

TITAN ZG 45 PCI



Instructions

Toni Clark practical scale GmbH

5 years guarantee for TITAN model aircraft engines

More than 20 years experience with TITAN engines plus our quality control allows us to extend the period of guarantee from one to five years. This guarantee covers the engine and the ignition only.

The following conditions must be met to obtain the guarantee:

Guarantee is for the first owner only and is not transferable to any other person.

In the event of any claim, the engine must be returned to us with the original invoice. The serial number on the crankcase must be undamaged, and must not have been removed and reapplied. The serial number is registered by us with the buyers name and the date of purchase.

The only fuel to be used is the petrol oil mixture as specified in the instruction manual. Use of Methanol invalidates the guarantee.

The guarantee includes the Microprocessor Ignition unit, the maximum voltage of 6,7 volts must not be exceeded. Mechanical damage to the cables is not covered by guarantee.

The guarantee is that we replace any defective parts free of all labour and material costs and pay only the return postage and packing. This guarantee covers only the engine and can in no way be construed to cover anything else.

This guarantee does not cover crash and related damage in any form whatsoever.

Congratulations on your purchase of a Titan ZG 45PCI

About the biggest problem facing man is that he does not know what he does not know. To resolve this problem requires enormous efforts, however try to avoid so much as possible unnecessary mistakes and please read the following pages carefully. Do not take fright at the amount written here, it is really a list of mistakes many modellers have made and you should at all costs avoid. A reliable running engine stands or falls with the way you instal the engine in your model, and how you handle your engine. It is up to you, to read and carry out these instructions, to have success and be able to get real fun out of the hobby of flying model planes.

The Titan ZG 45PCI, fitted with the Microprocessor Ignition, will start just as easily as with the Easy Start System. Although the starting technique is totally different to the ZG 45SL with the standard magneto ignition and requires a fully new approach. In other words, please forget all you have learnt with starting the magneto ignition engine and follow the starting instructions for the Microprocessor Ignition, given towards the end of this manual!

The Titan ZG 45PCI is not a complicated engine, it is a well proven industrial two stroke engine. To ensure your engine reaches you in perfect condition, we have specially trained people to completely strip each engine down and thoroughly check it. This stripping and reassembling takes between 25 and 30 minutes per engine and ensures that you receive an engine that is mechanically sound as can be.

The Titan ZG 45PCI is a very powerful engine, the thrust from the propeller is such that you simply cannot afford to take any chances. You take a chance and you run the risk of not only endangering yourself, but other people as well. Take care before each start, double check to see the throttle is not on full power. If you do not have anyone to help, you must anchor your model securely or flick the propeller over from behind the engine, using the other hand to hold the model, this way you are in no danger from the prop. A screwdriver stuck in the ground in front of each wheel is not only useless, it is dangerous!

Do not taxi your model right back to the starting place on your flying field, instead cut the engine and push the model back! Pushing your model back, you may think seems unprofessional. Forget such ideas! You never know, something might go wrong and your model suddenly has full throttle! Should the result be that you have reduced your club chairman's model to its component parts, you can count yourself lucky if it's not the chairman himself, or his dog.

Rigid mounting

The rigid mounting of your engine has the attraction that it is cheap and simple. A well constructed model can easily withstand the vibration. It is preferable to fit the receiver in a Balsa box with plastic sponge material as opposed to fitting the receiver to a rigid Balsa sheet with rubber bands or similar. It will certainly pay to buy more expensive servos with better motors and potentiometers as these will withstand the vibration without difficulty. Whether the rigid mounting of the engine will cause more noise depends largely on the covering. A really tightly shrunk silk, nylon or plastic heat shrink material is to be avoided, for these coverings will act just like drum skin, amplifying the sound from the engine.

For rigid mounting you have the choice between our three motor mounts #6590, #6561 and #6552. Alternatively you can cut a motor mount from a 5 mm thick aluminium sheet. The four screw holes in the rear crankcase half are M6 and are 38 mm equidistant. Secure the M6 mounting screws with either Loctite or spring washers. If you use a aluminium sheet mount, you must of coarse cut a hole in the firewall to take the rear crankshaft stub. No need to worry about oil getting into the fuselage, the seal is absolutely oil tight.

Secure the motor mount in the well proven way with M5 socket screws, spring washers and crown nuts in a 9 mm thick birch plywood firewall. If the firewall is hardly bigger than the motor mount you can safely use 6 mm birch ply.

Hydro Mount System

When you wish to have a real quiet model and already have tried many would be solutions, you will find our three HMS variations will bring astounding results. Our HMS uses two shock absorbers and four very soft rubber silent blocks, resulting in a very satisfactory decoupling of the engine from the airframe. The soft rubber silent blocks would not be possible without the shock absorbers. The swing amplitude of these rubber mounts with the engine throttled back would be 15 mm and with such a movement, a low speed tickover would be impossible, as the energy being absorbed by the rubber mounts would not leave enough over torque wise to bring the propeller over the next TDC. The use of harder rubber mounts to reduce the swing amplitude would only be partly effective at full throttle.

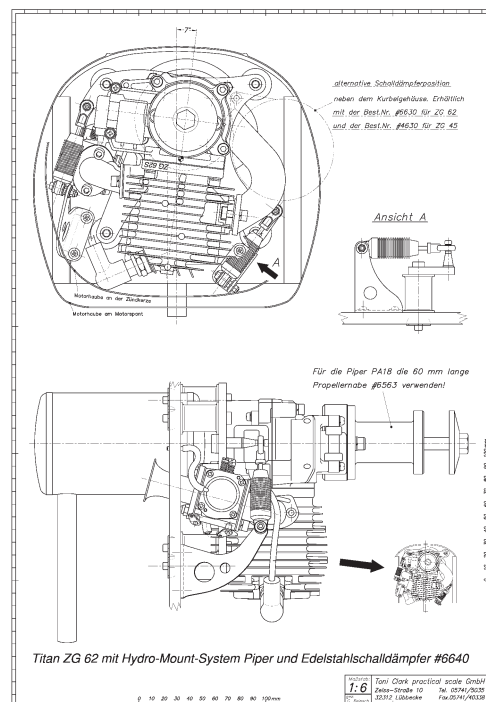
The purpose of the two shock-absorbers is to dampen the torsional oscillations. The shock-absorbers transmit some vibration from the engine into the airframe and this cannot be avoided. The advantage of these shock-absorbers is that they are purely dampening, without any form of springs, thereby it is impossible for them to come into resonance. The shock-absorbers can be regulated in their action from hard to soft by choice of oil viscosity. As opposed to various forms of fixed rubber-covered stops or similar to limit movement, the shock-absorbers are much quieter. With the shock-absorbers you have the advantage of the airframe being effectively insulated from the engine at full throttle with most torsional oscillation being dampened out at the tickover.

The shock-absorbers for our Hydro-Mount-System had to be specially designed and manufactured, using hydraulic rod seals, as none of the already available shock-absorbers could cope with the demands of being fitted into our Hydro-Mount-System.

You will see that our shock-absorbers are finned to provide adequate cooling, (they transform movement energy into heat), and fitted with a rubber grommet, which absorbs the very fine oscillatory movement at full throttle where the shock-absorber is getting stiffer.

The HMS is a complete system, with four special rubber silent blocks, two shock absorbers, mounting brackets and rubber grommets for the shock absorber, all screws nuts and washers and a ready formed spider leg engine mount are included.

The Hydro-Mount-System Piper is designed to fit into our Piper PA-18. The cylinder is inverted and 7 degrees left from vertical. The stainless muffler is placed right behind the crankcase and screwed to the aluminium spider leg mount. The Hydro-Mount-System Piper can be integrated in many other models, as long as the cowl is big enough to take the engine.



Ignition installation in the model

The most important rule covering battery ignition systems first:

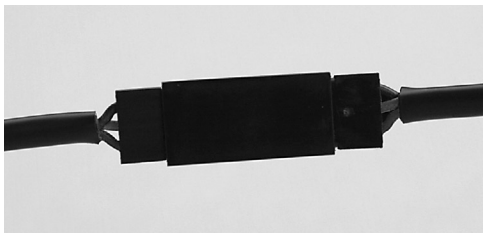
Never ever switch the system on without the spark plug cap being on the spark plug!

Keep all parts of the battery ignition as far as possible from the receiver, minimum distance being 25 cm.

The microprocessor Ignition is protected with a tough metal case and the electronics inside are encapsulated to protect against vibration. In spite of this it is not a good idea to simply mount the ignition box onto the firewall with a couple of cable ties.

Please fit the cables very carefully into your model, especially the high tension cable, as this will not contain the 21,000 volts if it is damaged due to scuffing against the cowl inner surface. If the screening flex is damaged due to scuffing when threaded through a GRP cowl opening, it will not be long before the inner insulation is damaged also. Then the HT will short out to the screening flex and this may cause massive radio interference and will of course lead to an ignition cutout.

Mechanical damage caused to the HT cable is not covered by the guarantee!



Take care with plugging together the JR-plugs and sockets by noting that the colours should line up on opposite sides. It is possible with a little extra effort to push these together with reverse polarity. No damage will be done but the ignition will of course be dead. I tape these plugs and sockets with insulation tape for additional safety.

Switch

Use only knife edge contact switches such as the Graupner receiver cable with charger socket order no. 3046. Toggle switches with roller contacts are not suitable as these are intended for 240 V. Used on 6 V, oxidation can occur, this increases the contact resistance and will lead to ignition failure.

Battery

The battery should be either a 4 or 5 cell NiCd or NiMH type with 1000 mAh capacity at least. More capacity will certainly do no harm. The power consumption is dependant on the rpm. At 2,000 rpm the ignition unit draws 200 mA, at 8,000 rpm it is 680 mA. Under normal conditions you will not fly at full throttle the whole time, so a 1400 mAh battery, that is carefully managed, will suffice for two hours with safety.

Using a 5,5 to 6,0 V linear voltage controller, like the "Digi-Switch" available from Modellbau Deutsch, you can also use twin cell Lipos.

Spark plug

The very robust Champion RCJ-7Y resistor plug is fitted. In the event of a plug change it is important to use only this type. The contact gap is 25 thou or 0,6 - 0,7 mm

Cooling air opening

For cooling the Titan ZG 45PCI it is not necessary to have a specially large opening in the cowl. But it is essential to ensure, that as much air as possible entering the cowl flows through the finning and around the carburettor, which also needs cold air. Air takes the path of least resistance and will not normally flow through the fins, unless you take positive steps to force it to do so by means of air-ducting. Balsa sheeting and blocks is the best material to use for this.

It is essential that the ducting almost makes contact with the engine, so balsa is better than aluminium, for should the latter make contact with the engine, this can easily cause severe radio interference due to metal to metal contact generated noise.

Fuel tank

With a tank of 500 cc, without an intake tube on the carburettor, the Titan ZG 45PCI will run for about twelve minutes on full throttle. But with an intake elbow between the carburettor and engine plus a bellmouth intake tube, so that the induction air is drawn out of the fuselage, a 500 cc tank will give almost twenty minutes at full throttle. A 500 cc tank is ample for a stunt model, while for glider towing our 1000 cc tank is a suitable size. It is better for the tank to be built into the model at a level above that of the carburettor. The carburettor has non-return valves fitted, so that the fuel cannot run out through the carburettor as long as the engine is not running. For starting, it is better when the fuel line is full with fuel. With the engine running, it does not matter how long the fuel line is. You can install the tank anywhere you please in the model, at the CG position for example. But keep the fuel line as straight as you can. Avoid bends that will hold air bubbles.

It is impossible to prevent the fuel in the tank from foaming. This foaming means you must use our special cotton felt clunk filter - omit this clunk filter and your engine will draw more air than fuel. Model aircraft fuel filters are useless for petrol engines; the transparent automotive paper element fuel filters are also useless. The former have too coarse a mesh, and the latter have a large capacity, allowing air to accumulate and thereby causing the engine to stop, due to the sudden ingestion of this accumulated air by the carburettor. The second and very important reason for using our cotton felt filter is that in petrol there is always a certain amount of suspended matter, that is almost impossible to see with the naked eye. This dirt will easily pass through the model filter and build up in the carburettor, mainly in the low speed fuel passages. When this happens, the only cure is a new carburettor.

Fitting a T-piece in the fuel line between the tank and carburettor for tanking will be an obvious mistake to most folks, but we have seen this method of short-circuiting the felt clunk filter in the tank, with the obvious results, more often than one would imagine.

Make two air vents made with fuel tubing, fitted to two single sided nipples in the tanks topside, central at the rear end. These two air vent lines must be led forward over the tank and then down into the fuselage floor at the cooling air outlet of the engine cowling. One of these vent lines (does not matter which) is used to fill the tank. These two lines are always shut off, with two 3,5 mm self tapping screws 15 mm long with heads removed, while the model is flying or otherwise parked. Because the threads are so coarse, enough air can enter the tank, but even during violent stunting no fuel will be lost. The saving in fuel is considerable! This system is simple and 100% reliable, also during filling the tank, you will not spill fuel over your model. The double sided tank nipple from the clunk filter is best placed in the middle of the tank cap.

It is best to leave a little fuel in the tank at all times, even when the model is in your home or workshop. This remaining fuel will prevent the carburettor diaphragms from drying out and becoming hard. Partially emptying the tank only when really necessary i.e. when tank is full. To drain excess fuel off, invert the model. As long as the self tapping screws are inserted, pressure cannot build up in the tank. Make these two vent lines airtight, then liquid fuel will be forced into the carburettor, causing a strong smell of petrol that cannot be ignored very easily.

Do not use transparent fuel tubing. This clear fuel tubing is usually PVC, it often fits neatly onto the nipples and seals nicely for a short while, but after a fairly short period, this clear tubing becomes hard and expands a little in the process, due to the action of the petrol. This tubing then moves due to engine vibration, allowing air to enter the fuel line. It is well nigh impossible to seal this PVC tube satisfactorily.

Our specially made, thick-wall Neoprene fuel tubing is fairly soft and can be sealed perfectly at the nipples with 0.5 mm copper or brass wire, by being wound twice around the tubing and twisted together. Do not be tempted to use nylon tie straps or small Jubilee clips to seal the fuel lines, these straps and clips do not exert pressure right around the tubing, they only serve to pull the tubing into an oval shape on a round nipple. The black fuel tube is very tough and due to having a very thick wall, it is not easily kinked.

A very good alternative tube is the transparent yellow **Tygon® F-4040** tubing. It is very much lighter and does not expand in contact with petrol, also you can see air bubbles in the fuel. You must use more care in laying this Tygon tube in the model to ensure that there are no sharp bends. This tube is not especially heat resistant, therefore it follows it must not make contact with any hot engine parts.

Fuel

For fuel, use normal grade unleaded petrol mixed with a two stroke oil with a ratio of 1:40, but for running in use a larger amount of oil, a ratio of 1:25 for the first five liters. The best two stroke oil you can buy is BEL RAY H1R. Using this oil, you can run your '45 with a ratio of 1:50. For running-in use 1:40 for the first 5 liters. The advantage with this BEL RAY racing oil from the racing bike world is a up to 10-times better lubrication, more power, plus a top quality anti-corrosion element.

Propellers

We have tested a range of propellers with the 45 and here are the results:

Menz "S" 2-blade props		Menz "S" 3-blade prop	
18x12"	7,300 RPM	19x10"	6,000 RPM
19x10"	7,100 RPM		
20x10"	6,800 RPM		
21x8"	6,800 RPM		
21x10"	5,950 RPM	Super Silence CF-3-blade	
21x12"	5,500 RPM	19x11"	6,800 RPM
22x10"	5,400 RPM	20x12"	6,200 RPM

The above list of props were tested with the standard muffler and the 40 mm ram tube order no. #0080 fitted to the carburettor. Without the ram tube the RPM is some 200 less; also the engine was not fully run-in, so the RPM figures can be in excess of the above after say five hours running time.

You must balance every propeller. Some manufacturers claim they balance their props, you should check this claim, as their definition for "balanced" may not coincide with what yours should be.

Caution: With a fairly thin propeller it is possible for the prop bolt to come against the end of the crankshaft, thereby preventing the propeller from being tightly fixed. You see, there are two propeller fixing bolts of different lengths with each engine. The longer bolt is to allow for our Titan spinner backplate of 5 mm. There is a threaded hole in this longer bolt to take the spinner fixing screw.

Warning: Do not be tempted to use semi-flexible thermoplastic props; thermoplastic material is not reliable enough for props of the required diameter, even if they are reinforced with either glass or carbon fibres. With the large diameter, plus the ability of the 45 to run at high RPM, these plastic props are performing at and above the limit of their durability. They will surely shed a blade sooner or later, due to material fatigue. This fatigue effect can be increased by a model tipping onto its nose and bending the prop severely, or by the plastic simply dehydrating.

Propeller fixing

Experience has shown that, without doubt, the safest method is to fix the propeller onto the ZG 45PCI with a single large bolt and a wide flange on the prop hub. As long as the bolt is tightened down enough, the prop will not come loose. Should the propeller come loose by normal starting, then the prop bolt was not tightened down sufficiently, or the propeller has shrunk under pressure from the tightening down. But again, nothing dangerous will happen, you will not be able to overlook the loose bolt!

It is a real danger for persons and property to fix the propeller to the ZG 45PCI with a multiple screw hub system. The problem is, that you will not notice if the screws are not tightened down sufficiently to provide enough friction between the propeller and the hub to prevent any movement at all between the two. The continuous firing stroke impulses from the engine can very quickly lead to metal fatigue in these fixing screws, should they not be tight enough. This fatigue will cause the screws to shear, allowing the propeller to fly off. This is not something I have dreamt up, it is something I have seen happen with multiple screw hubs.

For the single prop bolt it is not possible to come loose while the engine is running, as every firing stroke impulse only serves to tighten the bolt more. But should the ZG 45PCI be adapted for glow fuel and the timing be incorrect, it is then possible for the engine to start pinking (knocking) and, like the well known four stroke problem, this can lead to a prop being thrown.

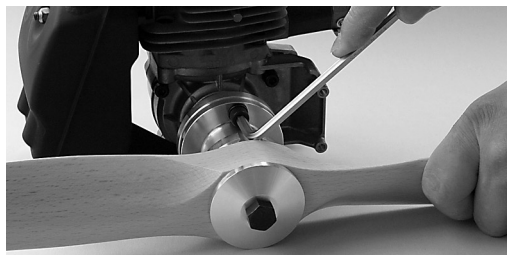
Please do not fit a steel pin through the propeller and hub, the reason being the dowel holds the prop in place although the bolt may be loose. You may not notice this looseness, then suddenly the prop is split in two by the dowel. You can count yourself lucky with a near miss when this happens.

Should there not be enough resistance to movement between a smooth aluminium spinner back plate and the prop hub, the answer is to put a disc of 320 grit wet or dry paper between the hub and the back plate, the grit side against the back plate.

When you have understood what I am saying about propeller fixing bolts, and see that the friction between propeller and hub is the only means to give a safe fixing, you do not then have to envy your club friends, when they must bore a chain of holes around the hub of each new propeller, only to try to compensate for a too small and smooth prop hub surface.

Changing the propeller hub

We have 3 different lengths of propeller hubs. To remove and refit the two socket head screws, securing the propeller hub only requires a propeller to be firmly fixed to the hub to act as a lever.



Carburettor linkage

Do not remove or disengage the spiral return spring on the throttle lever arm. All play in the throttle linkage will be taken up with the return spring and this spring is also preventing end play and premature wear on the throttle flap. Further, in the unlikely event of the throttle pushrod either breaking, or becoming unhooked, the spring will throttle the engine. Do not worry that the throttle spring will absorb too much servo power. The loading on the servo caused by this spring is relatively small in comparison to the loading on the other servos in flight .

If necessary, the throttle lever can easily be modified by cutting a horn from sheet Tufnol and using the existing hole in the steel lever, fixing the Tufnol horn onto it with a M2 screw and nut, then securing the whole with Araldite Epoxy. Keep the weight of this new horn as low as possible so as to keep the vibration-induced loading on the throttle-shaft bearing surfaces within reasonable limits. The throttle pushrod can be run from the servo to the throttle arm by way of a 90 degree bellcrank fixed to the firewall. A simpler and better alternative is a Bowden cable formed into a wide bend.

The key to a reliable and low idle: The Bowden cable between the servo and throttle lever has to be connected in such a way, that the return spring causes the throttle lever to press against the Bowden cable and not pull on it! Let me explain why this is so important: Engine vibration induces swinging of the bend in the Bowden cable, this wants to throw the cable outwards, similar to a skipping rope. If the return spring on the throttle lever pulls the cable inwards against this movement, it can cause the tickover speed to fluctuate considerably. On higher rpm there will be almost no swing and the spring is able to keep the cable inwards, but on lower rpm, often at about 2000 rpm, the cable may get into resonance and the swinging becomes stronger and will throw the cable outwards. This raises the rpm, as the cable now pulls on the throttle lever and opens the throttle. To compensate for this, you will be forced to throttle the engine down even more. At lets say 1800 rpm the cable will fall out of resonance and the spring will gain the upper hand again, closing the throttle completely and causing the engine to stop immediately.

When the servo is pushing against the spring, the centrifugal force and the spring are working in the same direction, the engine will then react smoothly and accurately to the throttle stick - always and at every rpm!

Never remove the butterfly valve from the throttle lever shaft so as to ease the fitting or soldering of a larger lever. The reason is, that the manufacturer spreads the end of the small screw, so that removing this screw damages the threaded hole beyond repair, and re fixing the butterfly valve safely is practically impossible. Either the shaft breaks, or the loose-fitting screw drops out and is sucked into the engine, with the result you have a heap of scrap on your hands.

The **choke valve** can be operated with a servo if required. Do not remove the spring and ball bearing selector for locking the choke spindle. A normal servo can overcome the resistance without a lot of effort. With mini servos set the servo throw on the transmitter to the maximum value, i.e. 150% and use a small servo arm.

To prime the engine, the choke butterfly valve must be completely shut and must not catch on the intake ram tube. This means that the intake ram tube must be exactly centred onto the carburettor. Shut the choke butterfly valve, mount the intake ram tube and tighten the two fixing screws. If you now cannot open the choke butterfly valve, you know that you have to readjust and try again.

Carburettor settings

The high and low speed needle valves have the letters **H=high speed**, **L=low speed** marked on the carburettor body adjacent to the respective needles.

Standard needle valve settings	H	L
Without intake ram tube	1 1/2	1 1/4
With intake ram tube	1	1 1/4
With intake ram tube and intake manifold	3/4	1 1/4

The large nickel plated screw for the throttle lever stop is useful for the test stand, but when the throttle is operated by a servo this screw should be removed.

The adjustment of the high speed needle is very much influenced by the size of the propeller, as well as by the use of an intake ram tube. If the engine is run as supplied with no intake ram tube and using a big prop, it may be necessary to set the high speed needle at up to 2 1/2 turns open.

Although the low speed needle setting will not differ much from 1 1/4 turns, it must be carefully adjusted, especially if you don't want to use an intake ram tube, as for a reliable low speed idle the needle must be on the lean side, but for a good throttle response the needle must be on the rich side. But it is not difficult to find a compromise setting whereby idle and acceleration is satisfactory. The acceleration will be greatly improved by an intake ram tube! It is advisable to have a standard servo for the throttle, do not use a high speed servo. Should you run the engine on the test rig, operate the throttle lever at the same speed as a servo, in other words do not slam open the throttle.

If you decide to fit the cast aluminium intake manifold or make one from a copper bend and use an intake ram tube so as to take the intake air from the fuselage, the high speed needle then needs only 3/4 of a turn open. A full turn open and the engine will run decidedly rich. A good setting for the low speed needle is 1 1/4. Both needles are more sensitive to adjustment with a manifold fitted.

The engine's ability to turn larger propellers increases in proportion to the length of the intake ram tube.

You can only tell from the engine performance in flight whether the carburettor is correctly adjusted, additionally you should check the colour of the spark plug. To check the spark plug colour it is essential that the engine be shut off at full throttle after running for few minutes on full throttle. It is no use to check for colour after the

engine has been running at tickover. The ideal colour is an even soft brown. When the plug is black and oily it is of course too rich, when whitish or with an appearance of being glazed over then the mixture is too weak.

Should you have fitted the intake ram tube so that it protrudes through the cowl and the engine is running rich at full throttle, in horizontal flight and when diving, but on the ground and when climbing it is running lean, the problem is that the cowl is so shaped that the air pressure inside the cowl is higher than on the outside where the intake is. This pressure differential affects the compensating diaphragm in the carburettor, causing the engine to run rich.

To avoid this you may increase the outlet area of the cowl or reduce the inlet area. A better answer is to solder a short piece of brass tube into the small hole on the steel cover plate above the compensating chamber and bring this tubing out to the same level as the intake tube bell mouth. The carburettor now reacts to the air pressure present at the intake and not the pressure inside the cowl. The engine should now run evenly in flight at every attitude. Should there still be a problem, then the acceleration of the airflow around the cowl, where the intake ram tube is located, is too intense, causing the air pressure to drop too much to be compensated by the carburettor.

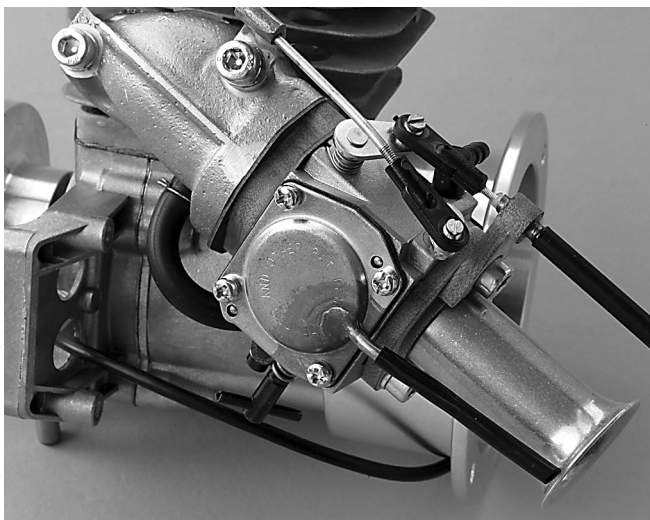
Sucking the intake air from inside the fuselage

The air flowing over a body is forced to accelerate. The increased velocity will cause a reduction in air pressure at local areas over the body. It is clear to most that the models we fly use this same induced difference of air pressure on the wing to achieve flight. But many modellers do not realize how large the difference in pressure over an engine cowling can be, especially when the flow is around a very small radius curvature it can have such a significant effect, as to deprive the engine of sufficient air. With a cowling like this, you will be forced to fit a 90 degree inlet manifold on the carburettor, so that it sucks the air out of the fuselage. On an air-tight fuselage this then requires that you bore two holes about 10 mm diameter opposite each other in the neutral part of the fuselage i.e. between wing and tail on the left and right fuselage sides. Do not place the holes anywhere near the wing, the engine cowl or in the firewall.

With enough space available, you can leave the carburettor on the insulator block at the cylinder and fit a 22 mm copper water pipe bend to the mouth of the carburettor. Cut the bend as short as possible, and epoxy the bend into the aluminium flange of the intake ram tube. Shorten the ram tube to about 15 mm long and epoxy this into the female end of the bend. It remains to solder a 3 mm brass tube to the compensating chamber cover on the carburettor and then fit a short length of fuel tube to this leading into the fuselage.

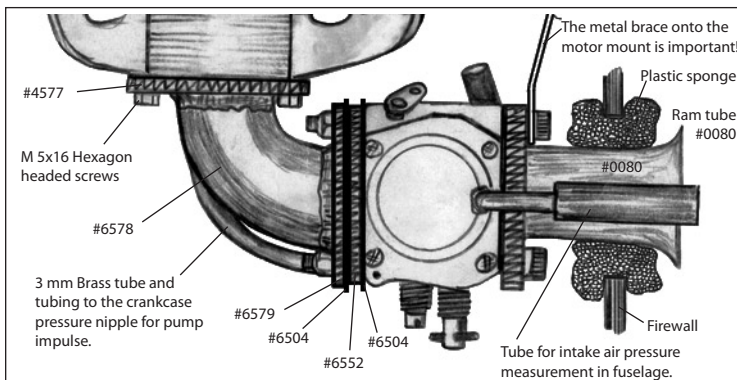
Carburettor Intake Bend

If you have very little space under your cowl, a good centimetre can be saved by fitting our aluminium intake bend #4587 between the cylinder and carburettor, so that the complete carburettor is directed rearwards.



The pictures show the cast aluminium intake bend #4587 and the intake trumpet with flange #0080. The throttle linkage is the bowden cable #6795, fixed to the carburettor with the CNC-milled bracket #6797. The choke is actuated by hand, using the 2 mm wire facing forward.

Self-made Intake Bend



Someone who can silver solder, can save money by making the intake bend from a 22 mm copper water fitting and the two flanges #4577 and #6579.

The straight ends of the copper bend must be almost all cut off. Shape one end to fit the form of the intake port on the engine, use pliers and the vice for this.

Slide the flanges over the ends of the copper bend, file off the surplus after soldering. Do not forget the short piece of brass tube for the pump impulse. The rear screw on the cylinder flange is difficult to reach, better use a hexagon headed screw for this. Secure with Loctite. The copper bend can break due to vibration, to prevent this, fit a steel supporting strap 10x1 mm between a carburettor and motor mount screw.

As written before, the straight ends of the copper water pipe bend must be cut off. The complete length of the copper bend has too large an internal surface area. This causes more droplets of petrol to form and cling to the inside due to the slow airspeed through the bend, when the engine is throttled back. By opening the throttle these droplets will be sucked into the engine, causing the engine to run extremely rich momentarily, it is even possible, that the engine will not accelerate at all. If you then decide to correct this problem by leaning out the low speed jet, you will notice that you now have a problem when advancing the throttle again straight after throttling. The engine will not accelerate into high speed, and will most probably stop, as not enough time had elapsed for the build up of droplets in the bend. Now you see why a too long a bend will not allow you to be able to adjust the two needle valves to cover the whole throttle range satisfactorily.

We have discovered that it is an advantage to paint the inside surface of these intake bends with two component car paint. This leads to less fuel droplets forming or more probable, these droplets do not adhere so strongly. This form of tuning, by the way, works as well with our cast aluminium bends. If you have the patience, you can make a bend from epoxy glass fibre, which would allow a rather longer bend, as the epoxy has the same desirable effect on the droplets as the car paint.

Where the intake ram tube is not long enough to reach right through the firewall, it is best to fit a tube of a minimum of 50 mm diameter to go over the bell-mouth of the intake ram tube. This tube can be fairly long and can end in a silencer box. The gap between the 50 mm tube and the ram tube should be sealed with a piece of plastic sponge to make it almost airtight. The tube need not be round, it also can be a square box from 3 mm thick balsa sheet glued together. This tube does not effect the engine's performance, as it is in effect a reservoir of air and it's length will not detune the intake resonance.

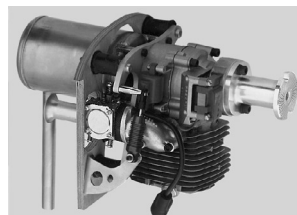
Something to be carefully avoided is any screw or other metal part that falls in the fuselage. You can guarantee it will end up being sucked into the engine. To avoid this you must make up an air filter, which can easily be done by cutting a square piece 10x10 centimetres from the filter mat that is supplied for kitchen air filters, and then gluing it to a Balsa frame. This filter element should be at least 20 mm away from the intake bell mouth.

A (plastic) tea sieve placed over the intake bell mouth and glued directly onto the firewall works just as well and is easier to make.

Warmed air from the exhaust system must not be sucked in by the carburettor!

Silencer

The silencer supplied with the Titan ZG 45PCI is not bad, but rather noisy and too big and in the wrong place for some models. We can offer you much quieter stainless steel silencers, that will fit better under the cowlings. You can choose from two variants, tailor made for our Piper with the Piper-Hydro-Mount-System, but they will also fit a variety of other models.



Silencer # 4640 for our Piper, actually a ZG 62 is shown here.

The silencer #6630 can also be used without the HMS, you will have to fit a piece of 1 mm thick metal plate between the engine and the motor mount #6590, #6561 or #6562, extend this plate to take the rear fixing lug on the silencer.



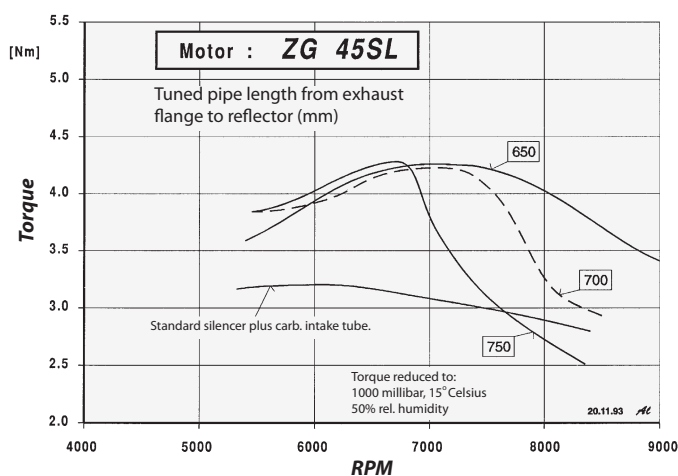
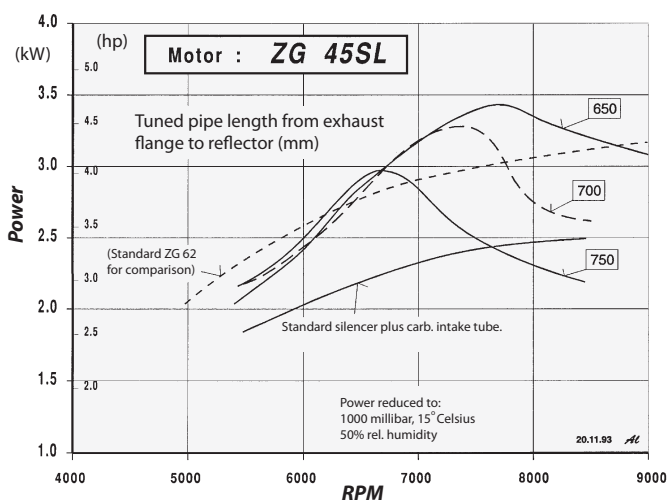
Silencer #6630

Tuned Pipe

The Titan ZG 45PCI performs very well with a tuned pipe. A tuned length of 700 mm from the exhaust flange to the beginning of the baffle cone is best for most purposes. The increase in power with a tuned pipe, as opposed to the standard muffler, is 35% at 7200 RPM. However, such an increase in power considerably increases the propeller noise. Therefore you should fly with carbon fibre propellers when using tuned pipes.



Laser welded stainless steel tuned pipe, order no. #6588



These power curves are from a test carried out by Dietrich Altenkirch for the magazine "Modell". They show the values of the old ZG 45SL. The power of the ZG 45PCI with the new standard silencer is more than shown, but the header lengths and rpm are correct also for the ZG 45PCI.

Stainless steel silencer unit with tuned length header



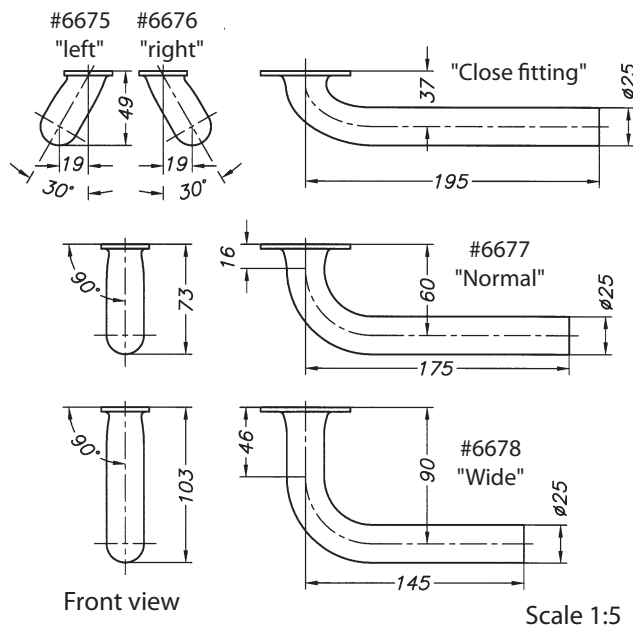
Tuned-Silencer #5770, mounted on a ZG62 - it won't look much different on the ZG 45PCI.

Tuned pipes are very long and far from simple to install in a model's fuselage. The stainless steel silencer #5770 is a realistic alternative. Including the header it is only half the length and thereby lighter. Originally developed for the DA50, it will increase the power of the ZG 45 by a good 20%. The ideal header length is 22 cm, this is measured along the centerline of the header tube from the exhaust gasket to the beginning of the silencer inlet pipe stub.



The Tuned-Silencer #5770, close fitting header #5576, Teflon tube #3896 and sprig clips #3899.

The coupling between the header and silencer, or tuned pipe, must withstand very high temperatures. Silicone is useless for this purpose, but Teflon also will not withstand the high temperature for a great length of time, meaning a constant checking and replacing when required. This applies especially to silencers and tuned pipes integrated inside a fuselage. A very robust alternative is the flexible steel tube #6581.



The drawing shows our standard ready made headers for the ZG 45 and ZG 62. If none of them fit your model, you can use the bent tubing #6569, the flange #6571 and the special silver solder for stainless material #0981 to make yourself a perfect fitting header.

Starting the engine

Due to the Microprocessor battery ignition starting the engine is very easy. Although the starting method is entirely different to what you are possibly used to with the magneto ignition.

One important point to begin:

**Never prime the engine by sucking in with a switched off ignition!
The battery ignition, unlike the magneto ignition, will not start the engine with a wet plug.**

For starting follow these rules exactly:

1. Fill the tank (very helpful).
2. Close the choke.
3. Set the throttle at a slightly higher setting than normal tickover.
4. Have someone hold the model.
5. **Switch on the ignition.**
6. Immediately hit the prop **without any prior sucking in.**
7. The engine will start as soon as enough fuel air mix is ingested due to the closed choke, and will turn a couple of times and stop as the choke is not opened. This is nothing for concern, the engine has shown you there is enough fuel ingested. It remains to open the choke and with a couple of flicks the engine will fire, burn off the excess fuel and run.
8. Let the engine warm up for about 15 seconds before advancing the throttle.

It is to no purpose to violently flick the propeller, just lightly flick the prop over the TDC, you will notice it only takes the small finger at the propeller tip to do this. An elegant method is to flick the propeller over from behind the engine, using the other hand to hold the model, this way you are in no danger from the prop. You will find it pays to have the transmitter in range from your flicking hand.

As a safety feature the ignition will automatically shut down when one minute has elapsed without the propeller being turned. This safety switching can be a slight problem if you get distracted when starting and you do not turn the propeller at least once inside one minute and forget to switch off and on to reactivate the ignition. With the ignition shut down you will easily suck the engine full of fuel before you notice what is wrong and it will then be probably too late and you will have to remove the spark plug and shake out the petrol.

Nevertheless **always switch off the battery ignition immediately after finishing a flight** as during the minute it only requires someone to carelessly flick the propeller once ...

Further with the engine stopped and the automatic shut down active, the ignition still draws a small current that will unnecessarily flatten the battery when forgotten.

Running in the engine

This is the critical time in a engine's life. Do not use the glow-engines method of a really rich set needle valve on a test stand on half power, rather set the needles on the Titan ZG 45PCI to a normal position and **fly** the new engine with very short periods of full throttle and long periods of tickover. You will of course ensure that the mixture setting is not on the lean side. Avoid letting the engine run at half or three quarter throttle for long periods. After the first tank full you can increase gradually the full throttle periods. After four tank full's you can fly full throttle for as long as you wish.

Experience has shown the power steadily increases over the first fifty flights and even after this time, the power will increase from season to season, due to the build up of carbon deposits on the piston crown and on the combustion chamber walls. This carbon build up increases the compression ratio. Because the engine is designed for an extraordinary long life span, even when mineral based two stroke oils are used, the designers had chosen a relatively low compression ratio to allow for a considerable amount of carbon built up. So "don't worry" about carbon build up and as long as it is not in the piston ring groove, do not remove it, instead "be happy" about the extra power!

It is far better to break in the engine in a model with the engine cowling fitted. Due to the unequal temperature distribution around the cylinder, because of the unequal cooling airflow, the cylinder always tends to slightly distort. A new piston ring, with his special surface treatment, can easily adjust to this condition. During the first hour of running in, the piston ring will continually get polished and thereby it's surface becomes harder. An engine, that has been run in on the test stand, must run for a considerable longer length of time, until it has settled down to the new and almost always completely different temperature distribution under the models engine cowling.

Very important:

Although the microprocessor ignition unit is perfectly screened, please make a range test with full throttle before the first flight. Use a small propeller to simulate the rpm when the model is in the air. The range difference with the engine shut off and running at full throttle should be minimal.

If you have a PCM-radio, use the fail-safe and programme it so that in the event of interference the engine will be throttled to a reliable tickover. If you can programme the time lapse, then make this half a second.

By the way, it is technically impossible to shut off the fail-safe with a PCM-radio, it is an integral component of the PCM-system, that cannot be removed. Should the fail-safe be activated by interference or a loss of range, you have several pre-programmable options. This means you can programme the radio as to what will happen, for example the length of time elapse, usually from 0,25 up to 1 second, during which the servos will stay in the last correctly received position before they move to your programmed „fail-safe position“. With fail-safe on or off, you get full control again in the moment the receiver gets a good signal. With the fail-safe „shut off“ the servos stay at the last correctly received positions and will stay there until either the model crashes or the receiver once more has a satisfactory signal from your Tx. With fail-safe in and the engine throttled by the fail-safe, the signal will often get better and you have a reasonable chance. Also you usually have some prior warning when something is not quite right.

Imagine when your model is taking off, someone switches on his Tx on your frequency. Your model is heading in the direction of bystanders at full power. You would be greatly relieved if your PCM-radio immediately switches the engine to idle. Or?

If you use a metal pushrod for your throttle, you must insulate this metal pushrod from the engine with a nylon ball joint.

I can advise you strongly, to fly only with a double battery pack. Experience has taught me that this is something never to fly without. The double battery pack I use is with two separate plugs, two separate switches and the batteries separated with diodes. You can use a servo socket for the second switch harness.

Install the receiver, battery and servos as far away as possible from the engine and particularly from the microprocessor ignition unit; in certain cases the interference comes not through the aerial, but through the wiring from the batteries or the servos. A double superhet will not help!!! Most cases of interference are not caused by the ignition, but through metal to metal generated noise or from a servo pot wiper that has suddenly become faulty.

Receiver aerial

In many radio instructions it states, that one should lay the aerial in a straight line. This is only OK when the Rx aerial is parallel to the Tx aerial and not pointing directly to the Tx as is mainly the case in take off and landing. When the Rx aerial points directly at the Tx this causes the reception to drop to its lowest value. The answer is simple: lay the aerial straight in the fuselage but bend up the last 25 cm to form a right angle

and fix the aerial in this position securely. You can of course have this 25 centimetre vertical element straight out of the Rx case and the rest laid flat along the fuselage. If your fuselage is very short, then you can have this vertical element along the fins king post. A vertical piano wire aerial on a model owes its better performance to being bent over with the airstream.

Maintenance

The Titan ZG 45PCI requires almost no servicing. If your engine is difficult to start after the hibernation, suck fresh petrol into the carb to loosen the thick oil left after the petrol has evaporated, and let this stand for a few days and you will find the engine will run again without any adjustment of the needle valves.

Never use compressed air to clean the carburettor. Never remove the fine stainless steel gauze filter in the carburettor for any reason. When you have followed our advice and fitted a cotton felt clunk filter, there will never be any dirt in the carburettor, but there may well be fine cotton fibres over the small gauze filter (this is the sole reason for this filter). You can remove these fibres carefully with a toothpick, or tweezers.

If you wish to check the screws on the engine for tightness, please use the following table showing torque settings. Especially critical are the four cylinder retaining screws. These must never be really „pulled down“, otherwise the cylinder gasket, which is fairly thick, will squash at the corners of the cylinder flange, causing the flange corners to bend down and resulting in distortion of the cylinder. Cylinders so over tightened will be difficult to turn through BDC when hot and will not be able to run at a low tickover and will have considerably less power. This easily can happen with owners who having just purchased a brand new engine and having nothing better to do than to really pull down all the screws, the cylinder will then be useless scrap metal. If you do not have a feel for tightening down screws or do not possess a torque wrench, then it is better and cheaper, you leave them well alone.

	Thread	Tightening torque
Cylinder bolt	M5	7 Nm (5 lbsft)
Crankcase bolt	M5	7 Nm (5 lbsft)
Propeller hub bolt	M6	10 Nm (7 lbsft)
Rotor nut	M10x1	30 Nm (22 lbsft)

Thank you for taking the trouble to read carefully what I have written here. Have fun with your ZG 45PCI!

Gerhard Reinsch and Toni Clark.

April 2006

