INSTRUCTIONS FOR
O.S. MAX-61RF ABC "HANNO SPECIAL" ENGINE

IMPORTANT:
Before attempting to operate your engine, please read through these instructions so as to familiarize yourself with the controls and other features of the engine. Also, pay careful attention to the recommendations contained in the "Safety Instructions and Warnings" leaflet enclosed.

The O.S. MAX-61RF ABC is a high-quality, high-performance, long-stroke type, two-stroke-cycle engine and this new "HANNO SPECIAL" version is a replica of the specially modified engine with which Hanno Prettner won the 1989 FAI World Championship for radio-controlled aerobatic (F3A) aircraft.
The demands of current world class F3A competition include the need to conform to new noise limitations, which mean that engines must now deliver higher torque at lower operation r.p.m. (corresponding to ground revolutions of between 9,000 and 11,000 r.p.m.) in order to drive larger, higher-pitched propellers. The "NANNO SPECIAL" has been specifically developed to meet these requirements and also takes into account the need to achieve greater durability through improved resistance to the crankshaft and main ball-bearing corrosion that may occur under the severe operating conditions of highly competitive FAI turnaround aerobatic flying.
The "HANNO SPECIAL" is equipped with a new O.S. Type 6P carburettor and O.S. Type PD-05 diaphragm fuel pump, specially developed for this engine. This fuel system provides stable power and consistent throttle response at all times, irrespective of fuel tank location or aircraft attitude.
The "HANNO SPECIAL" is an engine for experts and, in order to achieve the levels of performance of which it is capable, it is vitally important to correctly match the propeller and tuned exhaust system to the engine's operating characteristics. If propeller size and/or silencer length are incorrect, the engine may actually produce lower performance than that of a conventional standard engine. Therefore, please read all the following instructions carefully.
The "HANNO SPECIAL" is a "limited edition" model and each engine is stamped with a serial number. Please state the serial number of your engine if you have occasion to make any enquiry about it.

SPECIFICATIONS

Displacement	9.97cc (0.609cu.in.)
Bore	23.0mm (0.906in.)
Stroke	24.0mm (0.945in.)
Weight	584g (20.62oz.)
Shaft Thread	UNF 5/16"-24

INSTALLATION
With any single-cylinder engine, it is preferable to bolt the engine firmly to a body that has as much mass as possible, in order to minimise loss of power due to engine movement through vibration. However, the vibration that is transmitted through the fuselage of an aircraft may, dependent on the airframe construction, generate considerable resonant sound.
For F3A competition purposes, in order to reduce this vibration induced extra noise, it is now common to use a so-called "soft mount", e.g. to insulate the engine mounting from the actual fuselage structure with a resilient material (e.g. rubber) in the form of grommets, bushes or buffers.

- **Power loss**
  When a soft mount is used, full-throttle power output may be reduced by the equivalent of 300 to 600 r.p.m. under load, depending on the flexibility of the mounting. It is desirable, therefore, to select a degree of rigidity that will provide a reasonable compromise. The softer the mount used, the better the noise reduction achieved — **but at the expense of greater power loss.**
- **Throttle linkage**
  When the engine is throttled down to idling speed, vibration amplitude, with a soft mount, is considerably increased and this can result in fluctuation in the throttle opening and erratic operation if the idle position of the throttle rotor depends solely on the linkage to the servo. Therefore, it may be advisable to use the throttle stop screw on the carburettor, to positively fix the idling position. Remember to allow for some light spring compression in the throttle linkage travel, so as to avoid stalling the servo at the end of the throttle movement.

Note: Fixing the idling setting with the throttle stop screw, will also mean that the engine cannot be stopped by retarding the throttle control trim lever on the transmitter.

- **Installation of tuned silencer and exhaust header pipe**
  When a tuned silencer is firmly secured to the fuselage, engine vibration will impose considerable strain on the exhaust header pipe and, in extreme cases, the header pipe may be damaged. It is advisable, therefore, to insert some resilient material in the mountings for the exhaust system, also.
- **Installation of cowling, etc.**
  When a soft mount is used, the engine may vibrate more than expected. Make sure that the engine and spinner do not touch the fuselage or cowling, otherwise, over heating, additional noises and unreliable idling etc., may be caused.
- **Securing the engine**
  Be sure to secure the engine to the mount firmly, using 3.5mm steel screws, such as Allen type, with locknuts.

FUEL TANK
If the fitting of the "klunk" type fuel pick-up weight in the fuel tank is incorrect, the weight may stick to the tank wall, resulting in an irregular fuel flow to the carburettor, or, alternatively, in the fuel flow being cut off during the course of sharp aerobatic manoeuvres.

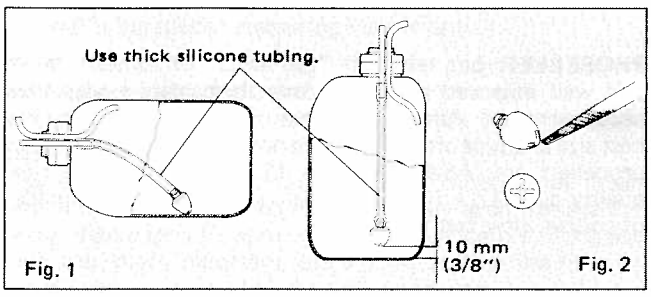

Fig. 1 Fig. 2

Therefore, it is advisable to make slots in the end of the weight, with a file or hacksaw blade, as shown in Fig. 2. Thoroughly wash out the weight to remove any minute particles of metal before reinstalling it in the tank.

- **Piping**
  For piping, use heavy duty silicone tubing of approximately 2.5mm bore and 5mm outer diameter. It is advisable to secure connections with commercially available tube clips.
  Tube lengths should be kept as short as possible. Take care not to cause any kinks in the "plumbing".

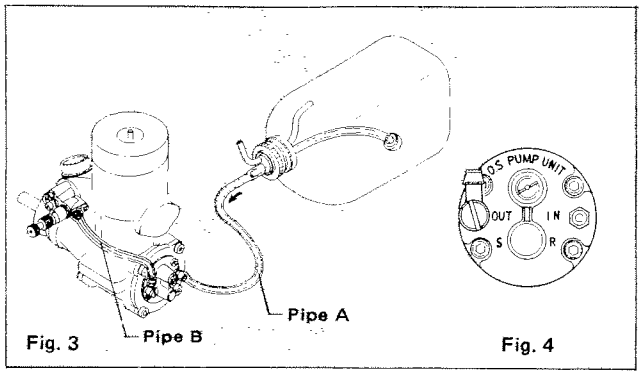

Fig. 3 Fig. 4

Pipe A: To draw fuel from the tank to the pump.
Pipe B: To deliver the fuel from the pump to the carburettor.

- **Installation**
  Here is an example of a typical installation. A muffler pressurized fuel feed is not required.
  It may be convenient to lead the pipes outside the fuselage and connect with approx. 35mm (1-½") length of silicone tubing, as shown.

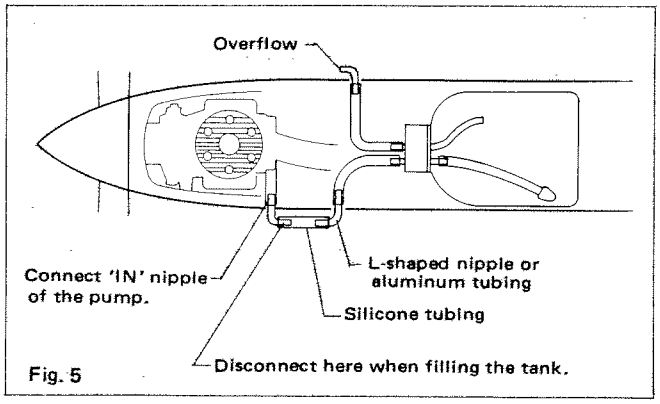

Fig. 5

When filling the tank from any position other than that shown in the sketch, be sure to pinch the silicone tube with a clip on the pump side to prevent fuel entering the pump.

GLOW PLUG

Since the suitability of the glowplug can have a considerable effect on performance and reliability of the engine, it is suggested that the user selects the R/C type plug found most suitable after practical experiments. Recommended O.S. glowplug is No.8.

PROPELLER

Use well balanced propellers only. Unbalanced propellers cause increased vibration and loss of power. Determine the best size and type after the engine has been run in. Suggested propellers are 'ASANO' 12 to 12-½ x 10 to 12 or high quality glass 12 x 10 to 14. Final selection should be made, of course, after test flights.

FUEL

Use a good quality commercial fuel containing 5 to 30% nitromethane and more than 18% lubricant. Lubricants can be either castor oil or synthetics provided that they are always of the best quality. Start with a fuel containing 10% nitromethane, and increase or decrease the nitro content if necessary.

TUNED SILENCER

This engine develops its full potential only when a suitable tuned silencer is used. In other words, in order to extract sufficient power to perform the F3A pattern within the lower engine r.p.m. range (below 11,000 r.p.m.) and enable the model to meet noise level requirements, accurate matching of engine and tuned silencer is essential. For optimum results, please observe the following:
A specially prepared O.S. tuned silencer (Type T-4010, Code No. 72101120) is available as an optional extra part. It is designed to provide optimum matching with the engine at lower r.p.m. For this reason, it is a little longer than a standard tuned silencer.
Here is an example of a combination with which maximum performance is obtainable at around 9,500 r.p.m. You may, of course, use other combinations, but it is recommended to refer to this combination as a starting point.

Propeller	'ASANO' DN 12×11-½ to 11-¾
Fuel	Commercial good quality fuel (10% nitromethane)
Exhaust Header Pipe	Length from the exhaust – 170mm (see Fig. 6)
Tuned Silencer	O.S. Type T-4010
Header Pipe Length	175mm (see Fig. 6)

Note: Hereafter, **header pipe length** means the length from the engine's exhaust flange to the entrance of the tuned silencer.

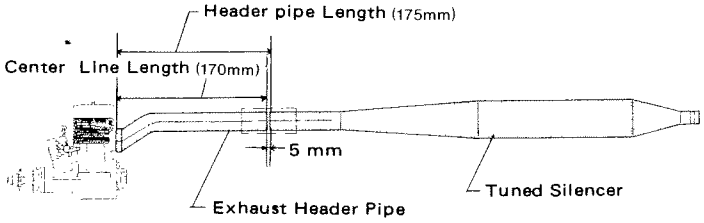

Fig. 6

- **Adjusting header pipe length**
  For other combinations or conditions, set the header pipe length as follows.
  (Important: Make sure that the engine is adequately run-in before operating it at full throttle for lengthy periods.)
  Use the silicone tube sleeve (60 mm long) supplied with the O.S. T-4010 tuned silencer (or approximately 70mm of similar silicone tube) and connect the tuned silencer and the exhaust header pipe together so that the header pipe length is as long as possible.
  Start the engine, open the throttle and measure the maximum r.p.m. at which the engine runs steadily for a lengthy period. Then shorten the header pipe length by 10mm and measure r.p.m. again. Repeat this procedure, checking r.p.m. each time, until no further increase in speed is recorded.

Note: Be sure to use the same fuel and propeller while making these checks.

From this measured data, you will find a range of header pipe lengths through which r.p.m. do not vary so much. Set the header pipe length at the center of this range as an optimum setting. (See Fig. 7)
If the measured data appear as in (A) or (B) in Fig. 8, the header pipe length is set too far off the optimum setting. It will be necessary to change the propeller or the header pipe length.
In the case of (A), the header pipe length is too long, and the needle-valve adjustment range, where the maxi-

mum r.p.m. are obtainable, is broad. In this case, shorten the header pipe length.
In the case of (B), the header pipe length is too short. The needle-valve adjustment range at maximum r.p.m. is narrow, and the maximum r.p.m. will tend to vary too much in the air, especially the r.p.m. build-up when the load decreases. Also, power tends to drop off excessively against increased load in the air. To correct this, increase the header pipe length.

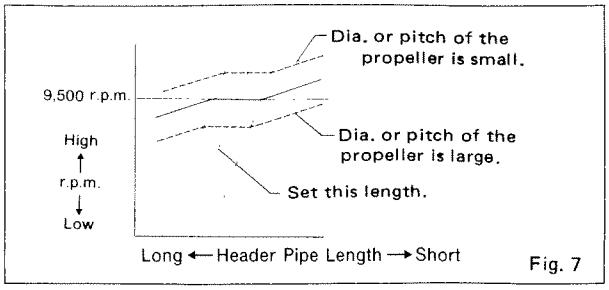

Fig. 7

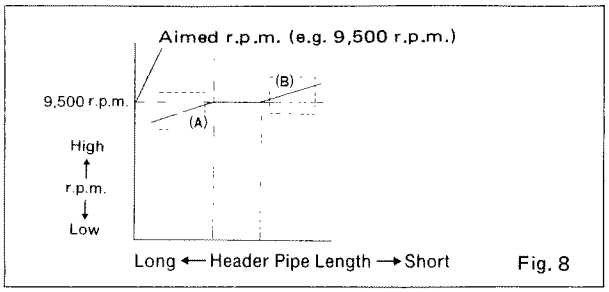

Fig. 8

Note: Engine r.p.m. on the ground are different from those in flight because of less wind flow to cool the engine and tuned silencer. Therefore, optimum header pipe length should be decided by actual flights.
The power absorption of individual propellers of the same size (dia. and pitch), even from the same manufacturer, may vary quite markedly. This can cause r.p.m. to vary between 300 and 500 with standard propellers and 100–200 with high quality propellers. Therefore, it may be necessary to readjust the header pipe length when a new propeller is fitted. Be sure to check the r.p.m., in addition to the balance and pitch of the propeller, before using it for flight.

If the header pipe length is not set properly, the engine will not only fail to develop its full performance but may also be damaged.
If you wish to further reduce sound level, to meet extra severe noise regulations, a larger (or coarser pitch) propeller may be fitted to lower operating r.p.m. It will, of course, be necessary to increase the header pipe length accordingly. Increasing the header pipe length by 10mm corresponds to a reduction in operating speed of approximately 200 r.p.m.
Because noise generated by the engine and propeller becomes louder as the r.p.m. increase, it is envrionmentally desirable to run engines at reduced r.p.m. for quieter operation, whenever possible.

RUNNING-IN ('Breaking-in')

This is an ABC type engine and running-in is required. Use a fuel containing 20% lubricant and not more than 10% nitromethane.

- **Needle-valve setting for starting**
  Open the needle-valve one and one-half turns from the fully closed position. When using the optional fine-tapered needle supplied with the engine, open the needle-valve approx. two turns.
- **Bench or ground running**
  Preferably, use a propeller of slightly lower pitch than the one intended for actual flight. Start the engine and open the throttle. Close the needle-valve gradually and allow the engine to run at its maximum r.p.m. for just one or two seconds, then immediately reopen the needle-valve a half-turn and run the eingine with this rich mixture for 5 to 6 seconds. Repeat this procedure until the fuel tank is empty.
- **Idling adjustment**
  Start the engine with the needle-valve setting at the original starting position. Close the needle-valve gradually and set it at 1/8 to 1/4 turn opened from the maximum r.p.m. position. Adjust the idling with this needle-valve setting.
- **In-flight running-in**
  During the first 3 or 4 flights, try to avoid successive nose-up manouvres. Since, during running-in, the engine tends to overheat, set the needle-valve carefully so that the mixture is always slightly rich. If the mixture becomes lean during a nose-up manoeuvre such as a loop, open the needle-valve 1/8 to 1/4 turn. If the engine becomes too rich during level flight with this needle-valve setting, increase the header pipe length 10 to 20mm and re-set the needle-valve. At least 15 to 20 flights are required for the completion of running-in. Note that the engine may develop its full performance only after running-in is completed.
- **Compression ratio adjustment**
  The "HANNO SPECIAL" is fitted with a 0.4mm aluminium cylinder-head gasket. If the exhaust note "crackles" (which sometimes occurs under certain atmospheric conditions, especially when a high-nitro fuel is used), carefully remove the cylinder-head and fit one of the two extra gaskets supplied, to lower the compression ratio. Two spare gaskets are included with the engine: a standard one (0.4mm aluminium) and a thinner one (0.2mm brass) to enable the user to determine, by practical experiment, how much to lower the compression ratio.
  Note: When a refitting the cylinder-head, take care to tighten the head screws correctly, i.e. in a diagonal sequence, a few degrees at a time.
- **Needle-valve sensitivity**
  If the needle-valve adjustment is found to be too critical when using the needle fitted to the engine, this may be replaced with the optional, less sharply tapered needle (Code No. 27681900), to de-sensitize adjustment.

Notes: It is important to be able to run the engine on a rich mixture during the break-in period to avoid overheating. If the fuel/air mixture does not become sufficiently rich, even when the needle-valve is opened more than 3 turns, first check that the carburettor has not become clogged with dirt or fluff. Also check that the fuel tubing has not become holed or split and that the fuel pick-up weight is not sticking to the tank wall. (See previous reference to 'FUEL TANK'.) If the engine cannot be persuaded to run rich after checking the above, it is possible that a fault has developed in the pump. In this case, consult the O.S. engine distributor in your country.

As the running-in proceeds, a slightly different idling mixture will be required for best carburettor performance. Therefore adjust the mixture control valve accordingly. During the first few (running-in) flights, the engine may sometimes stop because the carburettor adjustments have yet to be finalised at this stage. Be prepared, therefore, to make an emergency landing at this time.

PD-05 FUEL PUMP – WARNING!

Never disassemble the pump
Once the pump is dismantled, its original performance may not be restored.

Never move the screw on the pump
This is precisely adjusted at the factory. If the screw is disturbed, it cannot be re-set at its optimum position without using special measuring instruments.

Never attempt to "clean-out" the inlet and outlet nipples with a sharp instrument, such as a pin or thin wire
This will damage the pump and render it inoperative.

Use fuel filters
Any foreign matter entering the Pump System may interfere with its correct functioning and may even damage the pump diaphragm. Be sure to filter all fuel before filling the tank and, most important, use a good quality fine filter in the delivery tube between the tank and pump.

MAINTENANCE

As noted above, foreign matter in the fuel used may cause malfunctioning of the pump and/or carburettor. Be sure to use a high quality fuel filter between the refuelling can and fuel tank. The O.S. Super Filter (L) is available as an optional extra part. The Super Filter (L) is fitted inside the fuel can at the outlet and has a special double filter element to ensure that the fuel tank is always supplied with clean fuel.

Be sure to check the carburettor at least once every 30 flights. Remove the needle-valve holder from the carburettor, using the appropriate hexagonal wrench supplied with the negine, and extract any foreign matter that may have lodged in the threaded part of the carburettor body. Minute particles of foreign matter may upset mixture strength, so that engine performance becomes erratic and unreliable. Remember that obstruction to fuel flow may also cause the engine to become overheated, resulting in internal damage.

If, after use, the fuel system is left unattended for a lengthy period, there will be a tendency for the methanol content of the fuel to evaporate sufficiently for the oil content to "gum" the internal parts of the pump. Therefore, it is advisable, at the end of the day's flying, to empty the fuel tank, invert the engine, and pump out the remaining fuel in the system by rotating the propeller until no more fuel is ejected from the carburettor.

If the pump is not in use for a while (more than one month), remove the pump and wash out its interior by injecting methanol through the "IN" nipple. Fit the sealing caps (provided) to the nipples, after draining out the methanol.

Note: Kerosene will cause swelling and rapid deterioration of the fuel tubing. Do not, therefore, use kerosene for cleaning this engine.

PARTS LIST

Code No.	Description	Code No.	Description
27801020	Crankcase	27713000	Screw Set
27702040	Crankshaft	27714000	Gasket Set
27803010	ABC Cylinder & Piston Assembly	46120000	Thrust Washer
27704020	Cylinder Head	26731002	Crankshaft Ball Bearing (F)
27705000	Connecting Rod	29030010	Crankshaft Ball Bearing (R)
27806000	Piston Pin	27882000	Carburettor Complete (Type 6P)
26617004	Piston Pin Retainer	29081719	Carburettor Retainer (with nut)
27708000	Drive Washer (with Woodruff key)	72505000	Pump Unit PD-05
29008219	Woodruff Key	*72101120	Tuned Silencer (Type T-4010)
28009002	Propeller Washer	*72101241	Exhaust Header Pipe (L)
45010002	Propeller Nut	*50804000	Super Filter (L)

*Optional extra parts

CARBURETTOR PARTS LIST

Code No.	Description	Code No.	Description
27882000	Carburettor Complete (Type 6P)	27681340	Mixture Control Valve Stopper
27882100	Carburettor Body	27881330	Mixture Control Screw
25481200	Carburettor Rotor	27881120	Plug Screw
27381900	Needle Valve Assembly	27881400	Throttle Lever
26781620	Throttle Stop Screw Assembly	22681953	Fuel Inlet
27882300	Mixture Control Valve Assembly	29015019	Carburettor Rubber Gasket

The above specifications are subject to change without notice for improvement.

CARB "O" RING PT #

① 05MG 7399

② 7348 LARGE

③ 7355 NEEDLE O RING

④ 7357 SMALL

O.S. ENGINES MFG.CO.,LTD.
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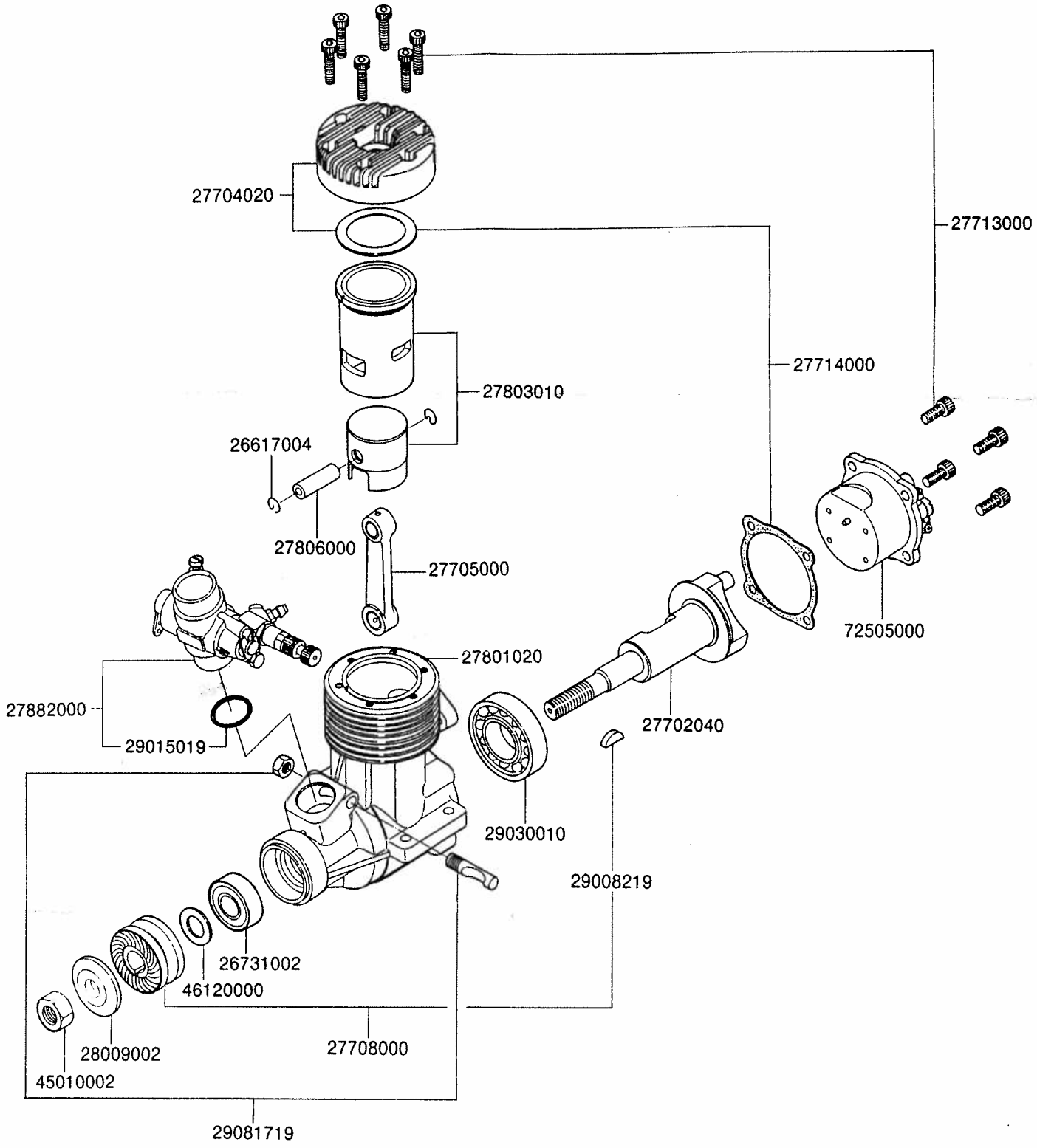
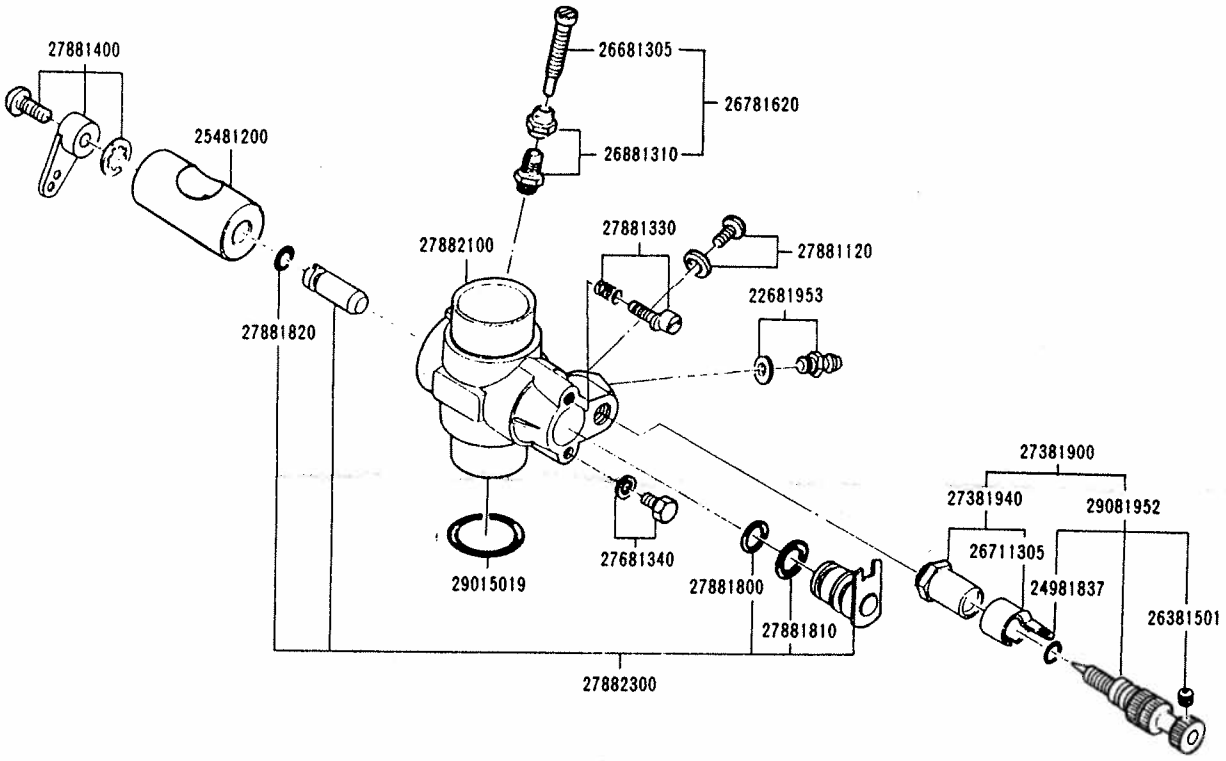


MAX-61RF ABC
"HANNO SPECIAL"
(17804)

TYPE 6P

27882000



INSTRUCTIONS FOR THE O.S. T-4010 TUNED SILENCER

This tuned silencer is specifically prepared for the MAX-61RF ABC "HANNO SPECIAL" engine. It is designed for the engine to develop maximum performance at the relatively lower engine r.p.m. range (below 11,000r.p.m. which enables you to gain noise bonus point).

Here is an example of the combination with which maximum engine performance may be obtained at around 9,500 r.p.m. While you may use other combinations, O.S. recommends that you refer to this combination as a starting point.

Propeller	:	'ASANO' DN 12 x 11-1/2 to 11-3/4
Fuel	:	Commercial good quality fuel (10% nitromethane)
Exhaust Header Pipe	:	O.S. Exhaust Header Pipe (L) (Code No. 72101241)
Tuned Silencer	:	O.S. Type T-4010
Header Pipe Length	:	175 mm

Note: Hereafter, header pipe length means the length from the engine's exhaust flange to the entrance of the tuned silencer.

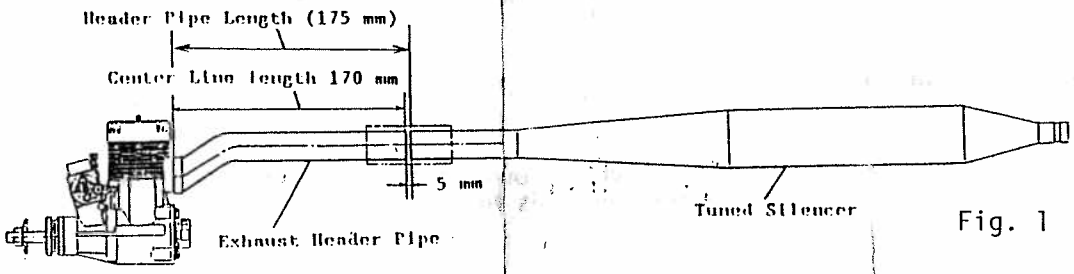


Fig. 1

In the case of other combination or conditions , set the header pipe length as follows.

Use the silicone tube (60 mm long) supplied with the O.S. T-4010 tuned silencer or an approximately 70 mm long silicone tube. Connect the tuned silencer and exhaust header pipe so the header pipe length will be as long as possible.

Start the engine and measure the maximum r.p.m. which the engine runs steadily at for a lengthy period of time. Then shorten the header pipe length by 10 mm and measure the r.p.m. again. Repeat until peak performance is obtained.

Note : Be sure to use the same fuel and propeller for each test. If either or both are altered , you will have to begin again.

According to the measured data, you will find a portion where the r.p.m. does not vary as much. Set the header pipe length at the center of this point as the best setting.

When measured data appear like (A) or (B) in the Fig. 3, the header pipe length is set far off of the ideal setting. It will be necessary to change the propeller or the header pipe length.

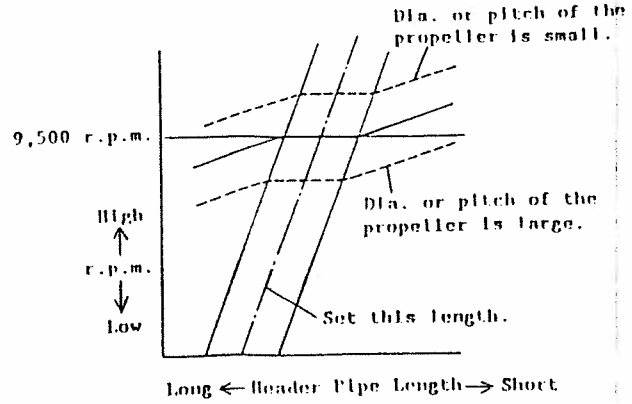


Fig. 2

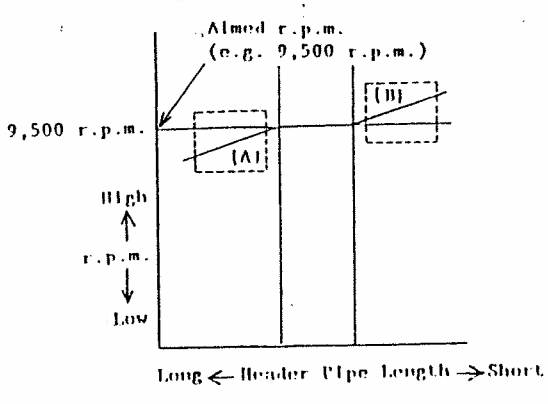


Fig. 3

In the case of (A) , the header pipe length is too long and the needle valve adjustment range, where the maximum r.p.m. are obtainable, is broad. In this case, shorten the header pipe length.

In the case of (B) , the header pipe length is too short. The needle valve adjustable length at maximum r.p.m. is narrow. The maximum r.p.m. vary when the aircraft is flown . In particular the maximum r.p.m. increases when the load decreases and the power tends to drop against the load in the air. In this case, lengthen the header pipe length.

NOTE:

The r.p.m. of each individual propeller of even the same size (dia. and pitch) of the same manufacturer may vary. With a standard propeller, the r.p.m. will vary 300 to 500 r.p.m. and with a high quality propeller the r.p.m. will vary 100 to 200 r.p.m. It may be necessary to change the header pipe length if there is fluctuation in the r.p.m. Be sure to check the r.p.m. , in addition to the balance and pitch of the propeller before using it for flight

If the header pipe length is not set properly, not only will the engine not develop full power but it will be damaged as well.

If you wish to reduce the noise level further for severe noise regulations, but the engine will require extra power to properly fly the model, it is suggested that the header pipe be lengthened thus lowering the r.p.m. Lengthening the header pipe by 10 mm will lower the engine speed by approximately 200 r.p.m.

When lowering the r.p.m. by using a larger load propeller, lengthen the header pipe from 10 to 20 mm.

The noise generated by the engine becomes louder as the r.p.m. increases. It is suggested that the engine be run at as low an r.p.m. as possible. This will allow for quieter flight.

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