O.S Max-61RF ABC-P Hanno Special

O.S. MAX .61RF ABC “HANNO SPECIAL”

RCM PRODUCT REVIEW

By Clarence Lee

Imagine that most of the readers of RCM and these engine reviews are pretty familiar with the name Hanno Prettner. A citizen of Austria., Hanno Prettner has won the FAI World Aerobatic Championships six times, taken the top money at the Circus Circus Tournament of Champions eight out of nine times (not competing once when his aircraft did not meet the rules requirement) and won many of the top pattern competitions in Europe. Recognizing the selling power of a name personality and his endorsement of their product, O.S. Engines made arrangements with Hanno Prettner to use his name in conjunction with a specially modified version of their Max-61RF ABC-P (pump) engine to be appropriately named the "Hanno Special” our review engine for this month. The Hanno Special is a limited production engine with each engine selectively hand fit and assembled, and individually numbered our review engine bearing the number 11.

Production manufacture of individual engine parts calls for very close tolerances phis or minus a half thousandths, plus nothing, minus half a thousandths, etc. The actual tolerance depends on the particular part and its intended usage in the engine. Some tolerances such as final grinding of the crankshaft, reaming of the con rod holes, and fitting of the piston, are held to ten thousandths or even millionths of an inch. The latest CNC machining equipment such as that used by O.S. allows even closer tolerances to be held than those used in past years.

O.S Max-61RF ABC-P Hanno Special

Tight tolerances and quality control is an area in which O.S. has always excelled setting standards for some of the other model engine manufacturers to follow. Even so, the ganging of tolerances can result in a variance between engines when assembled on the standard production line. To use closer tolerances than those normally used for model engine production would not be practical due to the additional cost involved. It might be nice to have an engine built with Swiss watch precision, but the average modeler would not be able to afford such an engine. So production compromises have to be made between tolerances and cost. As a result, if a bearing bore in the crankcase should be on the low side of the tolerance and the ball bearing on the high side of the bearing manufacturer's tolerance, the bearing fit could be tighter than what might be considered desirable. If too tight, the bearing could end up with insufficient internal clearance and be short lived. This is one of the reasons some of you have experienced bearing failure without understanding why blaming it on the fuel, rust, etc. If the crankshaft were finish ground on the high side of the tolerance and the bearing race bore is on the low side, then, again, the shaft fit could end up too tight and cause a bearing problem. This same tolerance situation also applies to rod lengths, the distance from the centerline of the crankcase to the top of the case, wristpin hole to the top of the piston, etc. When the engine is assembled by production line techniques, deck heights can vary, etc. By hand assembling an engine, the individual parts can be matched with the end result being an engine with longer life expectancy, more power, and better overall performance. This is the same basic treatment that I have been giving to engines in the K & B line with my Customizing and blueprinting procedure. This hand fitting, however, also increases the cost of the engine.

With the trend in recent years to use the higher pitch props turning at lower rpm to hold down the noise level, many of the model engine manufacturers have gone to "long stroke" engine designs to improve the engine's low end lugging power. O.S. first went to the long stroke design with their Max 61SF and RF series engines. SF and RF standing for side exhaust and rear exhaust respectively. The Hanno Special has been further modified to be run in the 9.000-11.000 rpm range with 11.000 rpm being the top recommended rpm for the engine. So let's take a look at the O.S. Hanno Special and see what additional modifications have been made to the Max-61RF to increase its low end torque and power in order to handle the higher pitch props.

The Hanno Special and Max-61SF and RF engines share the same .906" bore and .945" stroke. Any time the up and down movement of the piston (stroke) is greater than the diameter of the cylinder (bore), the engine can be considered a "stroker." Increasing the distance from the centerline of the crankshaft to the centerline of the crankpin increases the stroke of an engine. When you increase the distance between the crankshaft's centerline and crankpin, you also increase the mechanical advantage or lever action of the crankshaft when the crankpin is at the 90° position of its rotation. This results in an increase in the engine's torque and lowering of the rpm at which the engine will develop its maximum horsepower (horsepower being a function of torque times rpm). This increase in torque, in turn, allows an engine to utilize the larger propeller sizes. Larger not limited just to diameter, but pitch as well which is the situation with the Hanno Special. Quite often I receive letters from readers wanting to know if they can stroke their present engine by installing a longer rod. Stroking is a matter of increasing the crankpin throw and piston travel, not rod length.

O.S Max-61RF ABC-P "Hanno Special" parts.

O.S Max-61RF ABC-P Hanno Special

However, when increasing the stroke, the rod, in turn, has to usually be lengthened so that the piston will not hit the crankshaft counterbalance when the piston is at the bottom of its travel (BDC).

Crankcase:

The Hanno Special and Max-61RF share the same one piece pressure die-cast aluminum crankcase casting with removable back cover. However, the Hanno Special utilizes a larger diameter rear ball bearing so the bearing bore in the crankcase has been enlarged accordingly. By casting the front housing and crankcase as one piece, you have a stronger unit with less chance of distortion. You would be surprised at how much the front ends actually flex when viewed with a strobe light while checking engine rpm especially those with removable front housings. Quite often, by epoxying a removable front housing and crankcase together, the engine will pick up 300-400 rpm. Much depends, naturally, on wall thickness of the casting, etc.

Crankshaft and Bearings:

The one piece crankshaft is machined from bar stock steel, hardened, and finish ground on all bearing surfaces including the crankpin. A ground crankpin is always a very desirable feature due to closer tolerance control and better surface finish over a lathe turned finish. The Hanno Special crankshaft has been given a hard nickel plate finish for rust prevention prior to the finish grinding. After the finish grinding, the counterbalance and prop thread portions are left with the nickel finish. The counterbalance is of the constant thickness design milled away on either side of the crankpin for counterweight action. Unlike the standard 61RF engine that has had the sides cut completely away, the Hanno Special crankshaft has a .043” thick full disc section next to the rear ball bearing face that O.S. refers to as an "anticorrosion disc plate.” The counterbalance would balance out the full weight of the con rod and approximately half the weight of the wristpin. This would actually seem a little on the light side, however, the engine was very smooth for an engine of this displacement size and no undue vibration was noted.

Crankshaft, bearings, and prop drive assembly. Thin full disc section on forward portion of counterbalance shields rear bearing which O.S. calls the "anticorrosion disc plate." Woodruff Key used to drive prop drive washer. Care must be taken when changing props, not to lose.

The rpm range in which the engine operates undoubtedly playing a part here as well.

The crankshaft timing remains the same for both the Hanno Special and the standard Max 61RF, opening 35° after BDC and closing 50° after TDC. The prop thread is a 5/16”-24 rather than metric which, as I have mentioned many times, always wins points with me.

Although the Hanno Special and 61RF engine use rear ball bearings with the same 17mm (.669”) inside diameter, the Hanno Special's bearing has a whopping 35mm (1.378”) outside diameter versus the 61RF’s 30mm (1.181'*) o.d. The largest outside diameter bearing I have seen used in a .61 displacement size engine. Quite a few of the model engine manufacturers have gone to a 17mm inside diameter bearing, but none with as large an outside diameter. The Hanno Special’s rear bearing is also made of stainless steel as a rust preventative. Both engines use the same .875” o.d. x .375” i.d. (non-metric) single shield front bearing.

Piston, Sleeve, and Rod:

Up to this point the design modifications made to the Hanno Special were not ones that would particularly add power, just longevity. Now we get to the area where design changes have been made that do affect the power. The Hanno Special and standard Max 61RF are advertised

O.S Max-61RF ABC-P Hanno Special

as being ABC construction. However, rather than the brass sleeve being hard chrome plated, it has been given a hard nickel finish and would be more appropriately called ABN. There is a big difference between chrome and nickel and 1 personally believe that the proper terminology should be used so that the purchaser knows exactly which type he is getting.

Schnuerle scavenging is utilized in both engines with a single transfer port on either side of the divided exhaust port and a single boost port opposite the exhaust. Whereas the 61 RF has an exhaust duration of 142°, the Hanno Special's exhaust has been raised approximately .027" for a duration of 150". This is actually very conservative exhaust timing for a tuned pipe engine. However, this does play a part in the engine's low end lugging ability. Higher exhaust timing would also favor higher rpm operation. A further modification to the exhaust port has been the addition of notches at each outside corner (see photograph). This is atorque increasing mod first used in competition motorcycle engines and. to my knowledge, was first utilized in a model engine by K & B in their 6.5 and 7.5 engines. The transfer port and boost port timing remain the same at 114° and 104° respectively for the Hanno Special and standard 61 RF, however, the width of the Hanno Special boost port has been increased from the 61RF's .415" width to .495". Both engines share the same high silicon aluminum piston machined from a casting, 6mm o.d. tubular steel wristpin retained in the piston by wire snap rings, and con rod machined from aluminum bar stock and bronze bushed at both the crankpin and wristpin ends.

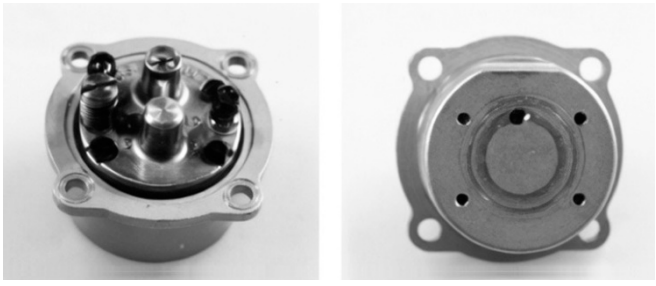
Cylinder Head:

The Hanno Special head has been machined from bar stock aluminum rather than a die-casting, as in the case of the standard 61 RF, and has been given a bright red anodize finish. The combustion chamber shape remains the same, being that of a flat bottomed bowl with a highly angled squish area. The measured combustion chamber volume to the bottom of the glow plug hole was exactly .9cc, the same as the 61 RF. However, due to the later closing of the exhaust port, the compression ratio works out a little lower for the Hanno Special (8.67:1 versus 8.99:1 for the 61RF). The slightly lower compression ratio actually benefits lower rpm, larger prop lugging ability without preignition.

Front and rear views of O.S. diaphragm actuated PD-05 pump. Four outer holes are bolt holes that hold pump together. Center hole cut at an angle to pump face actuates pump diaphragm. Note polish pattern from rod. Rod passing diaphragm hole actuates pump diaphragm as well as up and down pressure impulses of piston.

Carburetor and Pump:

O.S. uses what they call their 6P (pump) carburetor on the engine. This is a single needle, rotating barrel, mixture control type with idle mixture adjustment being by means of a small eccentric screw on the fuel inlet side of the carburetor body.
Rather than a steel barrel, an aluminum barrel is used that has been given O.S.'s hard nickel surface treatment.
The standard Max-61RF that we have for comparison is a non-pump equipped version. I was surprised to find that the pump carburetor used on the Hanno Special has a smaller throat diameter than that used on the standard non-pump engine. 9mm (.354") versus 9.5mm (.374"). Usually, with a pump equipped engine you use a larger throat size.



O.S Max-61RF ABC-P Hanno Special

Front and rear views of O.S. 6P (pump) carburetor. Carburetor in conjunction with pump performed flawlessly.

Larger throat sizes do benefit higher rpm operation and at the rpm the Hanno Special operates, a large throat size is not required. Although the use of a pump does allow the use of a larger intake carburetor, the main purpose of the pump is for non-critical fuel tank location and more constant engine runs through maneuvers. With a pump you do not have to set the engine oft rich at the beginning of the flight to compensate for a leaning tendency towards the end thus having more available power from the beginning.

The PD-05 pump is the diaphragm type operated by variations in crankcase pressure similar to the Perry pump. One thing was noted, however only one hole drilled at an angle to the pump face supplies pressure impulses to the pump diaphragm. The hole is positioned directly in line with the crankpin and big end of the rod. It would appear that action of the rod passing the opening would also be applying pressure surges to the pump diaphragm.

The pump includes a regulator section but the pressure has been factory' set and cannot be adjusted. This is actually a good thing because too often fellows fool with the pump pressure adjustment needlessly when they have a carburetor or fuel related problem and 99% of the time the pump is not at fault!

Tuned Pipe and Header:

Due to the lower rpm operating range of the Hanno Special, a longer pipe length is required. The engine comes equipped with a longer 170mm length header but the tuned pipe has to be purchased separately. O.S. has designed a tuned pipe especially for the Hanno Special that is slightly longer in length than the standard O.S. tuned pipe, with the Hanno Special pipe sporting a bright red anodize finish to match the head. Internally the tuned pipe has several baffles (hard to count when looking down the neck) to help lower the noise level.

UP: Shallow, flat bottom, bowl shaped combustion chamber with high angle squish area used. Head machined from bar stock aluminum rather than a casting and given a bright red anodized finish. Down: Hanno Special uses an extra long header pipe. Elongated mounting bolt holes would allow use on other engines as well.

O.S Max-61RF ABC-P Hanno Special

In actual operation the pipe was very broad ranged and completely non-critical in adjustment. In fact, after a little experimentation with pipe length.
I decided to leave the pipe length set at the recommended starting length specified in the operating instructions for all of the prop testing. This was 175mm from the exhaust flange to the start of the pipe neck.

Performance:
O.S. recommends that a fuel containing 5% to 30% nitromethane and at least 18% lubrication, either castor or synthetic to be used in the engine. Our testing was conducted with our standard test fuel composed of 18% Klotz KL-200, 2% castor oil, 10% nitromethane, and balance methanol. As mentioned previously, the tuned pipe length was set at O.S.'s recommended 175mm length from the exhaust flange to start of the tuned pipe neck. This makes the distance from the glow plug to the start of the maximum diameter section of the pipe 16 3/4". Recommended propeller sizes are 12 to 12 1/2" diameter x 10 or 12 pitch for wood props and 12 x 10 to 14 for the glass fiber type. I couldn't come up with a 14" pitch glass prop locally but figured I had enough sizes to check out the engine's potential. Zinger does not make an 11 x 12 so we used one of the new APC glass fiber props that are rapidly gaining acceptance among the competition pattern fliers. A 12 x 10 APC was also tested to see how it compared in rpm with the Zinger 12 x 10. Following our standard 30 minute break-in period as outlined in the November '89 Engine Clinic column, the following figures were recorded. The glow plug was an O.S. #8 that accompanied the engine. 1 am always glad to see a glow plug accompany an engine. Many engine manufacturers do not include a glow plug with their engine. You do not buy an automobile without spark plugs so why should our model engines come without glow plugs? The temperature of the day was 68°F, the relative humidity was 45%, and the barometric pressure 30.01" of mercury.
Nice running conditions.

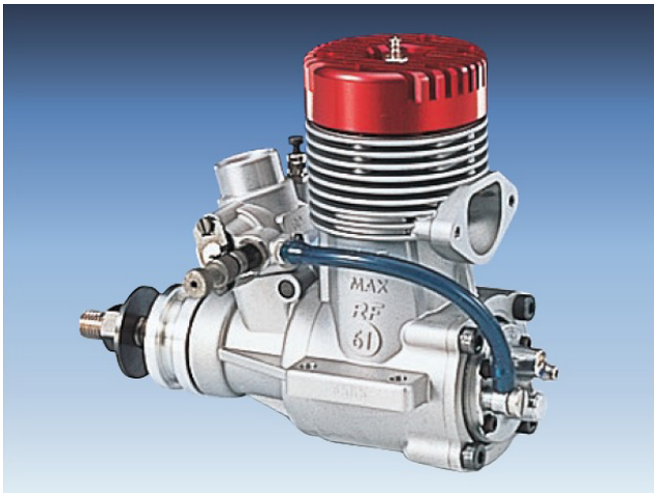
11x8	Zinger	12.500
11 x 10	Zinger	11.400
11 x 12	APC	11.000
12 x 8	Zinger	11.500
12 x 10	Zinger	10.400
12 x 10	APC	11.100
12 x 12	Zinger	10.300
13 x 10	Zinger	9.500
14 x 6	Zinger	11.000

As can be seen by the preceding figures, the Hanno Special is a real stump pulling power house. I thought I had enough variety in prop sizes to load the engine down. Wrong! The engine has a flat torque curve about like an electric motor. It wasn't until installing the 13 x 10 that I could get the engine below 10.000 rpm and we are talking major wood here. The 13 x 10 is actually a little large in diameter for most pattern type aircraft. The 14x6 has always been the prop used to check an engine's low end lugging power in the past so it was used to give a comparison with previous engines. Few .60 displacement size engines have ever turned this prop over 10.000 rpm and the Hanno Special exceeded this by a good 1.000. This makes the Hanno Special the strongest pulling .60 size engine I have tested to date in the 10.000-11.000 rpm range. This should be qualified by saying that the Hanno Special is the only long stroke .60 size engine I have tested to date. All the other 60's have been of conventional bore/stroke ratio intended to develop their maximum horsepower at higher rpm. How some of the competition's long stroke 60's would compare I cannot say at this time.

The overall handling could not have been better. The engine fired and took off running first flip of the prop out of the box following choking and connecting of the starting battery. Subsequent restarts, hot or cold, were always one or two flips. At no time did I have to flip the prop more than three times for the engine to take off running. Very impressive. The engine would hold a nice steady, reliable 1.950 rpm idle with the 12 x 12 Zinger and amazing 1.600 rpm with the heavier weight 12 x 10 APC. Acceleration was instantaneous. Those responsible for the development of the Hanno Special sure did their

homework. You could not ask for a better handling and performing engine.

The Hanno Special has been developed strictly for the serious competition pattern flier. All this long legged horsepower does not come cheap, however. The engine lists for $499.95, but Tower Hobbies, the retail subsidiary of Great Planes Model Distributors has the engine listed for $339.99 in their catalog at the time of this writing (mid April). If you are a serious competition pattern flier and want to increase the performance of your aircraft, the O.S. Max-61RF Hanno Special will do just that! □



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