

User Guide for MOKI Glow Engines

...is this a MARK or a MOKI?

The powerful MARK engines are manufactured in Hungary by MOKI Motor – previously known as MOKI. Throughout the world, the brand name MOKI has become the synonym of performance and dependability amongst demanding modelers – for competitions just as much as for the plain fun of the hobby. As famous as the brand name MOKI has become, unfortunately some ownership issues around the copyright of the name have occurred. For this reason MRC has chosen to re-brand the engines under the name MARK. So – regardless whether you own a MARK or a MOKI – your engine has been developed by some of the most experienced model engine experts and has been assembled by hand in Hungary to live up to your highest expectations.

History

MOKI/M/ARK engines have been manufactured since more than fifty years. The Hungarian Department of Defense founded MOKI in 1957 with the charter of developing and manufacturing engines for the use in airplane models as well as for military purposes. This heritage can still be found in the name **MOKI**: the acronym stands for “*Modell Kísérleti Intézet*”, which in Hungarian means “Institute for Experimental Modeling”. Until 2008 the factory has resided at the original location at the airport of Budaörs, a few miles west to the center of Budapest.

Until 1989, the entire production capacity was reserved for use by the competition modelers (airplanes, cars and boats) in Hungary and the army. The engines became famous due to the successes of Hungarian modelers, but there was no commercial pressure on production. This unique situation allowed the development team to focus on performance and dependability – the elements most important for success.

Hungarian modelers have gathered about two hundred European and World Championship titles, and a long list of world records. Many modelers participated at races, while at the same time working for MOKI. One famous example is Mr. Gyula Krizsma – World Champion in high-speed control-line flight in 1962 – and the engineer responsible for the development of MOKI’s two-stroke engines. Until today, his designs form the basis of the successful line-up of MARK engines.

The experience grown in more than fifty years of manufacturing high-performance model engines has survived all economical and political changes brought about by the fall of the iron curtain in 1989. Now a company in private ownership, the team is concentrating on fulfilling the demands of modelers world-wide for dependable, high-performance engines.

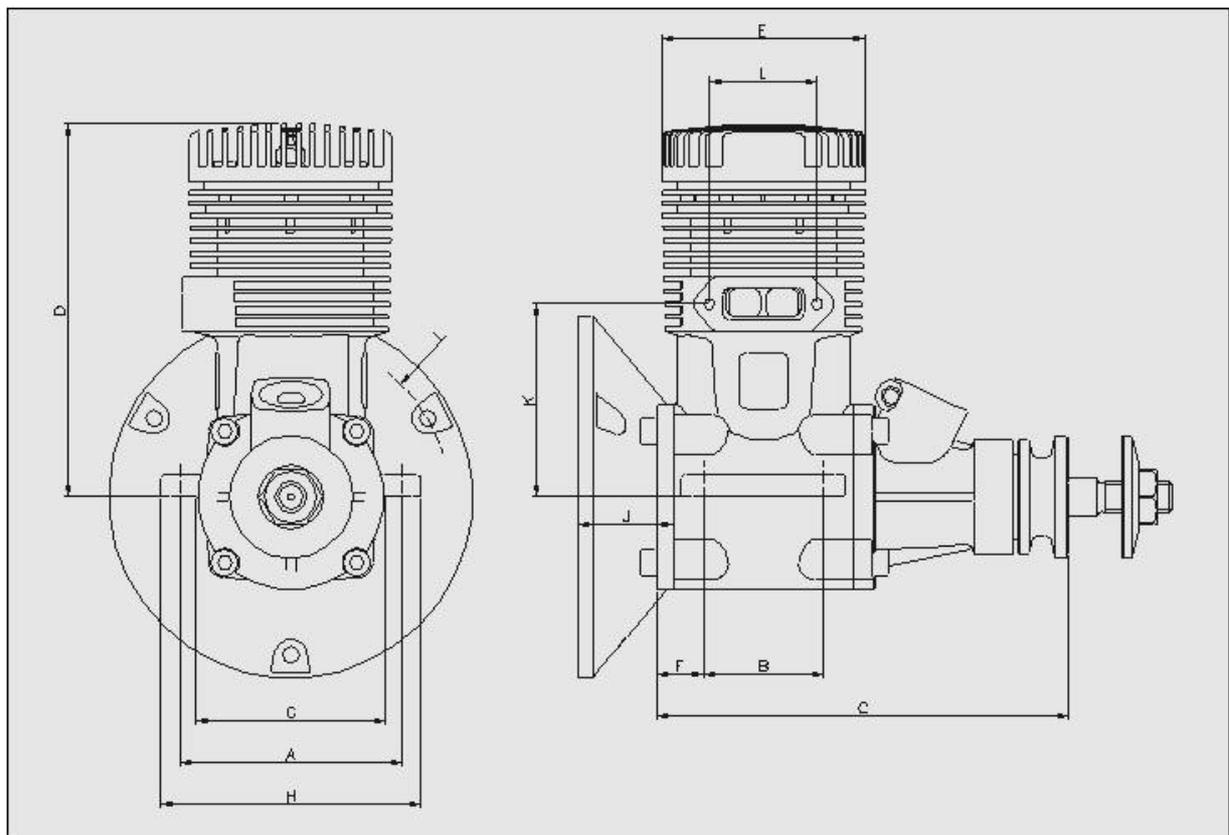
Our motto is “*Competition quality for the demanding modeler*” . Stringent, industry-level quality assurance processes and modern CAD and CNC equipment combined with half a century’s worth of experience are an excellent base to provide you with powerful, long lasting engines of classical design. Numerous tests in magazines and an impressive track record of international prizes are the testimonials to our claim. We strive to preserve these values for the future.

Technical Data

	Displacement cubic inches	Displacement cubic cm	Bore mm	Stroke mm	Max. R.P.M.	Performance kW / HP	Weight
M 51	0.51	8.37	22.5	21	12,500	0.65 / 0.9	390g / 13.76 oz
M 61	0.61	9.97	23	24	17,500	1.62 / 2.2	495g / 17.46 oz
M 135 M140	1.38	22.6	31.5	29	13,000	2.86 / 3.9	855g / 30.16 oz
M 180	1.82	29.8	35	31	12,000	3.0 / 4.1	1170g / 41.27 oz
M 210	2.11	34.6	36	34	10,000	3.3 / 4.5	1275g / 44.97 oz
M 360	2 x 1.82	2 x 29.8	35	31	11,000	5.7 / 7.8	2270g / 80.07 oz

Please note that the performance and RPM figures depend strongly from external factors such as barometric pressure / altitude, fuel and propeller used etc. The figures given above relate to typical measurements done at the factory.

Dimensions



(All dimensions below in millimeters)

	A	B	C	D	E	F	G	H	I	J	K	L
M 51	45	26	85	72	39	8	36	52	-	-	39	28
M 61	51	28	93	83	44	9	42	60	-	-	45,5	28
M 135												
M 140	60	35	112	102	57	9	51	71	85	22,5	54	40
M 180	68	36	126	112	62	10	56	80	100	32	56	34
M 210	70	38	127	118	64	11	60	82	100	30	61	34
M 360	68	36	195	112	62	-	56	80	-	-	56	34

Precautions

Throughout this User Guide we assume, that you have already gathered experiences in operating a glow engine, and that this is not the first engine you operate. Should this indeed be your first experience with a glow engine, we strongly recommend that you seek professional advice from a more experienced modeler, for example in your club, or from the reseller who has sold this engine to you. The power and performance of MOKI engines can be very dangerous if the engine is not handled with the appropriate precaution, serious injuries or even fatalities can be the result if insufficient care is taken. Please read the entire manual carefully before attempting to start the engine.

- The engine must be mounted firmly to a test bench or into a model, the model or the test bench must be fixed appropriately.
- A suitable, balanced and undamaged propeller of appropriate size must be used.
- The original propeller nut or another suitable propeller nut must be used and tightened firmly. Using spinners with thick back-plates and/or propellers with an unusually thick hub can lead to insufficient grip of the propeller nut. In this case a special adaptor must be used to ensure that the propeller and the spinner are held in place firmly. Please contact us or a third-party, specialized company (e.g. TruTurn) to acquire a suitable adaptor.
- Carefully check the tightness of the propeller nut on a regular basis. Some materials (like wood) have a tendency to be compressible by the propeller nut, leading to a loose propeller nut.

Breaking-In a New Engine

Breaking-in (sometimes also called running-in) your new engine carefully is an important measure to ensure longevity as well as high performance. You can either mount the engine to a test stand, or install it into your model. It is important that the engine gets sufficient cooling and that the propeller is not oversized.

Please use a quality fuel with at least 20% oil content and no nitro methane for the first hours of operation. Using a high quality castor oil in this phase makes sense and shortens the required time until the engine is run-in. If you prefer not to use castor due to its unpleasant side effects (like sticky exhaust residues, intensive odor), you can also use synthetic oil. Please consider that due to the better lubrication with synthetic oils the time required until the engine reaches its peak performance may take a bit longer. In any case, make sure you use first-class quality fuel or fuel components.

At the beginning, the carburetor's main needle should be set in such a way that the engine does not rev higher than 5-6,000 rpm at full throttle. Run the engine in short intervals of about five minutes, which you can subsequently increase by a minute after each run until you reach ten minutes. Allow the engine to cool out entirely between two runs (this is very important, as the temperature changes contribute significantly to the process). After the first few intervals you can start leaning the main needle click by click. **NOTE:** If the engine revs start decreasing ("sagging"), immediately open the main needle several clicks, as sagging revs at a constant throttle setting are a sure indicator for overheating.

After the first few intervals you should also try changing revs with the throttle – as soon as the engine safely holds an idle without a connected glow driver it's time to get the model in the air. Flying is a much better way of running-in the engine, as the cooling is much better, the static load on the engine is lower and the operation at alternating revs is good for the engine. Avoid long full-throttle phases, and change revs as often as you can.

You can tell that the engine is broken in as soon as the engine holds a peak rev without sagging, and you can dial-in a low, steady idle. Now you can also reduce the oil content in your fuel to about 17% of a high-quality synthetic oil (if you use castor, please do not reduce the oil content, stay at 20%). A very important notice: Many times we have heard that "an experienced colleague", "the club's engine guru" or "the guys at the field" have said something like "My engine of the brand xyz runs perfectly with x% oil (x being a very low figure like 8 or 12)". Please, **DO NOT LISTEN TO SUCH INCOMPETENT STATEMENTS**. First of all, we believe that we, as designers and manufacturers of our fine engines, do know best what the engine has been designed for. Secondly, the required amount of oil differs due to several facts and depends very much on the design specifications. A high-performance engine like ours has much tighter fittings than some of the competitor's engines – this is true for the connecting rod bushings as well as for the hand-selected cylinder/piston pair. The small tolerances used in these parts are an important contributor to the reliability and dependability of our engines. Low oil content not only can cause lubrication problems, but it also increases the engine temperature (thus increasing wear) and provides no reserves should you experience a lean run due to e.g. wrong carb setting, the pressure line on the muffler failing etc.. Please note, that our warranty does not cover any damages to the connection rod, piston or cylinder due to overheating or the use of insufficient or bad quality oil.

Installing the Engine

The engine can be mounted to your model either via the mounting lugs or with the help of the cone-shaped engine mount available as an accessory for some of our engines. This engine mount replaces the standard rear cover of the engine and can be attached directly to our model's firewall. Make sure to replace the standard rear cover mounting screws with the longer ones that come with the engine mount.

The Mark M360 In-Line Twin should always be mounted with the special engine mount available for this engine. Although the cone-shaped engine mount of the M180 mechanically also fits the M360, it should not be used as the engine's length and the sheer power it produces cannot be mounted securely using the cone.

Please do take the engine's power and high torque into consideration when mounting it to your model, especially if you use any rubber elements. Be careful as some types of rubber disintegrate over time under the influence of oil and fuel. Always use a locking compound on the screws used for engine mounting.

Make sure that there is sufficient air flow to cool the engine. The air stream should flow directly to the cylinder and cylinder head. If you use any cowl, make sure that the air outlet has at least twice the opening area of the air inlet – hot air expands and thus needs a larger exit to ensure a proper flow.

When installing the M360 In-line Twin particular care should be taken to ensure that the rear cylinder is appropriately cooled.

The following symptoms are clear indicators of overheating:

- Loss of power / sagging revs at full throttle despite correct carburetor settings
- Frequently fouled glow plugs (you can diagnose overheating before the plug fails – the coil should be shiny, and the plug body should not be discolored. If you see any discoloration, or the coil is not shiny, then the engine has been exposed to overheating).
- Loosening cylinder head screws – this is a severe alarm signal and a clear indicator of intensive overheating!

If you observe any of these symptoms, take action and ensure that your engine gets adequate cooling. This will ensure a long life and reliable high performance.

Fuel Tank and Fuel Lines

The fuel tank should be installed in the model in such way, that the centerline of the tank is on the same height as the engine's needle valve. This ensures a constant and steady flow of fuel. Use foam to protect the tank against vibration, and use muffler pressure to pressurize the tank. Please use fuel tubing (including the tank's plumbing, any filters or filling valves) of an adequate diameter, to ensure that there is sufficient fuel flow under all conditions. If you notice, that you can turn the needle valve counterclockwise without any effect on the engine's r.p.m., you have probably installed insufficiently sized fuel tubing.

The Carburetor

The carburetor used on MOKI engines uses a needle valve to regulate the engine's high speed fuel mixture. The fuel mixture from idle to mid-range is controlled by an idle disk.

On the same side as the needle valve you can find a knurled disk. This disk has a little groove on the top, and a "+" and "-" symbol are punched on its face. By turning the disk into the "+"-direction, the fuel mixture for idle and mid-range is made richer (so more fuel can flow), turning the disk into the "-"-direction provides a leaner mixture. Please change the setting of the disk only in very small steps! The factory setting of the disk is with the groove exactly on top center. For the time being, do not change the factory setting!

The main needle is delivered separately in the box. Carefully insert the needle into the valve, and gently screw it in all the way. Do not apply any force. After the needle has been completely screwed in, turn the needle valve out three full revolutions. With this base setting – main needle valve out three revolutions and idle disk centered – the engine should start and run in any case. Only minor changes to the main needle and the idle disk should be required to obtain the maximum power and a reliable idle. Please note that the ideal carburetor settings depend on the viscosity of the fuel, the barometric air pressure at your flying site (altitude), relative humidity and temperature of the air – just to mention a few factors. Please find below how to find the optimum settings.

Starting the Engine

MOKI engines are really easy to start, and can easily be hand started – provided you have the required practice. Always use a stick when starting the engine by hand! Please keep in mind that high-performance glow engines like the MOKI engines can cause serious injuries if handled improperly. For this reason, we strongly recommend to use an electric starter. If you prefer starting the engine by hand, **ALWAYS USE A STICK and protect your hands with heavy leather gloves.**

Optimizing the Carburetor Settings

This chapter explains how to get the best performance once the engine has been run-in. Begin by starting the engine, and allow the engine to warm-up, if necessary, with connected glow power. After

a few minutes, remove the glow power, and slowly advance the throttle to full power (make sure that the model is well secured, ideally a helper should hold it). Adjust the main needle valve so that the engine reaches its peak rpm, then open the needle valve (counterclockwise) until the rpm drops by about 500 rpm. Always keep the engine on the "rich" side when flying! Check that the engine runs stable also with the model's nose held straight up. A slight increase in revs is OK, but should you need to open the needle valve so much, that no clean running is possible once the model returns into a horizontal attitude, then probably the tank is installed incorrectly (too far from the engine, or too high/too low in relation to the carburetor). Once you are satisfied with the engine's setting at full power, reduce the throttle to a low idle and let the engine run at idle for a few minutes. Check if the engine's acceleration is quick and without any sputtering or hesitation. If the acceleration is not satisfactory, return the engine to idle, and briefly pinch the fuel line with your fingers. If the engine revs up, stop the engine and turn the idle disk a very small amount towards the "-" sign, if the engine suddenly stops without first revving up, turn the idle disk a small amount towards the "+". After changing the idle disk's setting, check the main needle's setting at full throttle as described above. Repeat the process until you are satisfied.

Shutting off the Engine

All glow engines produce a fair amount of exhaust residue containing acids and organic solvents. As long as the engine is hot, these corrosive residues will evaporate and exit through the exhaust. However, if you let the engine run at idle revs for a while, the engine will cool down and the residue will condensate and be trapped in the engine's exhaust system as well as the crank case. The colder the outside temperature, the larger the exhaust, the stronger this effect! It is therefore very important to ensure, that after the last flight of the day, the engine is shut off at full temperature. It is good practice to allow the engine to run at full power for one or two minutes, before shutting the engine off by closing off or pinching the fuel line (do not stop it by covering the carb inlet, this will draw additional fuel in the crank case and will contribute to the build-up of corrosive residues). Make sure that the exhaust is drained from any residues, and store the model with the engine pointing upwards – this prevents any residues to flow back into the engine. Please note that damages caused by corrosion are not covered by the warranty!

Selecting the Best Suitable Propeller

The choice of a suitable propeller depends on many factors, such as the characteristics of your model, your style of flying, the fuel you use, the type of exhaust system, the atmospheric conditions etc. Please note, that the same nominal size of propeller can deliver quite different results from brand to brand. In the case of wooden propellers even two propellers of the identical size and the same brand can deliver very different results. For this reason, the table below can only serve as a rough indication of typical propeller sizes – the best is to try several prop sizes until you find your favorite. The first number denotes the propeller's diameter; the second number represents the pitch (all measurements in inches). Please make sure not to exceed the maximum rev number in the table to prevent the engine from damages. Please note that the rev figures measured on a static model on the ground will be considerably lower than the peak rpm reached in flight – so keep a safety margin of at least 1000 rpm. MOKI engines are designed to deliver a very high torque; therefore you can use relative larger diameter props at lower revs. Not only will this render a better efficiency, it also contributes to lower noise emissions.

Please observe the following guidelines:

- Only use undamaged propellers
- Don't use propellers with an unknown history
- Heavy propellers (carbon fiber, composites) have a larger "flywheel"-effect and allow for a lower idle while wooden propellers result in a brisker acceleration of the engine
- Any discoloring on the surface of a plastic propeller is an indication of structural damage – do not use any props with such marks, discard them!
- Propellers have to be balanced carefully

- Take utmost care when enlarging the hole in the prop hub – use a drill press, or ream it by hand
- If you use a spinner make sure that the spinner is balanced and use the appropriate fastening nut. Please consult your MOKI dealer for special propeller nuts with an integrated thread for a spinner mounting screw. These are available both from MARK as well as manufacturers of spinners.

	Displacement cm³	Propeller size (2 blades)	Max. R.P.M.
M 51	8,37	10 x 9 – 12 x 6	12,500
M 61	9,97	10 x 12 – 12 x 10	17,500
M 135	22,6	14 x 12 – 18 x 6	13,000
M 180	29,8	17 x 12 – 19 x 8	12,000
M 210	34,6	18 x 12 – 20 x 10	10,000
M 360	2 x 29,82	22 x 10 – 24 x 8	11,000

Exhaust System

Suitable exhaust systems are available from many brands. Consult your MOKI engine dealer for the ones available in your market. If you plan to use a tuned pipe system, please make sure that you use the adequate length of header pipe. The longer the pipe is, the lower the RPM when the resonator effect kicks in. If the pipe is too short, the engine will have a tendency of overheating. Another important factor is the muffler's volume: if the muffler is too small, too much unburned exhaust gasses will flow back from the muffler into the engine. The typical symptom is that when cutting the throttle, the engine will not fall back to idle quickly, but will continue to run at a medium RPM level for several seconds. If you experience this symptom, you can try adjusting the mid-range of the carb slightly leaner, or increase the area of the muffler's exit pipe. If these measures don't help you will have to switch to a muffler with a larger volume.

Maintenance and Repair

Should you ever need to repair your MOKI engine, genuine spare parts are available through your MOKI dealer. Do not disassemble the engine unless you have the necessary skills, practice and tools. Please note that any disassembly by unauthorized persons will void the manufacturer's warranty.

Warranty

MOKI engines carry a two year manufacturer's warranty. In case your MOKI engine needs a repair in the warranty period, return the engine in its original packing, along with a proof of purchase, to your dealer or send it directly to the manufacturer. Please include a description of the problem and include all details about the fuel, propeller and glow plug used.

Please note that the warranty will be void if any unauthorized disassembly has taken place. Furthermore the warranty explicitly excludes coverage of all damages caused by corrosion, overheating and crashes.