LOM PRAHA
piston engines & propellers
production
Czech Air Forces pilots elementary training flights

M 337AK.1 engine & V 500A propeller
LOM piston engines
# LOM engines „C“ versions

<table>
<thead>
<tr>
<th>Engine</th>
<th>Number of cylinders</th>
<th>Displacement [dm³]</th>
<th>Take-off power [kW]/[HP]</th>
<th>Take-off RPM [min⁻¹]</th>
<th>Specific consumption on cruise regime [g . kW⁻¹.h⁻¹]</th>
<th>Weight [kg]</th>
<th>Specific kilogramme power [kW . kg⁻¹]</th>
<th>Specific litre power [kW . dm³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 132C</td>
<td>4</td>
<td>3,98</td>
<td>103/140</td>
<td>3000</td>
<td>265</td>
<td>107</td>
<td>0,96</td>
<td>25,9</td>
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<td>M332C</td>
<td>4</td>
<td>3,98</td>
<td>124/168,6</td>
<td>3000</td>
<td>265</td>
<td>113</td>
<td>1,10</td>
<td>31,1</td>
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<tr>
<td>M137C</td>
<td>6</td>
<td>5,97</td>
<td>151/205</td>
<td>3000</td>
<td>265</td>
<td>147</td>
<td>1,03</td>
<td>25,3</td>
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<tr>
<td>M337C</td>
<td>6</td>
<td>5,97</td>
<td>185/251,6</td>
<td>3000</td>
<td>265</td>
<td>153</td>
<td>1,21</td>
<td>31,0</td>
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</tbody>
</table>
LOM propellers

V-341
V-541
V-546
V-546A
V-532
Commercial partners of LOM PRAHA, Piston Engines and Propellers Division
LOM M 332C engine
LOM V-546 propeller
CESSNA 172 - Czech Republic

LOM M 332 C engine
LOM V-546 propeller
Light agricultural aircraft of Sukhoi company

with LOM M 337C engine

and LOM V 541 propeller
zlín Z 143 MAF
LOM M 332AK engine
LOM V 231 propeller
Great Lakes aircraft

LOM M 337AK engine
LOM V 546 propeller
Bücker Bü 131 JUNGMANN aircraft

LOM M 332AK engine
LOM V 231 propeller
Amphibian A25

LOM M 337AK engine
LOM V 341 propeller
LOM PRAHA s.o.e. piston aircraft engines.

1/ Foreword

Development and production of piston aircraft engines had a long and successful tradition in Czechoslovakia. In the past years were there the world famous producers WALTER, MOTORLET PRAHA, PRAGA and AVIA PRAHA. In the year 1989 the production and development of aircraft inverted piston engines and propellers for these engines were transferred into LOM PRAHA s.o.e. The in-line air-cooled inverted aircraft engines had been for a long period of time a successful industrial product of the Czechoslovak Republic as well as at the present of the Czech Republic with the high customers demand for upgraded engines with the increased power. The total number of original version engines model M 332 produced was 1323 pc, model M 337 2737 pc and their upgraded derivatives have been still produced.

2/ LOM PRAHA s.o.e. history.

The history of LOM PRAHA enterprise goes back to the date 5.10.1915 when the production of the first aircraft engine at the aeronautical department of the firm BREITFELD-DANĚK was finished. It was the engine type HIERO produced under the license of Vienna firm WARSCHALOVSKI & EISLER. The production of the own construction engine commenced after the independent Czechoslovak Republic came into existence in the year 1921. The engines produced under the trade mark PRAGA with their technical parameters and quality level successfully compete with the best English and French products.

The further production expansion started after the firm BREITFELD-DANĚK and ČKD concern fusion in the year 1927. In spite of the economic stagnation at the beginning of the 30th, the years 1918 – 1938 were extremely successful for aircraft production development. The repairs of the German engines JUMO and ARGUS were involved into the production program during the Second World War.

In the year 1942 the assembly lines and testing facilities were transferred on the south of Prague named Malešice into the new premises. So was the basis of the contemporary enterprise LOM PRAHA s.o.e. established. The basic factory at Prague – Liben was destroyed after the anglo-american air raids in the year 1945 and the only part of aeronautical department remained in Malešice which has gradually developed into the modern repair and production aeronautical plant. The production program during the post war years covered the repairs of engines Argus 410, 411, Jumo 211, Merlin and Continental for prize of war aircraft SIEBEL, ARADO, ME 109 and others as well as engines for the airplanes used by the Czech Army in England and in the Soviet Union.

At the end of forties and at the beginning of fifties the Czech air force went over to Soviet aircraft engineering and step by step the repairs of piston engines type AŠ-21, M-42, AŠ-62IR, AŠ-82T were introduced. At the same time the repairs of the latest Czech aircraft engines MINOR 4-III and 6-III, M-208 B and PRAGA D commenced. The introduction of these new engine type repairs required enlargement of production capacity.

The important turning point in the development of LOM enterprise was the year 1954 when it passed under the administration of Czechoslovak MOD. The goal was to fully provide aircraft engines repairs for Czech army air force as well as for other customers in Czechoslovakia and abroad. The quite new production program was the repairs and overhauls of jet engines RD-45 and VK-1 for MIG airplane. That required also a large capital construction. At the end of fifties and at the beginning of sixties the new combat aircraft MIG 19 and MIG 21 were launched together with the new Czech design and production aircraft L 29 DELFIN. These changes in the armaments involved also the introduction of repairs and overhauls of revolutionary new engines RD-9B, R-11 and M 701. The modern concept, design and technology required further
enlargement of production capacity during the years 1965 – 1970. The new assembly hall with shipping department and jet engine testing facilities at Stará Boleslav outside of Prague were constructed. Thus at the beginning of fiftieth the LOM enterprise had shaped into the current capacity. The repairs and overhauls of a new type of jet engine AL-7 for SU-7 were introduced on the break of 60th and 70th together with the repair of piston engine M 462RF for agricultural airplane Z-37 ČMELĂK. Besides the activity in repair of aircraft engines since the mid of 60th LOM enterprise carried out also the development and repairs of the ground support systems OZ-64, EZOP-4, EZOP-8, PANS-2 and other.

At the first half of 80th the repairs of the most in-line and radial piston engines were terminated except the types M 462-RF, M 137 and M 337. The same situation goes for the jet engines RD-45 and VK-1. On the other hand assortment was extended with new type of jet engines R 13, R 95S, R 29, R 33 and AL 21F3. The unique export article became the offer of the engine AI 25TL for L-39 ALBATROS airplane overhaul and upgrading.

The essential activity of LOM PRAHA since the year 1915 until 1989 were only the general overhauls of piston aircraft engines and later also jet engines.

At the end of the year 1989 based on the agreement between LOM PRAHA s.o.e. and AVIA PRAHA was production of piston engines type M 337 and M 137 at AVIA terminated and production commenced at LOM PRAHA s.o.e. It resulted in the fact that LOM PRAHA has become the bearer of documentation and a main designer.

3/The piston engine development and production at LOM PRAHA s.o.e.

By putting the signature under the delimitation agreement between LOM PRAHA s.o.e. and AVIA PRAHA and commencing of piston engines production, LOM PRAHA s.o.e. has become the main designer of inverted piston engines with the obligation to continue in development and serial production of engines and spare parts.

The first goal was to manage the aircraft engine production quality at least on the same level as by the former producer AVIA PRAHA and to work further on eliminating the deficiencies influencing the flight operation such as oil leakage and fast introduction of proper technical improvements.

After the production of essential engine parts had been adopted and production technical arrangements finished, the production of four-cylinder M 332 well known and appreciated by the airplanes L-40 Meta Sokol and Ae-145 users commenced.

The first four-cylinder engine designated M 332A was launched in the year 1992. In comparison with the original configuration it has a strengthened crankshaft case and the method of mutual camshaft housing sealing has been changed. But the oil system does not provide the back oil direction into the oil tank during the upside-down flight and this is the reason why the engine operation on this regime has been limited to 5 sec. The TC of airworthiness was issued on 30th November 1992. The derivative of M 332A has become the engine M 332AK which has no time limitation for inverted flight. The redesigned engine oil system enables, during inverted flight, back oil direction into oil tank conformable to M 337AK engine. The TC for engine M 337AK was issued on October 1994.

Further step in development of in-line air-cooled inverted engines has been the power increase for current produced engines. The result of increased take-off rpm of 10 % e.g. from 2750 to 3000 rpm has been the power gain for M 337B. Similarly for the engine M 332B rpm were increased from 2700 to 3000 rpm and power gain has been increased from 103 kW (140 HP) to 118 kW (160 HP). Usable operating times with engaged and disengaged compressor have been extended.

The significant M 337B and M 332B engines upgrading has been represented by the crankshaft front part modification. For the engines using hydraulic airscrew blades adjustment, the oil pressure distributor is attached to the engine front cover providing oil direction from the bushed crankshaft into the propeller servo. Integral part of engine modernisation has been application of oil pump with the higher delivery and a fine oil filtration. The oil pump has been modified so that pump delivery increased for about a 1/3 of total oil volume. The advantage of this modernisation resulted in higher airscrew blades adjusting speed for the hydraulical adjustable propellers. The design arrangement involved an oil pump casing too. The fine strainer equipped with the thermostatic valve was attached into the oil outlet, enabling after the oil temperature will reach 60° C oil flow through the oil cooler. The oil strainer attachment provide using of a strainer filter insert either of Czech origin, normally
used in lorries and tractors or with the engines exported to the USA and Canada and other countries.

The current trends in aircraft engine development require reduced fuel consumption and more simple engine control. LOM has advanced to the low pressure fuel injection pump improvement. The adapted pump provide a fully automatic fuel supply in dependence of flight altitude. The fuel pump main parts have not changed, upgrading was concerned to the barometric box. The extra inner pieces were added to provide the correction of fuel supply in dependence of flight altitude. The great attention has been permanently devoted to the engine operation maintenance and the time between overhaul (TBO). The engine TBO has been specified on the basis of oil used and the flight operation character e.g. whether tourist straight level flight or aerobatics. TBO for engines permanently operated on approved mineral oils:

- 1000 flight hours for common tourist operation
- 750 flight hours for aerobatic operation

TBO for engines permanently operated on approved disperse ashless oils:

- 2000 flight hours for common tourist operation
- 1400 flight hours for aerobatic operation

LOM engines have been installed on training and sport airplanes Meta Sokol, Aero 145, Morava L-200D, Z 526, Z 142C, Z 42, Z 143, Z 142MFA, Z 143MFA, V-23 Variant, or as a replacement for original engines on airplanes Bücker Bü-131 Jungmann, RV-3, Bushmaster, Stampe, Cessna 172 Skyhawk etc. During the years 2001 and 2002 TC for M 337C and M 332C has been earned. These engines are of identical design with M 332B and M 337B, except pistons. The new piston design shape has allowed to increase compression ratio from 1:6.3 to 1:7.4 and thus to increase power output (see table „Aircraft inverted piston engine production program of LOM PRAHA s.o.e.”)

The progressive way to lower the operating costs of aircraft piston engines has been successful through realisation of long term tests with autofuel BA 95N and BA 98N. To specify the use of these fuels Bulletin No M337AK/19b has been issued.

### Aircraft inverted piston engine production program of LOM PRAHA s.o.e.

<table>
<thead>
<tr>
<th>Engines</th>
<th>No of cylinders</th>
<th>Take-off Power (kW/HP)</th>
<th>RPM (1/min)</th>
<th>Measured Fuel consumption Cruise (gr/kW/hour)</th>
<th>Dry weight (kg)</th>
<th>Specific Weight (kg/kW)</th>
<th>Manifold Pressure (kPa)</th>
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<tbody>
<tr>
<td>M 337 AK</td>
<td>6</td>
<td>154/210</td>
<td>2750</td>
<td>292</td>
<td>153,0</td>
<td>0,99</td>
<td>118</td>
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<tr>
<td>M 337 A</td>
<td>6</td>
<td>154/210</td>
<td>2750</td>
<td>292</td>
<td>153,0</td>
<td>0,99</td>
<td>118</td>
</tr>
<tr>
<td>M 337 AK1</td>
<td>6</td>
<td>154/210</td>
<td>2750</td>
<td>292</td>
<td>153,0</td>
<td>0,99</td>
<td>118</td>
</tr>
<tr>
<td>M 332 A</td>
<td>4</td>
<td>103/140</td>
<td>2700</td>
<td>278</td>
<td>113,0</td>
<td>1,10</td>
<td>118</td>
</tr>
<tr>
<td>M 332 AK</td>
<td>4</td>
<td>103/140</td>
<td>2700</td>
<td>278</td>
<td>113,0</td>
<td>1,10</td>
<td>118</td>
</tr>
<tr>
<td>M 132 A</td>
<td>4</td>
<td>90/122</td>
<td>2700</td>
<td>280</td>
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<td>1,17</td>
<td>98</td>
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<tr>
<td>M 132 AK</td>
<td>4</td>
<td>90/122</td>
<td>2700</td>
<td>280</td>
<td>105,0</td>
<td>1,17</td>
<td>98</td>
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<td>M 137 A</td>
<td>6</td>
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<td>2750</td>
<td>299</td>
<td>146,5</td>
<td>1,10</td>
<td>100</td>
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<tr>
<td>M 137 AZ</td>
<td>6</td>
<td>132/180</td>
<td>2750</td>
<td>299</td>
<td>146,5</td>
<td>1,10</td>
<td>100</td>
</tr>
<tr>
<td>M 332 B</td>
<td>4</td>
<td>118/160</td>
<td>3000</td>
<td>278</td>
<td>113,0</td>
<td>0,96</td>
<td>118</td>
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<tr>
<td>M 332 C</td>
<td>4</td>
<td>124/168</td>
<td>3000</td>
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<td>0,91</td>
<td>122</td>
</tr>
<tr>
<td>M 337 B</td>
<td>6</td>
<td>173/235</td>
<td>3000</td>
<td>278</td>
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<tr>
<td>M 337 C</td>
<td>6</td>
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<td>3000</td>
<td>387</td>
<td>153,0</td>
<td>0,82</td>
<td>122</td>
</tr>
</tbody>
</table>

All above listed engines have been certified acc. to FAR 33. Beside Czech TC issued by CAA, LOM PRAHA s.o.e. engines have been reworded by German TC issued by LBA, Russian TC and Canada TC. LOM engines are very popular in USA and Canada for the use in „experimental“ category airplanes.
4/ The development and production of LOM PRAHA s.o.e. propellers

When the production of inverted piston engines was at AVIA PRAHA terminated, LOM PRAHA was forced to begin with the development and production of propellers for LOM engines. The production had started in cooperation with Aeronautical research and test institute Prague and the result was, fixed two blades wooden propeller V 231. The demand of US and Russian marketplace gave cause for the development and production and certification of propellers made of metal. The first metal propeller developed and produced exclusively at LOM was two blades fixed airscrew adjustable on the ground V 341. TC was issued on June 1996. The following type developed and involved into production program was the two blades all metal hydraulical adjustable of constant revolutions reversible and feathering airscrew V 541. TC was issued in the year 1998. In the year 2001 the development of three blades airscrew V 546, metal, hydraulical adjustable of constant revolutions, reversible and feathering was terminated and TC issued. All types of airscrews are involved in LOM production program and has been certified acc. FAR 35.

<table>
<thead>
<tr>
<th>Propeller type</th>
<th>No of blades</th>
<th>Diameter max (mm)</th>
<th>Dry weight (kg)</th>
<th>Power max (kW)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>V 231</td>
<td>2</td>
<td>1800</td>
<td>13</td>
<td>160</td>
<td>Fixed, wood</td>
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<tr>
<td>V 341</td>
<td>2</td>
<td>2000</td>
<td>15.5-17 (without shield) 19.5-20 (with shield)</td>
<td>170</td>
<td>Metal Adjustable on the ground</td>
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<tr>
<td>V 500A</td>
<td>2</td>
<td>2000</td>
<td>25</td>
<td>162</td>
<td>Metal, hydraulical adjustable</td>
</tr>
<tr>
<td>V 546</td>
<td>3</td>
<td>2000</td>
<td>32-34</td>
<td>220</td>
<td>Metal, hydraulical adjustable</td>
</tr>
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<td>V 541</td>
<td>2</td>
<td>2000</td>
<td>24-26</td>
<td>140</td>
<td>Metal, hydraulical adjustable</td>
</tr>
</tbody>
</table>

1/Producer AVIA Propellers

5/ Future upgrading of LOM PRAHA s.o.e. engines.

The trends of piston engine world development and various customers requirements, together with the EU noise restrictions have been influencing a continuous upgrading of LOM engines. At present following upgrading projects are under construction:
- gear box for 4 and 6 cylinder engines
- airscrew speed governor for LOM „driving unit“ (engine+airscrew)
- turbo-blower application on LOM engines
- development of the new type multi-cylinder engine
Résumé
LOM PRAHA s.o.e. producer of inverted aircraft piston engines has been ready to offer the customers four and six-cylinder engines with power output from 90 kW (122 HP) up to 185 kW (252HP) completed with the propellers of Ø 1750mm to Ø 2000mm. LOM PRAHA s.o.e. steadily proceed in long term tradition of inverted aircraft engines production by their permanent upgrading.

Piston engine division of LOM PRAHA s.o.e. offers and provide LOM ASSISTANCE service. The user’s hands on training including final test, issue of Certificate of maintenance and service of LOM engines and propellers can be organised just at the producer with practical training on the airfield.
Spare parts for all types of engines and propellers are being delivered to the customers to any place and in terms according to their requirements.

For any further information please write to

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