

## ENGINE REVIEW



### WEBRA 91 P5 HX

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There are only a limited number of companies producing 91 size helicopter engines and this power-plant from Webra adds a bit of choice and variety for the discerning modeler. Webra of Austria specializes in the design and production of quality model aircraft engines and modeling related electronic accessories. Webra offers several versions of their '91' series engines each aimed at a different flyer and flying style (3D, FAI, sport, etc). The 91 P5HX is their 3D engine which is aimed to deliver the maximum power extraction possible from this size piston and case.

For the purposes of this review I ran the Webra 91 P5HX in conjunction with a Curtis Youngblood MPII. Our test model was the popular Raptor 90SE.



#### *FIRST IMPRESSIONS*

The 91 P5HX has a very 'business-like' feel when first removed from the box. It struck me as a 'no frills' engine built to produce power. The cylinder head does not sport laser etching or any other such frivolity. The carburetor is large and clearly is intended to facilitate the movement of large volumes of fuel and air into the engine. The engine is very light for a 0.91ci (15.00cc) power plant at 590gm.

Overall, this is an engine to put in your model and use, not place in a display case.

#### *ENGINE CONSTRUCTION*

The 91 P5HX reflects continuing development work by Webra using original thinking when designing the engine. The engine is front intake, Schnurle ported, and features the proven Webra "AAR" system, consisting of an aluminum cylinder (no liner) with the "Special Coating" surface finish and a aluminum piston with steel ring. The "AAR" system is highly effective in dissipating heat from the combustion chamber to the motor's cooling fins, allowing it to develop full power safely without overheating. This is particularly the case when the liner is also eliminated. The special coating on the surface of the bore affords good wear and friction characteristics and excellent heat dissipation.



The cylinder head bolts to the engines one piece cast cylinder, which is in turn bolted to the cast crankcase. The backplate is sealed with an o-ring. The machined piston and connecting rod are connected by a heavy duty wristpin. Both the upper and lower ends of the

connecting rod are bronze bushed for reduced friction and long life. The one piece steel crankshaft is supported by two large ball bearings and has a large counterbalance and crankpin. The front end of the shaft is threaded in the traditional manner.

The carburetor is the Webra UltraMix 1064/417 design. It is sealed by an o-ring and held to the crankcase by a single pinch bolt. It is a two needle design and has proven to be very reliable. We chose to run the engine on standard 'muffler pressure' only, although I am sure the addition of a Webra Regulator as reviewed previously would not go amiss.

### *GLOW PLUG*

Although Webra glow plugs are available in selected outlets we used the locally available OS number 8 plug for all tests.

### *EXHAUST*

We chose to run the engine on the Curtis Youngblood MPII. This proved to be a good combination and produced great power over a large rpm range. The Webra uses a standard 91 size muffler bolt spacing, which would facilitate experimenting with a variety of exhausts if this was thought necessary.

### *ENGINE PERFORMANCE*

Testing was carried out in the 'real life' environment of our Raptor 90SE. The Raptor engine mount required some machining to accommodate the engine. Although we had access to a mill, some careful filing would produce satisfactory results. We found the supplied thrust washer to be a little thick which resulted in a slightly high clutch position for our liking. A 1mm thick steel washer was substituted. The crankshaft was of perfect length and the 5/16" thread size would be compatible with the vast majority of standard fans.

The Webra UltraMix carburetor requires a slightly different method of tuning to most. The high speed needle alters the mixture only near full throttle opening – perhaps 80-100 percent. The idle and hover mixtures are adjusted using the hover needle, and there is no idle mixture as such. We found the needles easy to adjust. It is important to only set the high speed needle at full throttle and then set the hover mixture using the hover needle. There was some leaning of the hover mixture as the high speed needle was bought in from its rich running-in setting, but this was easily corrected by richening the hover needle as required.

Webra claims a peak power output of 3.63hp, and a rpm range of 2000-16000. Webra engines are designed around no or low nitro fuels. Few people outside Europe use no nitro so we chose to run the engine on 15% nitro fuel containing 23% CoolPower oil. For the running in period we did, as recommended by Webra, run the engine quite rich using a home made brew of 20% castor oil and 80% methanol. After running about 8 liters of this fuel we switched to our standard mix above. This does seem to be a laborious process but the results speak for themselves in terms of resulting power output. Who are we to argue? From the first start the Webra 91 P5HX ran well. With the throttle at idle, attach the glow igniter, and a quick burst with the starter and the engine would come to life each

time. The engine has a nice smooth transition from idle to full power. It holds a nice consistent top end rpm setting. Even without a regulator there is no perceivable mixture change from full tank to empty.

Webra does include a selection of cylinder head gaskets to allow for a variety of nitro contents in the fuel. We found the standard installed gasket to work perfectly with our 15% fuel mix. In fact, the glow plug looks like new after now some 16 liters of fuel through the engine.

#### *IN USE – 3D PERFORMANCE*

With the engine run in and tuned it was time to see how it would perform under the harsh strain of serious 3D flight. Webra recommends a gear ratio of 1:8.4 to 1:8.8 for this engine. We tried several gear ratios around this range and the motor seemed to be happy through a wide power band. A convenient ratio for some would be 1:8.27 as is popular with some other engines. The Webra was happy with this ratio also through a wide range of head speeds. Again, after the run-in period we used a ‘RevMax’ governor and different head speeds of 1750 to 1900 RPM. Even poor cyclic and collective management resulted in hardly a change in engine note. All this on only 15% nitro.



The MPII was, as expected, well matched to the engine.

#### *FINAL THOUGHTS*

This is an impressive engine and I am completely happy with its quality, performance and operation. If you are considering an engine of this size range for your next helicopter, or wish to add new life to your current machine, this is an engine to look at. Webra engines are available from many on-line retailers throughout the world.

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