DeAGOSTINI MODEL SPACE™

Red Bull Racing
FORMULA ONE TEAM

RB7

RADIO CONTROLLED • BUILD IT YOURSELF • NITRO ENGINE

Pack 17

Stages 65-68

Contents

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THE GX21 CRANKSHAFT

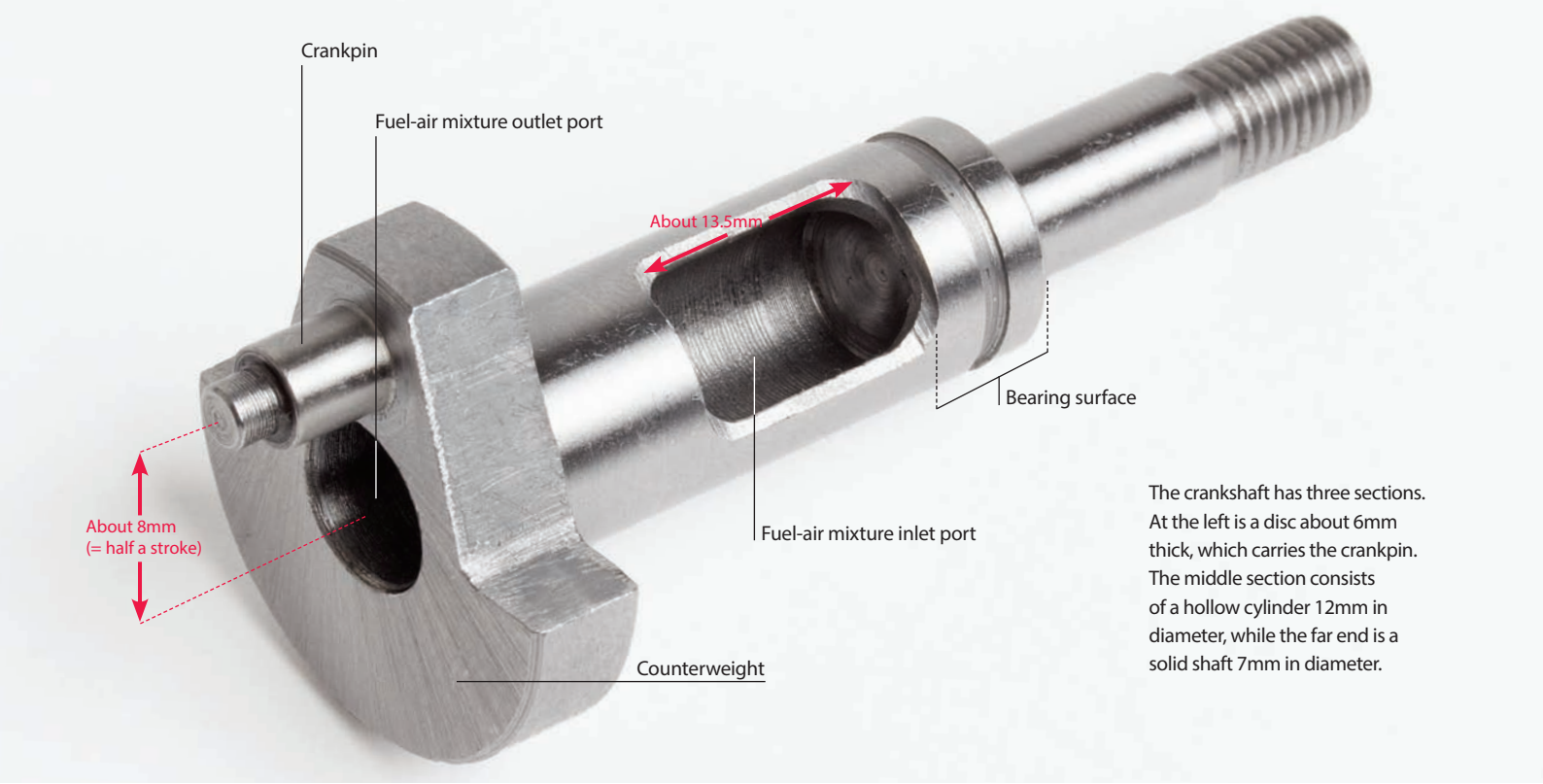
THE TASK OF THE CRANKSHAFT IS TO CONVERT THE UP-AND-DOWN MOVEMENT OF THE PISTON INTO ROTATION AND TO TRANSFER THIS TO THE TRANSMISSION. THE GX21 ENGINE ALSO SUCKS IN THE FUEL-AIR MIXTURE FROM THE CARBURETTOR THROUGH THE CRANKSHAFT.

The crankshaft of your RB7 car has to withstand enormous stresses. While the force of the piston bears continuously on the end of the crankshaft that is inside the crankcase (bottom left in the picture), the other end – which projects out of the engine – must continually overcome the resistance of the whole drivetrain (gearbox, cardan shafts, differential and wheels). To ensure that the crankshaft does not warp or bend, it is made of special hardened steel.

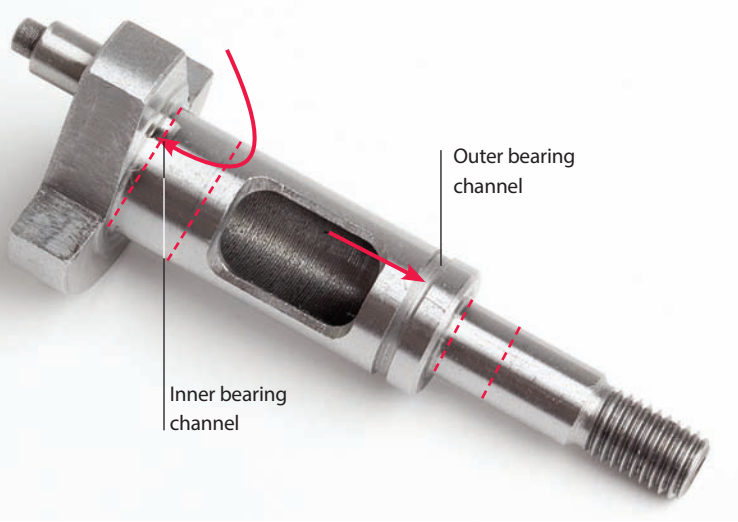
CONSTRUCTION AND DIMENSIONS

The overall length of the crankshaft (including the crankpin) is 67mm. The crankshaft consists of three sections. The section that projects from the crankcase consists of a solid steel shaft 7mm in diameter. At the end of this shaft is a threaded section onto which the flywheel and clutch shaft will later be screwed.

The middle section of the crankshaft is 12mm in diameter



The crankshaft has three sections. At the left is a disc about 6mm thick, which carries the crankpin. The middle section consists of a hollow cylinder 12mm in diameter, while the far end is a solid shaft 7mm in diameter.



Two lubricant channels ensure that the crankshaft runs smoothly. The dotted red lines mark the location of the two main bearings, while the two red arrows indicate the passage of the engine lubricant that is added to the fuel.

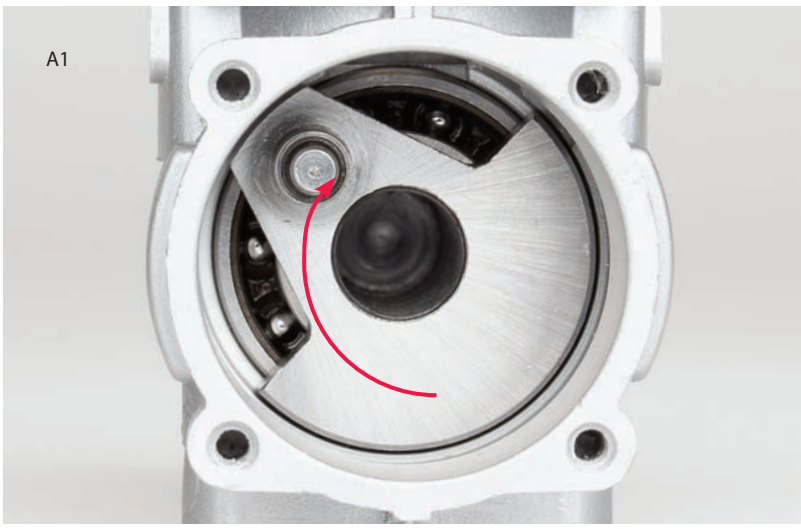


Photo sequence A1-A3 shows the position of the crankshaft from three different viewpoints (with the conrod and piston omitted for clarity). Shortly before the engine completes the first stroke, the crankpin is still moving upwards (red arrow).

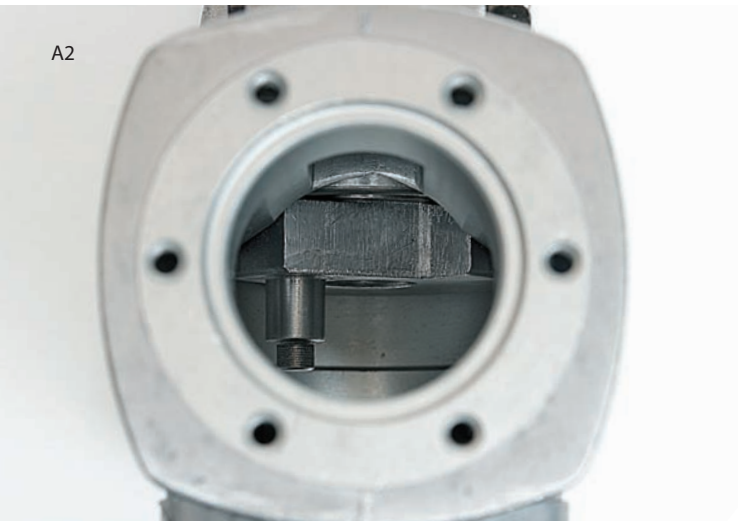
and is hollow as far as the short bearing surface, which has a groove all around it. Directly behind this bearing section, the cylinder wall of the middle section is milled away over a length of 13.5mm to make an oval opening, which forms the inlet port for the fuel-air mixture sucked in from the carburettor.

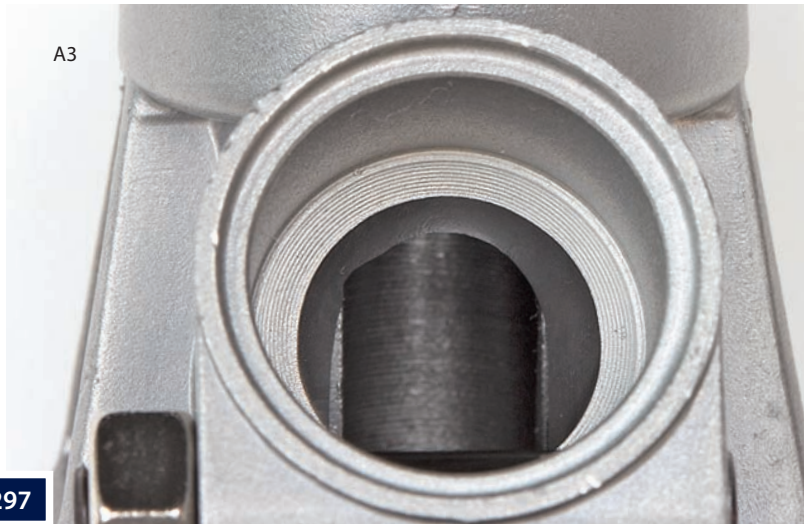
The third section is about 21mm across and 6mm thick. The lower half (see the illustration on page 296) forms a semi-circular counterweight, while the opposite half has two sections cut away to form a triangle with the apex missing. The crankpin is connected to this part, offset by about 8mm from the axis of rotation.

The crankpin connects the crankshaft to the conrod and piston, and as the crankshaft rotates, their weight is balanced by the semi-circular counterweight. The asymmetrical construction of this 'flywheel' at the end of the crankshaft cancels out the vibration that the rotation would otherwise cause.

Looking from the top of the cylinder shows that the crankpin has not yet reached its highest point (top dead centre) but is still slightly offset to the left of the centre position.

Looking down from where the carburettor would normally be fitted, you can see that the crankshaft inlet port is fully open, allowing the passage of the fuel-air mixture from the carburettor.





There is a small notch below the carburettor mounting in the inlet port. This acts as a channel for lubricant and supplies the groove in the outer crankshaft bearing with engine oil.

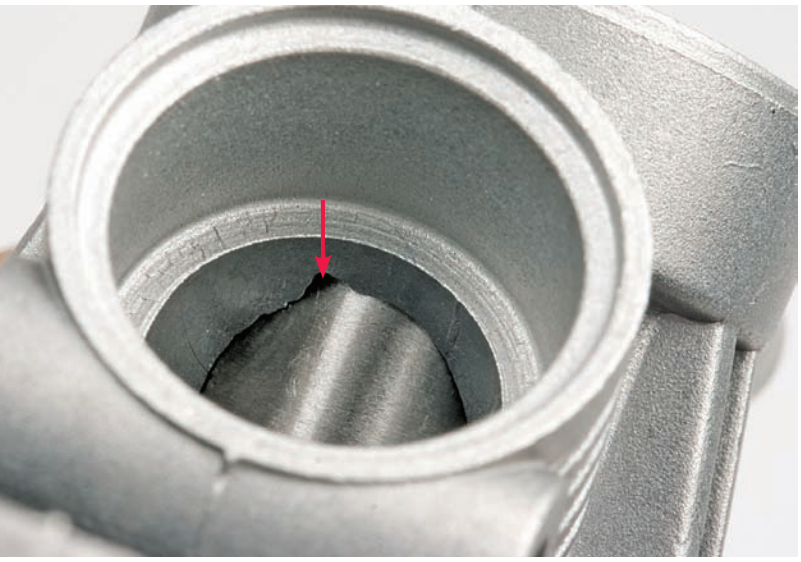
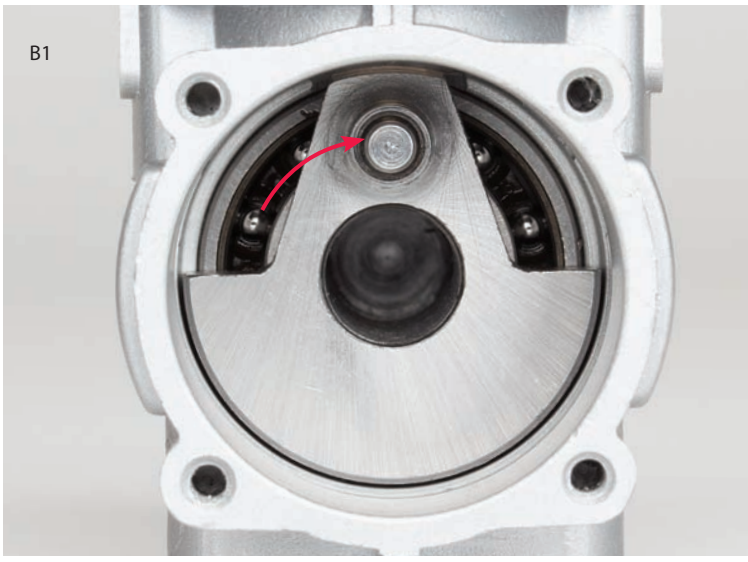


Photo sequence B1-B3, below, shows the situation at the moment of ignition. In B1, the crankshaft has rotated further (see red arrow) and the crankpin has reached its highest point, the top dead centre position.

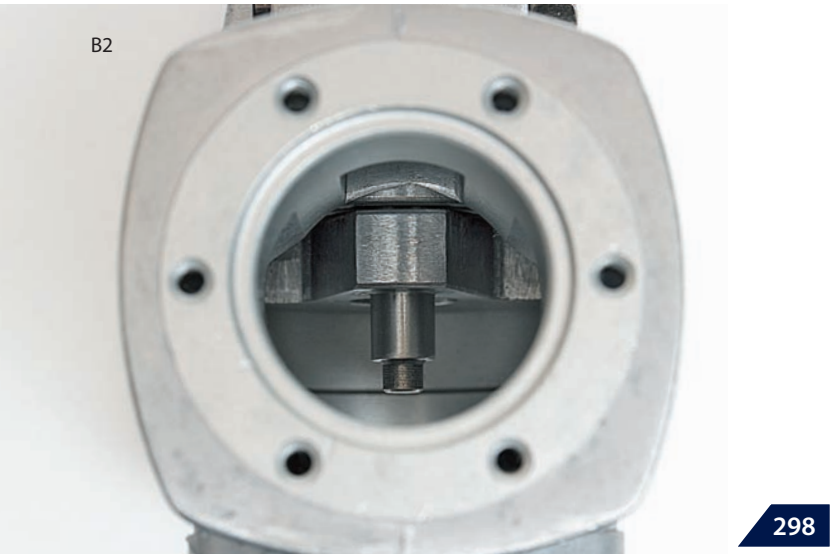


LUBRICANT CHANNELS

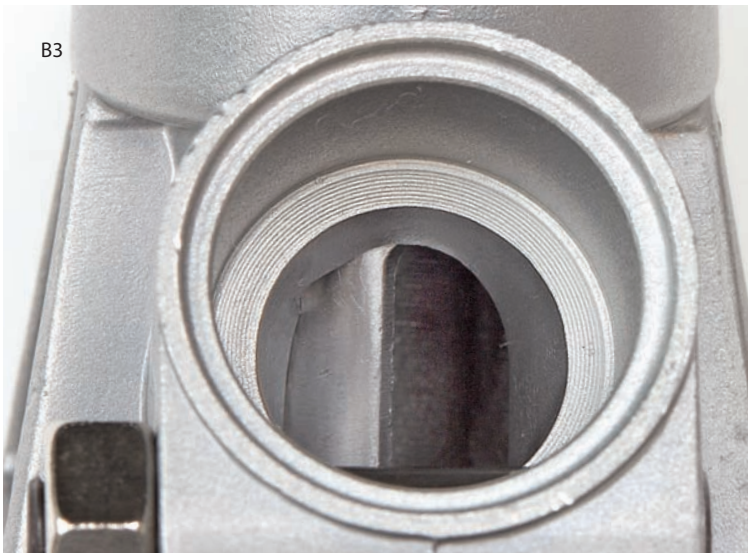
In the GX21, the fuel-air mixture is supplied to the combustion chamber through the hollow section of the crankshaft (for more details on this, see intro section of Pack 16). This type of two-stroke engine lubricates itself, as the oil it needs is added to the fuel and passes into the engine through the carburettor. To ensure that the two ball bearings inside the crankcase receive a steady supply of lubricant, the otherwise smooth middle section of the crankshaft has two narrow grooves machined in it at each end (see the illustration top left on page 297).

While the oil running along the crankshaft reaches the inner ball bearing directly through a narrow channel in the shaft itself, the lubricating channel for the outer ball bearing has to be supplied through a separate passageway from the carburettor mounting in the crankcase. You can see this as a small notch when you look down through the carburettor mounting (see illustration above left).

This view inside the cylinder shows that the crankpin is now centred on the bore.



At this point, the inlet port transferring the fuel-air mixture from the carburettor is beginning to close.



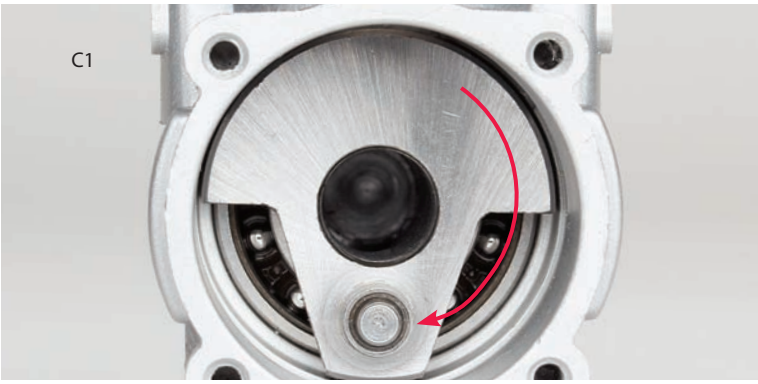
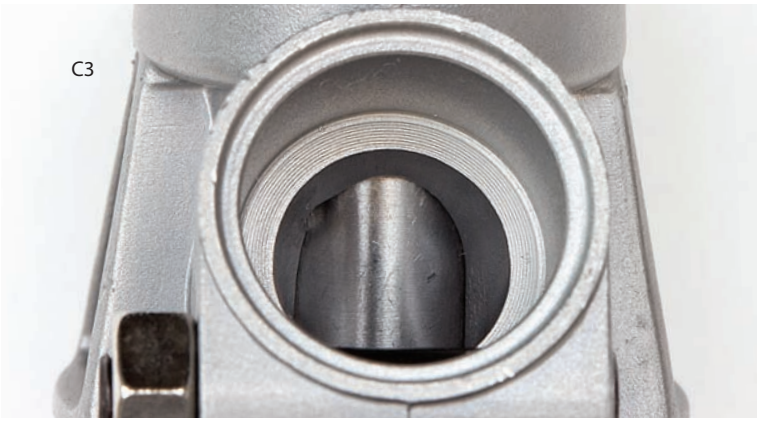


Photo sequence C1-C3 shows the second stroke continuing. When the crankshaft completes a half-rotation…

… the crankpin (and with it the piston) moves to its lowest position, bottom dead centre.



In this phase of the combustion process, the port admitting the fuel-air mixture is completely closed.

MECHANICAL CONTROL

Looking at the crankshaft from above, you can see that the crankpin and the fuel-air mixture inlet are not in line but are offset in relation to each other. The reason for this immediately becomes clear when you watch the rotation of the crankshaft through the three main openings of the crankcase, that is, the carburettor inlet, the cylinder and the rear end (see the three photo sequences on pages 297 to 299).

When the inlet port of the crankshaft is pointing directly upwards and is fully open, the crankpin still has a little way to go before reaching its highest position (see photo sequence A1-A3 on page 297). This is just before the completion of the first stroke in the two-stroke cycle. Because the piston is moving upwards, the pressure in the crankcase is reduced. This causes the fuel-air mixture to be sucked in from the carburettor through the open inlet in the crankshaft.

Next, the crankpin and piston move to the highest position (see photo sequence B1-B3 on page 298). The engine is at the start of the second stroke, which is initiated by the ignition. Further suction of the fuel-air mixture cannot take place because the piston is immediately propelled downwards by the explosion of the fuel-air mixture. This causes the inlet opening to start closing.

The explosion accelerates the piston and rotates the crankshaft further. The crankpin reaches its lowest point (see photo sequence C1-C3, left). The fuel-air mixture previously sucked into the crankcase is compressed by the downward movement of the piston. If the inlet were still open, the fuel would flow back in the direction of the carburettor, but the rotation of the crankshaft means that this backward route is closed. Instead, the mixture is forced out of the crankcase into the combustion chamber above the piston, where it is compressed.

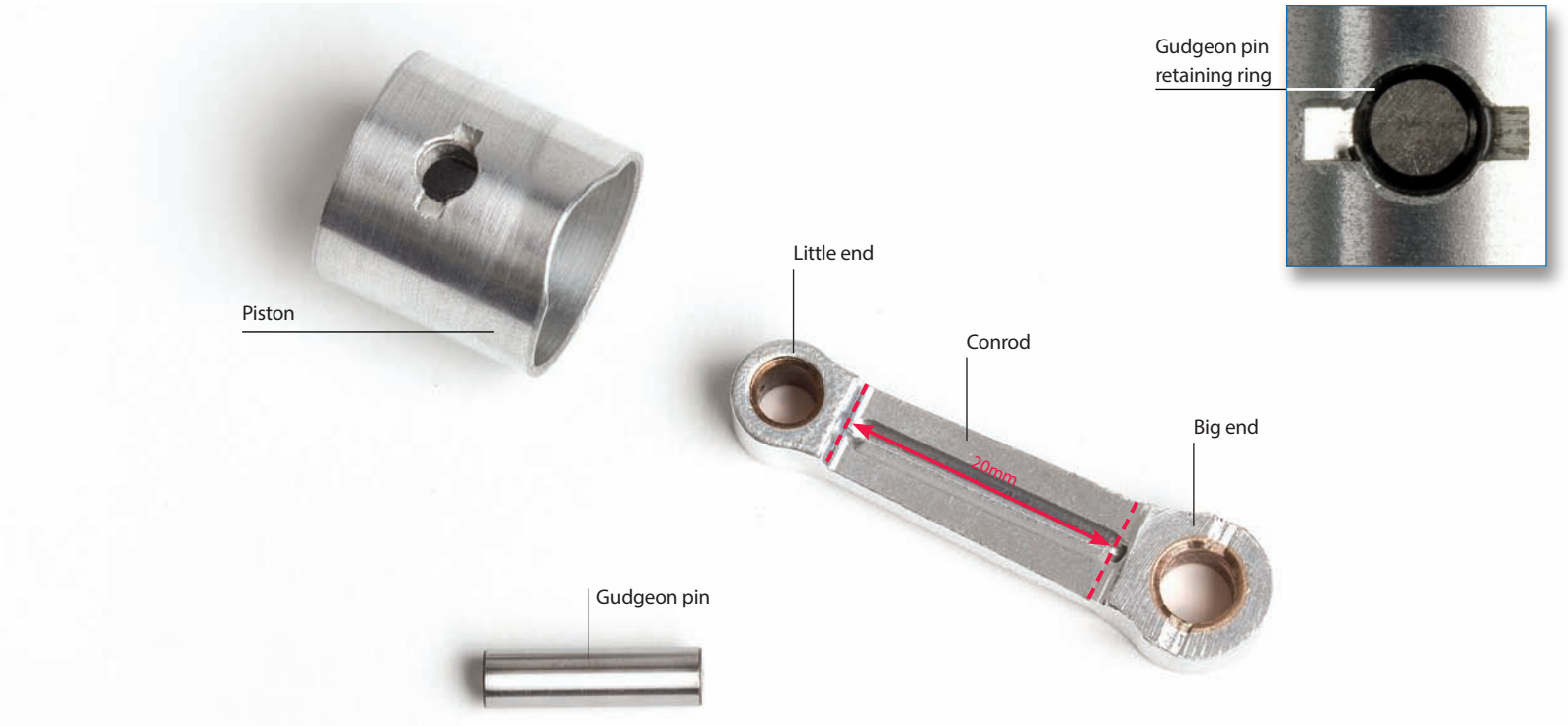
GX21 PISTON AND CYLINDER LINER

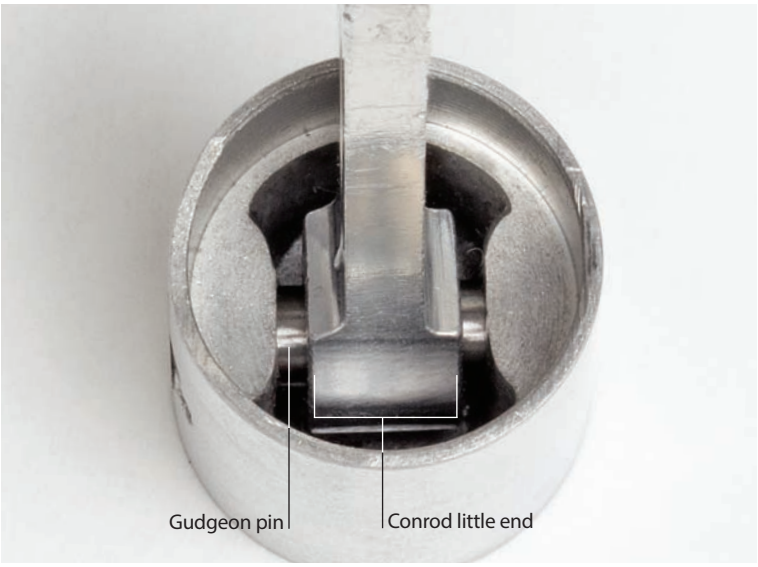
THE PISTON OF YOUR GX21 ENGINE MOVES UP AND DOWN INSIDE THE CYLINDER LINER AT A FREQUENCY OF UP TO 30,000 CYCLES PER MINUTE, ENABLING THE DRIVETRAIN OF YOUR MODEL RB7 TO REACH VERY HIGH SPEEDS.

The piston and the cylinder liner form the beating heart of your GX21 nitro engine: its piston-cylinder set. These components determine the performance of the engine more than any others, because to be efficient, the operation of a two-stroke engine depends on good interaction between the piston and the cylinder liner. This is because, unlike a four-stroke engine, a two-stroke such as the GX21 has no valves, and the induction and exhaust functions are timed and controlled by the piston and cylinder (see intro section of Pack 16).

The layout of the inlet and exhaust ports in the wall of the cylinder liner determines when the fuel-air mixture flows into the combustion chamber, how much the mixture is compressed, and when the exhaust gases are expelled from the cylinder.

These photographs show the individual components of the dismantled piston assembly. The conrod is 20mm long plus the little end and big end. The little end is connected to the piston by the gudgeon pin, which is held in place by a retaining ring (see small inset picture, below right).





The piston as seen from below. The conrod little end, 6mm wide, is centred on the gudgeon pin. A brass bearing within the little end ensures that movement of the conrod on the pin is as free and frictionless as possible.

THE PISTON-CYLINDER SET

The piston-cylinder set of your RB7 racer follows what is known as an 'ABC' construction. In the alphabet of RC modelling, this means a piston made of aluminium, which moves inside a cylinder liner made of brass, the inside of which is plated with chromium. This combination of materials ensures great robustness and a long service life for the engine. The inside of the cylinder liner and the top edge of the piston have been machined with the greatest precision so that they fit together perfectly. This is why it is very important to handle these components with the greatest of care, so that their operation is not affected by scratches or dents in either of them.

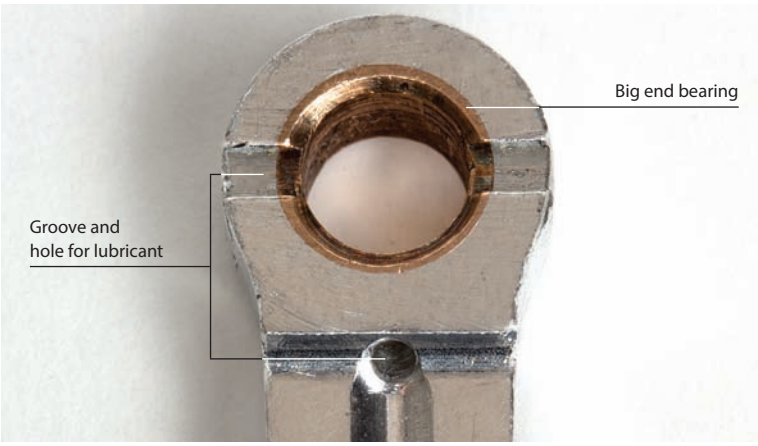
While the cylinder liner is made out of one piece, the piston supplied with this issue consists of pre-assembled parts: the piston itself and the connecting rod, or conrod, plus the gudgeon pin that connects these two parts together.

THE CONROD AND BEARING

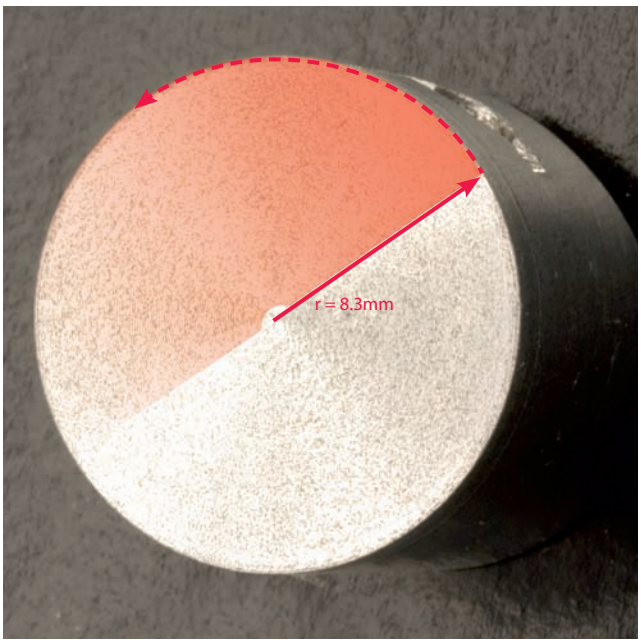
The conrod consists of a tapered, square-edged shaft about 3mm thick, with two rounded ends. The upper of these rounded ends is known as the little end, and the lower one as the big end.

The gudgeon pin connects the conrod to the piston via the little end. The pin is factory-fitted through the sides of the piston and secured with a small retaining ring (barely visible from the outside) to prevent it falling out (see the photos on page 300). The conrod pivots on the gudgeon pin and can swing within the piston.

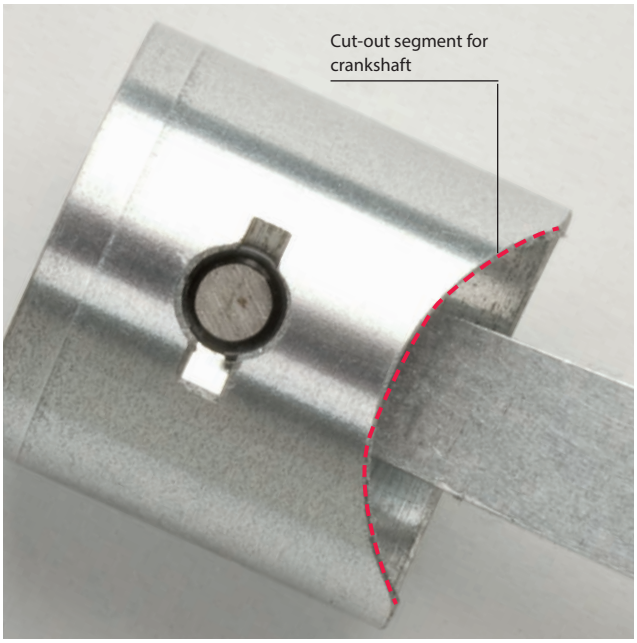
Below: the front side of the conrod big end. The fuel mixture contains oil for lubricating the bearings, and a hole and a transverse groove at the bottom of the rod enable lubricant to reach the bearing.



Unlike the conrod's big end, the little end is not supplied with lubricant by the longitudinal groove in the shaft. Its lubrication hole is in the middle of the outer wall, that is, at the highest point of the conrod when it is attached to the piston.



The piston radius of 8.3mm, when squared and multiplied by π (3.14159), gives the surface area of the piston – about 2.16 square cm.



The cut-out segment in the piston wall, indicated by the dotted red line, ensures that the piston doesn't hit the crankshaft when it's at bottom dead centre, the lowest point of its travel.

Brass bearings have been pressed into both the little end and the big end of the conrod. The lower one, in the big end, is 5mm in diameter and incorporates the crankshaft journal, while the upper one, in the little end, is 4mm in diameter and fits over the gudgeon pin. Holes at each end of the conrod and a transverse groove near the big end ensure that the bearings receive sufficient lubricant.

PISTON AND CYLINDER LINER

The top of the piston has a radius of 8.3mm (it is 16.6mm in diameter), and it is completely flat. In order to compress the fuel-air mixture in the combustion chamber formed by the piston liner and the cylinder head, the piston must fit within the cylinder as perfectly as possible.

The bore of the cylinder liner at the top is 16.6mm across and the combustion chamber is hermetically sealed off by the piston at the top of its stroke. At the bottom of the liner, the bore widens to 16.7mm to ensure that the piston can move up and down freely and that it is properly lubricated.

About 11.5mm below the rim of the cylinder liner is the exhaust port, which widens slightly towards the inside of the cylinder wall.

Further below the rim of the cylinder liner are three inlet ports. These become narrower towards the inside of the cylinder wall.

This is why the bore of the cylinder liner narrows from 16.7mm at the bottom to 16.6mm at the top. As the engine runs, the piston and cylinder work together in such a way that the piston forms a hermetic seal with the cylinder liner at top dead centre, while at the bottom of the stroke, the extra clearance of a tenth of a millimetre allows lubricant to reach the piston.

INLET AND EXHAUST PORTS

The key to the regulation of the combustion cycle of a two-stroke engine (induction, compression, combustion and exhaust) lies in the structure of the piston-cylinder set. The cylinder liner has four ports, which are at different heights in the cylinder wall (see photographs above). As it moves downwards, the piston first opens the exhaust port on the back (photograph above left) and the exhaust gases can escape. About 2.5mm further down from the exhaust port are two narrow lateral inlet ports. These allow the exhaust gases to be flushed out while filling the combustion chamber with a fresh charge of fuel-air mixture.

The third inlet is 2.5mm lower on the front of the cylinder liner (photograph above right). It opens the central duct through which the remaining fuel-air mixture is sucked out of the crankcase into the combustion chamber, and it is the first opening to be closed by the piston during its upward movement. Now the fuel-air mixture can no longer escape, and it is compressed by the piston until the ignition temperature is reached.

ENGINE MAINTENANCE

WHEN IT'S RUNNING, A TWO-STROKE ENGINE – SUCH AS YOUR GX21 – IS KEPT LUBRICATED BY THE OIL ADDED TO ITS FUEL. BUT BEFORE IT'S USED FOR THE FIRST TIME, AND WHEN IT'S NOT BEING USED FOR ANY LENGTH OF TIME, AN ENGINE NEEDS PLENTY OF CARE AND ATTENTION.

To maximise the lifespan of your RB7's engine, there are a few simple but essential maintenance procedures to carry out. In particular, the piston and inner surface of the cylinder liner need special care and attention to ensure their precise, smooth interaction. This includes preventing these parts getting scored, even before you first start the engine. Scoring may occur whenever the piston is moved – possibly unintentionally. It is also important to protect the engine from corrosion if it is stored for a long time, especially if it's in an unheated, poorly ventilated room. A reliable way to protect the engine from corrosion during storage is to coat all the metal parts with a thin film of oil. You will find suitable products in DIY stores and in specialist RC shops.

CHOOSING A SUITABLE OIL

The oil used to protect the stored engine must not contain any acids or resins. A light oil, such as bicycle or sewing machine oil, is ideal for the task of protecting the engine until it is used again.

As soon as you start running your RC car, a new task will be added to your maintenance checklist:

Before the engine is used for the first time, and in the event of long breaks between periods of use, a thin film of oil will protect your engine from corrosion. The best product for this purpose is after run oil, available from specialist RC model shops and online.

Drip about three drops of after run oil through the carburettor opening onto the engine's crankshaft, and a few more drops through the glow plug opening onto the piston.

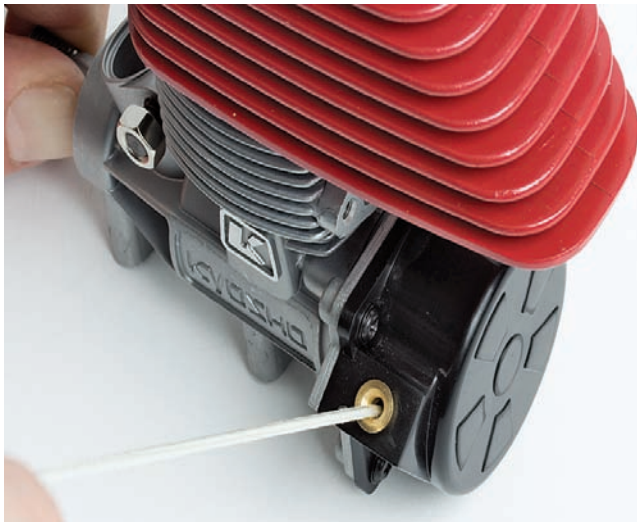
cleaning the engine. This is necessary because residues build up during the combustion of RC fuel within the cylinder – especially when the mixture used contains a large amount of castor oil.

REMOVING THE RESIDUES

When you use your RC model regularly, these residues won't cause any problems. But if the model isn't used for more than about three weeks, the fuel residues can thicken, become resinous and cause problems when you start the engine again. This is why, after using the engine, it is advisable to coat its interior with after run oil, which is available from specialist RC shops and online. The cleaning agents added to this oil gently remove any impurities that have built up. In addition, this oil has excellent penetrating properties.

First, remove the engine from the chassis and disconnect the fuel pipe, then hold it over a small bowl to drain away any fuel remaining inside it. Next, put the engine down and remove the glow plug and carburettor. Now drip two or three drops of after run oil into both the carburettor opening and the glow plug hole, and operate the recoil starter three or four times. This will remove the residues from the engine and ensure that the oil gets everywhere inside it, forming a protective coating on the insides of the crankcase and the cylinder liner. The coating will reduce the risk of water condensing on these surfaces. After dealing with the inside of the engine, wipe the outer surfaces with after run oil to remove any dirt that may have collected there. Then coat the engine in a thin film of oil to prevent corrosion, and replace the carburettor and glow plug.

After dripping oil into the engine through the carburettor and glow plug openings, operate the recoil starter three or four times to distribute the oil evenly all over the inside surfaces.



The outer surfaces of the engine must also be protected from corrosion. Drip a little oil onto a lint-free cloth and rub it all over the crankcase and cooling fins.

THE RECOIL STARTER RETRACTOR

THE RECOIL STARTER OF YOUR RB7 RACER IS MOUNTED ON THE REAR PLATE OF THE CRANKCASE. HERE, WE TAKE A DETAILED LOOK AT ITS RETRACTOR MECHANISM, WHICH WINDS THE STARTER CORD BACK IN AFTER IT HAS BEEN PULLED.

The recoil starter of your GX21 engine incorporates a retractor mechanism. When you pull the starter handle to get the engine going, the starter cord (which is about 35cm long) is drawn out of the starter case, rotating the reel around which it is wound. When you release the starter handle, the retractor pulls the cord back into the case and winds it back onto the reel.

The hub of the reel on the side facing the engine is connected to the starter clutch, the one-way bearing that spins the starter shaft of the engine. With the clockwise rotation caused by a sharp pull on the handle, the one-way

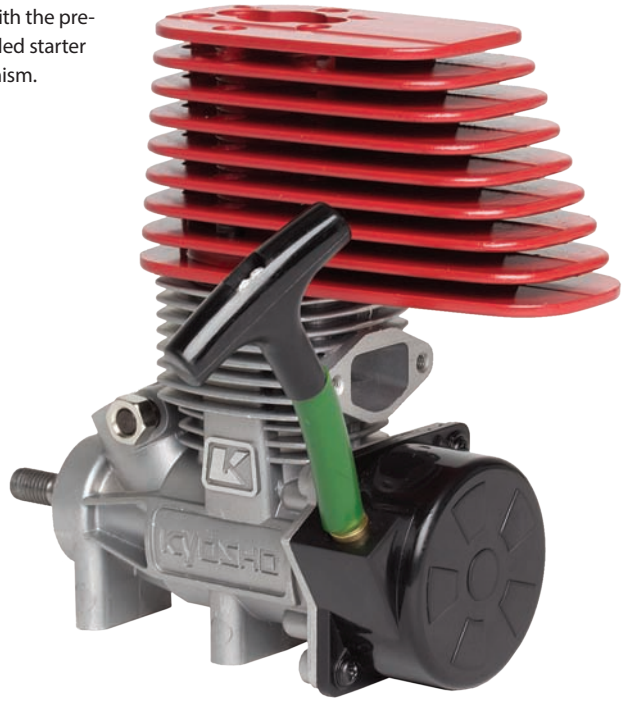
The reel of the retractor mechanism is shaped to prevent the starter cord getting tangled when wound onto it. The deep groove into which the cord is fixed, and the sloping inner part of the reel, ensure that the cord winds back evenly.

CAUTION!

We have taken the reel out of the starter case in order to illustrate how the retractor mechanism works and to show all of its components.

Do not try to dismantle the mechanism yourself.

The GX21 engine of your RB7 racer, fitted with the pre-assembled starter mechanism.



Seen from the rear, the outer end of the coiled spring is fixed into a notch in the wall of the reel's case (see red arrow). The inner end of the spring is fixed to the hub.

The side of the hub facing the engine is shaped so that it engages the one-way bearing on the starter shaft, which in this photograph is being held in position by the pliers.

bearing grips the shaft and sets the crankshaft/piston assembly in motion so that the engine starts. When you release the cord and it winds back into the case, the reel rotates anticlockwise, causing the one-way bearing to release its grip on the starter shaft, which now turns freely with the engine.

THE RETRACTOR MECHANISM

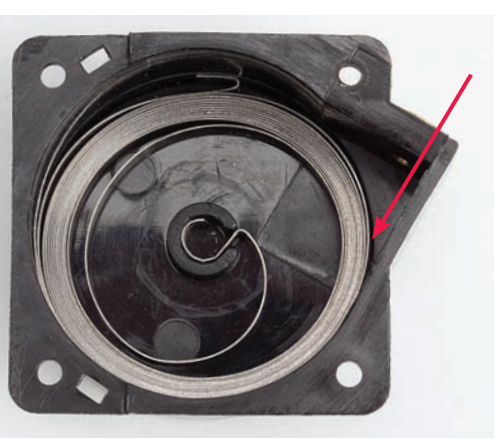
If you look at the reel from the side facing the engine, you will see a notch in the case wall (see photograph top left). This notch retains one end of a flat spring, 130mm long and about 0.1mm thick. The inner end of the spring is fixed to the starter hub, as can be seen in the centre of the photo at the bottom right of this page.

When the cord is pulled out of the case, the rotation of the reel tightens the coiled spring, and the further the cord is pulled out of the case, the tighter the spring becomes (see photograph bottom left). In the process, the individual coils of the spring gradually contract, like those of the spring of a clockwork mechanism when it is wound up ready for use.

When you release the starter handle, the spring unwinds again and turns the reel, pulling the cord back into the case. As it unwinds, the spring gradually expands outwards against the wall of the starter case (see right-hand photograph below).

With the rear cover removed, it can be seen that when the starter cord (red arrow) is pulled, the coils of the spring (dotted red line) are wound up increasingly tightly. When the cord is released, the spring unwinds again and pulls the cord back into the case.

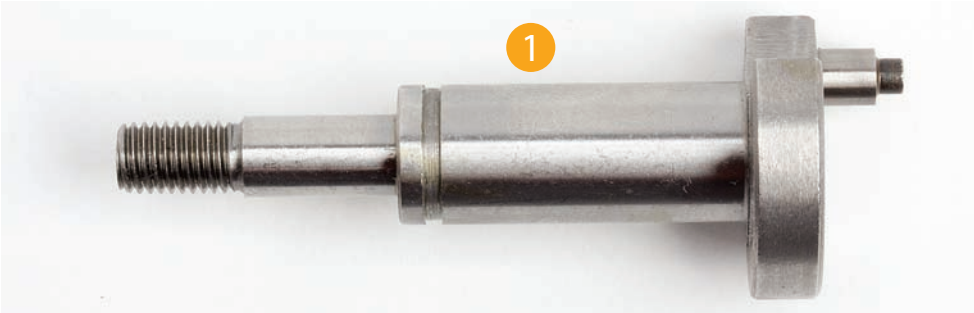
When the starter cord has fully retracted, the now unwound spring is retained by the outer wall of the case, as indicated by the red arrow. Here, the rear cover of the reel has been removed so that the spring can be seen.



Stage 65

INSTALLING THE CRANKSHAFT

IN THIS SESSION, YOU WILL INSTALL THE CRANKSHAFT OF YOUR RB7'S GX21 ENGINE. BEFORE YOU FIT THE PART, PROTECT IT FROM DIRT AND CORROSION WITH SOME AFTER RUN OIL.



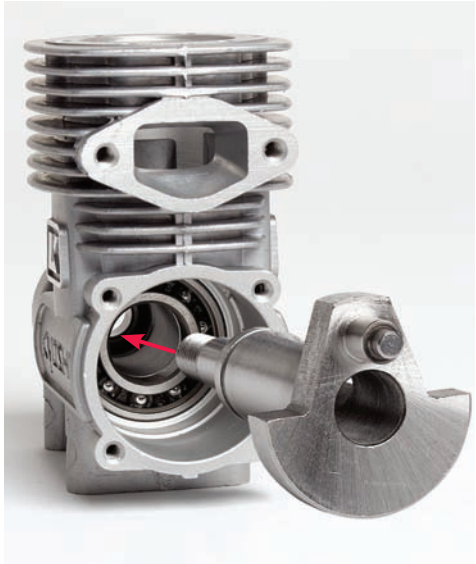
Tools & Materials

After run oil

1 Crankshaft

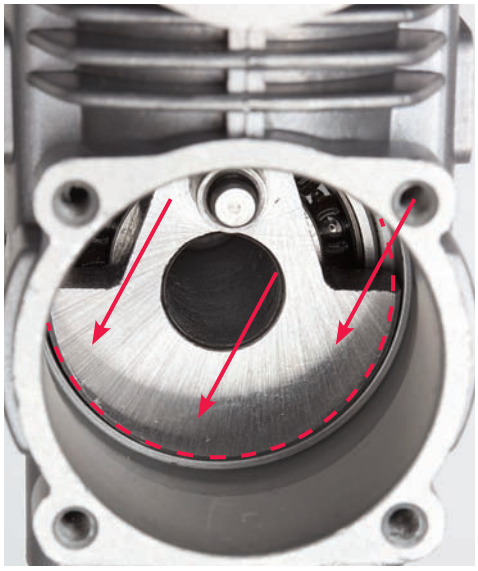
01 The crankshaft is a key component of your model RB7's GX21 engine, and you insert it into the crankcase through the two pre-fitted ball bearings. As the crankshaft won't be used until the engine is complete, protect it from corrosion, dirt and dust by applying a coating of after run oil. You can get this oil from your local model shop, or order it from an online supplier.

02 Hold the crankshaft by the pin on the counterweight, as shown, and apply a few drops of after run oil. Turn and tilt the shaft (and use a fingertip, if necessary) to spread a thin film of oil over the entire surface.



03 Hold the shaft by the counterweight and, keeping it horizontal, insert it into the bearing at the rear of the crankcase. Gently push it through until its threaded end protrudes from the bearing at the front.

04 When the tip of the crankshaft protrudes through the front bearing of the crankcase, grasp it with your fingers and pull it through as far as it will go. When you do this, make sure that the shaft remains perfectly level within the crankcase housing so that it sits correctly within the bearings.



05 Adjust the crankshaft so that its counterweight is positioned exactly as it is in the photo. The counterweight should sit directly next to the rear bearing and be clear of the milled ring on the inside of the crankcase (see dotted red line).

06 This stage is now complete. Store your engine assembly safely until the next session, when you will fit the cylinder and piston.

Stage 66

PISTON AND CYLINDER LINER

IN THIS SESSION, YOU WILL FIT THE PISTON INTO THE CRANKCASE, ATTACH THE CONROD TO THE PIN ON THE CRANKSHAFT COUNTERWEIGHT, AND THEN INSERT THE CYLINDER LINER.

Tools & Materials

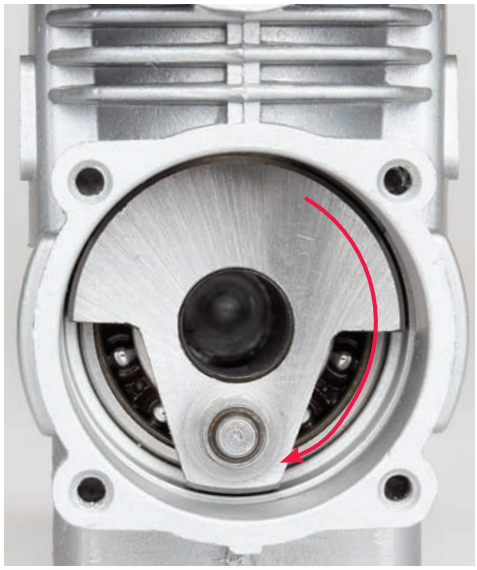
Angled needle-nose pliers (smooth)

1. Piston
2. Cylinder liner

01 For this stage, you will need the crankcase and crankshaft assembly from the previous session, so have these to hand before you start. The parts supplied with this stage are the piston and cylinder liner. The piston will fit inside the crankcase, within the cylinder liner, and when the engine is in operation, the conrod attached to the piston will rotate the crankshaft to power the car's drivetrain. The cylinder liner is made of brass with a chromium-plated inner surface that allows the piston to move up and down with minimal friction and wear.

02 The piston has been supplied pre-assembled. The big end of the conrod will fit onto the crankpin on the crankshaft counterweight. The lengthwise and transverse grooves on one side of the rod carry lubricant to the big end's bearing.

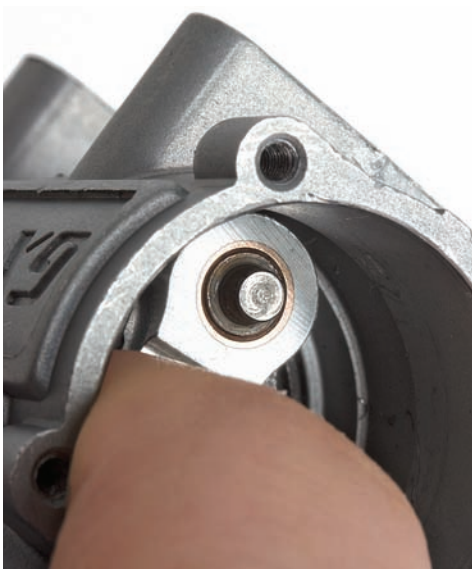
03 Place the crankcase assembly flat on your work surface, as shown, then pull the tip of the crankshaft forward to make sure it is sitting flush with the bearing within the crankcase housing.



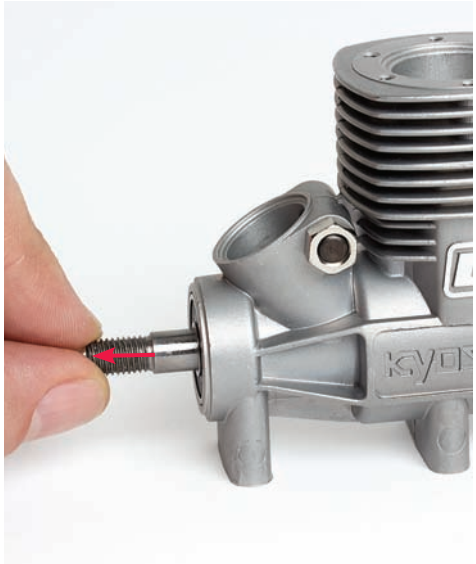
04 Looking into the crankcase from the rear, rotate the crankshaft by hand until the counterweight is at the top and the crankpin is at the bottom.

05 Hold the piston with the cut-away section (see photo for Step 02) facing the front of the crankcase. Then lower the piston into the top of the crankcase.

06 When the piston is in place, use angled needle-nose pliers and carefully pull the big end of the piston's conrod over the crankpin on the crankshaft counterweight.

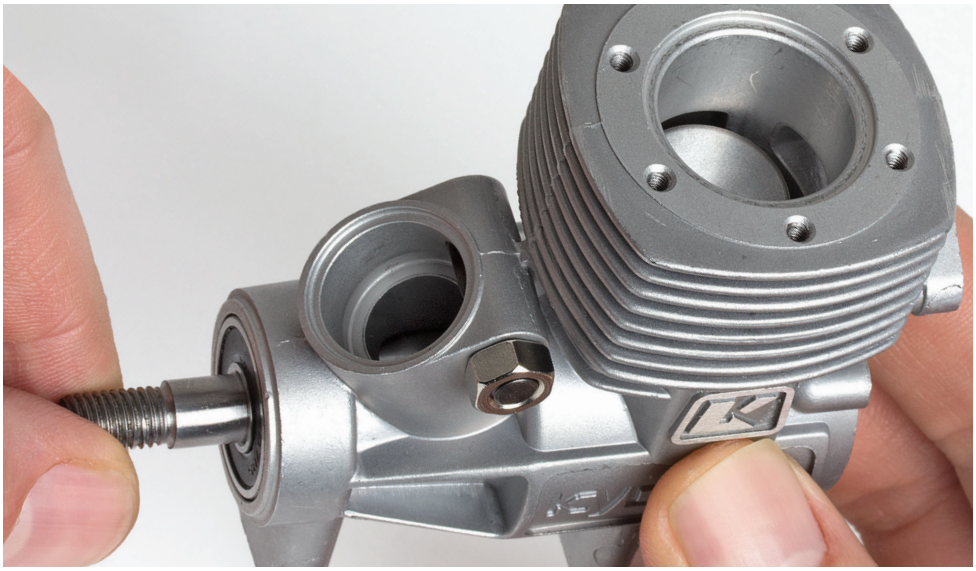


07 Use your finger to push the big end onto the crankpin, until it clicks into place. Check that the big end is fully in place, as shown in the photo.



08 Pull the tip of the crankshaft forward to check that it is properly seated within its bearings, then rotate it a few times in each direction. The crankshaft should rotate freely, but if it won't, check back over the previous two steps to make sure that the conrod is seated properly on the crankpin.

09 After rotating the crankshaft a few times, check again that all the parts are still in place. The crankshaft should move freely – never use force to turn it. If it is at all difficult to turn, check again to make sure the parts are fitted correctly.



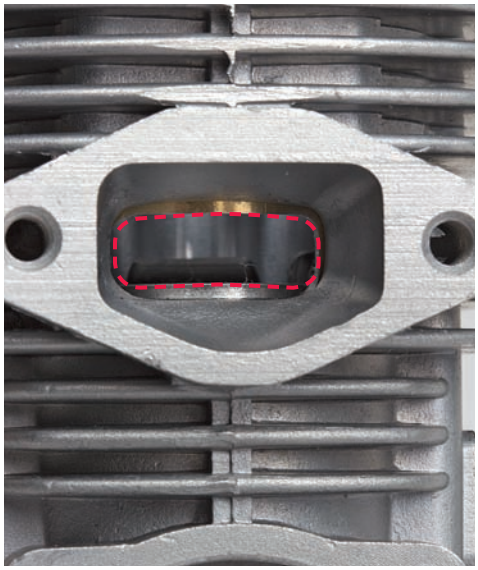
10 Once you are sure that the piston is connected to the crankshaft as it should be, turn the tip of the shaft to bring the piston down to its lowest position.

11 Viewed from above, your assembly should look like this.

12 Next, hold the cylinder liner above the opening in the top of the crankcase, with the largest rectangular hole in the liner facing the exhaust port at the rear of the crankcase.

13 Lower the cylinder liner very gently into the hole, until it comes to rest on the top of the piston. Do not use too much force to do this, as you may damage the parts.

14 Turn the crankshaft slightly in each direction to help the cylinder liner fit over the piston, then carefully push the liner fully into place within the crankcase.



15 When the cylinder liner is fully inside the crankcase, look through the exhaust port and adjust the liner so that the large rectangular hole is fully lined up with the opening of the exhaust port, as shown by the dotted red line.

16 This stage is now complete. To prevent dust or dirt getting into the crankcase, which can cause damage, store your assembly in a sealed plastic bag until the next session, when you will fit the cylinder head.

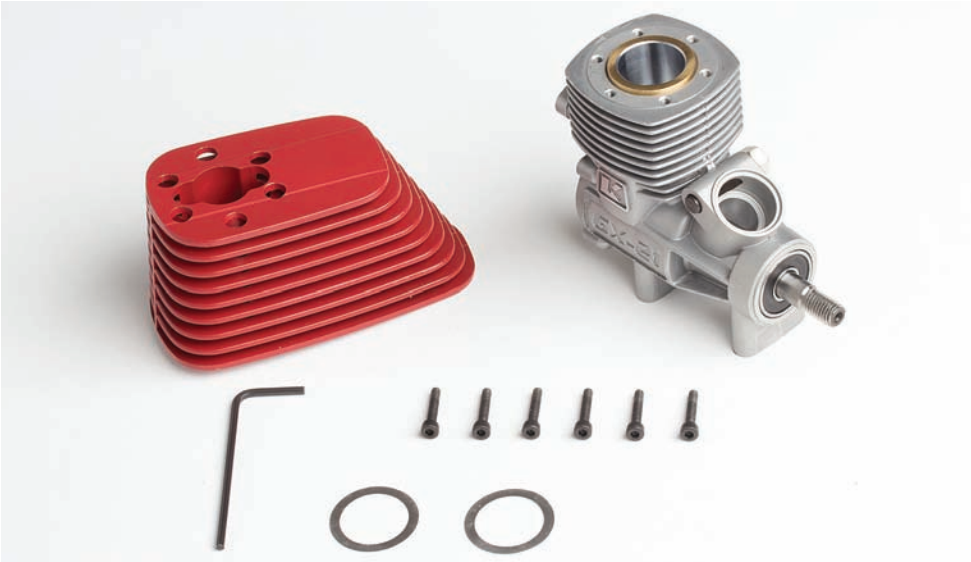
Stage 67

FITTING THE CYLINDER HEAD

IN THIS SESSION, YOU WILL FIT THE CYLINDER HEAD TO THE TOP OF YOUR RED BULL RACING RB7's GX21 ENGINE.

Tools & Materials

1. Cylinder head
2. Allen key 2mm
3. 2 cylinder head gaskets
4. 6 cap screws 2.5 x 14mm



01 Lay out the parts supplied with this stage, along with the crankcase assembly from the previous stage.

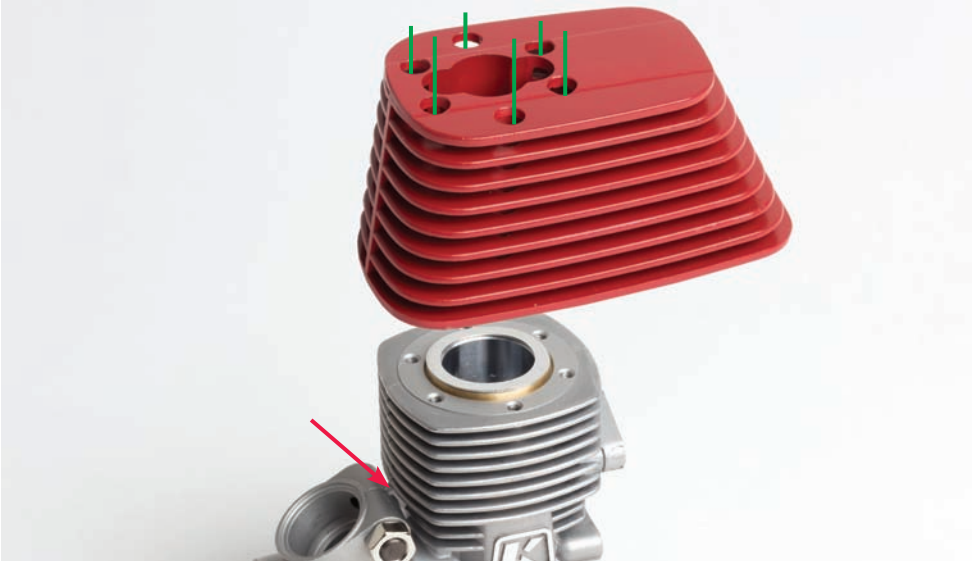
02 Familiarise yourself with the cylinder head. From above, you will see a large hole surrounded by six smaller ones. The large hole is where you will fit the glow plug at a later stage, and the six cap screws supplied with this stage will fit through the smaller holes to fix the head to the top of the crankcase.

03 From the side, you will see the nine cooling fins that surround the central cylindrical section into which the glow plug will be fitted. The purpose of the fins is to prevent overheating, by increasing the overall surface area of the head to dissipate the heat produced when the engine is running.

04 On the underside of the head, you will see the profiled aluminium disc that forms the top of the engine's combustion chamber, and the central hole for the glow plug. The six surrounding holes are those through which the cap screws will be fitted.

05 Before you begin the assembly work, double-check that the cylinder liner is correctly positioned – see Step 15, Stage 66. Correct alignment of the liner is essential for the engine to work properly, and you won't be able to adjust it after you've fitted the cylinder head. If the liner is misaligned, you may need to remove it, working carefully to avoid damage, then refer to Steps 12 to 14 in Stage 66 to re-install it correctly. When the liner is correctly positioned, your first task (see Step 06) will be to fit the two gaskets to the top of the liner, as indicated here by the red arrows.

06 Place the two gaskets on top of each other on the upper rim of the cylinder liner, as in the above photo. As with the liner, you won't be able to adjust the gaskets once the cylinder head is screwed into place, so make sure you position them precisely.



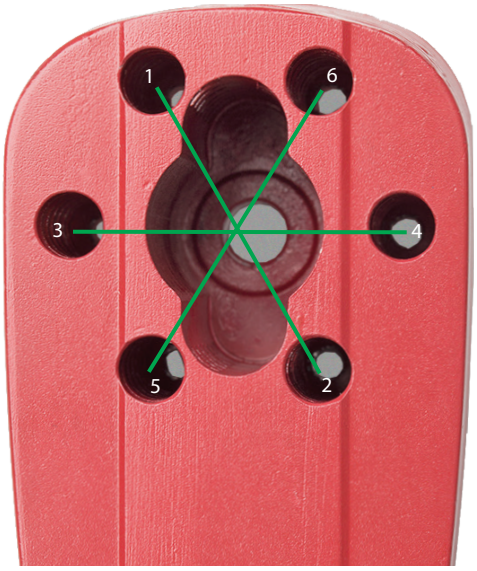
07 Very carefully lower the cylinder head onto the top of the crankcase, so that the screw holes indicated by the green arrows line up and the front edge of the head is level with the rear of the carburettor mounting. Be very careful not to displace the gaskets when you do this.

08 When the cylinder head is in position, make sure that neither gasket has moved. If one (or both) of them has shifted, remove the head again and repeat Steps 06 and 07.

09 Next, check that the cylinder head is sitting perfectly straight (see dotted green line).

10 Carefully hold the cylinder head in place on the crankcase, and one by one drop the six cap screws supplied with this stage into the six holes in the top of the head.

11 Holding the 2mm Allen key by its shorter arm, insert its longer arm into each hole and tighten the six screws, following the sequence shown in the photo for Step 12.



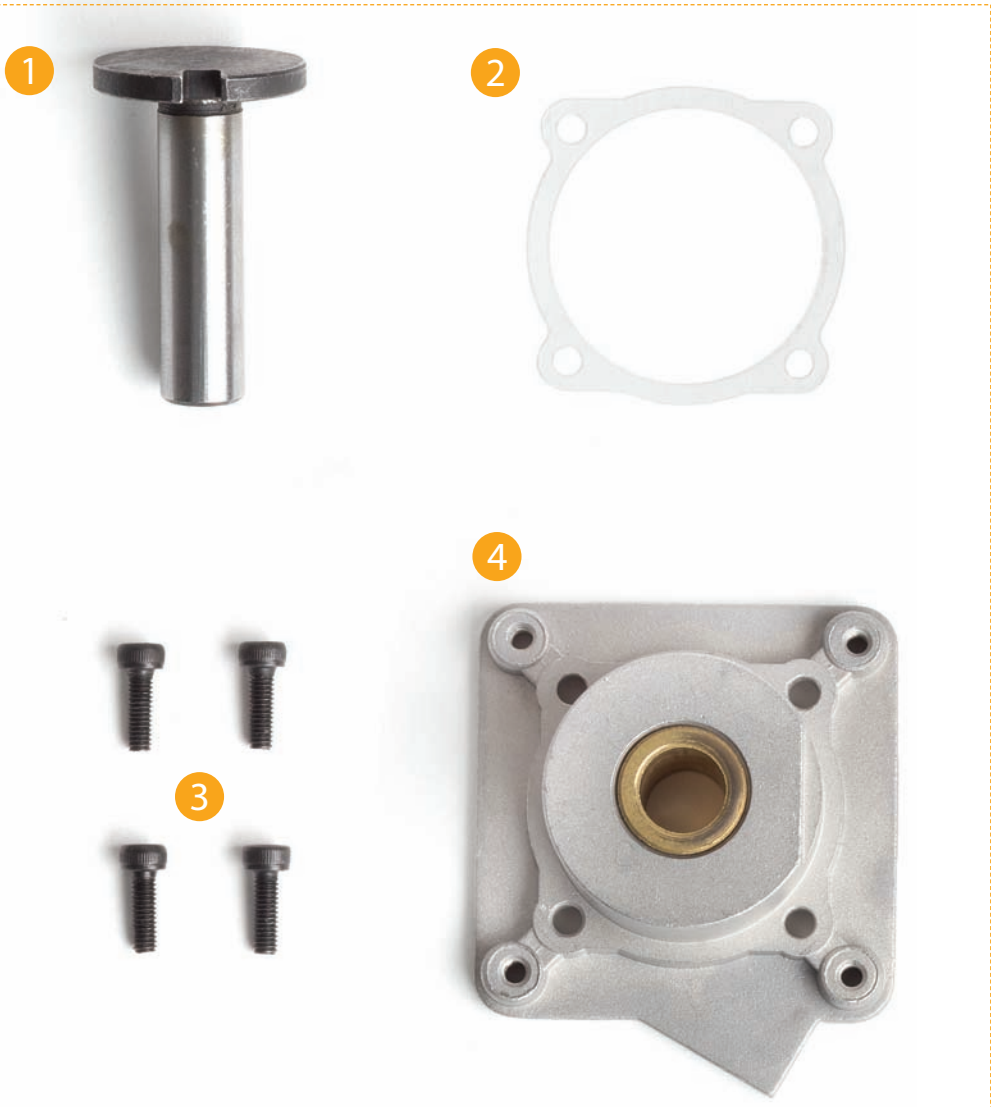
12 To fasten the head evenly, tighten the six screws in the order shown above.

13 This stage is now complete. The cylinder head of your RB7's GX21 engine is fitted to the top of the crankcase, with the cylinder head gaskets ensuring that the top of the combustion chamber is fully sealed.

Stage 68

REAR PLATE AND STARTER SHAFT

IN THIS SESSION, YOU WILL BEGIN BUILDING YOUR MODEL'S RECOIL STARTER BY FITTING THE REAR PLATE TO THE BACK OF THE CRANKCASE AND CONNECTING THE STARTER SHAFT TO THE CRANKSHAFT.



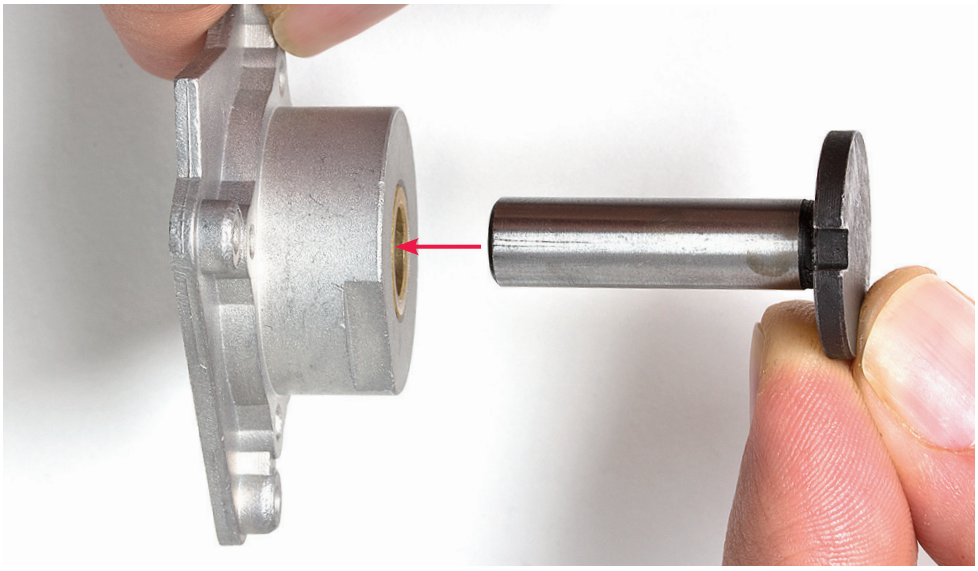
Tools & Materials

Allen key 2mm
Angled needle-nose pliers (smooth)

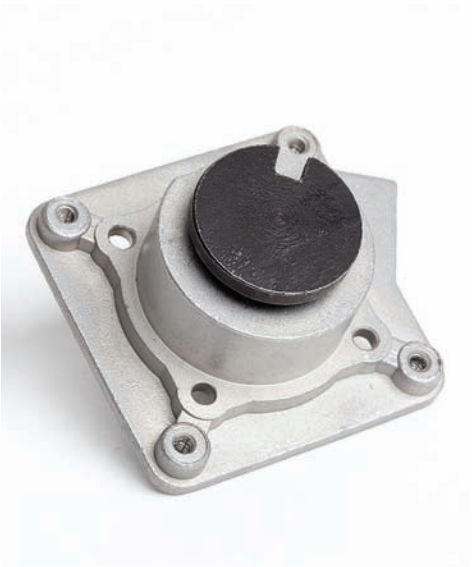
1. Recoil starter shaft
2. Gasket
3. 4 cap screws 2.5 x 8mm
4. Rear plate

01 For this session, you will need the parts from this stage plus your GX21 engine assembly. The rear plate will be attached to the wide circular opening at the back of the engine's crankcase, below the cylinder head's overhanging cooling fins.

02 The raised circular section in the centre of the rear plate is fitted with the bearing for the recoil starter shaft.



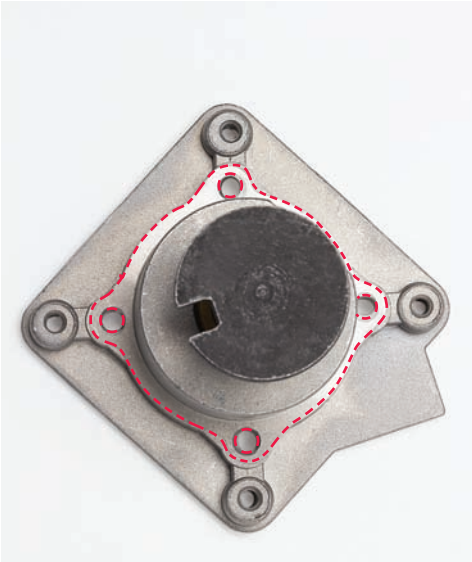
03 Insert the recoil starter shaft into the bearing in the rear plate as shown, and push it in until the circular flange at its end is flat against the raised section of the plate.



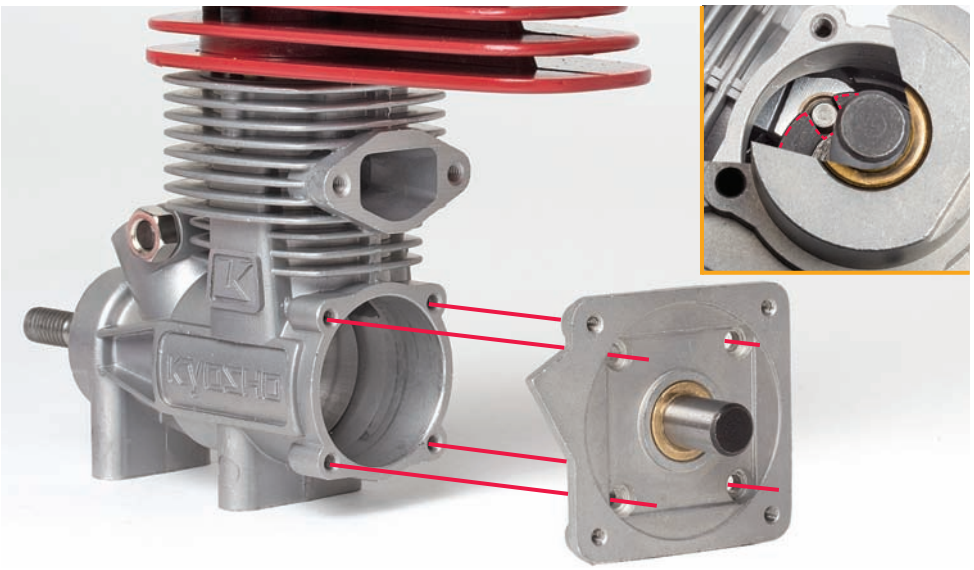
04 Your assembly should now look like this.

05 Using pliers, gently place the gasket over the raised cylindrical section of the rear plate.

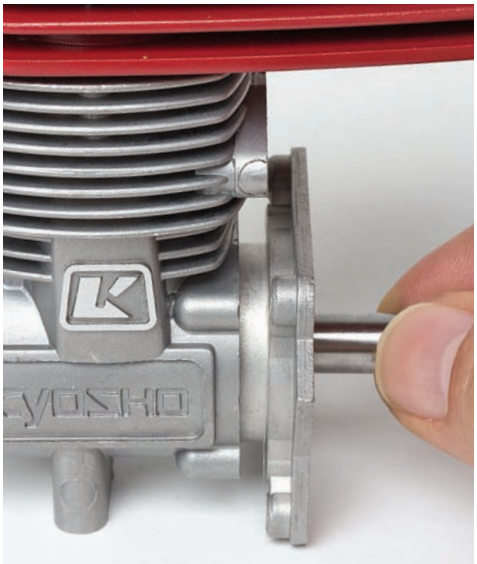
06 Put the rear plate flat on your work surface and adjust the gasket so that the four small holes in it line up with those on the rear plate.



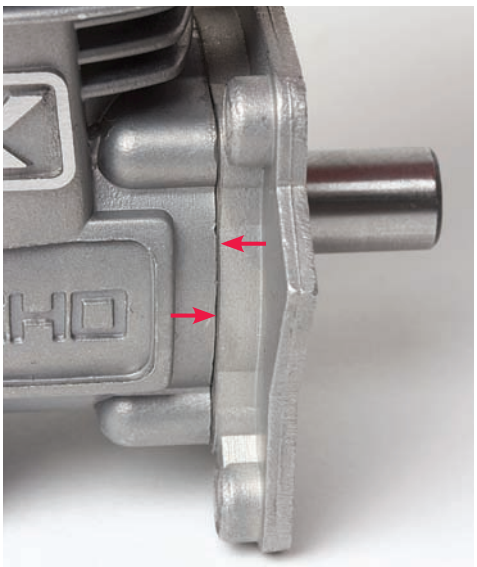
07 Check that the gasket is properly aligned, as indicated above by the dotted red lines.



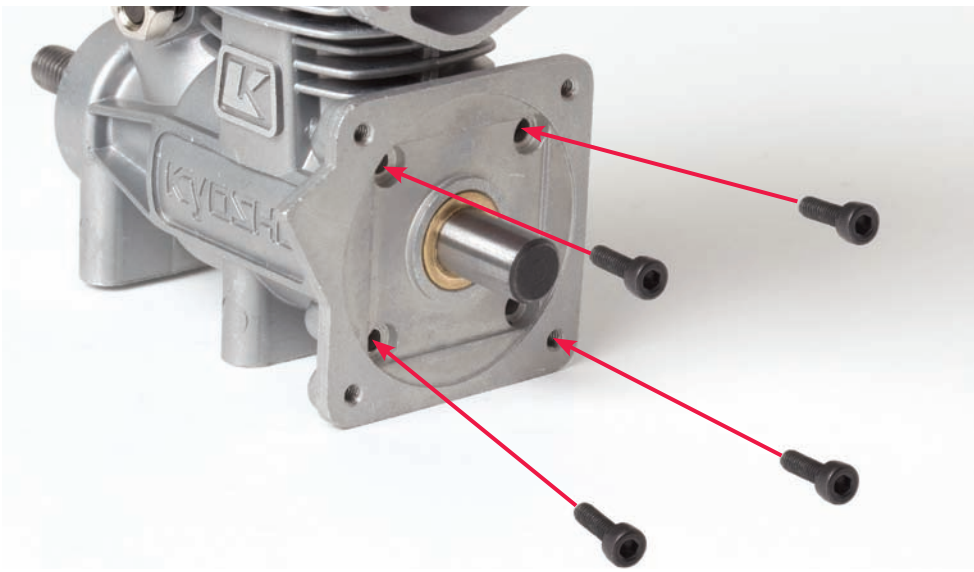
08 Place the engine upright on your work surface with its back towards you. Now place the rear plate against the open end of the crankcase, with its triangular projection on the left and its four screw holes lining up with those on the crankcase, as indicated by the red lines. Make sure that the gasket stays in place, as shown in the photo for Step 07. Note that the rear plate will only fit fully into place when the notch in the starter shaft flange fits over the crankpin on the crankshaft (see inset photo).



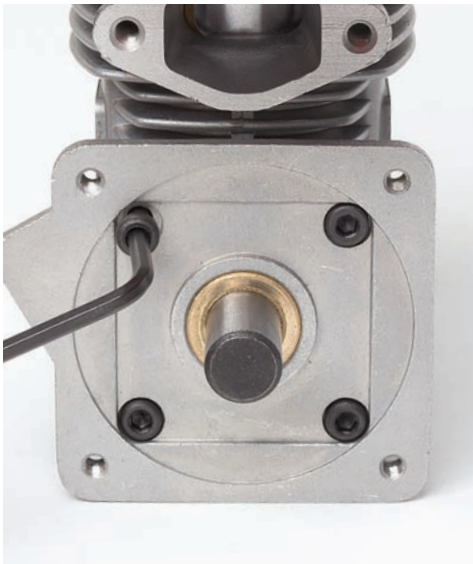
09 Turn the starter shaft until the notch on the flange engages fully with the crankpin. Then press the rear plate snugly up against the crankcase.



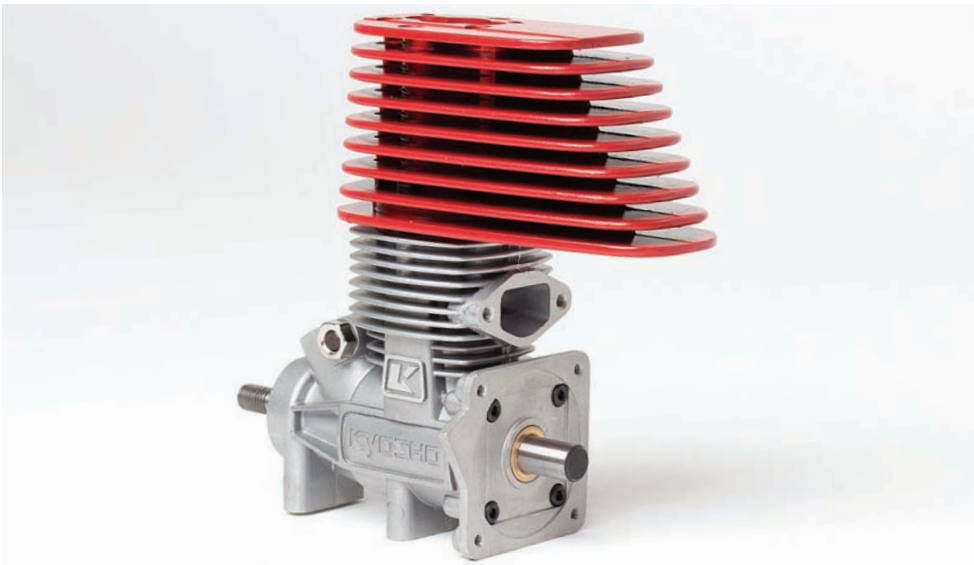
10 Make absolutely sure that the rear plate is sitting tight against the crankcase, with no gaps in the join (see red arrows) between the two. If the plate isn't fitting correctly, repeat Steps 07-09.



11 When you are sure that the rear plate is sitting perfectly flush with the crankcase, insert the four cap screws supplied with this stage and screw them in loosely by hand.



12 When you have tightened all the screws by a few turns each, use the 2mm Allen key to tighten each one fully to fix the rear plate to the crankcase.



13 This stage is now complete, and your engine is ready to be fitted with the recoil mechanism that you will eventually use to start it.