

Displacement	7.45cc	Output	1.62ps @ 16,000 r.p.m.
Bore	22.0 mm	Practical r.p.m. range	2,000 r.p.m. - 17,000 r.p.m.
Stroke	19.6 mm	Weight	371.5 g

Force Model Engines have been developed specially to answer the needs of R/C modellers all over the world. They incorporate a carburettor that has automatic mixture control together with a high silicon content aluminium piston and aluminium alloy cylinder with a chromed liner.

“Powerful, Reliable High Performance”.

RUNNING IN (Breaking in).

For a long life and high performance every engine needs to be properly “run in” or “broken in” before being put to full use.

BEFORE CARRYING OUT ANY OF THE PROCEDURES BELOW, YOUR ATTENTION IS DRAWN TO
“SAFETY THE THIRTEEN COMMANDMENTS” AT THE END OF THIS LEAFLET.

The procedure for running in is as follows:

Before installing the engine in a model, beginners are recommended to follow the “test bench running in procedure” as explained later.

1. Install the engine in your model and fit a suitable propeller, for example a 9 x 5 or a 10 x 4 depending on the type of model that the engine is fitted to.
2. Use a fuel, during the running in period, containing not more than 5% Nitromethane and not less than 20% Castor oil.

STARTING

1. Fill the fuel tank with a suitable fuel.
2. Open the needle valve 2 turns from the fully closed (screwed in) position.
3. For the next step the “Glow Start Battery” must be DISCONNECTED.
4. With a finger blocking the carburettor intake, rotate the propeller through three complete revolutions. This should draw fuel, from the tank, up through the fuel tube and into the engine. Now you can connect the “Glow start Battery” to the glow plug, this will cause the plug to glow and will assist in starting the engine.
5. Close the throttle down to the normal idle position. Hold the aircraft firmly and flick the propeller counter clockwise using a “Chicken stick” or an electric starter. There are various “Chicken sticks” and starting aids available.
6. When the engine starts and before opening the throttle fully, it is advisable to move position relative to the aircraft and to make sure that you are behind the arc of the propeller for your safety.
7. You should now be able to remove the “Glow start battery” and the engine will continue to run. If the engine cuts out as soon as the battery is disconnected, turn the main needle valve clockwise $\frac{1}{4}$ of a turn and start the engine again following steps 5 – 7 above.

RUNNING IN

8. For the first few minutes let the engine run with the fuel mixture very rich so that when the throttle is open the engine is “Four stroking”.
Gradually screw the needle valve in until the engine just breaks into a rich “Two stroke”. At this point stop turning the needle valve and allow the engine to run until the fuel tank is empty.
Care must be taken not to run the engine in a dusty or gritty environment as foreign matter sucked into the engine whilst running will dramatically shorten it’s life.
1. With the needle valve set up as above make 2 or 3 flights. At this stage the engine will still be running slightly rich and will therefore not be developing full power however there should be enough power to fly your model unless it is too heavy, too large or the weather is too windy.
2. It sometimes happens that, due to the position of the fuel tank in the model, the mixture becomes leaner in flight. If this should happen, close the throttle, land the model and open the needle valve slightly before continuing with flying.
3. For the next 3 or 4 flights the needle valve can be very gradually closed to give more power however it is recommended that the engine is not “leaned right out” and it should be allowed to run just a little rich.
During these early flights avoid manoeuvres such as “top hats” or “stall turns” as these can make the engine “lean out”. Loops will assist the running in process as they allow the engine to speed up and then run rich again.
4. After 6 to 10 flights, it should be possible to run the engine continuously at its optimum needle valve setting. This setting is with the needle valve adjusted $\frac{1}{4}$ to $\frac{1}{2}$ a turn on the rich side of the position at which the engine reaches it’s highest speed.
Your engine can be said to be run in when it holds a steady speed at the optimum setting.
Never attempt to lean the engine out to far to obtain a few more revs as this will cause the engine to run too hot and it may be damaged by overheating.

TEST BENCH (Running in)

1. Install the engine in a suitable bench mount. Use a 10 x 6 or 11 x 6 propeller and run the engine for approximately 10 minutes with the needle valve adjusted so the engine is running rich "four stroking".
2. Close the needle valve until the engine speed picks up and the engine starts to "two stroke". Allow the engine to run like this for about 30 seconds only and then re-open the needle valve until the engine resumes four stroking. Run for a further 2 minutes.
3. Repeat this procedure, alternately running the engine fast and slow by means of the needle valve. Gradually extend the periods of high speed running until a total test running time of 30 minutes has been achieved. Using this method of running alternatively rich (cool) and lean (hot) helps the engine to run in.
4. Now gradually close the needle valve until the engine reaches its maximum r.p.m. and then open the needle valve very slightly as a safety margin. If, at this stage, the engine holds a steady speed then the initial running in is complete. If the engine will not hold a steady speed extend the running in period as necessary.
5. After running in and before installing the engine in your model it is advisable to check carburettor adjustment. Refer to the separate carburettor instruction sheet.

INSTALLATION

Mount the engine securely on to the engine mounting using steel screws and locknuts. Particular care must be taken to ensure correct alignment of the lugs on the engine mounting. An incorrectly mounted engine can give rise to vibration and can also damage the engine itself. Special care must also be taken to ensure that mounting holes in the engine and the mounting are correctly aligned so that the engine is not damaged when the mounting screws are tightened.

FUEL

Use a good quality commercial fuel or one of the blends shown in the table. Fuel "A" is for ordinary use Fuel "B" is for use where more power is required.

Use only Castor oil and Methanol of the highest quality and purity.

	A	B
METHANOL	75%	65%
CASTOR OIL	20%	20%
NITROMETHANE	5%	15%

Synthetic lubricants are less tolerant of a "lean run" than Castor oil.

If a synthetic oil is used in a fuel mixture, the needle valve should be set a little rich as a safety measure in case the engine runs too lean whilst in the air.

In Helicopter installations it may be necessary to experiment with different glow plugs and fuels to obtain optimum mid range performance.

Whatever fuel is used the engine should be checked to ensure that it is sufficiently run in to operate satisfactorily on the chosen fuel.

Do not use fuels containing less than 20% lubricant.

GLOW PLUGS

Select a plug that will give the most satisfactory results. We would suggest a medium cold plug for this engine.

PROPELLER

Use a well-balanced propeller only. You will need to experiment with propeller sizes, as performance will vary depending on the model that the engine is fitted to.

Below is a chart of recommended sizes. This chart will give you a starting point for your experiments.

	40 SIZE	46 – 51 SIZE
R/C STUNT	10 x 6 – 11 x 6	10 x 7 – 11 x 6
SCALE	11 x 6 – 12 x 4	11 x 6 – 12 x 5
R/C SPORT	10 x 6 – 11 x 6	10 x 7 – 11 x 6

MAINTENANCE

1. Avoid unnecessary dismantling of your engine.
2. Always keep your engine clean and do not let dirt or dust enter the engine through the intake or the exhaust.
3. Fuel should be filtered. Use a fuel filter on your fuel container and another filter in the fuel line from the tank to the carburettor.
4. If the engine is fitted with a flywheel instead of an aircraft propeller, do not allow the engine to run at peak revolutions without adequate provision for cooling.

ADJUSTING THE CARBURETTOR

Three adjustable controls are provided on this carburettor.

1. The main needle valve (located on the right hand side of carburettor) Part No MN4626 see overleaf
2. The mixture control screw (centre needle valve) Part No CN4615 see overleaf
3. The throttle rotor set screw (angled at rear of carburettor body) Part No S009 see overleaf

SETTING UP

NOTE. The high-speed set-up MUST be carried out before the idle speed is adjusted. Settings may change as the engine "Runs in" and may need readjusting after the engine has been run for an hour or so.

1. The main needle valve is used in the same way as on all model engines. It is used for adjusting the high-speed set-up of the engine.
Start the engine and with the throttle fully open gradually close the needle valve until the engine is running at its maximum speed. Caution, do not close the needle valve too far as this will "lean out" the mixture too much and cause the engine to run too hot and slow down.
Set the needle valve just slightly on the rich side of the peak r.p.m setting.
Make sure that the engine is fully run in (about 1 hour of total running time in short runs) before operating continuously at full throttle.
After setting the main needle valve it may be necessary to set the idle mixture to obtain reliable idle performance.
2. The mixture control centre needle valve is for adjusting fuel mixture at part throttle and idle speeds. Having set the main needle as described above, close the throttle. The engine should idle continuously.
3. If the engine idles unevenly, open the throttle, if the engine hesitates before picking up speed it is probable that the idle mixture is too rich. Check this by closing the throttle and letting the engine idle for about 5 seconds before again opening up. If the engine now puffs out a good deal of smoke and hesitates or even stops, it will be necessary to close the mixture control centre needle valve. Do this by inserting a small screwdriver into the recessed screw on the right hand side of the carburettor and turning it clockwise about ½ turn.
4. If instead of being too rich, the mixture is too lean, the engine will stop when the throttle is closed, or will lose speed while idling and then cut out abruptly (without smoking) when the throttle is opened again. In this case turn the mixture control centre needle valve about ½ turn counter clockwise.
5. The mixture control centre needle valve adjustment is not critical and by remembering the symptoms of rich and lean running, mentioned above, it is a simple matter to get to the best setting.
6. The throttle rotor set screw is for setting the minimum idling speed. If the engine runs too fast when the throttle is in the fully shut position, the rotor set screw should be turned counter clockwise to allow the carburettor to close down more.

SAFETY: THE THIRTEEN COMMANDMENTS

Please observe the following safety information: Your model engine is not a toy but a precision engineered motor, which if abused, or if these safety precautions are ignored, is powerful enough to injure the user and / or bystanders.

FORCE ENGINES ARE UNSUITABLE FOR USE BY PEOPLE UNDER 14 YEARS OF AGE.

1. Keep onlookers at a distance of at least 5 metres when operating your engine.
2. During initial running, mount the engine securely in an engine test stand / model, making sure that the engine is secured firmly by means of 4 x high tensile (or equivalent) bolts.
FAILURE TO FIRMLY SECURE YOUR ENGINE CAN LEAD TO SERIOUS PERSONAL INJURY!
3. Use a good quality, balanced propeller of correct size and pitch. See specification table for this information.
4. Check propeller before installation and before each engine operation for any cracks or defects. Fit a new propeller if you have any doubts. Ensure that the propeller type matches the rotation of your engine and that the propeller is bolted securely to your engine using a propeller wrench.
5. Keep face and body clear of the propeller when starting the engine. Use only a "Chicken stick" or an electric starter to crank the engine. Never use your finger to start a model engine!
6. Make all engine adjustments from behind the motor, keeping your body and clothing away from the rotating propeller. Do not wear loose clothing or neckties.
7. To stop the engine, close the throttle or disconnect the fuel tubing from the carburettor. Never put anything into a rotating propeller.
8. If you carry your model plane with the engine running, ensure that the aircraft is held securely at length, with engine and propeller facing away from your body as far as possible. Do NOT run engine in an area with loose sand or gravel, or in an enclosed space or indoors. Models should NEVER be flown in built-up areas, near children, or near high tension cabling or electric and telegraphic wiring.
9. Store fuel in a safe place and keep well away from heat sources, sparks and cigarettes.
10. Model engines generate a lot of heat when they run. Avoid touching your engine until it has cooled.
11. Model flying should only be carried out in approved places. This is usually the local model flying field.
12. Newcomers to model engines must read all instructions and safety warnings before running an engine. If you have any doubts about safe operation, seek advice from your local model shop or from where the engine was purchased.
13. Never disassemble your model engine. This will void any existing warranty agreement. Only the authorised and appointed Force Engines service agent should carry out servicing and repairs. Please enclose details of the problem. Fuel and propeller size used, along with a copy of purchase receipt.