

NORVEL AX-40

A HIGH-TECH, RUSSIAN-MADE POWERPLANT WITH AN INNOVATIVE DESIGN

by Bruce Smith



The Norvel AX-40 is a high-quality, high-tech, Russian-made glow engine with several innovative features.

Just over 10 years ago, Norvel (then Northern Velocity) produced a high-performance .049 combat engine: the AMD 049. At the time, 1/2A modeling was hardly a blip on the model-aviation radar screen, and Norvel's engine completely kicked the doors open for our hobby. In Norvel's own words, it was "the first company to produce a reliable small engine with a respectable throttle." Over the past 10 years, the 1/2A RC aircraft market has grown impressively, and more new kits and ARFs are offered every year. But the revival of 1/2A wasn't enough for the company; Norvel has marched on to produce engines with larger and larger displacements. Enter the long-awaited Norvel AX-40.

specifications

ENGINE: AX-40
MANUFACTURER: Norvel
DISTRIBUTOR: Sig Mfg.
DISPLACEMENT: 6.48cc (.40ci)
BORE: 20.85mm (0.82 in.)
STROKE: 19mm (0.75 in.)
COMPRESSION: 9:1 to 12:1
LENGTH OVERALL: 3 1/4 in.
WIDTH AT MOUNTS: 2 in.
HEIGHT OVERALL: 3 in.
PRACTICAL RPM: 2,000 to 16,000
POWER: 1.4hp @ 16,000rpm
WEIGHT W/OUT MUFFLER: 10.79 oz.
PRICE: \$109.99

FEATURES: the Norvel AX-40 engine has an aluminum piston and an aluminum cylinder with an oxide ceramic coating covered with Sliktek, a proprietary cylinder coating and a single-unit cylinder and head; investment-cast aluminum crankcase; two ball-bearing races; a hard-anodized prop hub; a keyed prop nut/washer; an adjustable prop shaft; and a 2-year warranty.

COMMENTS: the AX-40's AAO construction is revolutionary, and the engine was very easy to use. It was easy to start and adjust and is extremely well made. It boasts slick machine work and precision casting.

NORVEL'S REVOLUTION

Engine manufacturers have typically depended on either ABC or ABN technologies—essentially a heavy brass sleeve with either hard chrome or nickel plating. Norvel knew that it had to do something revolutionary to make its mark in the model-aircraft-engine market. Norvel's engineers, among them some of the former Soviet Union's best aerospace talent, decided to make their engines unique. The team wanted to manufacture lighter, more fuel-efficient model engines, so they developed a new cylinder/piston technology: AAO Revlite.



The 2-needle carburetor has a unique shape that slants the main needle valve aft and away from the prop.



The cylinder head has a unique multipiece design. The three tapered holes in the central ring are for setscrews that provide additional support of the combustion chamber when high-nitro fuel is used.

Revlite engines feature an aluminum piston with an aluminum cylinder that has an oxide coating (ceramic plating) lined with Sliktek, Norvel's proprietary cylinder coating (think Teflon). Sliktek protects the porous ceramic coating to reduce friction and improve fuel efficiency. Norvel says that its Revlite cylinder technology improves combustion and increases power by 20 to 40 percent. An aluminum cylinder sleeve offers a weight savings of 20 to 25 percent and a comparable fuel-efficiency gain. All Norvel engines use the new Revlite technology.

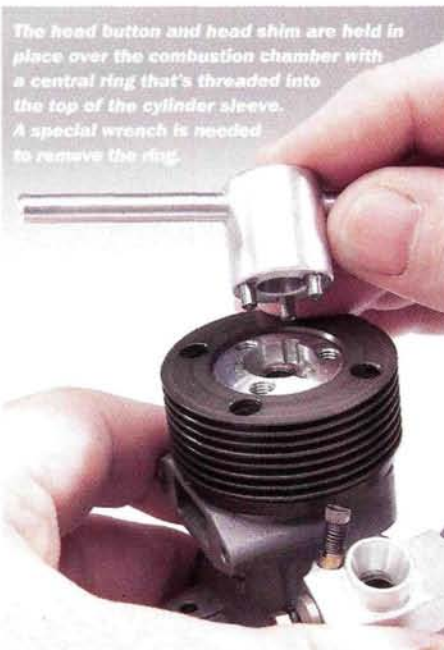
NORVEL AX-40

The AX-40 is the largest Norvel engine, and it's the first to be produced by its new production equipment. The new AX-40 weighs only 13.2 ounces; a comparable O.S. engine weighs 17.2 ounces. Many AX-40 features resemble those of its smaller-displacement siblings. Its cylinder and head are combined in one component that is bolted to the investment-cast aluminum crankcase. The crankshaft is supported by two ball-bearing races and features a hard-anodized prop hub and a nut/washer combination. As in its smaller units, Norvel employs the reversible prop shaft that effectively shortens the overall working length of the crankshaft to further reduce vibration.

All of the AX-40 components scream "high quality." At the top of the CNC-machined cylinder head, two additional inserts complete the engine's combustion end: the glow-plug adapter, which is set at the top of the cylinder, and the top cover, a threaded ring that secures the plug adapter. The top cover has three threaded holes that are intended for the use of setscrews, which supply additional support for the adapter plate and lock the



The cylinder sleeve includes the cooling fins and has a ceramic coating. The inner surface of the sleeve that houses the piston has been lined with Sliktek. The central ring, head button and head shim are also shown.



The head button and head shim are held in place over the combustion chamber with a central ring that's threaded into the top of the cylinder sleeve. A special wrench is needed to remove the ring.

plug-adaptor plate further when you use higher nitro fuel (up to 35 percent).

The 2-needle-valve carburetor features an angled-back design that makes needle-valve adjustment safer. This is by far the best machined, highest-quality Russian carburetor I have ever seen. It has the fit, finish, material and hardware quality you would expect of a high-performance engine. To quiet the engine, the standard muffler is a very nicely cast unit that I feel lets the engine breathe without compromising the noise limits of even the most restrictive air-fields. The instruction manual is comprehensive, clearly written and well-supported with drawings, photographs and 3D CAD carburetor schematics. It covers all the topics you'll need to break in, fine-tune, care for, maintain, choose propellers, glow plugs and fuel, troubleshoot and obtain maximum performance. If you ever need to repair your engine, the manual also features a complete exploded parts view and parts table. The stamp and signature of a "real person"—the person who tested the engine to ensure that it complies with all technical specifications and quality conditions—is a very nice touch. The AX-40 is covered by a 2-year warranty.

GET YOUR ENGINE RUNNING

Well, friends, it's time for the rubber to hit the road. I used a McCoy MC-59 glow plug (medium heat range), an APC 10x6 prop and Sig all-synthetic oil, 10-percent nitro fuel for break-in. After I had primed the engine with a few propeller hand-flips with my finger covering the venturi, I set the carburetor at a fast idle, engaged the glow igniter and gave the prop a few backflips. The engine popped with little effort, started and then stopped—not unusual for a tight new engine. After a couple of minutes of repeating this pattern, the runs began to last longer and longer until the engine stayed ignited. Once the engine

Norvel AX-40 Performance with standard muffler

Propeller	Rpm	dB*
Top Flite 11x6	11,300	90
APC 11x4	12,270	92
Top Flite 11x4	12,330	92
APC 11x3	13,830	95
Top Flite 10x8	10,560	90
Top Flite 10x7	11,220	90
APC 10x6	12,500	93
Top Flite 10x6	12,630	93
APC 10x5	13,590	95
Top Flite Powerpoint 10x5	12,660	94
APC 10x4	14,520	95
APC 9x6	15,270	97
Kyosho 9x6	15,120	96
Open port		
APC 9x6	16,290	106

TEST CONDITIONS • Temperature: 54 deg. F
Humidity: 33% • Barometric pressure: 30.31 in. Hg
Fuel: Sig Syn-Plus 10% nitro/18% synthetic oil
*Decibel readings measured at 3 meters

had warmed up, I advanced the throttle and made sure that the fuel mixture was set rich. I continued to break in the engine (at a rich needle setting) and went through ½ gallon of fuel, 10 ounces at a time, with cooling periods between each tankful.

At this point, the engine was ready to be tested with the props that I had selected. I ran the engine tuned to ⅛ turn on the rich side of peak rpm. The performance tables include the rpm and decibel readings for each of the test props.

CONCLUSION

The Norvel AX-40 is an extremely well-made engine that boasts slick machine work, anodizing and precision casting. The engine is very user-friendly, easy to start and quick to cool, and it has a dependable idle and a lightning-quick throttle response. It's also easy to fine-tune. Norvel's goal of greater fuel efficiency was accomplished; turning an APC 10x6 at 12,500rpm, the engine consumes 10 ounces of fuel in about 16 minutes. The AX-40 is a revolutionary engine! ✚

APC Props; distributed by Landing Products
(530) 661-0399; apcprop.com.

Great Planes Model Distributors (217) 398-6300;
(800) 682-8948; greatplanes.com.

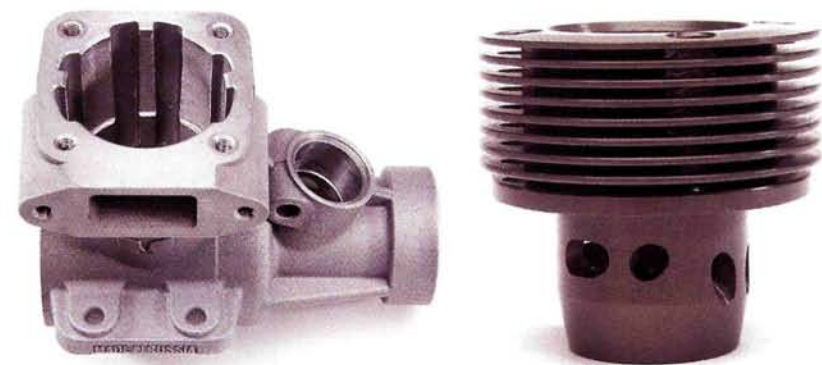
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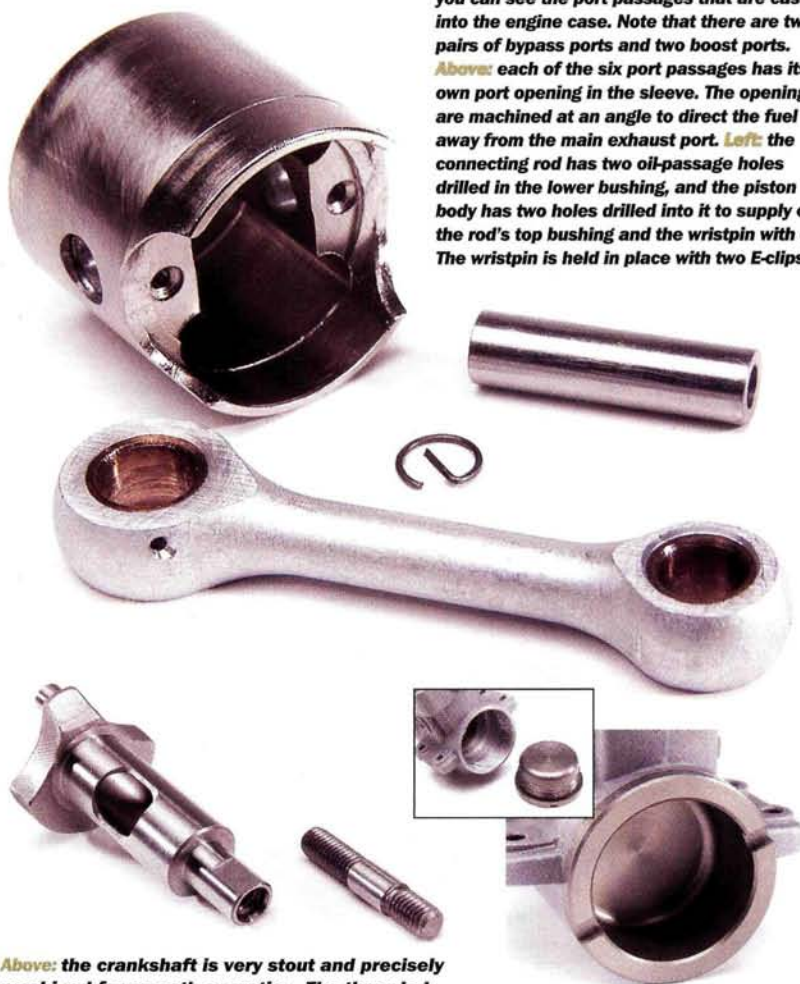
An inside look

When Norvel started out in 1990, the company's production equipment was old Soviet-era CNC aerospace industry machinery. Its equipment was slow and antiquated but produced high-quality engines up to a .25cc displacement. To build larger engines and to produce them in quantity, Norvel made the expensive switch to modern multi-axis equipment. Following Russian economic shortfalls, the company won approval from its aerospace-electronics parent company to upgrade its outdated equipment with nearly 2 million dollars' worth of state-of-the-art CNC machinery. Norvel never looked back! A look at the AX-40's internal parts proves that the company's money was well spent.



Above left: with the cylinder sleeve removed, you can see the port passages that are cast into the engine case. Note that there are two pairs of bypass ports and two boost ports.

Above: each of the six port passages has its own port opening in the sleeve. The openings are machined at an angle to direct the fuel away from the main exhaust port. **Left:** the connecting rod has two oil-passage holes drilled in the lower bushing, and the piston body has two holes drilled into it to supply oil the rod's top bushing and the wristpin with oil. The wristpin is held in place with two E-clips.



Above: the crankshaft is very stout and precisely machined for smooth operation. The threaded prop shaft is screwed into the front of the crankshaft and can be installed for a long or short thread length.

The AX-40 has a clever rear engine-case plate design. It threads into place for a positive, no-gasket seal.