TechnoPower Engines Owners Manual

The TechnoPower miniature radial engine, originally based on the full scale Armstrong Siddeley Genet engine of the 1930's era, has taken over 5 years of design and development work. The result is a unique, aesthetic, highly practical scale flying engine of great engineering interest. These engines are fully operational, multi-cylinder, 4 stroke, O.H.V. (with enclosed rocker arms), glow ignition engines. Each engine is an assembly of over 300 skillfully engineered and precision machined components, carefully hand assembled, motored (pre-break-in), compression checked, vacuum measured, and test run.

Our small 7 'A' and 'B' series engines are built to 2" or approximately 1/6 scale. The 'C' engine is 2.4"or about 1/5 scale. Propeller sizes for the 'A' & 'B' engines are 14x6 to 20x8, and 18x8 to 24x6 for the 9 'C' engine. The engines should have static rpm's of 6000 to 7500 rpm. Never run a TechnoPower engine more than 8000 rpm static.

The key to successful model flying with these engines is to keep the aircraft wing loading within reasonable limits. WW II fighters like the Corsair were very heavy and had relatively short wings giving a very high wing load per square foot. The same applies to a scale model - unfortunately the power to weight ratio in a 4-stroke model engine is not as good as with a 2-stroke engine. While the Corsair or Hellcat will fly reliably if built lightly, a biplane of the same weight is a better choice. Two wings, twice the area, ½ the wing load, or a monoplane with a large wing area such as the Beaver or Otter, the Kinner Sportster (which used a 5 cylinder radial), Cessna 195, Norseman, Lindberg's Ryan, etc. In biplanes-the Gloster Gladiator, P12E, Stearman, Waco, Stagger Wing Beech - all would be better choices than high performance aircraft types.

These engines are intended for applications where appearance and sound are more important than performance!

GENERAL INFORMATION

Each engine has been tested and run before leaving the factory, and is known to be in good working condition. The operation of this engine is similar to its full size counterpart, and has characteristics peculiar to radials that require particular attention.

It must be thoroughly emphasized that this is a low speed "torque" engine with a maximum rev range to 8000 rpm. Engine revs, however, should be held down to around 6000/7500 rpm, by using larger propellers. See specifications for propellers. Should the engine be run with propellers of a smaller diameter or pitch, the engine will over rev causing valve bounce and possible damage due to piston/valve contact. DO NOT attempt to modify the engine, e.g.: stronger valve springs, etc. While this will increase the rev range, the resultant increased loading to the cam drive gearing and valve train will drastically shorten the life of the engine!

The carb is adjusted at the factory and should only require fine tuning. The carburetor will appear to have a small choke diameter; do not attempt to increase this size, as you will create more problems than you gain in performance.
Frequent checks of valve clearances should be made, especially during the running-in period. [See valve adjustment.]

Because of the geometry of the radial engine and its use of oil containing fuel, the lower cylinders are liable to "oil up" when the engine is not being run. [This characteristic is common in the full size counterpart.] The oil, which collects in the crankcase, seeps past the piston rings on the lower cylinders to the cylinder's head. Always remove the lowermost glow plugs and drain the cylinders prior to start-up. This point is strongly emphasized with regard to two important aspects: first, small amounts of oil will seep past the piston rings in a relatively short space of time and will cause fouling of the glow plugs; second, if over a longer period of time, large amounts of oil seep into the cylinder head, hydraulic lock will occur when the engine is turned over, causing serious damage.

These engines tend to overheat if run statically for prolonged periods. The reason for the heat buildup is the transmission of heat from the cylinders to the crankcase and nosecase, which act as a heat sink. When run static, the nosecase and crankcase are not adequately cooled by the reduced airflow generated by the large propeller close to its hub. For this reason it is recommended that static running be done only in short time periods, or that supplemental external cooling blower is used.

Because of the complexity of this engine, it is recommended that any repairs required should be carried out <u>only</u> by the manufacturer!

<u>INSTALLATION:</u>

The engine should be mounted to the firewall using the holes provided on the engine mounting flange.

Optional billet aluminum engine mounts, in two lengths, are available for purchase from TechnoPower, or the builder can make whatever type or style of mount he prefers. We recommend that at least 4 mounting holes be used on 7 cylinder engines, and at least 5 fasteners be used on the 9 cylinder engines. The holes are sized for 4-40 threaded fasteners, and we recommend quality cap screws, preferably stainless steel (also available from TechnoPower). The optional billet engine mounts are pre-threaded for easy engine installation with four holes provided on the firewall flange. Whatever mount is used, it must hold the engine securely and evenly to the firewall. With the shorter of the TechnoPower mounts, it may be advisable/necessary to have a relief/opening in the firewall center for airflow clearance to the carburetor.
Ideally, all engines should have a plenum box & air filter, just as full scale engines use.

The fuel tank should be located within 4 inches (100mm) of the carburetor, with the full-tank level of the tank even with the centerline of the carb. Siphoning should not be allowed to occur! Pressurization is not required or recommended. The Perry Carburetor instructions are included with the engine. It can be remounted inverted (180 degrees), if necessary, for linkage fit or needle valve access.
It is normal to mount the engine with the master rod cylinder (No.1 cylinder is in-line with the serial number on the back plate) straight up, but the engine will work in any position.

TechnoPower Engines highly recommends the use of SonicTronics/McDaniel on-board glow drivers (what we call a "FlitePack") to insure good ignition at all times, or according to throttle position. The FlitePack comes with an excellent harness, but an optional harness is available which uses the more full-scale appearance Kavan glow plug boot/connectors. If the FlitePack is used, installation issues require consideration: the positioning of the glow driver control box, battery pack, RC receiver, fuel tank, throttle servo, and firewall pass-throughs for the ignition harness and throttle linkage must be carefully planned before construction! The recommended battery pack (4 ea, 3300 mah sub-C NiMH cells) weighs about 10 oz., plus 8 oz. for the control box and harness, which requires that careful consideration be given to locating the battery pack both for weight and balance, and for access (to remove for inspection and for charging). For most single engine tractor aircraft, we recommend putting the battery pack on the inside of a hatch, located on the belly of the A/C, immediately behind the firewall and held by four nylon screws (at least no. 8's). When the 4 screws are removed, the battery pack will drop into a waiting hand. It is disconnected at it's connector to the glow driver, and it can then be set aside for charging and easier handling of the model.

STARTING:

With the engine and tank mounted correctly, connect the glow plugs in parallel with the ignition harness provided to a Ground Power Unit (2 ea. "D" size NiCad cells) or other suitable 1.5 volt (DC) supply. Note that each glow plug draws 1 to 2 amps, so any GPU will have to be capable of delivering a reliable continuous 18 amps for a 9 cylinder engine, or 14 amps for a 7 cylinder engine. If you are using the FlitePack, make sure the battery is fully charged and all leads are making a good connection.
If the engine is cold (first start in more than an hour): FIRST, make sure that there is NO power to the glow plugs (!) (disconnect the GPU, or make sure switch is 'off' on the FlitePack control box – LED *not* illuminated); choke the engine (to begin fuel flowing to the carburetor) by placing one finger over carb inlet and then hand turning the propeller through six blades (three full revolutions of the engine). Remove your finger from the carb and there should be fuel on your finger. If not, check the fuel tank/lines to make sure that fuel is flowing freely to the carb and prime again.

With the engine primed, put power to the glow plugs-either by connecting the GPU, or by turning the FlitePack control box switch "on" (LED should illuminate). Using an electric starter (TechnoPower recommends the Sullivan DynaTron Hi-Tork starter with the Miller R/C Products 3" belt drive for the 9C engine), with the rubber cup held firmly onto the engine's spinner nut, begin cranking the engine with the throttle at ¼ to 1/3. The engine should fire immediately.
If the engine is warm it should start easily with one or two hand flips of the prop, given appropriate fuel and glow plug heat.

RUNNING IN:

Mount the engine and fuel tank as per installation instructions. A static test stand held in a vise or bolted to a heavy table is recommended. The stand should not under any circumstances be too close to the rear of the cylinders where it will impede airflow. It is essential that the engine be run at varying throttle positions, less than ¾, for its first half hour's use. During this time the engine should be run for 2 or 3 minute periods, allowing adequate time for complete cooling. As the engine becomes completely broken-in, and experience gained in throttle setting, hand starting is easy.
DO NOT ALLOW THE ENGINE TO GET UNDULY HOT.
We recommend a cooling blower, closely located, be directed on the engine during extended test running.

VALVE ADJUSTMENT:

These checks should be carried out when the engine is COLD. The correct clearance is .002" to .003" (0.05 to 0.08 mm), i.e. just perceptible movement when rocker is rocked about its pivot. Adjustment is made by loosening the adjuster locknut and rotating the adjuster with a small Allen wrench. The necessary special valve adjusting wrench is provided as part of the tool kit supplied with each engine. This adjustment should be carried out with a particular cylinder on its power stroke at T.D.C., which will ensure that both valves are in the rest position (valves closed). The adjustment screw has the same thread pitch as a micrometer, so that 1/8 to ¼ turn would equal .003" to .006".

The engine should be rotated gently while carrying out these adjustments to feel for any resistance to rotation, which would indicate the valve touching the piston at T.D.C.
DO NOT FORCE ENGINE OVER AGAINST ANY RESISTANCE!
Go over valves already adjusted and check for improper clearance.

This process is best done with the glow plugs removed.

FUEL:

During the "running-in" period, a fuel with a15-20% oil content should be used. This assures adequate lubrication and heat carry-off. It may necessitate maintaining power to the glow plugs, as the extra oil tends to cool them off.
The engine is considered "broken-in" when the exhaust residue is mostly clear (one to 1 ½ hours operation); then switch to a 10 to 12 (50% castor oil, 50% synthetic) percent oil mix fuel. This reduced oil content is completely adequate for lubrication and will allow the best performance and operation without requiring heat to the glow plugs.

		During "Running-in"	After "Running-in"
Fuel ratio	Castor/Synthetic Oil (50 –50)	15% - 20%	10% - 12%
	Nitromethane	10%	15%
	Methanol	70%	75%

The nitromethane content is useful in keeping the glow plugs alight in 4 stroke cycle engines. Starting may become difficult below the recommended figure of 10%, and low speed running may become erratic. Increasing the nitromethane content will cause overheating problems and pre-ignition.

PROPELLERS:

"A" Series	7 cylinder 14" x 6" to 14" x 8"
"Big Bore" Series	5 cylinder 14" x 6" to 14" x 8"*
	7 cylinder 14" x 6" to 16" x 8"
	9 cylinder 16" x 6" to 20" x 8"
"C" Series	3 cylinder 14" x 6" to 16" x 8"*
	5 cylinder 16" x 6" to 20" x 6"*
	7 cylinder 18" x 6" to 22" x 6"*
	9 cylinder 18" x 8" to 24" x 6"

It will likely be necessary to try several props – just keep the max revs below 7500 RPM static.

Note: No three or five cylinder engines, or 7 C engines are available new. The propellers listed above are for reference only. [*]

DO'S AND DON'TS

DO

1. Follow manufacturer's instructions.
2. Ensure that push rods are correctly seated in the rocker arm adjusters, and that the valve clearance is set correctly.
3. Use correct size tools when making adjustments.
4. Check all screws for tightness periodically.
5. Drain oil out of cylinders by removing glow plugs.
6. Keep engine clean.
7. Gain engine operating experience before flying.
8. Purge fuel residue out after running, and use "after-run" oil when the engine will not be used for more than a day.

DON'T

1. Leave fuel residue in the engine when storing, - purge, flush & oil!
2. Over-tighten propeller, glow plugs or any adjustment screws.
3. Modify.
4. Increase nitromethane content above that recommended.
5. Restrict cooling airflow to engine in any way.
6. Over-rev. [Use too small a prop.]
7. Depress rockers by hand - push rods may leave seating.
8. Over-tighten valve clearance adjuster lock nuts.
9. Dismantle.
10. Turn engine over against any resistance. [Check valve clearance and pushrod position; remove lower plugs and drain cylinders.]

STORAGE:

If the engine is to sit unused for more than a few weeks, purging and after-run oil will be insufficient to insure rust/corrosion prevention of internal components.
We recommend the following procedure for long-term storage:

1.) Remove valve covers, glow plugs and carburetor.
2.) Submerge engine in lacquer thinner, agitate, and remove, drain and blow dry with compressed air.
3.) Put several drops of oil in each cylinder, rocker box, and the crankcase, and *hand turn* the engine at least 10 times.
Re-install removed components, with glow plugs *loose*.
4.) Hand turn engine, slowly, every week or so.

RETURN FROM STORAGE:

To return a long-term-storage engine to service:

1.) Remove valve covers, glow plugs and carburetor.
2.) Put several drops of oil in each cylinder, rocker box, and the crankcase, and motor the engine with an electric starter motor for several seconds.
3.) Check valve clearance, and if you have a compression gauge, check compression.
4.) *Carefully* clean the glow plugs and carburetor (rinse in lacquer thinner), and re-install removed components.
5.) Re-connect throttle and ignition, and you should be “Good to Go!”

Technical Specifications

[Includes dimensions for obsolete engines no longer available – supplied for reference only!]

Bore			
"A" Series	7 cylinder	.625"	(15.875mm)
"Big Bore" Series	5 cylinder	.750"	(19.050mm)*
	7 cylinder	.750"	(19.050mm)
	9 cylinder	.750"	(19.050mm)
"C" Series	3 cylinder	.875"	(22.225mm)*
	5 cylinder	.875"	(22.225mm)*
	7 cylinder	.875"	(22.225mm)*
	9 cylinder	.875"	(22.225mm)
STROKE			
"A" Series	7 cylinder	.630"	(16.002mm)
"Big Bore" Series	5 cylinder	.630"	(16.002mm)*
	7 cylinder	.630"	(16.002mm)
	9 cylinder	.630"	(16.002mm)
"C" Series	3 cylinder	.750"	(19.050mm)*
	5 cylinder	.750"	(19.050mm)*
	7 cylinder	.750"	(19.050mm)*
	9 cylinder	.750"	(19.050mm)
CAPACITY PER CYLINDER			
"A" Series	7 cylinder	.193 cu. in.	(3.167cc)
"Big Bore" Series	5 cylinder	.278 cu. in.	(4.555cc)*
	7 cylinder	.278 cu. in.	(4.555cc)
	9 cylinder	.278 cu. in.	(4.555cc)
"C" Series	3 cylinder	.451 cu. in.	(7.390cc)
	5 cylinder	.451 cu. in.	(7.390cc)*
	7 cylinder	.451 cu. in.	(7.390cc)*
	9 cylinder	.451 cu. in.	(7.390cc)*
TOTAL DISPLACEMENT			
"A" Series	7 cylinder	1.353 cu. in.	(22.171cc)
"Big Bore" Series	5 cylinder	1.392 cu. in.	(22.811cc)*
	7 cylinder	1.948 cu. in.	(31.928cc)
	9 cylinder	2.500 cu. in.	(40.98cc)
"C" Series	3 cylinder	1.353 cu. in.	(22.17cc)*
	5 cylinder	2.255 cu. in.	(36.952cc)*
	7 cylinder	3.157 cu. in.	(51.733cc)*
	9 cylinder	4.059 cu. in.	(66.515cc)

WEIGHT

"A" Series	7 cylinder – approx. 31 oz.	(879 grams)
"Big Bore" Series	5 cylinder – approx. 26 oz.	(731 grams)*
	7 cylinder – approx. 31 oz.	(879 grams)
	9 cylinder – approx. 40.5 oz.	(1148.16 grams)
"C" Series	3 cylinder – approx. 30.8 oz.	(868 grams)*
	5 cylinder – approx. 52 oz.	(1474 grams)*
	7 cylinder – approx. 62 oz.	(1757 grams)*
	9 cylinder – approx. 73 oz.	(2070 grams)

* Obsolete engine – no longer available new.

Rev. range	1000 to 8000 R.P.M.
Compression ratio	9 to 1 (8 to 1 on many older engines)
Pistons	2024 Aluminum alloy
Cylinder	2024 Aluminum alloy
Cylinder head	2024 Aluminum alloy
Cylinder bore	Hard Chrome plating
Front & rear housing	2024 Aluminum alloy
Master connecting rods	2024 Aluminum alloy
Cam followers	440 C Stainless steel hardened to 61 - 63 Rockwell C.
Rocker arm	8620 Steel, hardened ball end
Valve guides and cam follower guides	544 Phosphor bronze
Valves	420 S.S.
Crankshaft, Crank pin, Gears and Gear shafts	4140 Chrome alloy steel hardened and ground
Cams	8620 Steel to 55 - 57 Rockwell C.
Bearings	Stainless steel
Oil seal	I.N.A. G.S.C. 04
Glow plugs	¼" x 32 "4 stroke" [OS Type "F" recommended and supplied.]
Valve clearance	.002" to .003" (0.05 to 0.08 mm)

NOTE: The manufacturer reserves the right to alter the specifications at its discretion.

Glow Plugs:

Do not use idle bar plugs – some will contact the top of the piston. Best performance will be had using "4 stroke" plugs - original equipment.

1.2 volt or 2 volt plugs work equally well – just match your power supply to the plug voltages.

The amperage draw on glow plugs differs dramatically between different manufacturers – in the range of 1 to 2 amps each. So the power source must have the ability to provide sufficient current for all the glow plugs in the engine.

HYDRAULIC LOCK

In a full scale radial engine the oil and fuel are separate and a scavenger pump is used to keep the crankcase dry. In model engines the fuel and oil are mixed together – the action of the master rod and link rods tends to centrifuge the oil out of the fuel mixture. Thus a percentage of the oil remains in the crankcase. When the engine is shut down this oil will seep past the rings or in some cases drain down a lower cylinder induction tube.
THIS CAN TAKE PLACE VERY QUICKLY!

When the operator attempts to restart a flooded engine, manually or with an electric starter, breakage of rods or cylinders may occur.
THIS IS A CUSTOMER PROBLEM, NOT A MANUFACTURER PROBLEM!

Before starting, the operator should rotate the engine slowly at least four turns, feeling for unusual resistance and, if any is felt, remove the lower glow plugs, allowing a minute or two for the oil to drain, before re-installing the glow plugs and starting.

Remember:

Checking the valve lash, being careful about hydraulic lock, and purging the engine of residual fuel after shut down are essential "every-run" operations that will insure better performance and longer life from your TechnoPower engine.

Warranty

There is no warranty, guarantee, or assurances of any kind, expressed or implied!!

All engines are sold *"As is"* !!

The customer accepts all responsibility for the engine – for its condition as received, for its operation, and for its maintenance.

The manufacturer will, at its discretion, respond to customer contacts regarding perceived problems; if the issue appears legitimate, then the manufacturer will allow return of the engine, at the customer's expense, for examination. If the manufacturer finds a problem, then the nature of the problem will determine the manufacturer's response: if the problem is customer caused, then the manufacturer will provide an estimate for repairs, which the customer can accept or not. Return shipping costs will be the responsibility of the customer in either case. If the problem is manufacture related, then the manufacturer will repair or replace the engine without cost to the customer, and pay return, insured shipping. The manufacturer will be the ***sole*** determiner of the whether there is a problem, and who is responsible! No third party opinions will be acknowledged!

This response by the manufacturer will be available ***only*** to the original purchaser, for a period of 180 calendar days from date of purchase.