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AERONAUTICAL RECOMMENDED PRACTICE

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HORSEPOWER CORRECTION FORMULAE

I FOREWORD

These formulae are considered applicable to aircraft engines having integral supercharging without aftercooling, and using gasoline introduced at the entrance to the supercharger. Such engines are normally designated as single and two speed engines. Correction formulae for engines having two stage or exhaust turbo supercharging will not be discussed since the correction formulae for these engines are involved, and insufficient experience has been obtained with their application. Corrections for engines having a high degree of integral supercharging will be discussed in general terms only and no specific formulae will be presented.

The correction formulae and methods listed are empirical and subject to error due to conditions beyond the scope of known corrections. Usage has indicated, however, that the correction formulae listed will provide a satisfactory approximation of power output under standard conditions.

II GENERAL

For simplicity, the formulae or discussion will be presented under two sections:

Section A - Formulae applicable to unsupercharged engines and to engines having a low degree of supercharging, i.e., less than 500 ft./sec. impeller tip speed at normal rated speed.

Section B - Items for which corrections are desired for engines having a high degree of supercharging, i.e., greater than 500 feet per second. Such corrections will be based upon data obtained on the particular type of engine.

Note: The value of 500 ft./sec. is arbitrary and permits inclusion of unsupercharged engines and engines having a low degree of supercharging in the same class since the effect of the supercharger pressure ratio upon correction factors for engines with a low degree of supercharging is almost negligible.

III FORMULAE

SECTION A - UNSUPERCHARGED ENGINES OR LESS THAN 500 FT./SEC. TIP SPEED

1. Part Throttle Horsepower Correction Formulae

Applicable to operation at constant manifold pressure and constant speed regardless of degree of supercharging. For correction at constant speed and fixed throttle, the formulae under section III A-1 should be used.

Case I

$$HP_s = HP_i \sqrt{\frac{460 + t_{ci}}{460 + t_{cs}}}$$

Where HP_s = Corrected HP at standard carburetor air temperature

HP_i = Observed or brake HP at observed carburetor air temp.

t_{ci} = Observed carburetor air temperature, °F.

t_{cs} = Standard carburetor air temperature, °F. (60°F. at sea level)

Case II - For air cooled engines only

$$HP_s = HP_i \sqrt{\frac{460 + t_{ci}}{460 + t_{cs}}} \sqrt{\frac{460 + t_i}{460 + t_s}}$$

Where t_i = Observed cooling air temperature - °F.

t_s = Standard cooling air temperature - °F. (60°F. at sea level)

Note: The cooling correction formula is applicable only to similar cooling installations, i.e., installations having generally similar air flow conditions. For even this type of installation, it is necessary that the cylinder temperature actually vary with the cooling air temperature and controlled cooling, such as control of cooling air pressure, will preclude the use of a correction factor of this nature.

2. **Full Throttle Horse Power Correction Formulae**

Applicable to engines having no supercharging or supercharging less than 500 feet per second impeller tip speed at normal rated engine speed.

Case I

$$HP_s = HP_i \sqrt{\frac{460 + t_{ci}}{460 + t_{cs}}} \times \frac{B_s}{Pci + B_i - p_v}$$

Where HP_s = Corrected full throttle horsepower at standard carburetor air temperature and pressure.

HP_i = Observed or Brake Horsepower.

Pci = Observed static carburetor scoop pressure in inches Hg. relative to atmospheric pressure.

B_s = Standard Barometric Pressure (29.92"Hg. at sea level)

B_i = Observed Barometric Pressure - inches Hg.

p_v = Observed vapor pressure - inches Hg.

t_{ci} = Observed carburetor air temperature - °F.

t_{cs} = Standard carburetor air temperature - °F. (60°F. at sea level)

Case II - For air cooled engines only

$$HP_s = HP_i \sqrt{\frac{460 + t_{ci}}{460 + t_{cs}}} \sqrt{\frac{460 + t_i}{460 + t_s}} \times \frac{B_s}{Pci + B_i - p_v}$$

Where t_i = Observed cooling air temperature, °F.

t_s = Standard cooling air temperature, °F. (60°F. at sea level)

Note: The cooling correction formulae is applicable only to similar cooling