



## FORMULA TKM 2-STROKE

TKM BT82 (Direct Drive, Clutched and TAG)

### *TKM Junior & Senior Installation & Running Guide V7*

*(Note: For TKM Inter see separate Inter TKM Guide V1)*

#### **Introduction**

Thank you for buying the TKM BT82 2-stroke engine which offers to karting the combination of high performance and low weight to bring great racing at a budget cost.

TKM BT82 engines are designed and manufactured exclusively for use within kart racing environments on fit for purpose kart tracks with sealed type smooth surfaces. Any other type of usage is outside the engine's use of parameters.

TKM BT82 engines should only be installed and operated by those with suitable knowledge and experience, and we take no responsibility for warranty or other claims where incorrect installation or operation has been carried out.

As with any high-performance engine it is vital that you look after the engine to ensure it is running correctly. Look after the engine well, run it correctly and you'll have many hours of trouble-free driving.

Please be very careful to study this guide before you install and run the engine to ensure it is being operated correctly. Also make sure that you keep within the service periods recommended within the guide. We wish you great racing and fun.

The TKM BT82 engine package is provided to you in a form which is easy to fit to your kart and should take less than an hour with minimal needs.

**▲ Warning:** Identifies an instruction, which if not followed may cause injury or endanger the life of the driver, mechanic or third party or may cause damage to your TKM BT82 engine.

#### **General precaution and safety information for engine installation & running**

**▲ Warning:** For the best possible engine operation, compliance with the following advice regarding installation of engine and equipment is required.

**▲ Warning:** Modifications to engine or equipment are not allowed unless specified in the TKM regulations & BT82 official engine fiche.

**▲ Warning:** Besides the engine-specific installation advice, also take note of information from the respective chassis manufacturer where available.

**The information given in this installation & running guide is based on many years of experience with the engine both in high end kart racing and on the TKM factory engine test bed.**

**▲ Warning:** Use of excess revs will not only lead to reduced engine life but poor performance on the track.

**▲ Warning:** Use of insufficient carb settings with less than 5 minutes (1/8) of high jet opening will not only lead to reduced engine life but poor performance on the track.

## Step 1

New Engine comes complete with following items (Ticked ✓)

Item	Direct Drive	V Clutched	TAG
NGK Spark Plug	✓	✓	✓
Walbro Carb + Throttle Return Spring	✓	✓	✓
Induction Air Box with Filter & Aluminium Flange	✓	✓	✓
Exhaust System Complete with End Can	✓	✓	✓
Standard PVL Ignition System	✓	✓	✗
TAG PVL Ignition System	✗	✗	✓
10 Tooth Engine Chain Sprocket	✓	✗	✗
10 Tooth Clutch Chain Sprocket	✗	✓	✓
Ignition On/Off Kill Switch	✗	✓	✗
TAG Engine Starter Assembly	✗	✗	✓
TAG Complete Wiring Loom with Start/Stop Buttons	✗	✗	✓
TAG Battery Mount Assembly	✗	✗	✓
Chassis Engine Mount (Optional)	✗	✗	✗
Wet Cover for Induction Air Box (Optional)	✗	✗	✗
Li-Po High Battery for TAG Engines (Optional)	✗	✗	✗
Tal-Ko Factory Running in of your new engine prior to installation	✗	✗	✗

## Step 2 Engine Mount (Direct Drive, Clutched & TAG)

The engine mount top plate required has a drill pattern of 80 X 102mm which is different to the old type BT82 one which is 80 X 123mm. These are bolt centre line dimensions. The engine mounts can be supplied by Tal-Ko as an optional extra. Fix optional top plate mount to the engine using 4 off M8 minimum grade strength 12.9 bolts so length of thread in crankcase is between 17-19mm.

**⚠ Warning:** Correct length and 12.9 grade of mount to engine cap head bolts & engine mount clamp bolts must be used ensuring they are the correct length and neither too long so that they bottom or too short so that there is insufficient thread holding.

## Step 3 Mounting on Chassis (Direct Drive, Clutched & TAG)

Place the engine with its fitted top plate engine mount onto the chassis and ensure that the engine mount fits your chassis correctly. Make sure that the engine is clear of seat and side bar brackets and can slide along the chassis rails a small distance to allow for chain adjustment. Fit your existing engine mount clamps providing they are suitable and tighten lightly with mount clamp bolts.

## Step 4 Sprocket Alignments (Direct Drive, Clutched & TAG)

Check the alignment of the axle sprocket with the engine chain sprocket using a straight edge or laser, adjusting the axle sprocket carrier on the axle as necessary ensuring that you have sufficient axle key located in the sprocket carrier. If the sprocket carrier does not have sufficient location on the key, then it can always be turned around on the axle so its offset can cover the key. Remember to tighten sprocket carrier clinch bolt/bolts.

Your BT82 engine is fitted with a 10-tooth chain sprocket so fit a rear axle sprocket to suit your required track and a starting point suggested maximum RPM of around 15,000.

Fit a new quality kart chain and adjust (12mm of total up & down movement) ready for use, remembering to fully tighten the mount clamp bolts and then lubricate chain with correct kart chain spray, but avoiding getting any on the V clutch internals if fitted.

## Step 5 Chain Guard (Direct Drive, Clutched & TAG)

You will need to fit a fully enclosed chain and clutch guard. Tal-Ko can supply this guard if required.



Picture of Fully Enclosed Guard Covering Clutch as well as Chain

### Step 6 Exhaust Systems (Direct Drive, Clutched & TAG)

Fit the exhaust manifold onto the engine first placing the manifold gasket on the two M8 studs, then the manifold and finally the M8 spring washers and special extended M8 x 13mm A/F nuts. A special deep cranked ring spanner available from Tal-Ko will be required to tighten these nuts to 13ft/lbs or 17.5Nm.

Then fit the chrome exhaust end can provided to the exhaust pipe by first removing the 3 self-tapping screws holding on the already fitted end with tail pipe. The exhaust end can then slide over the still in place end with tail pipe. Ensure that it is fitted with the 3 large holes at 180 degrees opposite from the tail pipe. Then replace all 3 screws to locate both.

Slide the exhaust flex piece supplied with new engine into engine manifold and then slide exhaust onto other end of flex with the flex ring provided. At this point wrap the heat proof webbing provided around flex and lock wire around its O/D in 3 places. Then use the flex securing springs provided (3 on TAG engines & 5 on others) and locate with your two existing cradle springs onto rear exhaust cradle mount on kart. The position of this rear cradle MUST be adjusted to ensure a natural line of the exhaust, so no tension is put on the flex or manifold.

We recommend 60-65mm length flex plus flex ring on all models of BT82, but it is permitted to adjust these lengths if required. The rule is, the longer the flex the more low-down power you will get at the expense of high top end power and the reverse with shortening the flex. Flex lengths less flex ring between 50mm – 80mm is an acceptable range. Please Note Flex is only supplied in 63mm Lengths from Tal-Ko.

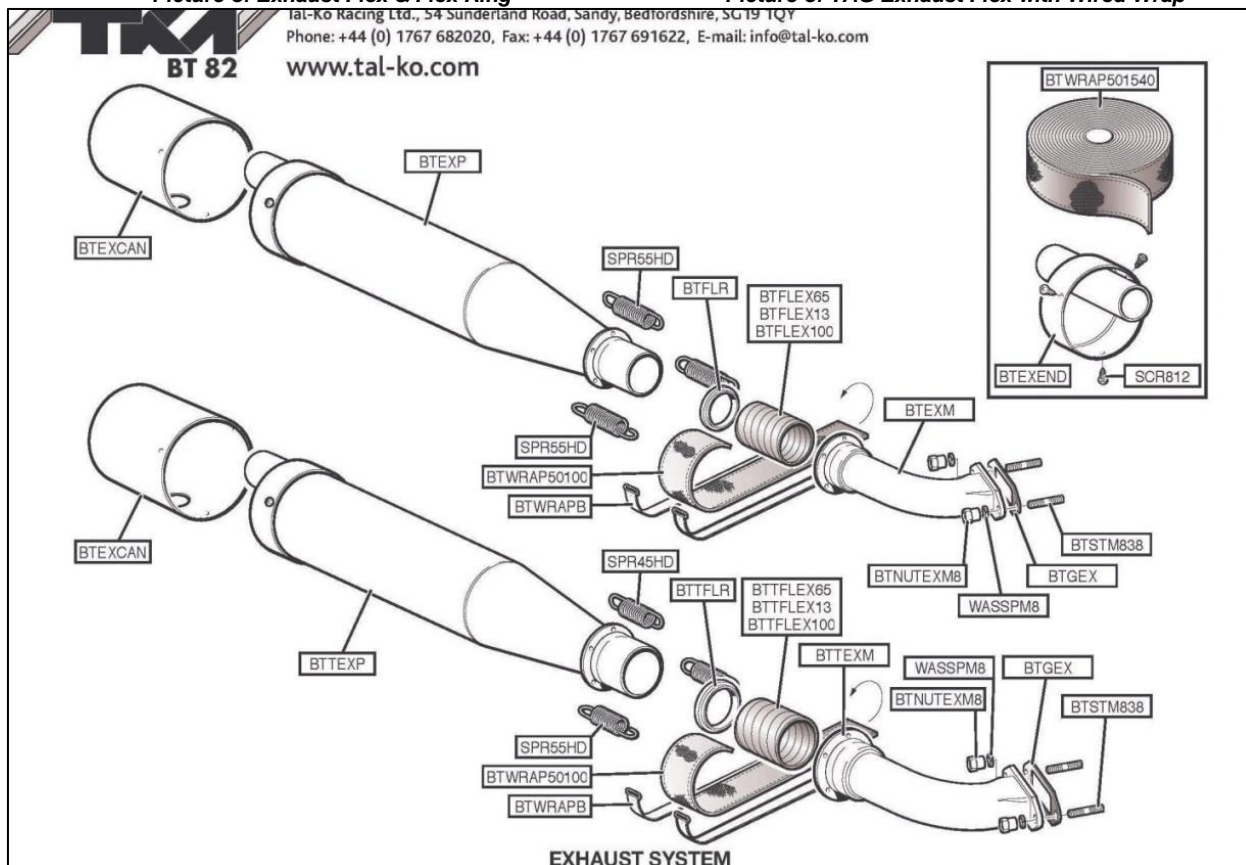
**Note: TAG engine uses a larger diameter manifold, flex, flex ring and exhaust to the other model BT82's.**



Picture of Exhaust Flex & Flex Ring



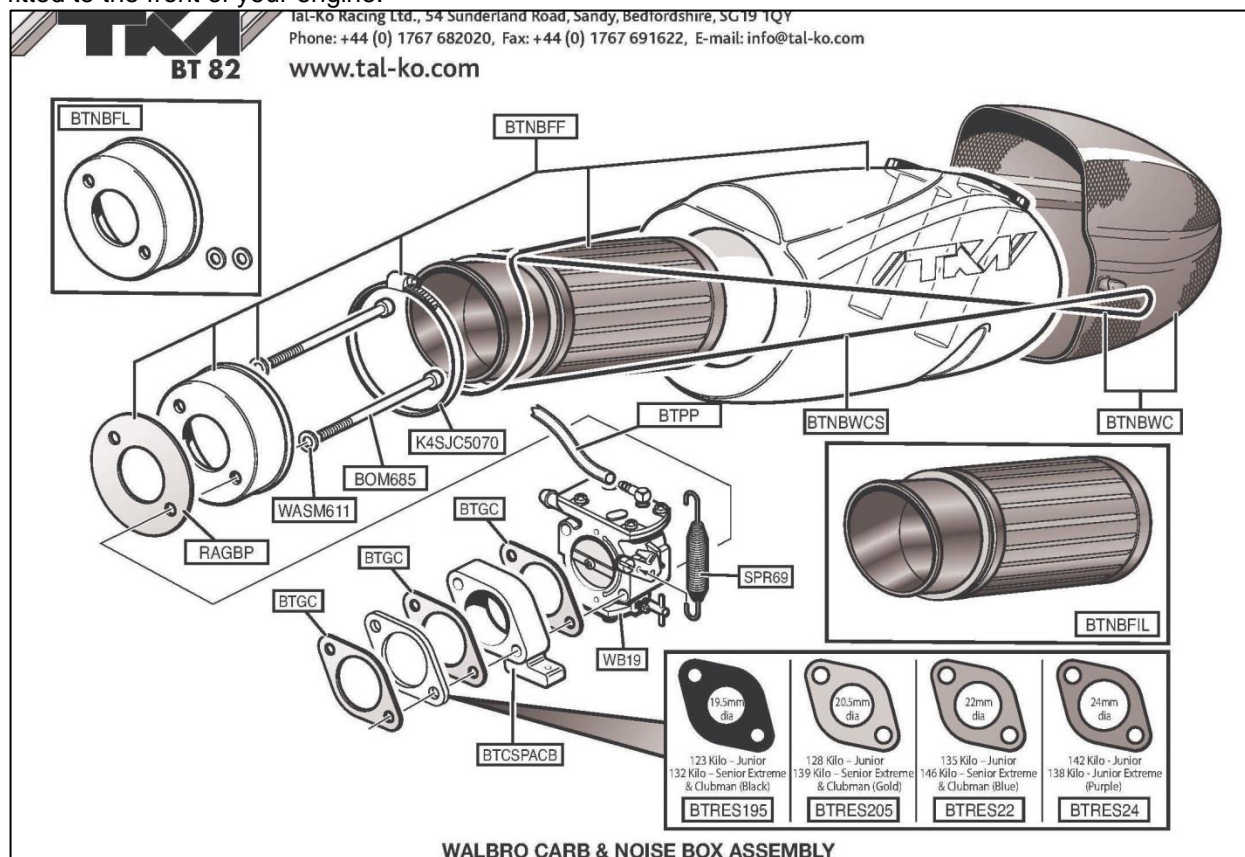
Picture of TAG Exhaust Flex with Wired Wrap





### Step 7 Carb & Induction Air Box (Direct Drive, Clutched & TAG)

The carburettor with its gaskets, coloured air restrictor (if required) and induction air box filter flange is already fitted to the front of your engine.



You will need to fit the induction air box filter in the induction air box by carefully folding its rubber and filter element, so it slides into the large end hole and then locates in the air box in the rubber groove on filter. Fit complete induction air box to the carb mounting flange with the twin air inlet filters facing approximately upwards and carefully tighten with clip provided.

Note you will need to drill a small 5mm diameter hole on the small tab sticking down from bottom of air box so you can cable tie air box to kart frame. This 5mm hole is also used for the optional wet cover fixing as well as its elastic strap when wet track conditions apply.



**Picture of Air Induction Box Fitted**



**Picture of Air Induction Box Cable Tied to Frame**



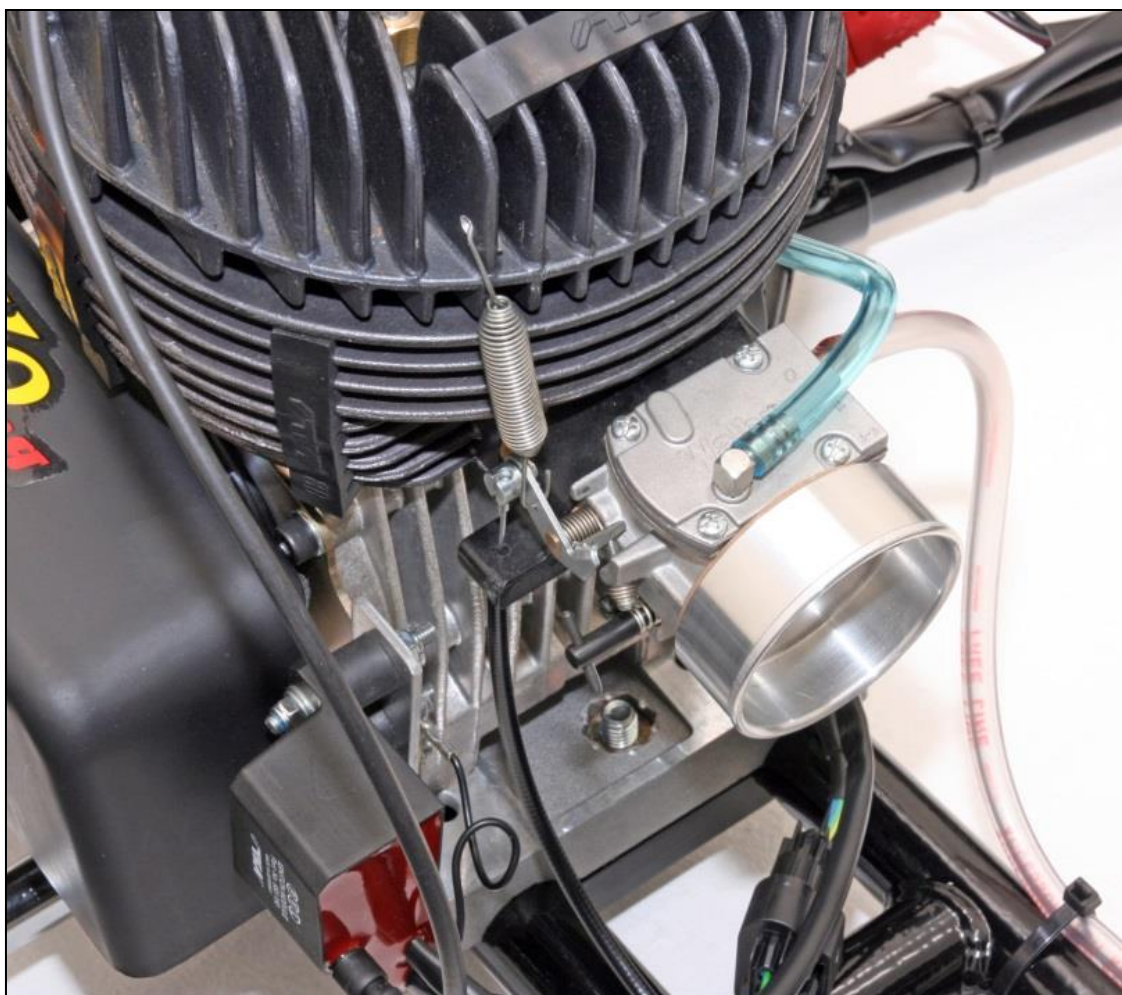
*Picture of the Optional Wet Cover Fitted to Air Induction box*



*Picture of Available Colours & Sizes of Carb Restrictors*

### **Step 8 Throttle Cable (Direct Drive, Clutched & TAG)**

Always use the correct size inner and outer cable to suit fitments. Place special shaped end of the inner cable into the carb cable slot in swivel assembly and then thread through outer cable and connect to the pedal. It is important to ensure that the pedal locates hard against a pedal stop bolt at full throttle to prevent damage to the carb or inner cable stretch and eventual breakage. A pedal and carb return spring must be used.



*Picture of Carb with Air Induction Box Flange, Return Spring and Throttle Cable*

- ⚠ Warning: The carburettor throttle inner cable must not be kinked or restricted as the carburettor opening butterfly shutter might stick in full throttle open position.
- ⚠ Warning: The provided throttle return spring to head must always be used as the carburettor opening butterfly shutter might stick in full throttle open position.



### Step 9 Petrol Fuel Systems (Direct Drive, Clutched & TAG)

Connect the petrol fuel system piping. But first remember that if you have previously been using the petrol fuel tank with old petrol fuel you MUST empty the tank and flush with clean petrol fuel in a safe environment.

**Warning:** When handling petrol fuel, do not smoke or allow naked flames. Petrol and petrol vapour are highly flammable and explosive under certain conditions.

**Warning:** Ensure that all petrol fuel pipes cannot chafe or rub against other parts which could cause a petrol fuel leak.

An inline tank filter is highly recommended and should be fitted in the fuel supply pipe from tank to carb with the direction of flow arrow on filter fitted the correct way. The fuel supply pipe is fitted direct to the brass union on side of carb. When fuel pipe is trimmed to length and connected it must be cable tied neatly in position without deforming or reducing its internal bore which could cause fuel starvation. An overflow fuel catch tank should be fitted to your kart as per MSUK regulations. Note that the special material blue pulse pipe from the engine pulse union located on the side of the engine goes to the silver-coloured pulse union on top of the carb.

### Step 10 Carb Jet Settings (Direct Drive, Clutched & TAG)

At this stage you will need to adjust your carburettor fuel supply jets accordingly to the TKM class and class weight and if running a coloured carb air restrictor plate.

**Table of recommended carb fuel supply jet settings in Hours & Minutes as on a clock face**

<b>TKM Class</b>	<b>Restrictor</b>	<b>LOW JET</b>	<b>HIGH JET</b>
Junior 123 Kg	Black: 19.5mm	2 hrs + 30 minutes	17-19 minutes
Junior 128 Kg	Gold: 20.5mm	2 hrs + 30 minutes	16-18 minutes
Junior 135 Kg	Blue: 22.0mm	2 hrs + 30 minutes	15-17 minutes
Junior 142 Kg	Purple: 24.0mm	2 hrs + 30 minutes	14-16 minutes
Junior 148 Kg	No Restrictor	2 hrs + 30 minutes	14-16 minutes
Senior <i>Extreme</i> & Clubman 132 Kg	Black: 19.5mm	2 hrs + 30 minutes	17-19 minutes
Senior <i>Extreme</i> & Clubman 139 Kg	Gold: 20.5mm	2 hrs + 30 minutes	16-18 minutes
Senior <i>Extreme</i> & Clubman 146 Kg	Blue: 22.0mm	2 hrs + 30 minutes	15-17 minutes
Senior <i>Extreme</i> & Clubman 152 Kg	No Restrictor	2 hrs + 30 minutes	14-16 minutes
Senior <i>Extreme</i> Masters 160 Kg	No Restrictor	2 hrs + 30 minutes	14-16 minutes
<b>The above carb setting are based on carbs with 8 to 10 psi / 0.5 to 0.7 Bar Pop Off Pressures.</b>			

The Low and High screw jets are located on the side of the carb and marked with an L for the Low jet and an H for the High jet. The high jet is adjusted by fingers and the low jet with a small screwdriver. To fully close the jets simply screw them in until they gently stop and are seated on the taper of the jet in the jet hole. Once you have closed/seated the jets you can then turn out the jets to correct amount to suit.

**Warning:** Never use force to seat these jets as you will damage the carb and jets.



*Picture of the Carb Low Jet, High Jet & Tick over Adjustment Screw*

**NOTE:** That on the Clutched and TAG engines you may have to turn the low jet in less than the recommended settings and then turn out the high jet out to get you engine to tick over and run correctly.

### **Step 11 Tick Over (Clutched & TAG)**

The V clutch is designed to permit easy starting with a battery operated hand-held remote starter or with the TAG (touch & go) on-board starter system. When the engine starts, the clutch will be in neutral until the engine reaches approximately 3600rpm. At about 3700rpm the V clutch will start to engage, and the kart will start to move. Since the V clutches engages at a low rpm, driving technique will be the same as a direct drive vehicle.

When using the V clutch the carburettor must be set to allow the engine to tick over. This is done by setting the carb-mounted throttle butterfly adjustment tick over screw and the low jet. First using the tick over screw, which is positioned just above the High & Low jet, set the throttle butterfly slightly open so that you can just get the tip of a 0.6mm feeler gauge between it and the bore of the carb. This is the starting point and when you start your engine for the first time this tick over should be adjusted to about 3400 rpm. Make sure the V clutch is not biting which will happen if the tick over is too fast. If so turn out throttle adjustment screw located on side of carb. If too slow the engine will stall. It may be necessary to fine tune the setting of the Low jet to get a smooth tick over. If the engine is too rich it will not run smoothly on tickover when hot or cold, turn the Low jet in and the high jet out the same amount until correct tick over is achieved.

**⚠ Warning: Before engine operation, check through the Installation Guide and then read the Running Guide**

### **Step 12 Battery Mounting (TAG Only)**

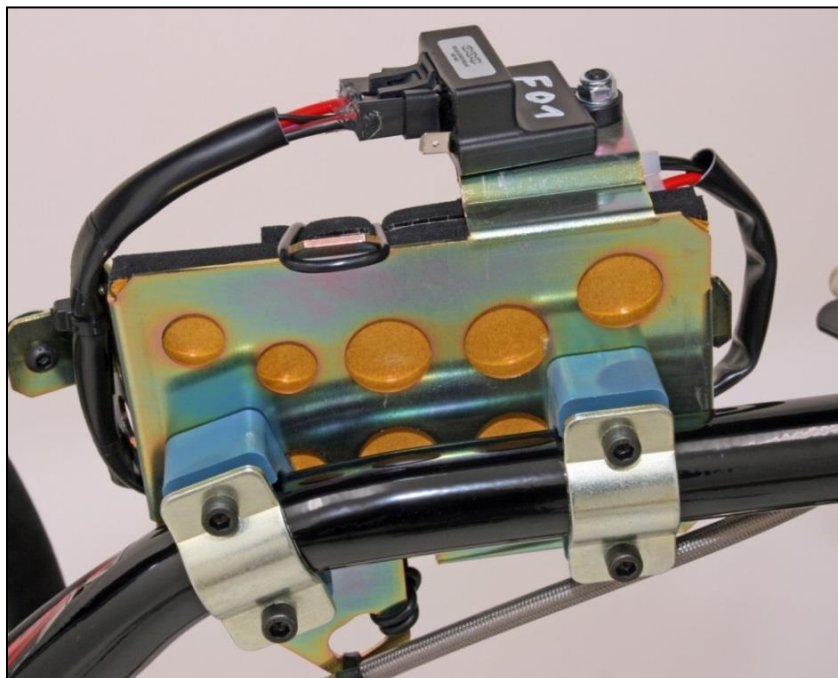
Take the supplied standard mounting bracket assembly with the PVL starter motor relay already attached. First remove the black plastic cover by undoing the M6 Nyloc retaining nut and washer, then release the battery retaining large O-Ring and battery rubber sponge pad. At this stage we advise that you fully charge your chosen battery with the appropriate charger.

**⚠ Warning: Damage will occur to your battery and the PVL Tag system if you short circuit or fit red and black connection wrong way round.**

**⚠ Warning: Make absolutely sure to avoid short-circuiting of the battery terminals . A short circuit would ruin the battery and could lead to explosion of the battery.**

Then locate the battery mounting bracket assembly on the brake side main chassis tube next to the seat. You are provided with a set of tube mounting clamps which slot into the base of the battery mounting bracket which allow for multiple positions so all chassis can be catered for. Ensure the position you choose with the plastic cover installed is good for the wire harness connection and clears the seat and seat mounting stays. If required, you may modify both the battery mounting bracket and the plastic cover to ease fitment.

Once the battery mounting bracket is positioned and tightened, replace back the special adhesive backed rubber sponge pad (we advise you do not remove the sticky backing and just place pad in position) in the base, so the battery is cushioned from vibrations. Then replace the retaining large O-Ring over the fully charged battery to keep it in place.

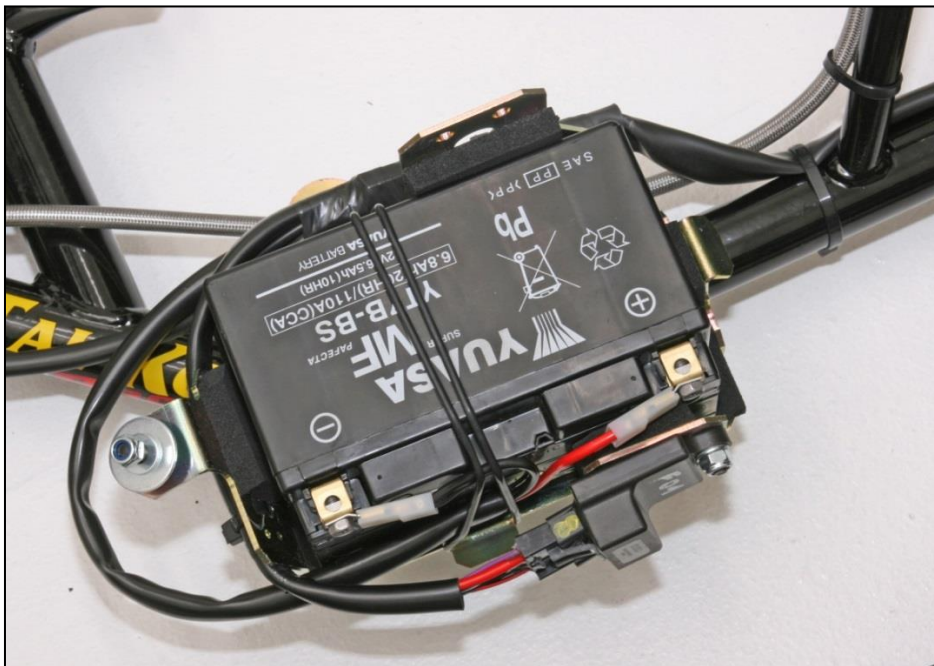


**Pictures of TAG Battery Mount with Chassis Tube Connectors**

### **Step 13 Wiring Loom Battery Side (TAG Only)**

Position the main wiring loom harness provided as in the pictures below making sure the correct connector is firmly pushed and clipped into the PVL Starter relay which is already fixed at a slight angle on the battery mount. This slight angle aids to the natural flow of the wiring loom with connector to this starter relay.

**Note: At this stage do not connect the battery to wire harness connectors.**



*Picture of Wiring and Battery O-Ring Retainer with a Standard Battery (Non-Li-Po) Connected*

The wire loom harness is positioned and fastened so that it cannot move around which could cause chafing and possible short circuiting.

### **Step 14 STOP / START BUTTONS (TAG Only)**

#### **Option 1**

Fit the Start / Stop push button controls into the steering wheel holes as in picture below, with the green start button on the brake side. Make sure their 19mm A/F lock nuts are tight.



*Picture of Start Stop Buttons fitted to Steering Wheel*

Ensure that the wiring from the push buttons is then cable tied to allow full movement of the steering wheel without causing the wires to chafe and short circuit.



### **Option 2**

Fit the Start / Stop push button controls into the special steering wheel steel chrome switch bracket as in the picture below, with the green start button on the brake side. Make sure their 19mm A/F lock nuts are tight.



*Picture of Start Stop Buttons in Tal-Ko supplied steel chrome bracket*

Ensure that the wiring from the push buttons is then cable tied to allow full movement of the steering wheel without causing the wires to chafe and short circuit.

### **Step 15 Wiring Loom Engine Side (TAG Only)**

Route the main wiring loom harness from the battery holder along the top of the brake side chassis tube and then across the top of the main rear cross chassis tube at the rear of the seat and connect as follows:

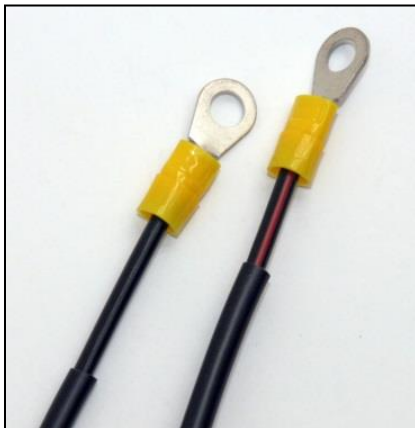
- 1) PVL HT coil module. (Medium Size Black Connector)
- 2) Starter motor lead which is already attached and fitted to your engine. (Large Size Red Connector)
- 3) Earth terminal on very end of starter motor. (Small push on Connector)

Cable tie wiring loom as required so chafing and dangerous short circuiting is avoided.

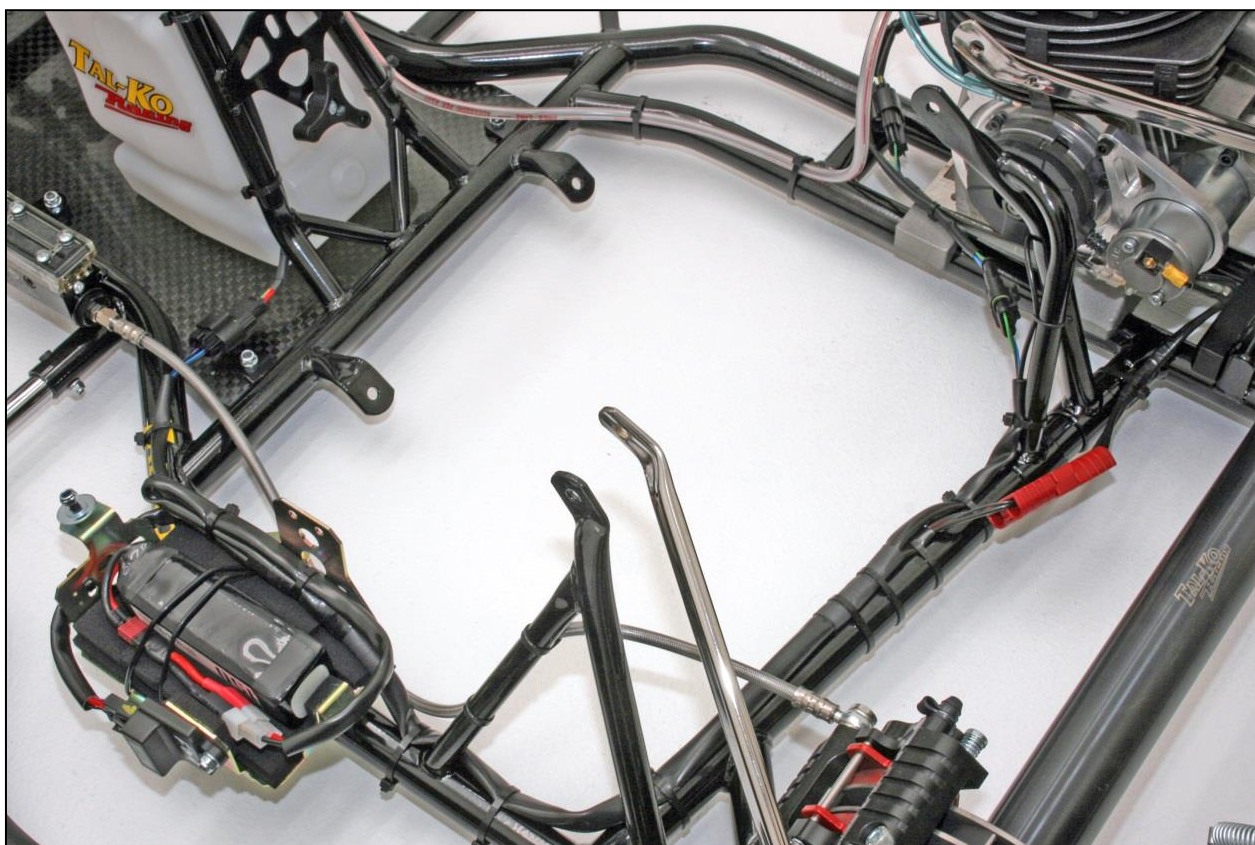
**▲ Warning:** The wiring harness must not touch moving parts of the track or be allowed to chafe and short circuit against other parts on the kart.



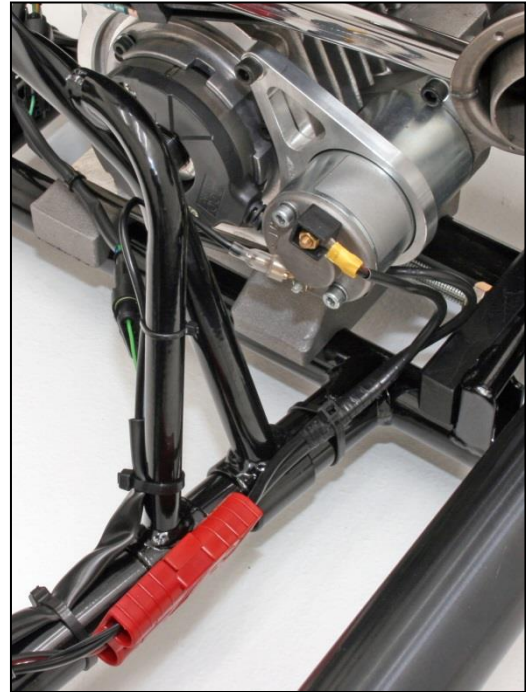
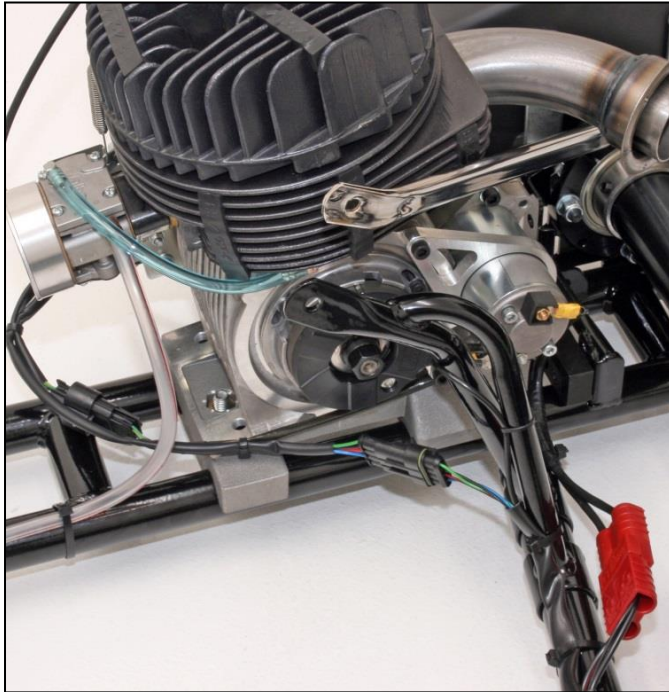
Both starter motor leads have yellow terminals and the one connected to the solid black wire is the main earth lead already bolted to support starter motor bracket bolt and the other with the red line running along the black lead is the live already bolted to the live terminal on starter motor. Do not mix these up as damage will occur!



*Picture of the Live & Earth Leads to Starter Motor*



**Picture of Wiring Loom Route from Battery Mount to Engine (Li-Po Type Battery in picture)**



*Pictures of Wiring Loom Connections to Engine*

**Note at this stage do not connect the battery to wire harness connectors or put spark plug in engine.**

**▲ Warning:** Make absolutely sure to avoid short-circuiting of the battery terminals . A short circuit would ruin the battery and could lead to explosion of the battery.

#### **Step 16 Petrol Fuel Mixture** *(Direct Drive, Clutched & TAG)*

Next fill your fuel tank to at least halfway with correctly mixed petrol fuel and oil.

It is vital that you only use **Super Unleaded (E5) 97 Octane pump petrol fuel** with a high-quality castor based 2-stroke racing oil at the correct ratio of **320ml oil (minimum) with 5 litres of petrol fuel**

#### Recommended Oils:

**Ravenol Racing Castor 2T**

**Vroom Factory Racing 2T**

**Fuchs Silkolene Pro KR2**

**Elf HTX 909**

Remember this engine is not a 4-stroke engine and so does require the correct lubricating oil mixed in with the fuel which is vital to lubricate your TKM BT82 engine internals.

**Thoroughly mix 5 litres of super unleaded (E5) 97 petrol fuel with 320ml of high-quality castor based 2-stroke racing oil for correct ratio.**

**▲ Warning:** Use only super unleaded (E5) 97 petrol fuel. Other types could cause engine damage.

**▲ Warning:** When handling petrol fuel, do not smoke or allow naked flames. Petrol and petrol vapour are highly flammable and explosive under certain conditions.

**▲ Warning:** Never perform petrol fuelling in closed rooms, handle petrol fuel in well ventilated areas only.

**▲ Warning:** Fuel the kart only when engine is not running.

**▲ Warning:** Do not run the engine with incorrect grade oil, as this could lead to engine failure.



⚠ Warning: Do NOT use motor-cycle type oils instead of those recommended.

⚠ Warning: Do not run the engine without oil, as this will lead to engine failure.

⚠ Warning: Do not run the engine with a different to recommended fuel to oil ratio, as this could cause engine failure.

You must then ensure that your carb is primed with fuel without flooding the engine! The best way to do this is listed below for each model engine.

At this stage on the TAG engine, you can connect your battery terminals to the main wiring harness.

⚠ Warning: Remember **RED** is **+** Positive & **BLACK** is **-** Negative.

⚠ Warning: Damage will occur to your battery and the PVL Tag system if you short circuit or fit red and black connection wrong way round.

⚠ Warning: Make absolutely sure to avoid short-circuiting of the battery terminals. A short circuit would ruin the battery and could lead to explosion of the battery.

#### ***TAG Engine (Priming Carb)***

With the spark plug and carb induction air box removed turn the engine over using the green starter button whilst kart is on chassis stand. When doing this, fully cover the front induction flange of the carb with palm of your hand until fuel is just present in the carb bore induction. This action is called choking the carb and will aid fuel being drawn up from the fuel tank. Only do this in 2-3 seconds amounts.

⚠ Warning: Do not over choke carb as possible flooding of engine will occur.

#### ***Direct Drive Engine (Priming Carb)***

With the spark plug removed turn engine quickly by spinning the rear wheels whilst kart is on chassis stand. When doing this, fully cover the front induction flange of the carb with palm of your hand until fuel is just present in the carb bore induction.

#### ***Clutched Engine (Priming Carb)***

With the spark plug removed turn engine quickly with the remote handheld starter whilst kart is on chassis stand. When doing this, fully cover the front induction flange of the carb with palm of your hand until fuel is just present in the carb bore induction.

Then refit the induction air box back to the carb flange with its clip and cable tie.

#### ***Step 17 Spark Plugs (Direct Drive, Clutched & TAG)***

Remove the supplied NGK spark plug from its box and check that the electrode gap is between 0.65mm & 0.75mm (0.026" to 0.029") Next carefully screw in the provided NGK BR9EIX spark plug for the Direct Drive & Clutched engines or the provided NGK BR10EIX spark plug for the TAG engine and tighten to 18ft/lbs or 24Nm. Place the plug cap already fitted to your coil's HT lead on the spark plug. You should now be ready to run your engine.

# ***Engine Running Instructions***

## **Please Read Carefully Before You Use Your Engine**

- ▲ **Warning:** Identifies an instruction, which if not followed may cause injury or endanger the life of the driver, mechanic or third party or may cause damage to your TKM engine.

### **General precaution and safety information for engine running**

- ▲ **Warning:** For the best possible engine operation, compliance with the advice regarding installation of engine and equipment is required.
- ▲ **Warning:** Besides the engine-specific installation advice, also take note of information from the respective chassis manufacturer if available.
- ▲ **Warning:** Before engine operation, check through the Installation Guide and then read the Running Guide to ensure all other steps are carried out, such as filling fuel tank with correct fuel to oil ration before starting the engine.

## ***Starting you New BT82 Engine for the First Time***

Before you even attempt to turn over the engine or start you **MUST** ensure that it has been filled with the correct petrol fuel to oil ratio and your carb jets set at recommended start settings. You must also ensure that the petrol fuel is fully primed into the carburettor without it being flooded.

- ▲ **Warning:** Always wear protective clothing for kart operation (helmet, overall, gloves, shoes, neck and rib guards).
- ▲ **Warning:** Driver must always be seated in kart when starting engine wearing protective clothing for kart operation.

### ***Direct Drive Starting***

With the driver sitting in the kart there are two methods of starting procedures with both requiring the rear of the kart being just lifted enough to that the rear wheels are clear, and kart can be pushed briskly forward and then lowered so rear wheels make contact with the ground causing them to rotate which then turns engine over until it fires, and driver safely pulls away and onto the track.

**Method 1** is using one or two people to lift rear of kart just off ground and push bump to start.

**Method 2** is by one person using a special starter pushing trolley which does same job.

Please note that hand choking of both induction trumpets on the Induction Air Box maybe required during initial cold starting. This hand choking is only used if engine does not fire immediately, and hand must be removed the instant the engine fires or flooding of the engine will occur causing the spark plug to become wet/fouled and inoperable.

To STOP a direct drive kart, you simply apply brake pedal which will stall and stop engine.

### ***Clutch Drive Starting***

The ON / OFF kill switch provided must be in the ON position. With the driver sitting in the kart another person simply inserts the handheld option Coleman remote electric starter through the suitably sized (Min 35mm O/D) and position drilled hole in the plastic side pod onto the starter nut located on the end of the crankshaft.

- ▲ **Warning:** Remember the BT82 is an air-cooled engine and kart must be in motion for cooling of the engine to take place otherwise overheating will occur which will lead to engine failure.
- ▲ **Warning:** When you pull off from stationary only use partial throttle to slowly move away until in full motion as stalling of the engine could occur!
- ▲ **Warning:** With Clutched & TAG engines the driver must be seated in the kart in suitable race protective clothing and with the brake depressed to prevent any sudden acceleration during starting.

With the remote handheld starter shaft firmly on the crank starter nut then spin the starter to start engine. As soon as engine has started the remote handheld starter must be quickly removed to avoid damage or accident should driver pull away with it still in position.

⚠ **Warning:** You must ensure that engine is not ticking over too fast when kart is stationary, or the clutch will start to drag which will cause excessive wear.

⚠ **Warning:** Sideway or up and down movements of the handheld remote starter motor when engaged on starter crank nut could cause damage to crankshaft. Always ensure the starter is supported.

⚠ **Warning:** Always make sure handheld remote starter is fully removed before you pull away.

To STOP a Clutch drive kart, you put the kill switch in the OFF position which will stop engine.

## ***TAG Starting***

With the driver sitting in the kart, they can easily start the engine by pushing down the Green start button until the engine fires. As soon as it starts the driver must release the green starter button.

⚠ **Warning:** The green starter button must instantly be released as soon as engine fires and must never be pressed whilst engine is running on, or off track or damage will occur.

⚠ **Warning:** You must ensure that engine it is not ticking over too fast when kart is stationary, or the clutch will start to drag which will cause overheating and excessive wear.

⚠ **Warning:** Remember the BT82 is an air-cooled engine and kart must be in motion for cooling of the engine to take place otherwise overheating will occur which will lead to engine failure.

⚠ **Warning:** When you pull off from stationary only use partial throttle to slowly move away until in full motion as stalling of the engine could occur!

⚠ **Warning:** With Clutched & TAG engines the driver must be seated in the kart in suitable race protective clothing and with the brake depressed to prevent any sudden acceleration during starting.

To STOP a TAG drive kart, you simply keep pressed down the RED stop button until engine stops.

## ***Running In***

This must be carried out on a track and not stationary as the engine will overheat!

⚠ **Warning:** The engine must never be run without load on the kart trolley as this will dramatically shortens the lifetime of internal components as well as cause overheating of the engine.

This is an important process which takes at least 60 minutes of track time. This is vital to ensure the long-term condition of the engine. You should divide your running in into 4 periods of 15 minutes.

**0-15 minutes:** Use minimal throttle starting at first around 8000rpm and do not exceed 11000rpm. Use the throttle to power on and off during all of the running in periods. Do not hold engine at constant speed but vary up and down. At all times there should be a small puff of blue smoke from the exhaust when accelerating out of corners. If not, turn out the carb high jet accordingly.

⚠ **Warning:** Because the internal lubrication of the BT82 engine is provided by the oil in the petrol fuel to oil mix, it is vital that that you avoid long periods of completely closed throttle after high-speed running as this may cause piston seizure.

At the end of this period check the kart and engine thoroughly and add more correctly mixed petrol fuel and carefully lubricate chain.

**15-30 minutes:** Build the revs up over this next 15 minutes to a maximum of 13000rpm. At all times there should be a small puff of blue smoke from the exhaust when accelerating out of corners. If not, turn out the carb high jet accordingly.

At the end of this period check the kart and engine thoroughly and add more mixed fuel and carefully lubricate chain.



**30-45 minutes:** Build the revs up over this next 15 minutes to a maximum of 14500rpm using more throttle by taking the power on and off. At all times there should be a small puff of blue smoke from the exhaust when accelerating out of corners. If not, turn out the carb high jet accordingly.

At the end of this period check the kart and engine thoroughly and add more mixed fuel and carefully lubricate chain.

**45-60 minutes:** Build the revs up over this next 15 minutes to a maximum of 15500rpm and using full throttle and higher revs, though we recommend that you do not use these extended high revs until the engine has done at least a total of 1.5 hours running. At all times there should be a small puff of blue smoke from the exhaust when accelerating out of corners. If not, turn out the carb high jet accordingly.

At this point carry out another thorough check to see that the kart and engine is fully ready for high-speed use, including checking and adjusting the tension of the chain which will have stretched with initial use. (12mm up & down movement of chain is about correct tension).

## ***Racing, Maintenance & Repair***

**Spark Plugs:** For normal racing, use the NGK B9 series spark plug. If running in very hot weather and at high load it may be advisable to use the NGK B10 series spark plugs. Only the use of the NGK B10 series plugs should be always used in the TAG engines. Plug gaps for all listed spark plugs is (0.65mm to 0.75mm)

### ***Permitted Spark Plugs***

Brand	Model of Spark Plug
NGK	B9EG / B10EG / BR9EG / BR10EG / B9EGV / B10EGV / BR9EIX / BR10EIX
DENSO	W27ES-ZU / W31ES-ZU / IW27 / IW 31

### ***RPM***

The factory recommended rev limit for sustained running is 15,000rpm. You are strongly advised not to exceed 15,750rpm as an absolute maximum. Although higher revs can be achieved this will be at the expense of power and straight-line speed and will also substantially reduce engine life. The TAG version engine has a built-in soft rev limiter which acts as a safety should you lose a drive chain. If a chain is lost in operation, then it is likely the crank will twist out of true which will need straightening before the engine can be run again. Contact your engine service dealer to do this work for you as engine will need to be fully stripped.

### ***Carburettor***

The carburettor settings should always err on the side of richness for maximum performance and engine life. Settings may be slightly different between the junior and senior engines and different size restrictor plates.

**Table of recommended carb fuel supply jet settings in Hours & Minutes as on a clock face**

TKM Class	Restrictor	LOW JET	HIGH JET
Junior 123 Kg	Black: 19.5mm	2 hrs + 30 minutes	17-19 minutes
Junior 128 Kg	Gold: 20.5mm	2 hrs + 30 minutes	16-18 minutes
Junior 135 Kg	Blue: 22.0mm	2 hrs + 30 minutes	15-17 minutes
Junior 142 Kg	Purple: 24.0mm	2 hrs + 30 minutes	14-16 minutes
Junior 148 Kg	No Restrictor	2 hrs + 30 minutes	14-16 minutes
Senior <i>Extreme</i> & Clubman 132 Kg	Black: 19.5mm	2 hrs + 30 minutes	17-19 minutes
Senior <i>Extreme</i> & Clubman 139 Kg	Gold: 20.5mm	2 hrs + 30 minutes	16-18 minutes
Senior <i>Extreme</i> & Clubman 146 Kg	Blue: 22.0mm	2 hrs + 30 minutes	15-17 minutes
Senior <i>Extreme</i> & Clubman 152 Kg	No Restrictor	2 hrs + 30 minutes	14-16 minutes
Senior <i>Extreme</i> Masters 160 Kg	No Restrictor	2 hrs + 30 minutes	14-16 minutes
<b>The above carb settings are based on carbs with 8 to 10 psi / 0.5 to 0.7 Bar Pop Off Pressures.</b>			

These settings are close for racing and a good starting point which should give a slightly rich (safe) mixture. If the engine is too rich, then turn in the high jet in small steps until the carburation is correct. If the engine is too lean, then open high jet until carburation is correct. Never run the High Jet below 10 minutes as this could cause fuel starvation and overheating at high RPM resulting in poor performance and possible damage.

With **TAG** engines it is advised to use a slightly richer setting on high jet (+ 2 Minutes) to give better performance and cooler running.

For V clutched & TAG engines you may have to reduce your advised low jet setting by up to 15mins to 30mins turns in and increase your high jet setting by the same 15mins to 30mins turns out to get your engine to tick over correctly when engine is hot or cold. See **Step 10** in the installation part of this guide.



*Picture of Inside of Exhaust Bend Manifold for Carburation Checking*

After a stint (say 8 to 10 laps) on the track and engine has cooled you can check the carburation mixture setting by either removing the cylinder head and inspecting the piston crown or using the far easier and reliable method of simply sliding off the exhaust with its connecting flex and inspecting the colour of the carbon inside the end of the engine exhaust bend manifold. Do not rely on spark plug colours as these will change immediately you run slowly back into pit entrance lane etc.

<b>Carbon Colour</b>	<b>Conclusion</b>	<b>Action to be taken</b>
<b>Wet Black</b>	Too rich and will cause lack of power and possible fouling of the spark plug.	Turn in High Jet 5mins and check again after next session or race.
<b>Dry Black</b>	Perfect.	Leave carb setting and monitor through the day.
<b>Dark Grey to Light Grey</b>	Too lean and could lead to engine damage and slowing towards the latter part of race.	Turn out High Jet 10mins minimum and check again after next session or race.
<b>Light Grey to White</b>	Probably too late as you would have already suffered with piston seizure.	If engine has not seized, then turn out High Jet 20mins minimum.

The easiest and best way to set correct jet settings is to start off as listed above in the recommended settings and engine should be safe rich so that it 4 strokes (this is the name given to an over rich 2 stroke engine) at some point down the fastest part of the track!

You may have to even turn out the High jet some more to induce this over rich 4 stroking starting point.

The driver will hear this 4 stroking and feel the engine holding back with it not able to reach higher RPM.

Simply turn in the high jet a fraction at a time until the 4 stroking just disappears as driver is about to apply the brakes at end of fastest section or straight.

Carb setting should now be about right but of course can be checked by the carbon colour method listed above.

It is very important to keep your entire fuel system meticulously clean. If carb problems do occur, they are often as a result of minute particles of dirt upsetting its fine tolerances.

Your petrol cans should be kept clean inside and swilled out occasionally. Filter your petrol fuel through a funnel into the tank and make sure that the funnel is clean - keep it in a plastic bag when not in use. You should have an in-line filter in the petrol fuel pipe. Replace the in-line filter from time to time.

**⚠ Warning: When handling petrol fuel, do not smoke or allow naked flames. Petrol fuel and petrol fuel vapour are highly flammable and explosive under certain conditions.**

The carb internals must be also spotless. If you have a problem then carb needs to be striped and cleaned through thoroughly, ideally using an airline. Then fit a new full repair kit WB-K10 and set pop off pressure at between 8 to 10 psi / 0.5 to 0.7 Bar using the special pressure checking gauge. See carb blow-up parts drawing on next page.





### **Setting Ignition Timing**

Using a metric dial gauge and adaptor, screw into spark plug hole with cylinder head attached to engine. Turn the engine to Top Dead Centre (piston at top). Ensure the gauge does not bottom out, adjusting as necessary. Set dial of gauge to zero (0). Looking at the engine from ignition side, turn the crankshaft clockwise to the desired reading on the gauge – e.g., 2.0mm BTDC. Check if the timing line on the ignition stator-plate and rotor are exactly aligned. If not loosen the three M5 bolts securing the ignition stator and rotate until timing lines are in line. Tighten bolts, re-check alignment.

**Ignition Timing settings are as follows:**

Type	Permitted Setting Range	Recomended Setting for Racing
Motoplat	2.0 – 3.0mm BTDC	2.9mm BTDC
PVL	1.5 – 2.1mm BTDC	2.0mm BTDC
PVL TAG	3.0 – 3.6mm BTDC	3.3mm BTDC





### **Battery**

Your chosen battery must be treated with care and always fully charged with correct remote charger before each event.





Always disconnect the battery connections when kart is not being run same day or in transit or stored.

The PVL TAG ignition does not re-charge battery when engine is running on track so this charging must be carried out with correct chargers with battery completely removed from kart.

The TAG battery is only used to start engine and is not used to generate spark while running. This is produced solely from the PVL Rotor & Stator on engine.

-  **Warning:** Battery must be fully disconnected from the PVL wiring loom and removed from kart while re-charging takes place as damage will occur to PVL system & Starter Assembly.
-  **Warning:** Damage will occur to your battery and the PVL Tag system if you short circuit or fit red and black connections wrong way round.
-  **Warning:** Make absolutely sure to avoid short-circuiting of the battery terminals . A short circuit would ruin the battery and could lead to explosion of the battery.
-  **Warning:** Always disconnect the battery power leads from the kart wiring after each day's use.

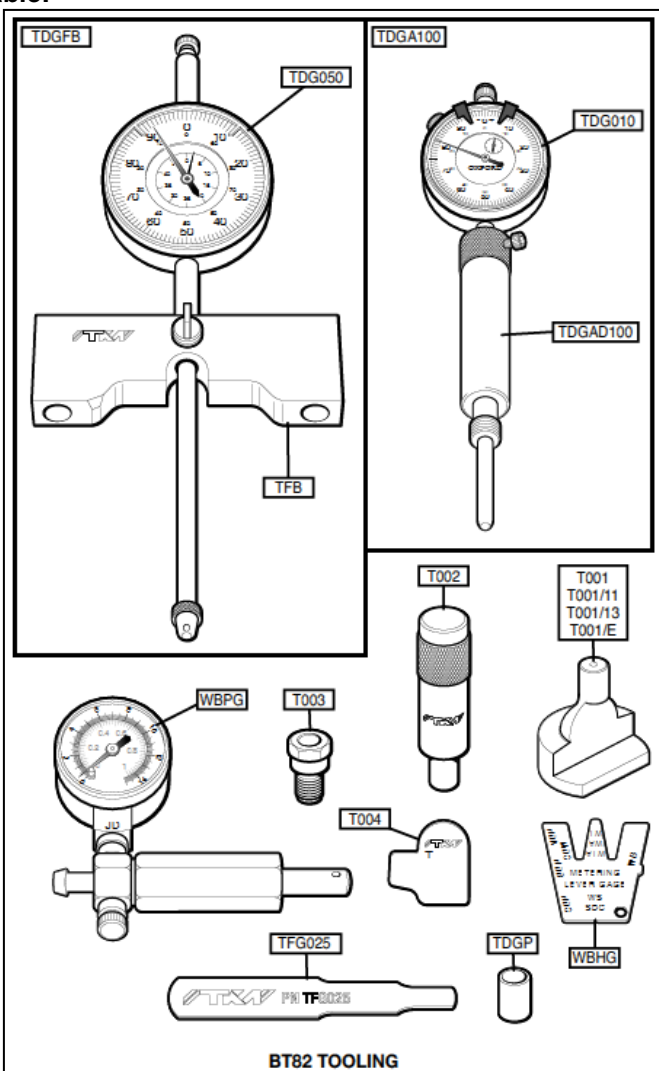
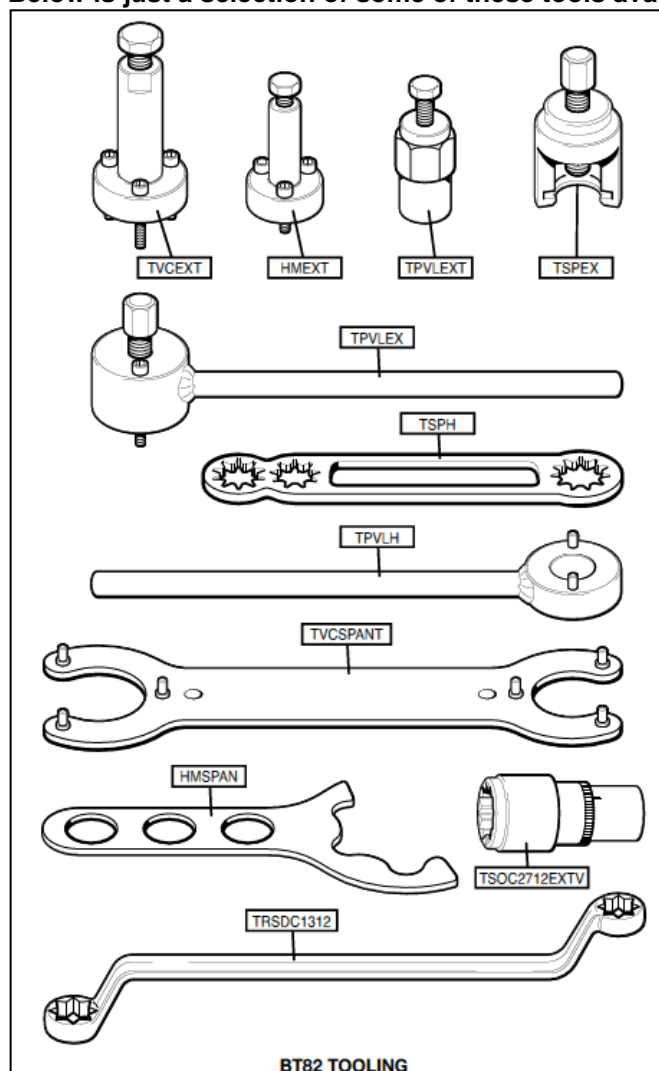
### **General Warnings & Advice to Avoid Engine Damage**

-  **Warning:** The crankshaft is assembled in three pieces and can be damaged by failing to adopt the correct procedure when tightening or removing the clutch / sprocket / ignition securing crank nuts.
-  **Warning:** You must never hold the crank nut at the other end of the crankshaft to tighten or remove the crank nuts. Only use the special tools to hold either the V clutch hub, sprocket, or ignition rotor while you use a spanner on the nut. This is vital to prevent crank misalignment.
-  **Warning:** TAG IGNITION ROTOR – Only use the PVL manufactured extractor for the removal of this part or damage may occur with resulting failure of rotor. Hold rotor with hand only to do up or undo securing nut with impact gun or damage will occur to rotor. Always ensure tapers are clean and dry and use the correct torque value of 20ft/lb or 27Nm on securing crank nut.
-  **Warning:** Only use the specially designed tooling to carry out work on your engine to avoid engine damage.

## Specialist Tools

Tal-Ko offers a range of special tools to assist in carrying out engine work to the correct standards. These are available direct from Tal-Ko or from official dealers.

Below is just a selection of some of these tools available:-



### Recommended Engine torque wrench settings

Part	Nut / Bolt	Foot-Pound	Newton-Metre
Cylinder Head Brass Nuts	M8 x 13mm A/F	13.0	17.5
Cylinder Head Long Seal Nut	M8 x 13mm A/F	13.0	17.5
Cylinder Head Bolts	M6 C/H	8.0	11.0
Crankcase Joining Bolts	M6 C/H	10.0	13.5
Carb & Filter Flange Bolts	M6 C/H	8.0	11.0
Engine Mount Bolts	M8 C/H	20.0	27.0
Ignition Stator Bolts	M5 C/H	5.0	7.0
Ignition Rotor PVL & Motoplat Nut	M12 x 17mm A/F	50.0	68.0
Ignition Rotor PVL TAG Nut	M12 x 17mm A/F	20.0	27.0
Chain Sprocket 10/11T Nut	M12 x 17mm A/F	42.0	57.0
Chain Sprocket 9T Nut	M12 x 17mm A/F	22.0	30.0
Chain Sprocket Clutch Conversion Nut	M10 x 17mm A/F	30.0	41.0
Exhaust Manifold Nuts	M8 x 13mm A/F	20.0	27.0
Spark Plug	M14 x 21mm A/F	18.0	24.0
Horstman Clutch Starter Nut	M10 x 17mm A/F	15.0	20.0
Horstman Clutch Hub Nut	M16 x 24mm A/F	40.0	54.0
Horstman Clutch Spring Green Nuts	M6 x 10mm A/F	2.5	3.5
Horstman Fixed Plate Bolts	M5 CSK	2.5	3.5
V Clutch Starter Nut	M10 x 17mm A/F	15.0	20.0
V Clutch Hub Nut	M18 x 27mm A/F	50.0	68.0
V Clutch Chain Sprocket Fix Bolts	M5 CSK	8.0	11.0
TAG Starter Ring Gear Fix Bolts	M8 CSK	15.0	20.0

Tal-Ko strongly advises the following engine clearances.

**▲ Warning:** Use of abnormal settings may cause excessive wear, damage, and loss of power.

#### Recommended Engine Clearances

<i>Item</i>	<i>Dimensions in MM</i>
100cc Piston to bore clearance on New Bore & New Piston	0.10 – 0.11mm
115cc Piston to bore clearance on New Bore & New Piston	0.11 – 0.12mm
Crankshaft assembly end-float measured in crankcase	0.12 – 0.17mm
Piston crown to head squish measured on outer edge of piston crown	Min 0.76mm
Piston ring gap measured with the bare ring inserted in top of bore	Min 0.10mm    Max 0.50mm

#### Engine Servicing

At 15-20 hours it is recommended that the engine has a full strip and rebuild. This will completely depend on how you have run and looked after your engine. If you have constantly run engine at over 16000 RPM, cut down the oil to fuel ratio, run in the rain without wet cover etc., then all of this will seriously reduce the service interval running times.

Naturally, you may if you wish, have your engine serviced at more frequent intervals. All services can be carried out by Tal-Ko and will be recorded.

In between factory servicing you are recommended to check that your engine complies with Formula TKM rules, and that carbon build up in the combustion area does not bring permitted head volumes or stuck piston rings outside of these regulations

The Walbro carburettor should be regularly checked and cleaned every few race meetings.

The chain drive sprocket should be inspected regularly and replaced as soon as wear on the teeth appears.

Due to the extreme demands of racing, it is also important to properly maintain your V clutch to obtain maximum performance and reduce risk of clutch breakage or clutch slip. Please see the separate V Clutch Service & Fitting Guide available on [www.tal-ko.com](http://www.tal-ko.com).

