 24 nm (190 - 210 in-lb)

Figure 2-22

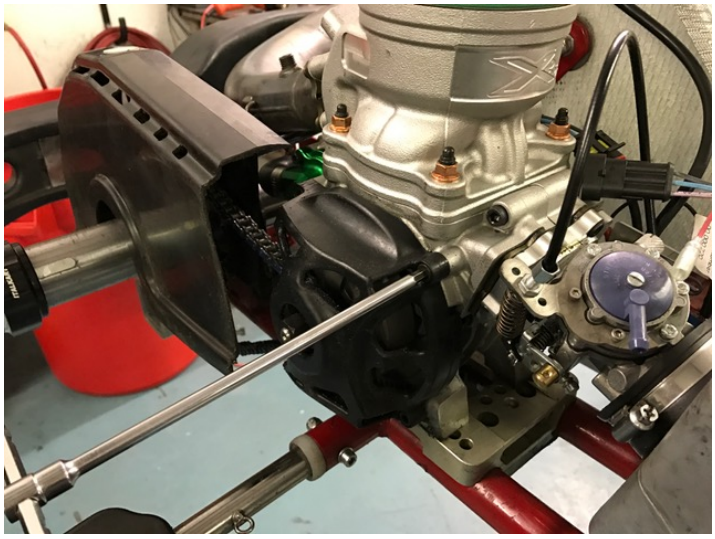


2.8 *INSTALL THE CLUTCH COVER AND COIL*

2.7.1 Remove the 3 M6X25 allen bolts on the crankcase and install the clutch guard.

Torque the 3 allen bolts to 8 - 10 nm (70 - 90 in-lb)

If a horizontal motor mount is used check to see if there is sufficient space between the chain and the upper part of the clutch guard. If the gap is less than 6 - 7 mm then widen the chain opening as required. We suggest installing the sprocket with the highest number of teeth available.
Figure 2-23

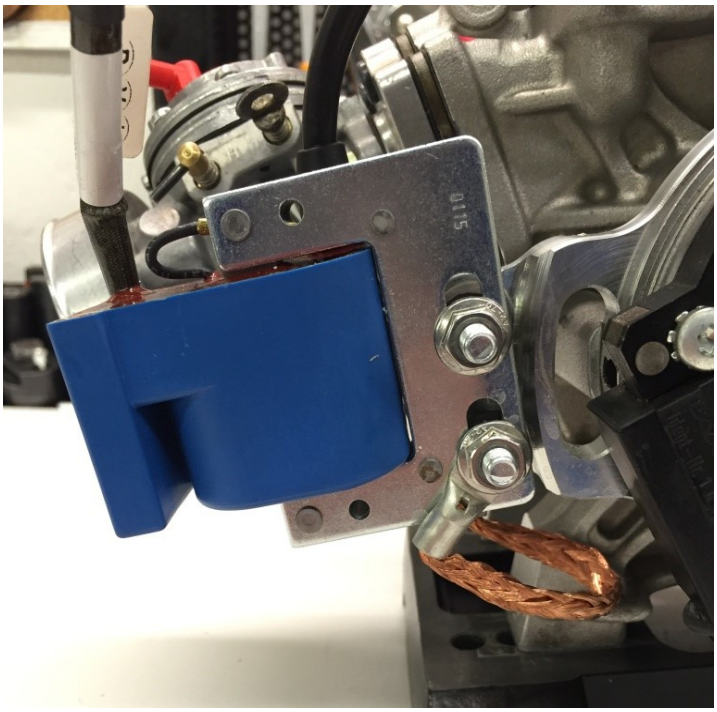


2.7.2 Connect the coil copper ground cable from the hole on the crankcase to the coil with the M6X12 allen bolts and M6 nylock nuts provided.

Torque to 8 - 10 nm (70 - 90 in-lb)

Make sure the ground cable always connects the coil with the engine. An inadequate ground could damage the coil. The position of the coil has been chosen to be away from the exhaust so that excessive heat will not damage the coil.

Figure 2-24



2.7.3 Bolt the other end eyelet terminal of the ground cable to the coil using the M6 nylock nuts supplied .

Torque to 8 - 80 nm (70 - 90 in-lb)

Make sure that there is good contact between the ground cable and the coil to avoid damage to the coil.
Figure 2-25

2.9 *ELECTRICAL CONNECTIONS*

2.8.1 Place the battery support box on the left hand side frame rail of the chassis beside the seat and attach with the clamps to the under side of the frame rail using the M6X25 allen bolts provided.

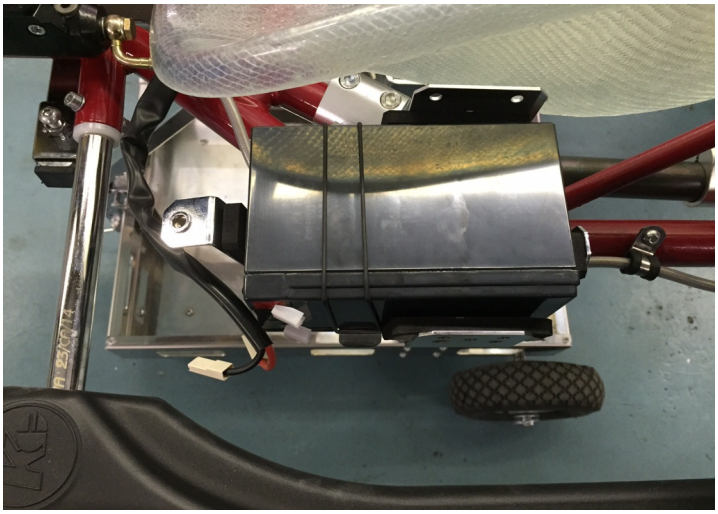
Torque to 8 - 10 nm (70 - 90 in-lb)

The battery support box and clamps will allow installation on most chassis types.
Figure 2-26

2.8.2 Insert the battery in the support box and fasten with the battery strap.

Position the battery terminals onto the battery posts. Take care not to short-circuit the battery terminals as the battery could be damaged.

Figure 2-27



2.8.3 Fasten the battery support cover over the battery assembly using the M6X20 flathead allen bolt and rubber dampening spacer supplied.

Figure 2-28

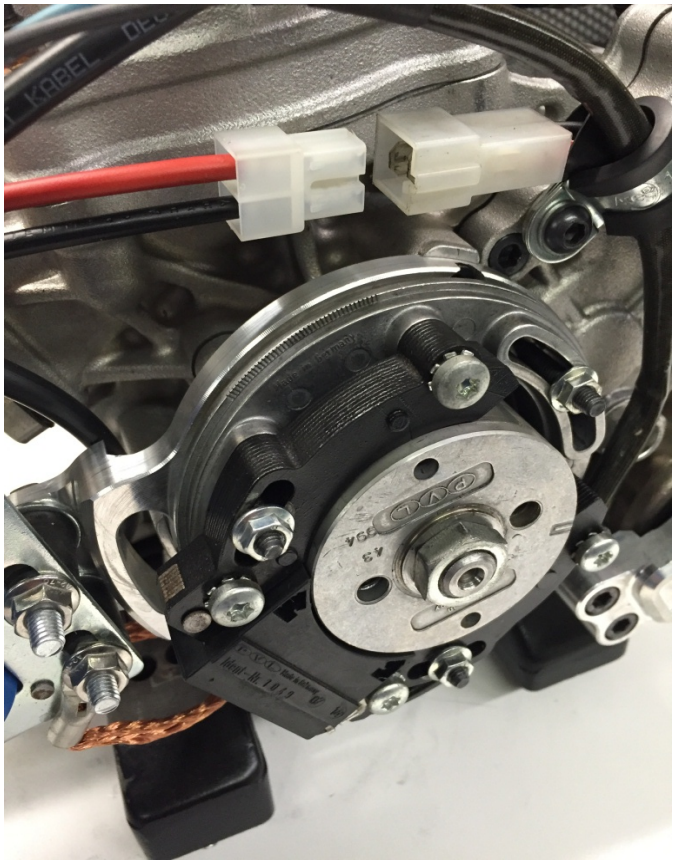
2.8.4 Position the wiring harness starting from the battery along the chassis in front of the seat over to the engine and fasten with plastic zip-ties.

Take care not to let the harness contact the ground or rotating parts, as damage will result.

Figure 2-29

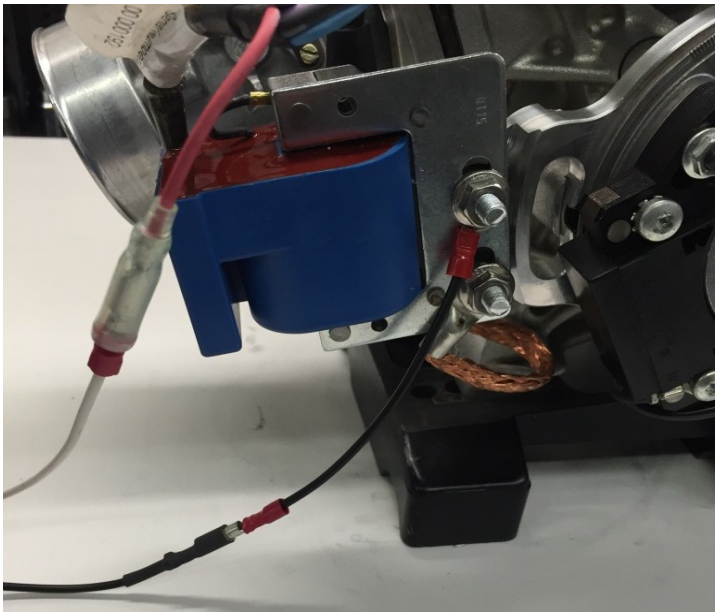
2.8.5 Connect the 8 pole terminal from the ignition to the corresponding terminal on the wiring harness. Make sure that the fixing tongues in the terminal are straight and properly inserted to guarantee the best possible connection of the terminals.

Figure 2-30



2.8.6 Connect the terminals from the coil to the wiring harness.

Figure 2-31



2.8.7 Drill two holes in the side of the front fairing (Nassau panel). The first 22mm for the start button, and the second 12mm for the on - off switch.

Figure 2-32

2.8.8 Secure the starter button and on - off switch assemblies using the supplied ring nuts on the inside of the front fairing.

Figure 2-33

2.8.9 Screw the spark plug cap onto the coil wire. We recommend a small squirt of WD40 inside the cap to facilitate screwing the plug cap all the way onto the coil wire.

Figure 2-34

2.8.10 Secure the spark plug cap to the coil wire with a plastic zip-tie.

Install the spark plug in the cylinder head.

Place the plug cap all the way down securely onto the spark plug.

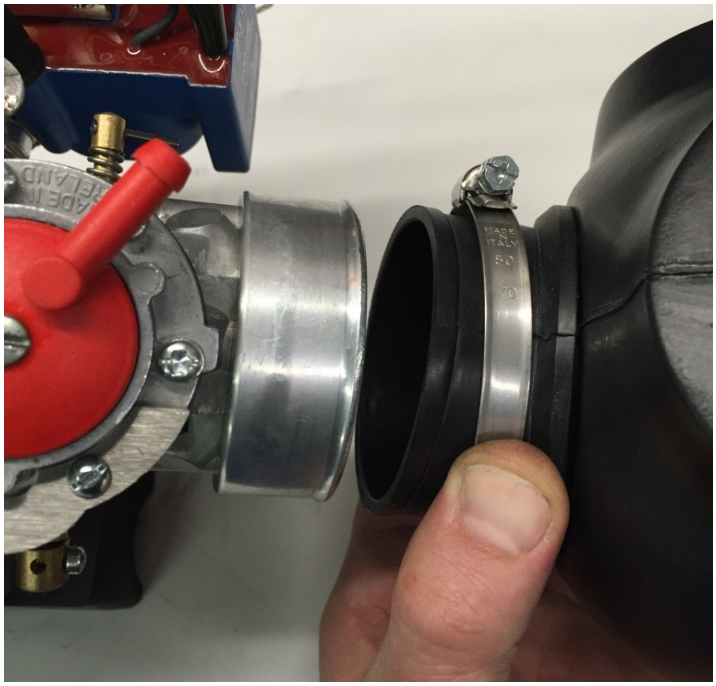
Figure 2-35

2.10 *INSTALL THE INTAKE SILENCER*

2.9.1 Make sure the inlet silencer has the inlet tubes facing upwards.

Place the inlet silencer over the carb cup with the steel clamp.

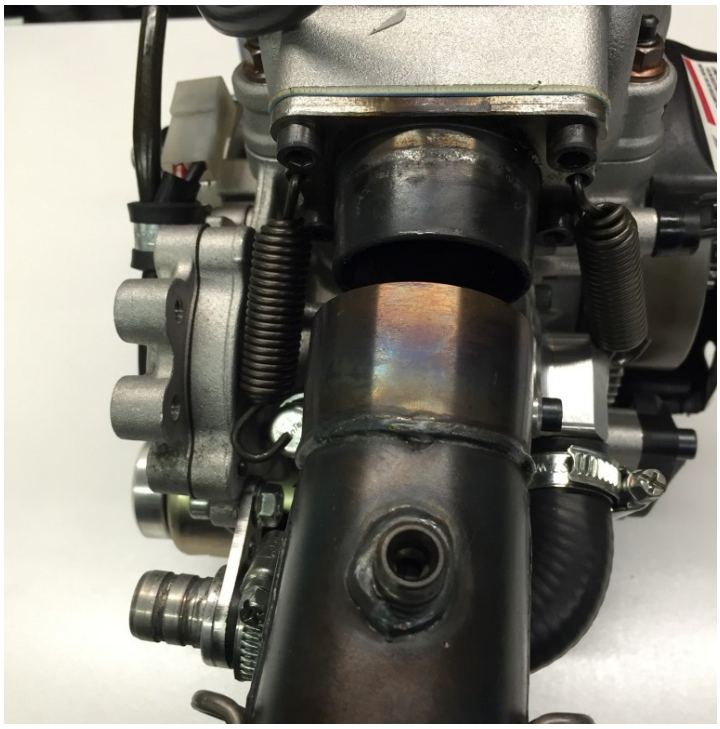
Figure 2-36



2.11 *INSTALL THE EXHAUST PIPE*

2.10.1 Insert the pipe onto the exhaust manifold with the two springs.

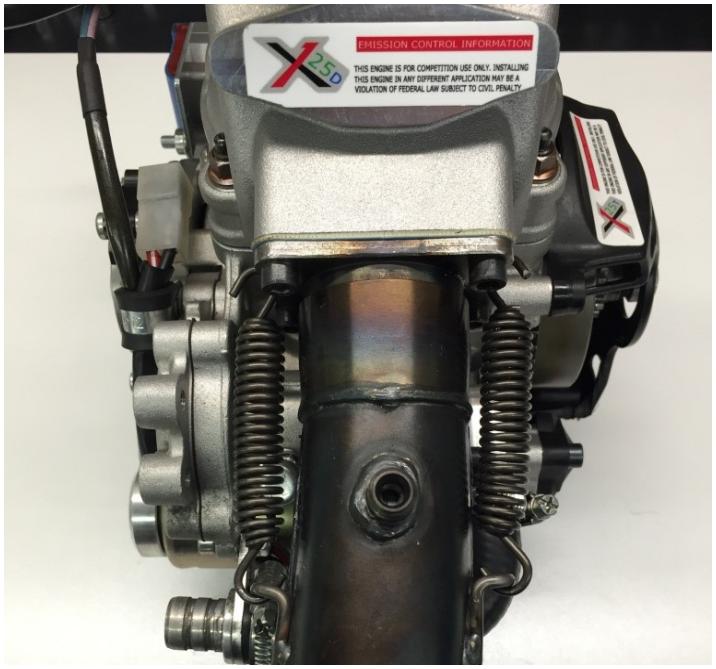
Figure 2-37



2.10.2 Attach the springs to the clips in the pipe and exhaust manifold.

Note that an Exhaust Gas Temperature (EGT) probe coupling is provided on the pipe. Drill out the coupling the size of your EGT probe to install.

Figure 2-38

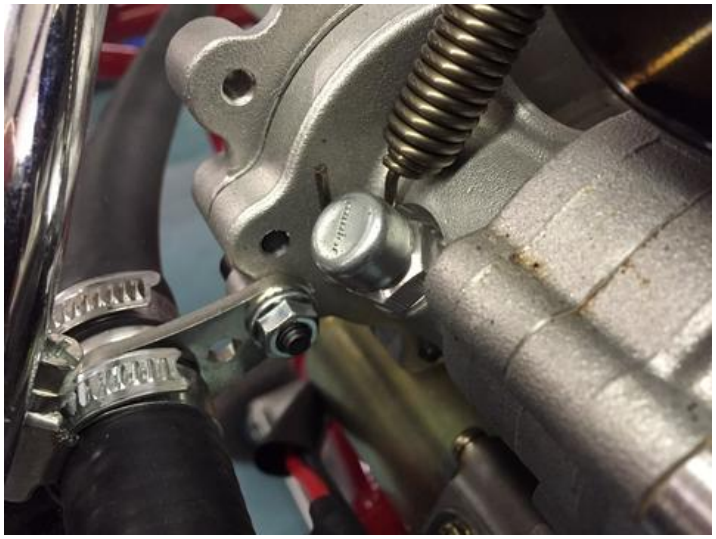


2.12 *ADD OIL TO THE CRANKCASE*

2.11.1 Remove the crankcase filler cap and add 60 millilitres of oil to the crankcase per Section 3.1.

The engine should now be ready to start.

Figure 2-39



3. OPERATION OF THE ENGINE

3.1 *FILLING THE GEARBOX WITH OIL*

- **Filling the gearbox:**

Put the engine in horizontal position, unscrew the oil filling plug Figure 3-1 and oil level plug Figure 3-2 and fill with oil until it comes out from the oil level plug (approximately 60 milliliters of oil).

Figure 3-1 Gearbox Filling Plug

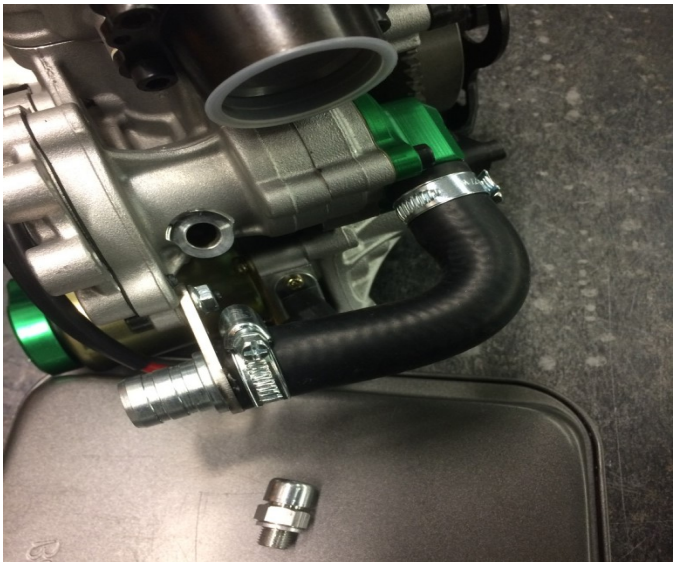
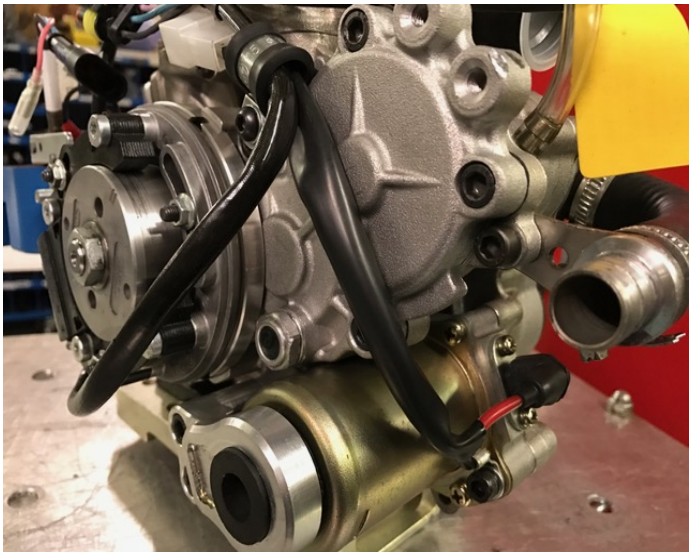


Figure 3-2 Gearbox Filling Plug



- **Check the oil level**

Put the engine in horizontal position and unscrew the oil level plug. If the level is correct you should see a light outcome of oil, otherwise top up.

- **Draining the oil**

Unscrew the oil level plug and loosen the filling plug. Tilt the engine to discharge the oil through the oil level plug.

3.2 *FUEL MIXTURE*

Use leaded or unleaded Premium gasoline 95 octane, mixed with 2 cycle racing oil at 6% (16:1). Use oils containing Castor Oil which guarantees an optimized lubrication at high temperature. However the use of Castor Oils creates gummy residues which can cause carbon deposits. We recommend checking and cleaning the piston and cylinder head at least every 5 to 10 hours. Examples of oils include:

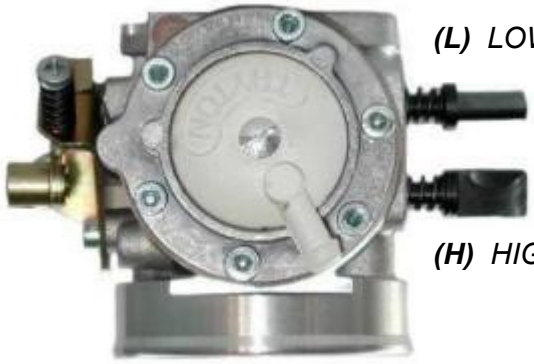
- MOTUL GP 2T
- SHELL ADAVANCE RACING M
- ELF HTX 909
- ERG K KART FO0RMULA

Once the fuel tank is filled, make sure that the gasoline reaches the carburetor before starting the engine. Never use the electric starter to suck the gasoline as this could discharge the battery.

We suggest disconnecting the fuel line from the carb and the vent tube from the tank, then pressurize the vent tube until the gasoline comes out from the fuel line at the carb. Make sure that there is no air in the fuel line. Connect the fuel line onto the carb and reconnect the fuel tank vent line.

3.3 *CARBURETOR ADJUSTMENT GUIDE*

Figure 3-2 Carburetor Adjustment



The X125T engine is supplied either with a 23mm Tillotson HL334AB carb or a 27mm Tillotson HW-32A carb. Please use the following settings as the correct settings for the fuel mixture screws, after engine break in is completed:

- **23mm Tillotson HL334AB carburetor**

L (close the screw completely and then open): 1 3/4 turns counter clockwise
H (close the screw completely and then open): 1 turn counter clockwise

- **27mm Tillotson HW-32A carburetor**

L (close the screw completely and then open): 1 3/4 turns counter clockwise
H (close the screw completely and then open): 1 turn counter clockwise

Based on various factors such as altitude, ambient temperature etc. it may be necessary to adjust the carburetor to optimize the performance of the engine. If you have an exhaust gas temperature gauge, the target operating temperature is 565°C to 593°C (1050°F to 1100°F).

Never lean the fuel mixture settings too much as a lean mixture will overheat the engine and may cause seizure. Do not force H or L closed. It may damage the precision machined orifice and render the carb unserviceable. Any adjustment of the fuel mixture settings must be performed with the engine warmed up.

3.4 *STARTING AND STOPPING THE ENGINE*

To start the engine press the black start button mounted on the Nasau panel as shown in Figure 3-3.

Figure 3-3 Start and Stop Buttons

3.5 *BREAKING IN THE ENGINE*

The break-in of the engine must be performed following a few fundamental rules:

1. Adjust the carburetion. Start with an adjustment on the rich side.
2. Warm the engine gradually for about 5 minutes at half throttle, making some laps at low speed, gently closing and opening the throttle (if a tachometer is installed never exceed 11,000 to 12,000 RPM). Never keep the same RPM for a long time. Stop the engine and let it cool down.
3. Increase the speed for 5 minutes at ¾ throttle opening. Never keep the same RPM for a long time. Stop the engine and let it cool down.
4. Increase the speed for 5 minutes, at maximum load on the corners of the circuit and making the engine rich at half straight (hold your hand over the tubes on the inlet silencer keeping the throttle wide open). Stop the engine and let it cool down.
5. Once the break-in is completed and the engine is cold, check the torque of the exhaust header nuts to 8 - 10 nm (70 - 90 in-lb) as, during the break-in the nuts may to become loose. Refer to the Torque Values table in section 4.8.

3.6 *REV LIMITER*

The ignition incorporates a rev limiter which prevents the engine from exceeding 15,500 RPM. This limit cannot be exceeded otherwise the engine could be damaged by the extremely high RPM.

Do not keep the engine for a long time at the RPM at which the limiter is functioning. This may cause malfunctions on the induction and damage the reed valves.

When choosing the gear ratio always refer to a maximum limit equal to the engine maximum RPM of 15,500 so that the incorporated limiter is not switched on continuously when the engine is running.

3.7 *INLET SILENCER AND AIR BOX*

Make sure that the inlet tubes on the air box are facing towards the upper side and that they are not plugged. Make sure that the clamp on the carburetor cup is not loose and that the filter is well fastened to the chassis.

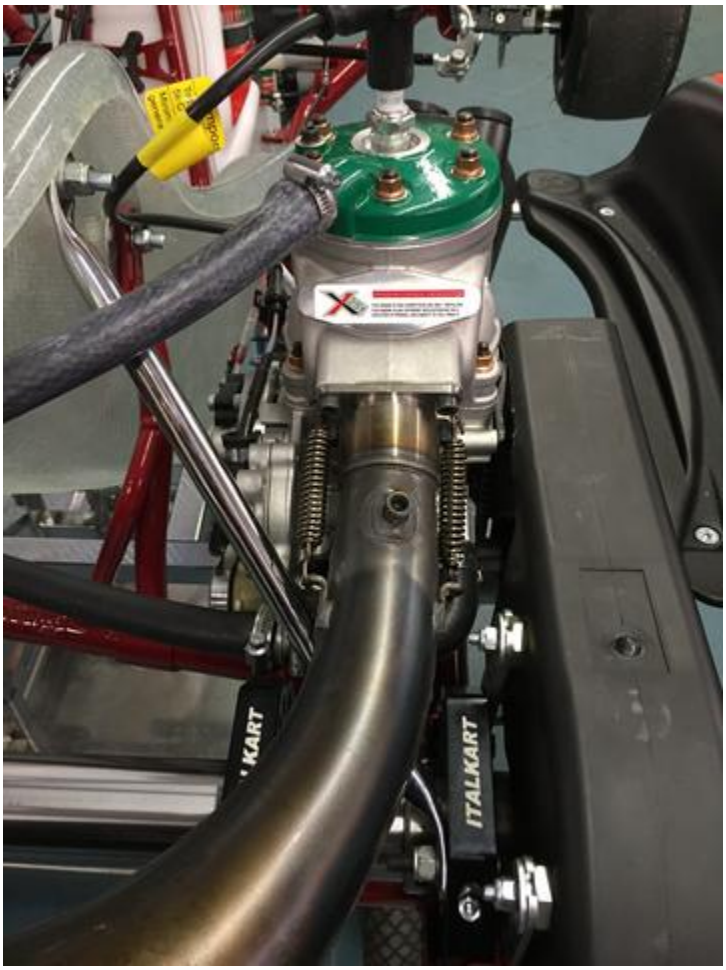
Regularly clean the inside from oil deposits and any debris. If necessary remove the rubber manifold with filter and clean it with filter cleaner.

3.8 *EXHAUST SYSTEM*

Always make sure that the springs are well hooked and in place as per Figure 3-4. In case of breakage, replace the broken spring. Never race the kart without the 2 springs in place, as otherwise the exhaust pipe could vibrate off.

The best performance is achieved with the pipe attached directly to the exhaust header. If extra length is required install an exhaust spacer (part no. A10.1323311-Spacer) in between the exhaust port and the header using extra exhaust gaskets (part no. A10.1560000) as required.

Figure 3-4 Exhaust System Placement



3.9 *BATTERY*

The battery should be a 12 volt – 9 ampere hour sealed maintenance battery, and purchased separately from engine package. In order to enhance the battery life it is recommended to follow a few suggestions:

- When the voltage drops below 12.6volts. it is necessary to recharge the battery.
- Maximum allowed recharging current is 1.8 amperes.
- The ideal recharge is achieved with an average charging current of 0.8 to 1.0 amperes for a recharging time of approximately 10 hours and with an ambient temperature between 0° and 40°C.

Overcharging or fast charging with excessive current could damage the battery causing the battery to swell. Choose a battery charger with the following characteristics:

- Input voltage: 90/250 volts ac – 50/60 hertz
- Output voltage: 15 volts full charge – 13.8 volts stand-by
- Maximum output current: 2 amperes at full charge

During transportation or storage, the battery could loose its charge due to the self discharge of approximately 0.1% per day. Fully recharge battery before use.

- Always connect the negative (-) terminal first and then the positive (+) terminal. Always disconnect the battery in the opposite order.
- Recharge the battery at least once every 6 months while not in use.
- Never let the battery voltage drop under 8volts, as whenever it drops under this limit, the battery cannot be used any longer and it has to be replaced.
- Never put the battery in contact with solvents, oils or rags containing such elements. The external case of the battery could be damaged.
- Never press or bend or overheat (by welding) the battery terminals.

OTHER RECOMMENDATIONS

- Pay attention not to have open flames near the battery.
- Never short-circuit the terminals.
- Never open the battery or throw it in a fire.
- In case the sulphuric acid electrolyte comes into contact with skin or clothes, wash immediately with water. In case it comes into contact with eyes, wash and seek medical assistance.
- Carefully check the external case of battery and replace in case of breakage, swelling of the case or of the battery cover.
- Before use, clean the battery of dust and debris and check that the terminals are not oxidized or damaged.
- When the battery must be replaced never throw it in the garbage but recycle it at an authorized recycle outlet.

3.10 *WARNINGS ON THE ELECTRICAL SYSTEM*

Please follow the electrical system suggestions and warnings below to limit engine damage and maintain long engine life:.

1. Do not press the start button when the engine is running.
2. Never disconnect the ground cables with eyelets when the engine is in operation.
3. To fasten the eyelet terminal (grounds) of the wiring harness always use flat or open washers. Never use tab washers.

4. When disconnecting the connectors, always press the fixing tongues. Always pull the connectors to disconnect. NEVER PULL THE CABLES
5. Always correctly fix the coil with both nylock nuts, make sure that the laminations pack on the coil is connected to the engine with the grounding cable. The eyelet connector must be directly in contact with the laminations pack on the coil.
6. The digital assembly needs use of a resistive spark plug cap or spark plug. The resistor value must be equal or higher than 5 kilo ohms. Avoid use of resistive spark plug cables.
7. Only use sealed lead type batteries as specified by X125. Only use 12 volt batteries.
8. Always disconnect the battery from the electrical system when recharging the battery with an external battery charger, otherwise the internal voltage regulator could be damaged.
9. DO NOT connect batteries in parallel; this might cause explosion and injury to the operator.
10. In case the battery must supply other loads (Tachometer, Telemetry etc…), first contact your dealer to check the recharge capacity of the system.
11. Modifications, interventions and additions to the original electric system might cause malfunctions. No obligation to the manufacturer exists in this case.

3.11 *SPARK PLUG AND HEAT RANGE*

The engine is supplied with a standard NGK BR10EG spark plug, which is a good compromise for break-in and racing in normal conditions.

Use of different spark plugs is possible and for general information, we have provided Table 3-1 as a cross reference among spark plug manufacturers, based on heat range capacity of the spark plug to dissipate internal heat. The color of the various parts of the spark plug more exposed to the combustion flames gives a good indication on the carburetion. It is necessary though to understand which of the two parameters has to be changed and only the experience tells how to identify the best heat range of a spark plug as lean or rich mixtures can generate the same color which can also be achieved with a hot or cold spark plug.

Table 3-1 Spark Plug Manufacturer numbers

Heat Range	Bosch	NGK	Champion
Hot	WO8CS	BR9EG	N54R
Medium	WO7CS	BR9EG	N52R
Cold	WO6CS	BR9EG	

Table 3-2 Spark Plug Symptoms

Spark Plug Temperature	Symptoms
An excessively hot plug may show these symptoms: *Always use a warmer than standard plug with cold or rainy conditions*	*Some of these symptoms may be due to lean mixtures:* Extremely clear, porous look and calcification of the electrodes and plug insulator. Inconsistent ignition, pre-ignition and detonation with a possibility of perforating the top of the piston.
The correct heat range shows:	Colour of the insulator from yellow gray to dark brown for mixtures respectively lean to rich.
An excessively cold plug may show these symptoms: *Always use a colder than standard plug with hot climates.*	Insulator end and electrodes covered with black shady soot. Difficulty starting. Wet or oily electrode could also be due to excessively rich mixture.

3.12 *SELECTING THE BEST GEAR RATIO*

The life of an engine depends on many factors but most of all, upon the speed at which the engine is operated. If an engine is normally operated at speed higher than what is recommended, the wear and stress of the various components (con-rods, roller cages, bearings, reeds, etc.) will drastically reduce the life of the engine. It is therefore extremely important that the user respects 15,500 RPM maximum RPM limit of the engine imposed by the built in rev limiter.

To select the best gear ratio for the track to achieve the best performance, without abusing the engine, use the following recommendations.

The engines are supplied with an 11 tooth 219 pitch sprocket, but 10, 11, 13 and 16 tooth sprockets are also available as accessories. Table 3-3 shows the various ratios between the axle sprocket and engine sprocket given the different axle sprocket sizes.

Table 3-3 Sprocket Ratio Calculator

Axle Sprocket Teeth	Engine Sprocket Teeth				
	10	11	12	13	16
72	7.20	6.55	6.00	5.53	4.50
73	7.30	6.64	6.08	5.62	4.56

Axle Sprocket Teeth	Engine Sprocket Teeth				
	10	11	12	13	16
74	7.40	6.73	6.17	5.69	4.63
75	7.50	6.82	6.25	5.77	4.69
76	7.60	6.91	6.33	5.85	4.75
77	7.70	7.00	6.42	5.92	4.81
78	7.80	7.09	6.50	6.00	4.88
79	7.90	7.17	6.58	6.08	4.94
80	8.00	7.27	6.67	6.15	5.00
81	8.10	7.36	6.75	6.23	5.06
82	8.20	7.45	6.83	6.31	5.13
83	8.30	7.55	6.92	6.38	5.19
84	8.40	7.64	7.00	6.46	5.25
85	8.50	7.73	7.08	6.54	5.31
86	8.60	7.82	7.17	6.62	5.38
87	8.70	7.91	7.25	6.69	5.44
88	8.80	8.00	7.33	6.76	5.50
89	8.90	8.09	7.42	6.84	5.56
90	9.00	8.18	7.50	6.92	5.63
91	9.10	8.27	7.58	7.00	5.69
92	9.20	8.36	7.67	7.08	5.75
93	9.03	8.45	7.75	7.15	5.81

For operation at a maximum of 15,500 RPM see Table 3-4.

During testing we recommend using a tachometer for recording the maximum obtained engine RPM. Use spark plug caps with a resistance of 5 kilo ohms to avoid the interference between the engine ignition and the tachometer and/or telemetry.

The following should clarify the procedure for the optimization of the sprocket ratio. Assume you have a 10 tooth engine sprocket and that during the preliminary testing a 70 tooth axle sprocket has been used. From Table 3-3 with a 10 tooth engine sprocket and a 70 tooth axle sprocket, a sprocket ratio of 7.00 is determined.

Make a few laps on the track and record the maximum engine RPM achieved. Assume that you record a maximum RPM of 13,600 RPM. Looking at Table 3-4, to achieve a maximum RPM of 15,500 RPM a sprocket ratio between 7.83 and 8.05 should be used if during testing a sprocket ratio of 7.00 was used and a maximum RPM 13,600 achieved. From Table 3-3, for a 10 tooth engine sprocket an axle sprocket from 78 to 81 should be chosen.

If you change the engine sprocket to an 11 tooth, then you would require an axle sprocket between 86 and 88 on Table 3-3 to achieve the similar 7.83 to 8.05 sprocket ratio from Table 3-4.

Table 3-4 Sprocket Ratio Change for 15,500 RPM

Sprocket ratio to achieve max 15500 RPM																		
	Existing Sprocket ratio																	
Engine max RPM during tests	5,71	5,9	6,1	6,29	6,48	6,67	6,87	7,06	7,26	7,45	7,64	7,84	8,03	8,22	8,42	8,61	8,8	9
13000	6,81	7,03	7,27	7,50	7,73	7,95	8,19	8,42	8,66	8,88	9,11	9,35	9,57	9,80	10,04	10,27	10,49	10,73
13200	6,70	6,93	7,16	7,39	7,61	7,83	8,07	8,29	8,53	8,75	8,97	9,21	9,43	9,65	9,89	10,11	10,33	10,57
13400	6,60	6,82	7,06	7,28	7,50	7,72	7,95	8,17	8,40	8,62	8,84	9,07	9,29	9,51	9,74	9,96	10,18	10,41
13600	6,51	6,72	6,95	7,17	7,39	7,60	7,83	8,05	8,27	8,49	8,71	8,94	9,15	9,37	9,60	9,81	10,03	10,26
13800	6,41	6,63	6,85	7,06	7,28	7,49	7,72	7,93	8,15	8,37	8,58	8,81	9,02	9,23	9,46	9,67	9,88	10,11
14000	6,32	6,53	6,75	6,96	7,17	7,38	7,61	7,82	8,04	8,25	8,46	8,68	8,89	9,10	9,32	9,53	9,74	9,96
14200	6,23	6,44	6,66	6,87	7,07	7,28	7,50	7,71	7,92	8,13	8,34	8,56	8,77	8,97	9,19	9,40	9,61	9,82
14400	6,15	6,35	6,57	6,77	6,98	7,18	7,39	7,60	7,81	8,02	8,22	8,44	8,64	8,85	9,06	9,27	9,47	9,69
14600	6,06	6,26	6,48	6,68	6,88	7,08	7,29	7,50	7,71	7,91	8,11	8,32	8,53	8,73	8,94	9,14	9,34	9,55
14800	5,98	6,18	6,39	6,59	6,79	6,99	7,19	7,39	7,60	7,80	8,00	8,21	8,41	8,61	8,82	9,02	9,22	9,43
15000	5,90	6,10	6,30	6,50	6,70	6,89	7,10	7,30	7,50	7,70	7,89	8,10	8,30	8,49	8,70	8,90	9,09	9,30
15200	5,82	6,02	6,22	6,41	6,61	6,80	7,01	7,20	7,40	7,60	7,79	7,99	8,19	8,38	8,59	8,78	8,97	9,18
15400	5,75	5,94	6,14	6,33	6,52	6,71	6,91	7,11	7,31	7,50	7,69	7,89	8,08	8,27	8,47	8,67	8,86	9,06
15500	5,71	5,90	6,10	6,29	6,48	6,67	6,87	7,06	7,26	7,45	7,64	7,84	8,03	8,22	8,42	8,61	8,80	9,00
15600	5,67	5,86	6,06	6,25	6,44	6,63	6,83	7,01	7,21	7,40	7,59	7,79	7,98	8,17	8,37	8,55	8,74	8,94
15800	5,60	5,79	5,98	6,17	6,36	6,54	6,74	6,93	7,12	7,31	7,49	7,69	7,88	8,06	8,26	8,45	8,63	8,83
16000	5,53	5,72	5,91	6,09	6,28	6,46	6,66	6,84	7,03	7,22	7,40	7,60	7,78	7,96	8,16	8,34	8,53	8,72
16200	5,46	5,65	5,84	6,02	6,20	6,38	6,57	6,75	6,95	7,13	7,31	7,50	7,68	7,86	8,06	8,24	8,42	8,61
16400	5,40	5,58	5,77	5,94	6,12	6,30	6,49	6,67	6,86	7,04	7,22	7,41	7,59	7,77	7,96	8,14	8,32	8,51
16600	5,33	5,51	5,70	5,87	6,05	6,23	6,41	6,59	6,78	6,96	7,13	7,32	7,50	7,68	7,86	8,04	8,22	8,40
16800	5,27	5,44	5,63	5,80	5,98	6,15	6,34	6,51	6,70	6,87	7,05	7,23	7,41	7,58	7,77	7,94	8,12	8,30
17000	5,21	5,38	5,56	5,74	5,91	6,08	6,26	6,44	6,62	6,79	6,97	7,15	7,32	7,49	7,68	7,85	8,02	8,21

4. BASIC ENGINE MAINTENANCE

4.1 *CENTRIFUGAL CLUTCH*

The engine has a low maintenance dry, low stall speed centrifugal clutch.

Carefully following the steps below, will provide a long clutch life. When starting the engine, make sure that the brake pedal is fully pressed to avoid sudden acceleration. Once the engine is started, avoid needless acceleration which can overheat and deteriorate the clutch. Lube the chain before each session out on the track.

After each race or test session, check the engine sprocket. Replace if necessary. A bad alignment of the engine sprocket with the axle sprocket or the lack of chain lube will damage irreparably the sprocket.

Check the clutch:

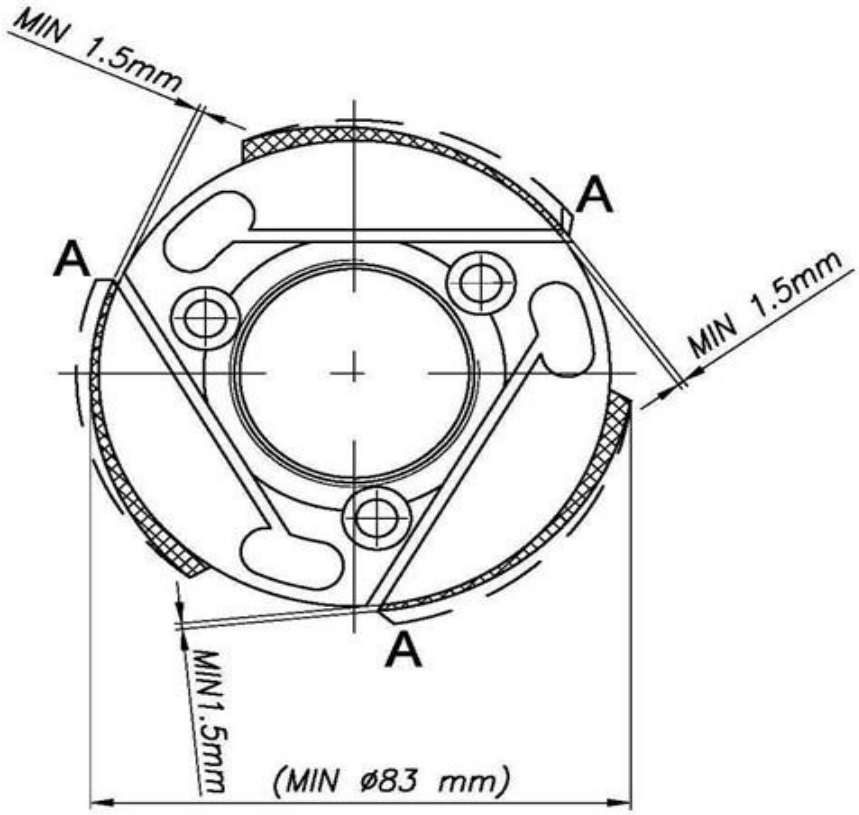
- Every 5 hours of use.
- When any metallic noises are heard inside the clutch.
- If the engine stall speed exceeds 6000 RPM.
- Every time the clutch has overheated (presence of smoke or smell of burning).

To check the clutch, you must remove the clutch cover and the clutch drum.

Replace the clutch:

- Whenever the thickness of the friction material (see drawing) is lower than 1.5mm on point A of the clutch or if the body diameter is lower than 83mm.
- Whenever the external friction material in the A portion of the clutch is very rough (wear or degradation of the friction material due to overheating).
- If the friction material has been totally worn out and there has been metal to metal contact between the clutch body and the clutch drum, it is necessary to replace the clutch drum. See Figure 4-1.

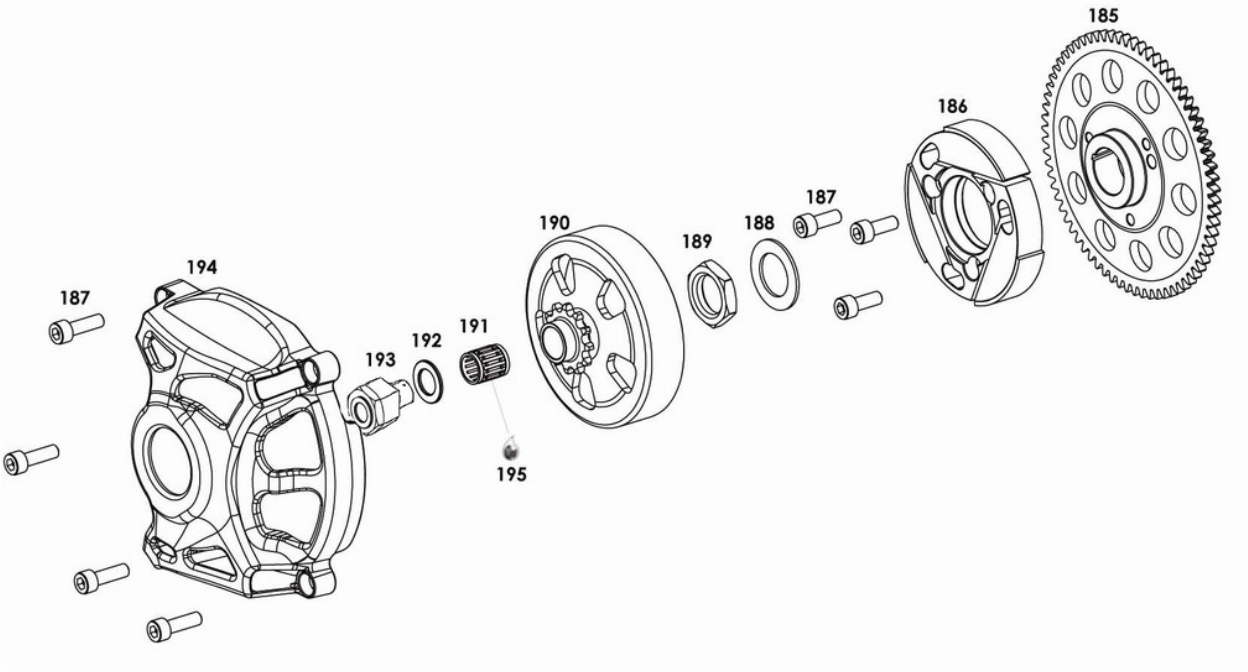
Figure 4-1 Centrifugal Clutch Pad



4.2 *DISASSEMBLY AND RE-ASSEMBLY OF THE CLUTCH*

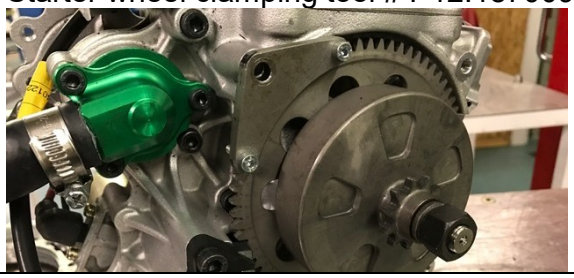
The following should be performed by a skilled mechanic, who has available the required tools shown in this manual, otherwise you should take it to an authorized service center. Please refer to Figure 4-2 during the disassembly and re-assembly process.

Figure 4-2 Clutch Exploded View



185 Starter wheel
186 Clutch pad
187 Screw M6X16
188 Concave washer
189 Inner clutch nut
190 Clutch drum
191 Roller bearing
192 Clutch washer
193 Clutch nut
194 Clutch cover

Table 4-1 Clutch Disassembly Steps

Disassembly Steps	Tools Required
1. Remove the clutch cover	M5 allen T-handle
2. Remove the clutch cover and replace with the starter wheel clamping tool to prevent the crankshaft from turning.	Starter wheel clamping tool # P12.1870091 
3. Remove the M10 locking nut.	17mm socket
4. Remove the external washer, the drum complete with roller cage and the internal washer.	
5. Remove the starter wheel clamping tool from the starter wheel, and using a	Starter wheel clamping tool #P12.1870091 27mm socket

Disassembly Steps	Tools Required
wrench remove the 27 X 6 inner locking nut and concave washer. Note that the locking nut is a left hand thread.	
6. Using the clutch puller, remove the clutch pad with starter ring.	Clutch puller P10.2500091  12mm 12 point wrench
7. Remove the starting ring, 3 - M6 bolts.	M5 allen T-handle

Before assembling the clutch, wash with solvent the tapered shaft, the connecting hole on the clutch body, the clutch drum and the starter wheel.

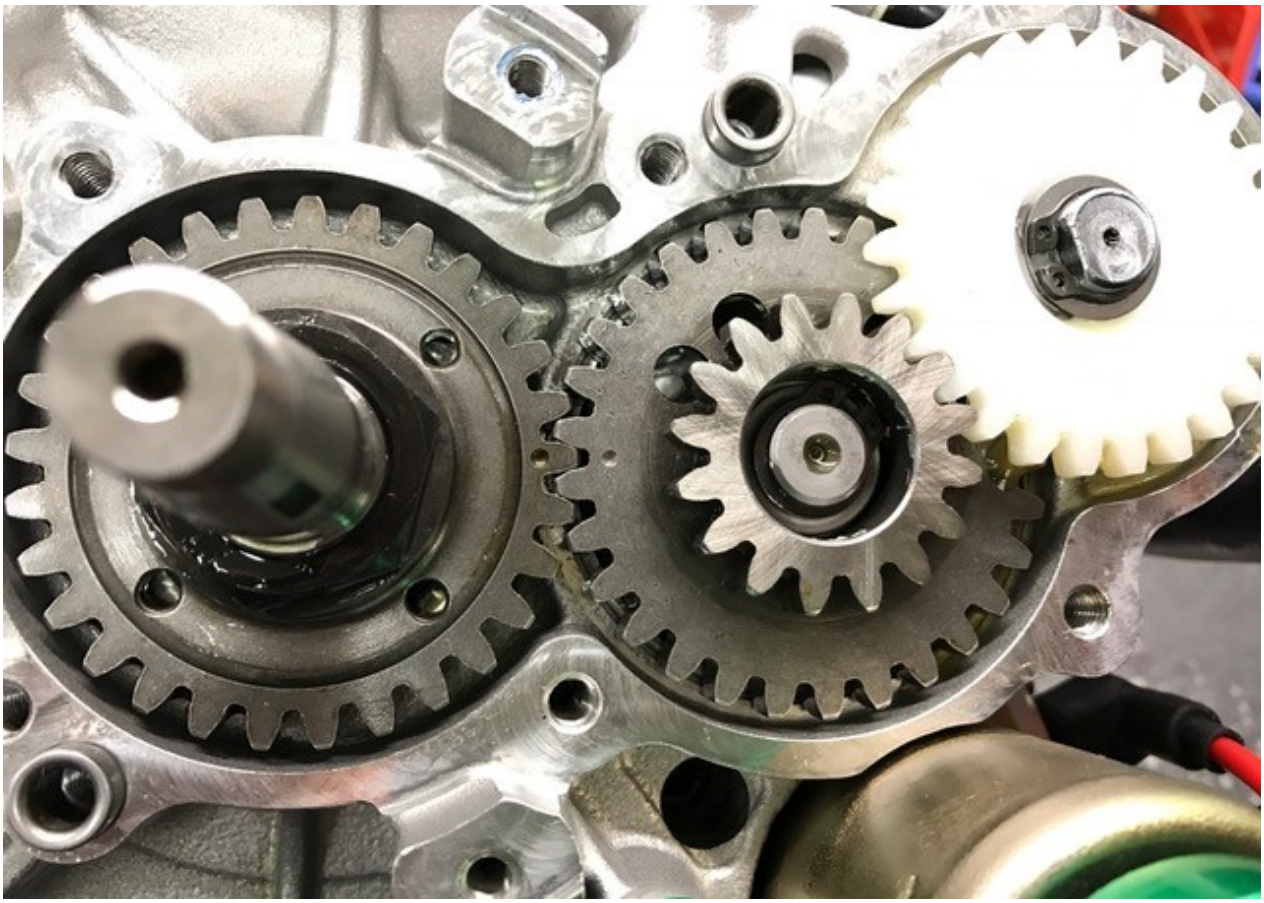
Table 4-2 Clutch Re-assembly Steps

Re-assembly Steps	Tools Required
1. Install the starter wheel on the clutch body by matching the dowel pin and the 3 M6 bolts. Always install the M7 dowel pin, otherwise the torque of the engine may break the 3 M6 bolts.	M5 allen T-handle socket, apply Loctite to the threads Torque to 10 nm (90 in-lb)
2. Install the clutch body and concave safety washer.	Apply Loctite 641 to the coaxial surfaces
3. Install the clutch body lockng nut and starter ring using the starter wheel clamping tool. Note the locking nut has a left hand thread.	Starter wheel clamping tool #P12.1870091 27mm socket Torque to 100 - 110 nm (885 - 970 in-lb)
4. Clean the roller cage and grease it before installing it on the crankshaft.	
5. Install the clutch drum and the external washer with the bevel toward the internal part of the engine.	
6. Install the Starter wheel clamping tool to prevent the crankshaft from turning and install the clutch drum with the M10 drum nut.	Starter wheel clamping tool #P12.1870091 17mm socket Torque to 30 - 40 nm (265 - 350 in-lb)
7. Install the clutch cover with the 3 M6 bolts.	5mm allen t-handle Torque to 8 - 10 nm (70 - 90 in-lb)

4.3 *TIMING GEAR SCHEMATIC*

To assemble the gears that drive the balance shaft, the assembly must be performed following Figure 4-3 below matching the dots on the timing gears as shown. An incorrect assembly of the gears can cause a malfunction in the vibration reduction system.

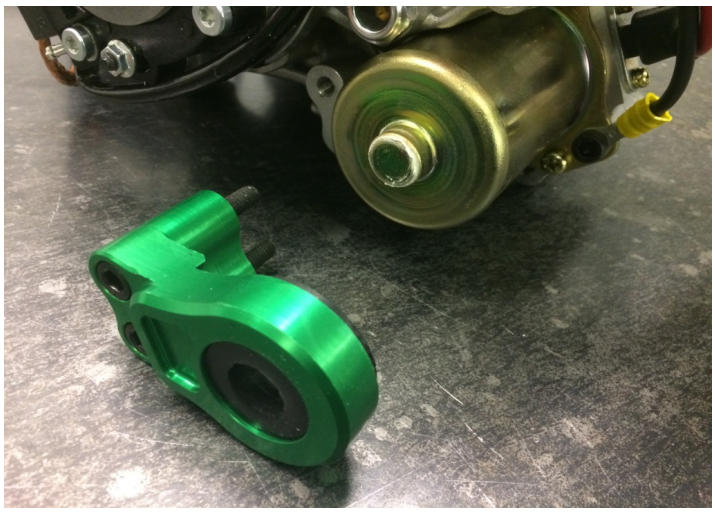
Figure 4-3 Balance Shaft Gear Timing



4.4 *STARTER BRUSH REPLACEMENT*

4.4.1 Remove the 2 - M6X35 allen bolts using an M5 allen T-handle and remove the green outer support.

Figure 4-4



4.4.2 Remove the 2 - M6X35 bolts using an M5 allen T-handle.

Figure 4-5

4.4.3 Pull back the rubber boot, remove the M4 screw using a Phillips screwdriver and detach the starter motor positive power cable.

Figure 4-6

4.4.4 Remove the starter.

Figure 4-7

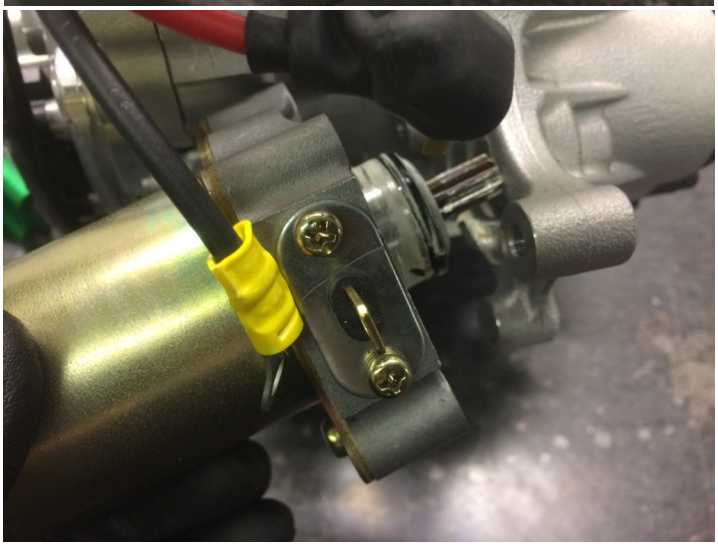
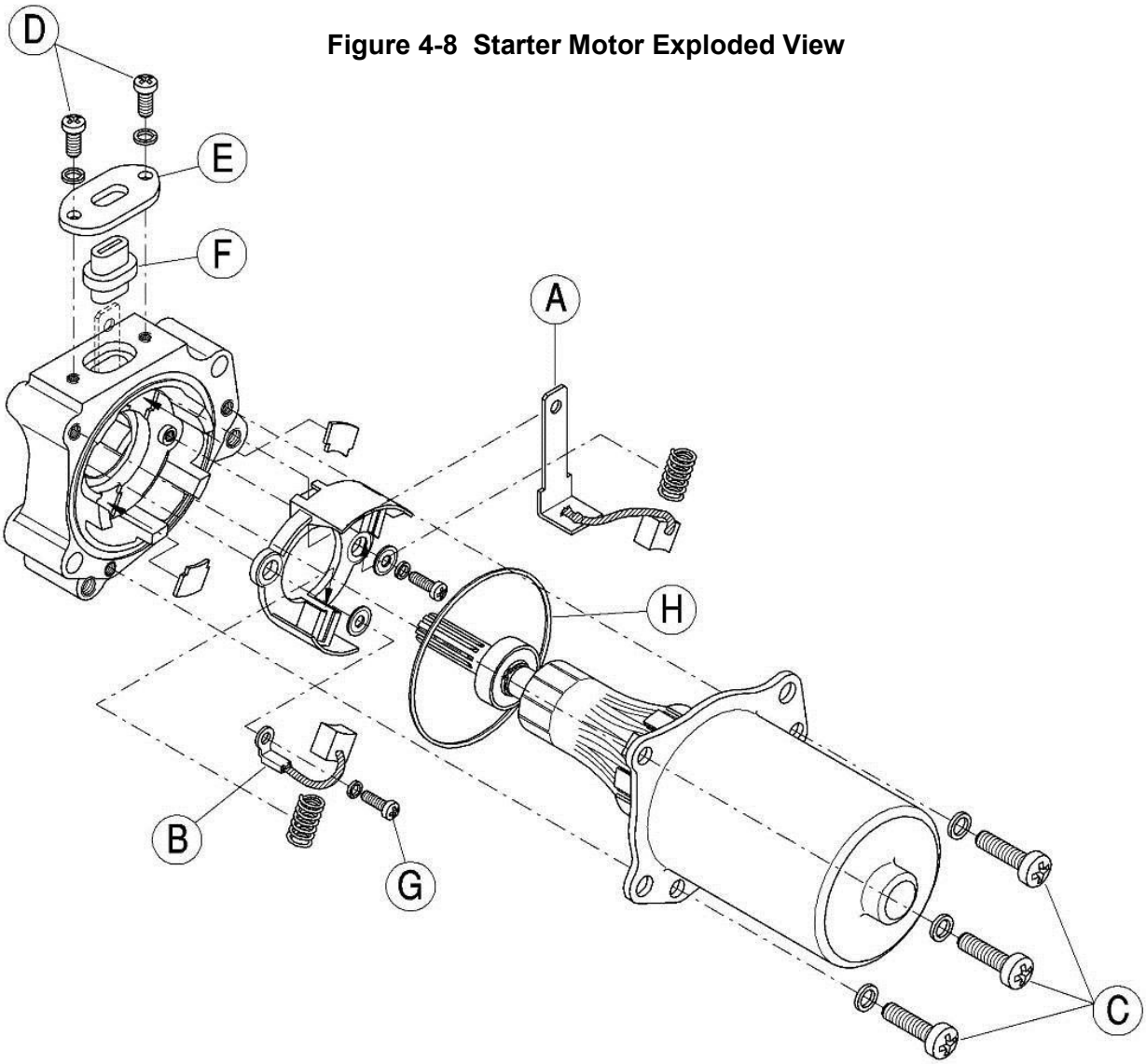


Figure 4-8 Starter Motor Exploded View



4.4.5 Unscrew the 3 M5 screws using a Phillips screwdriver.

Figures 4-8 and 4-9

4.4.6 Remove the outer can from the starter keeping the rotor in its seat by holding the rotor pinion gear to prevent the brushes from falling out of their seats.

Figure 4-10

4.4.7 Remove the rotor from the starter head. Note that when removing the rotor the brushes may spring out from their seats.

Figure 4-11

4.4.8 To replace the brushes, first unscrew the two M4 screws holding the retaining plate.

Figure 4-12

4.4.9 Remove the rubber terminal cap.

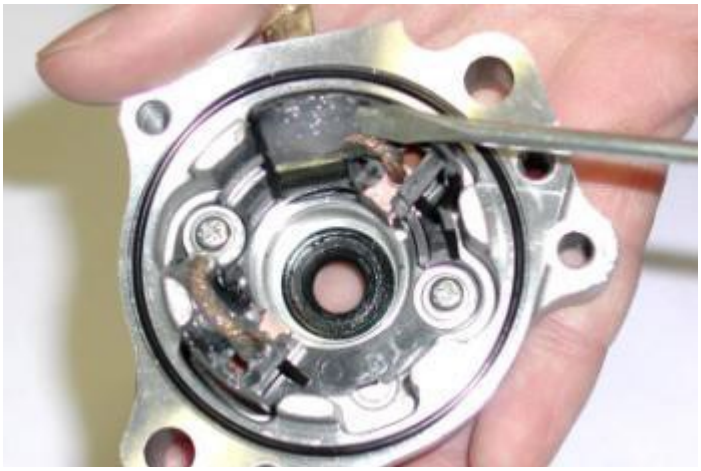
Use a drop of WD40 to coat the terminal end to make removal of the terminal cap easier.

Figure 4-13

4.4.10 Remove silicone from the brushes with a screwdriver.

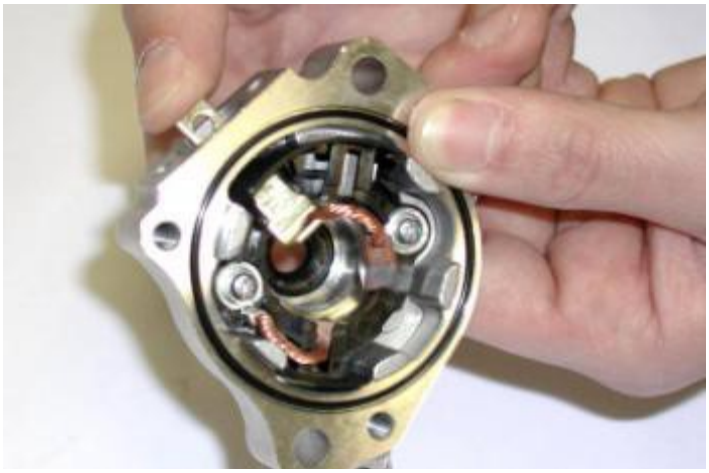
Remove the springs.

Figure 4-14



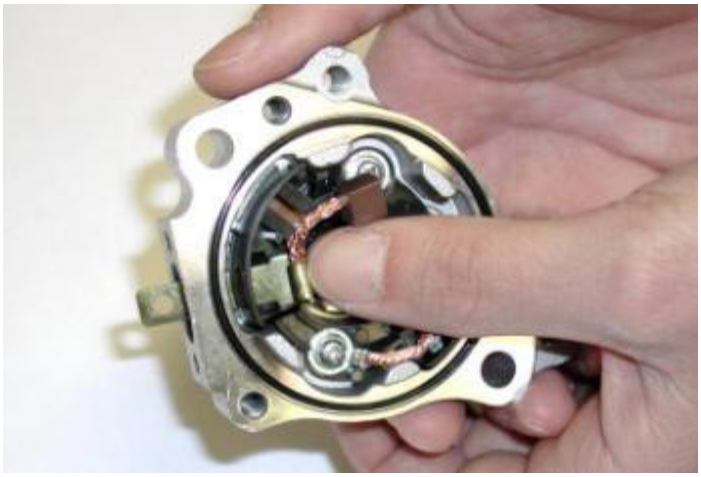
4.4.11 By pressing externally on the brushes terminal, remove the brushes.

Figure 4-15



4.4.12 Install the new brush terminal and put the rubber cap on the terminal.

Figure 4-16

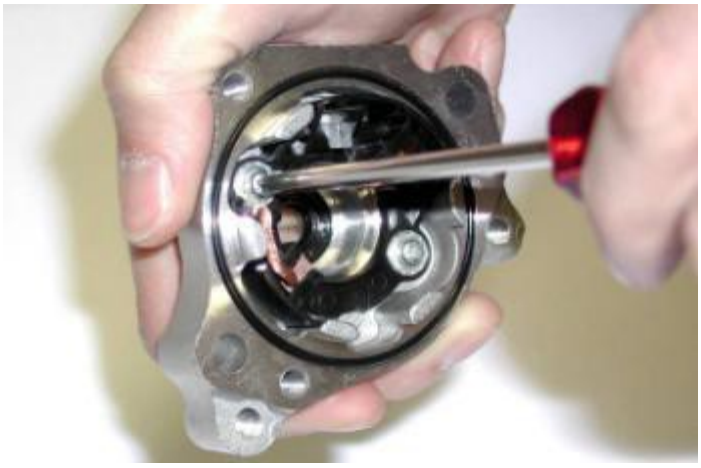


4.4.13 Reinstall the plate with the two M4 screws.

Figure 4-17

4.4.14 For replacement of the second brush, loosen the M3 screw. Remove the brush, insert the new brush and install the M3 screw.

Figure 4-18

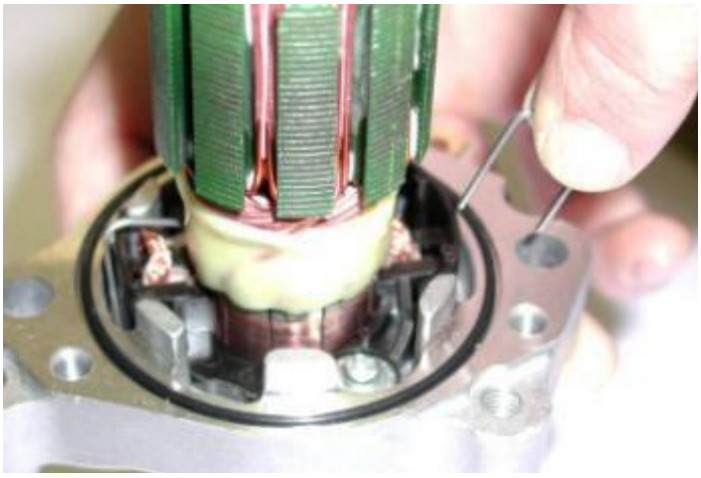


4.4.15 Insert the new brush spring into its seat and Install the brush. Keep the brush in place by pressing towards the outside and clamp it with a length of steel wire bent as a hook. Repeat the same with the next bush.

Figure 4-19

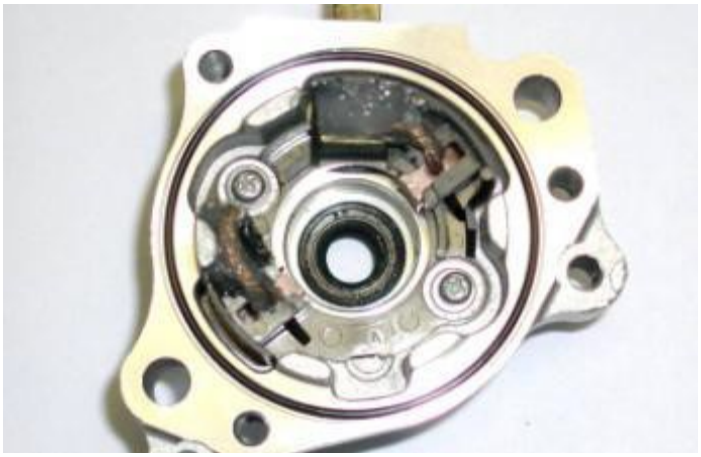
4.4.16 Install the starter rotor between the brushes and check that they are always in contact with the copper commutator on the rotor when you release them from the iron wire hooks.

Figure 4-20



4.4.17 To improve the brushes life secure the brush wires with some silicone. .

Figure 4-21



4.4.18 Check that the o-ring is installed on the starter head.

Insert the starter rotor in to the can being careful to prevent the rotor from rotating and prevent the brushes from falling out of their seats.

Figure 4-22

4.4.19 Screw in the 3 M5 screws to the can. Check that the starter rotor rotates freely.

Figure 4-23

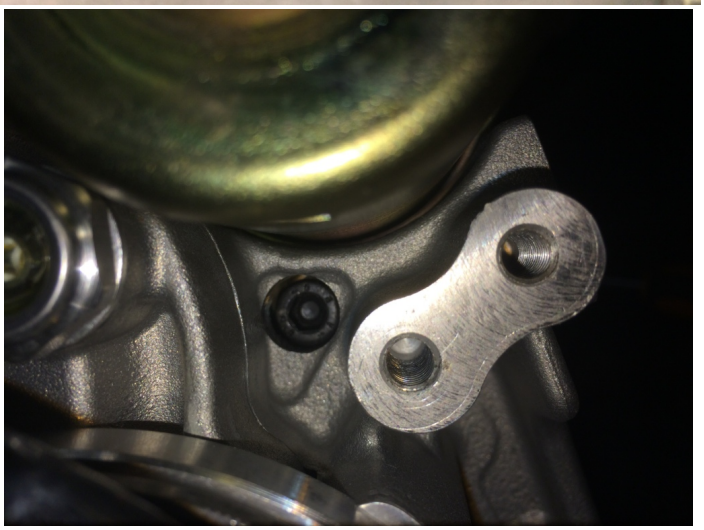
4.4.20 Place the starter into the crankcase. Lube the o-ring to make it easier to install.

Figure 4-24

4.4.21 Use the two M6X35 allen bolts, one on each side of the starter housing.

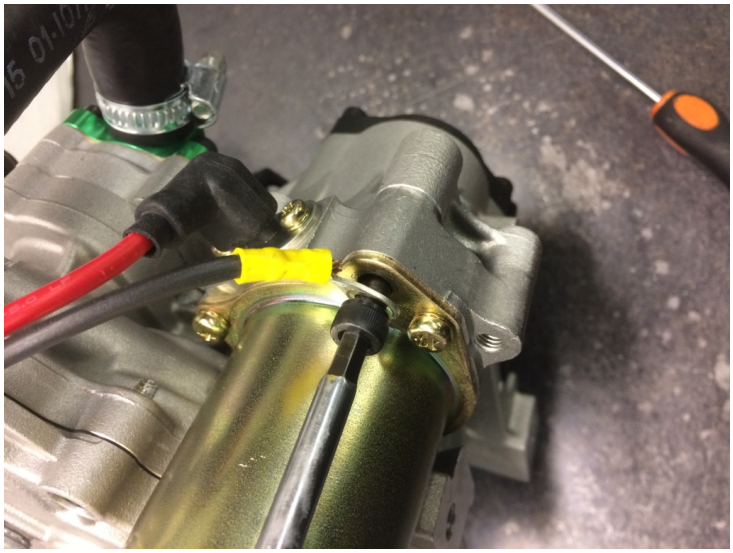
Torque to 8 - 10 nm (70 - 90 in-lb) or use an M5 allen T-handle.

Figure 4-25



4.4.20 Connect the input wiring to the starter with the M4 screw. Secure the wire to starter using a zip-tie.

Figure 4-26



4.5 *SCHEDULED MAINTENANCE*

Following some simple maintenance standards will allow the engine to perform more reliably and have a longer life.

Table 4-3 Engine Maintenance

Schedule	Components	Actions and Comments
Before using	Exhaust spring	Check status
	Silencer	Check status and fix if needed.
	Engine sprocket	Check waer and alignment with the axle sprocket
	Chain	Check wear, tension and lube chain
	Battery	Check and charge
	Cables and connectors	Check status and connectors
	Engine - coil ground strap	Check status and connectors
	Engine mount and butterfly clamps	Check and re-torque
After use	Battery	Disconnect
	Chain	Check status and lube cain
	Engine	Clean external
Every 5 to 10 hours	Bendix assembly	Remove cover and clean inside Figure 4-27

Schedule	Components	Actions and Comments
	Exhaust silencer	Remove silencer tip and clean
	Inlet silencer	Open and clean
	Cylinder head	Open and clean
	Clutch	Open, check status of friction pad and bearing.
Every 20 hours	Piston and con-rod assembly	Check and replace worn parts
	Crankshaft	Check and replace worn parts
	Bearings for balance shaft	Check and replace worn parts
	Gears	Check and replace worn parts
	Balance shaft	Check and replace worn parts

4.6 *TROUBLESHOOTING*

Below are some common faults, their probable causes and suggested remedy.

Table 4-4 Troubleshooting

Faults	Probable Causes	Remedy
Starter will not crank when turning the key to RUN position	Bad connection on starter cables	Check and tighten
	Bad ground	Check connections and tighten
	Damaged cables	Replace
	Battery connection loose	Check and tighten
	Battery discharged	Recharge or replace battery
	Starter failure	Overhaul starter
Starter cranks but engine won't start when pressing the start button	Damaged cables	Replace
	Battery connections	Check connectors
	Bad coil connections or coil failure	Check/replace
	Bad coil - engine ground	Check ground strap
	Ignition failure	Check ground
	Fouled/wet spark plug	Install fresh plug
	Malfunction on fuel intake system	Check status and connection on fuel line
		Replace gaskets and diaphragms on carb
		Check reeds and replace if

Faults	Probable Causes	Remedy
		necessary
Engine starts but it stops after a few seconds when turning the key to RUN position	Bad cable connections	Check stator connector
	Bad throttle speed adjustment screw (***I***)	Check carb adjustment, section 3.3
Rough idle	Bad throttle speed adjustment screw (***I***)	Check carb adjustment, section 3.3
Drop in engine performance	Bad compression	Check piston
	Bad throttle speed adjustment screw (***I***)	Check carb adjustment, section 3.3
	Insufficient fuel flow	Check fuel line and filter
	Dirty/blocked air box	Check and clean
Burning smell, smoke	Clutch overheating	Check clutch, section 4.1
Clutch engages at too high an RPM	Excessive wear of friction material on clutch pad	Check clutch, section 4.1
Exhaust too noisy	Springs damaged or missing	Check and replace if necessary
	Damaged exhaust header	
	Damaged pipe	

4.7 *ENGINE STORAGE*

When engine is to remain inoperative for a long period of time it should be stored in the following condition:

- Disconnect the battery and charge it periodically - section 3.9.
- Disconnect carburetor and purge the gas from it using a pop-off tester.
- Seal with tape the engine inlet and exhaust.
- Drain the water from the engine and radiator cooling system by disconnecting the bottom cooling system hose from the radiator. If available use a shop vac to suck out any remaining water after draining.

The outside of the engine must be cleaned. Spray with protective oil, al steel parts subject to rusting. Keep the engine in a dry ambient condition.

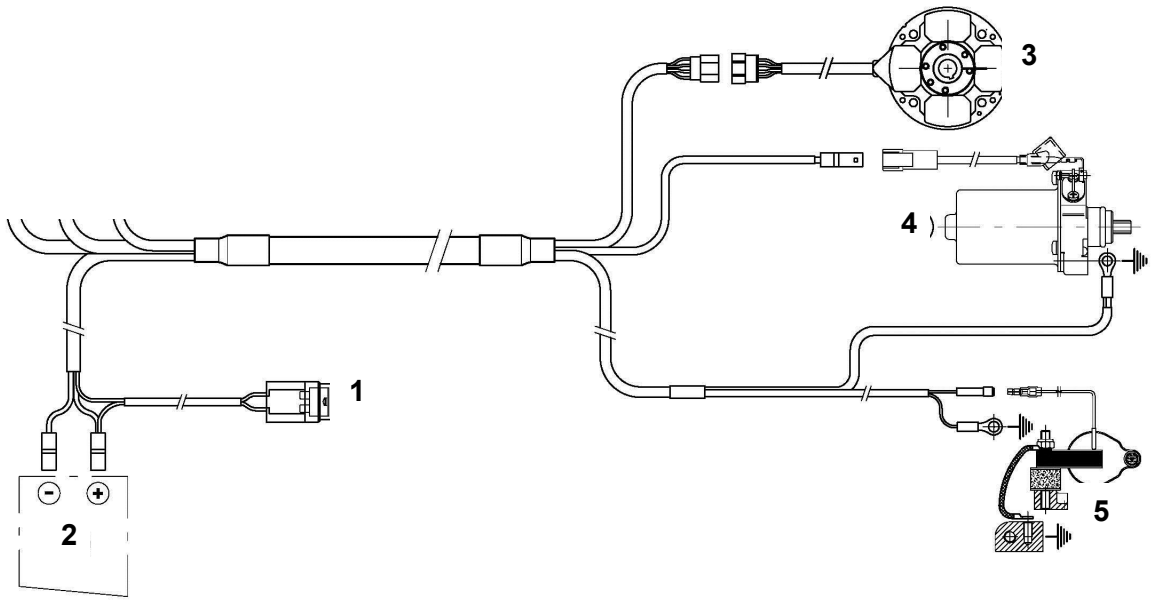
4.8 TORQUE VALUES

NOMINAL SIZE	Q.TY	FASTENER NAME	WRENCH	VALUES(Nm)	VALUES(in • lb)
M14 x 1.25	1	Spark plug	Hex.20.8	20 – 26	175 – 230
M8 x 1.25	4	Head and cylinder nut	Hex. 13	18 – 22	160 – 190
M8 x 1.25	2	Exhaust nut	Hex. 13	18 – 22	160 – 190
M6 x 1	4	Reed group screw	Allen 5	8 – 10	70 – 90
M6 x 1	2	Carb. fixing stud–bolt	Allen 5	6 – 10	50 – 90
M5 x 0.8	4	Ign.Digit."K"stator fixing screw	Allen 4	5 – 6	45 – 50
M10 x 1	1	Ign.Digit."K" rotor fixing nut	Hex. 17	20 – 26	175 – 230
M6 x 1	3	"Bendix" support screw	Allen 5	6 – 8	50 – 70
M6 x 1	2	Starter fixing screw	Allen 5	8 – 10	70 – 90
M6 x 1	3	Clutch cover fixing screw	Allen 5	8 – 10	70 – 90
M10 x 1	1	Clutch drum holding nut	Hex. 17	30 – 40	265 – 350
M20 x 1	1	Starter ring fixing nut	Hex. 30	100–110	885 – 970
M5 x 0.8	4	Engine sprocket fixing screw	Allen 3	6 – 8	50 – 70
M6 x 1	3	Clutch fixing screw	Hex. 10	9 – 11	80 – 100
M6 x 1	10	Crankcase fixing screw	Allen 5	8 – 10	70 – 90
M6 x 1	7	Gears cover fixing screw	Allen 5	8 – 10	70 – 90
M5 x 0.8	1	Bal. shaft bearing fix. screw	Allen 3	6 – 8	50 – 70
M6 x 1	2	Coil fixing nut	Hex. 10	8 – 10	70 – 90
M6 x 1	2	Coil/starter ground. fix. screw	Allen 5	8 – 10	70 – 90
M10 x 1	2	Oil charge/discharge plug	Hex. 17	12 – 15	105 – 130

5. WIRING DIAGRAM

See Figure 5-1 attached below.

Figure 5-1 X125T Wiring Diagram



1. Starter button and on-off switch
2. Battery
3. Ignition
4. Starter motor
5. HT coil