AIR COOLED PISTON ENGINES – GENERAL RULES OF OPERATION

- **PREFLIGHT SCOPE:**
  (PREFLIGHT CHECK IAW AFM AS STANDARD – FOLLOWING REMARKS ARE INFORMATIVE AND SHOULD BE CONSIDERED AS APPLICABLE).

  - ENGINE COMPARTMENT (BIRDNEST – ICE – LEAVES – GRASS).
  - OAT DETERMINES USE OF PREHEATERS (REMEMBER 80% OF MECHANICAL WEAR HAPPENS IN THE WARM UP PHASE - TEMPERATURES LOWER THAN -5°C CALL FOR PREHEATING).
  - OIL LEVEL? CONSIDER CONSUMPTION RATE (REFER TO LOG BOOK ENTRIES).
  - IS YOUR PROPELLER SAFE AND CLEAN?
  - MANIFOLD PRESSURE READING SHOULD BE EQUAL TO QFE.
  - OAT EQUAL TO ATIS TEMPERATURE?
  - ENGINE CONTROLS FREE AND EASY (FULL TRAVEL)?
  - COWL FLAPS OPEN (FOR ALL TEMPERATURE CONDITIONS)!
  - LEAKAGES (OIL – HYDRAULIC – FUEL)?
  - EXHAUST PIPE(S) CONDITION(S) TELLS YOU SOMETHING (STAINS)!
  - AIR FILTER CONDITION?
  - OIL PRESSURE BEHAVIOR DURING START (TO BE COMPARED AT SHUT DOWN).
  - UPON START CHECK FOR TWO MAGNETOS ALIVE!
  - WARM UP PHASE TO BE MATCHED TO OAT & AND CONDITIONS.
  - SYSTEM TEST IAW AFM. DO NOT RUN ON ONE MAGNETO LONGER THAN 5 sec! IN WARM CLIMATE CONDITIONS WAIT FOR TESTS UP TO GETTING TAKE OFF CLEARANCE (ONCE THE ENGINE(S) ARE HOT THERE IS NO RPM HELPING YOU TO STAY OUT OF TROUBLE – OIL TEMPERATURE WILL RAISE CONTINOUSELY WITH THE CONSEQUENCE OF LOSING OILPRESSURE).

- **TAKE OFF:**

  - IN MOST AFMs FULL POWER CHECKS ARE NOT MENTIONED AS A CHECK LIST ITEM. MORE LIKELY IT IS EXPLAINED IN THE AMPLIFIED SECTIONS OF THE AFMs. CONFIRMING THE POWER AT Vo IS A MUST (AT LEAST IN THE ROLLING PHASE)!!!
  - MINIMUM OILTEMPERATURE FOR TAKE OFF – CHECK AFM!
  - IN COLD CLIMATE (COLD OILTEMERATURE) OILPRESSURE(S) HAVE A TENDENCY TO OVERSHOOT RED LINE (OIL COOLER BURST DANGER).

- **CLIMB:**

  - CLIMB POWER IAW AFM. FIXED PITCH PROPELLER AIRCRAFTS CALL FOR FULL POWER AND RICH MIXTURE (NORMALLY UP TO 5 000ft AND NO CARBURETER HEAT APPLIED)!

- **CRUISE**

  - WHEN TRANSITION TO CRUISE POWER HAS BEEN SET, WAIT 2 TO 3 MINUTES FOR FINAL MIXTURE ADJUSTMENTS!
  - ANY POWEWRSETTING CHANGE SHOULD BE DONE SMOOTHLY AND IN PROPER SEQUENCE!
  - **DECREASING POWER** ALWAYS REDUCE MANIFOLD PRESSURE FIRST FOLLOWED BY RPM AND MIXTURE ADJUSTMENTS!!!
  - **INCREASING POWER** ALWAYS ENRICH FIRST FOLLOWED BY RPM AND MANIFOLD ADJUSTMENTS!!! DEVIATIONS FROM THESE RULES ARE VERY RARE!!!
  - COWL FLAP POSITION IAW AMBIENT CONDITIONS!!!
  - POWER SETTINGS PREFERABLY SHOULD BE 65% WITH LOWEST PROPELLER RPM TO BE CHOOSED FROM (GRAPHs).

- **DESCENT:**

  - **ANY** DESCENT SHOULD BE MADE WITH AS MUCH POWER AS POSSIBLE!!!
  - ON VARIABLE PITCH PROP AIRCRAFTS SELECT LOWEST RPM POSSIBLE (BY GRAPHs).
  - AIRCRAFTS EQUIPPED WITH EGT AND POWER SETTINGS BELOW 50% SHOULD OPERATE AT OR NEAR PEAK!
  - BUIDING UP VOLUNTARELY AERODYNAMIC DRAG ALLOWS HIGHER POWER SETTINGS TO KEEP THE CHTs IN LIMIT!

- **LANDING:**

  - THE OPTIMUM IN GOOD ENGINE TREATMENT WOULD BE SLOWLY DECREASING POWER UP TO FLARE (PROVIDED WEATHER AND TRAFFIC ALLOWS DOING SO).

- **TAXING:**

  - FURTHER COOL DOWN DURING TAXI SHOULD BE IN MIND SETTING POWER IN THIS SEGMENT OF OPERATION! ON TURBO CHARGED AIRCRAFTS KNOW YOUR SYSTEM OF EXHAUST GAS CONTROL IN THIS LOW POWER RANGE (SOME SYSTEMS FORCE ALL EXHAUST GASES OVER THE TURBOCHARGER)!!!

- **SHUT DOWN:**

  - UPON SUFFICIENT COOL DOWN CHECK BOTH MAGNETOS ARE STILL ALIVE AND DEAD CIRCUIT IS OK!!!
  - OBSERVE OIL PRESSURE DURING SHUT DOWN. NORMALLY PRESSURE DECREASES VERY RAPIDLY, IF NOT SO AIR IN THE OIL PRESSURE LINE WOULD KEEP PRESSURE FOR SOME SECONDS (MAINTENANCE REQUIRED)!

- **AIR COOLED PISTON ENGINE SPECIFIC REMARKS:**

  - IN THE WARM UP PHASE CONSIDER MASS OF OIL COMPARED TO ENGINE MASS! NEVER COMPARE THIS WARM UP PHASE WITH YOUR CAR EXPERIENCE!!! IT TAKES A WHILE TO WARM WITH THAT SMALL AMOUNT OF OIL SUCH A HUGE MASS OF COLD METAL!
  - **HIGHER THEN RECOMMENDED** PROPELLER RPMs TO EXPEDITE WARM UP IS THE WORST IDEA A PILOT CAN HAVE!!!
  - LOW POWER SETTINGS IN FLIGHT CREATE A LOT OF PROBLEMS WHICH COULD BE EASILY AVOIDED BY THE PILOT. MIXTURE CORRECTIONS (LEANER) AND LOWER RPM AND HIGHER MANIFOLD PRESSURE KEEPS PISTON RINGS IN PROPER POSITION!
  - MANY PISTON ENGINES (DOWN TO 180 HP) ARE DESIGNED WITH FREE MOVING COUNTERWEIGHTS MOUNTED ONTO THE CRANKSHAFTS. **ANY RAPID** POWER CHANGE (MANIFOLD PRESSURE OR RPM) CAUSES HEAVY TORSIONAL VIBRATIONS AND SHAKING WEIGHTS (COMMONLY REFERED AS DETUNING THE CRANKSHAFT). THIS KIND OF ABUSE LEADS TO HIGH MAINTENANCE COSTS!!!
  - **SHOCK HEATING** SETTING TO HIGH POWER TOO RAPIDLY IS ALSO VERY DETRIMENTAL AND LEADS TO PROBLEMS IN THE CYLINDERS!
  - **SHOOCK COOLING** SETTING TO LOW POWER TOO RAPIDLY IS LEADING TO OTHER SERIOUS PROBLEMS!
  - **DETONATION** – THIS KIND OF DANGER IN THE CYLINDERS CAN HAPPEN ANY TIME WHEN THE MIXTURE IS TOO LEAN AT HIGHER POWER SETTINGS (>70%).
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- **AIR COOLED PISTON ENGINE ENEMIES:**

  - POOR PREFLIGHT PROCEDURES.
  - NO PREHEAT IN COLD TEMPERATURES!!!
  - OVERPRIMING AT ENGINE START.
  - WRONG START PROCEDURES (RESTART ATTEMPT BEFORE ENGINE CAME TO STOP).
  - INPROPER WARM UP PHASE!!!
  - ROUGH PROPELLER TESTS (TOO RAPID)!!!
  - HIGH POWER SETTINGS THAN 65% IN CRUISE.
  - OPERATING IN CRITACAL RPM RANGE.
  - RAPID POWER SETTING CHANGES (SHOCK HEATING & COOLING). ENGINE WITH CRANKSHAFT COUNTERWEIGHTS SUFFER PARTICULARY.
  - TOO LESS SPEED IN CLIMB (HIGH CYLINDER HEAD TEMPERATURES).
  - IMPROPER MIXTURE SETTINGS (EITHER TOO RICH OR TOO LEAN).
  - TOO LESS POWER IN DESCENT PHASE
  - HIGH RPM AND LOW MANIFOLD PRESSURE IN DESCENT PHASE.
  - ACTUAL SINGLE ENGINE TRAINING WITH SUBSEQUENT RESTART IN AIR.
  - OVERSHOOTING RPM LIMIT (FIXED PITCH PROP).
  - SHORT FLIGHT DURATIONS.
  - IMPROPER COOL DOWN PHASE.
  - WRONG OIL GRADES AND SPECs.
  - OVERSHOOTING OIL CHANGE INTERVAL (EITHER HOURS AND/OR CALENDER LIMITS).
  - WRONG FUEL SPECs (MOGAS IS NOT RECOMMENDED BY SERIOUS TECHNICIANS)!!!
  - POOR AIR FILTER CONDITION.