Setting the Required Fuel Mixture Ratio

Juan Nunez

[Institutional Affiliation(s)]

Author Note

Setting the Required Fuel Mixture Ratio

Generally, when an aircraft engine is replaced or overhauled, it is important to fine-tune the engine's idle settings for both the fuel-air mixture and rpm. The engine idle rpm has to be set high enough so that the engine does not turn off when the throttle is reduced, yet not high enough to waste fuel. Similarly, any excessively rich mixtures at idle would lead to incomplete combustion and fouling on the spark plugs, yet if the mixture is excessively lean, it can lead to faulty acceleration (FAA, 2006). The adjustment of the rpm, as well as the fuel-air mixture, can affect the aircraft's operations up till the cruise range.

In an aircraft engine that uses a conventional carburetor, the idle mixture is determined through a manual process from the mixture control panel on the cockpit. The carburetor mixture controls are gradually moved towards the idle cutoff position through turning a star wheel. The star wheel is moved in the opposing direction to create a leaner mixture. A slight movement of the controls will cause a noticeable change in the idle rpm as well as the manifold pressure. A higher manifold pressure indicates that the mixture is too lean and requires enriching the mixture by turning the star wheel to the other direction. A small movement of the controls would bring the manifold pressure down. In aircrafts without a manifold pressure gauge, the idle speed can be observed from the tachometer (Mcbride, 2007). During the installation, the mixture has to be adjusted in a manner to provide a slight rpm rise before the engine starts to shuts down. A momentary rise in the engine rpm will then drop and the idle mixture control has to be moved again to rich to prevent an engine halt. As a precaution, the engine has to be warmed up until the cylinder head and oil temperatures are normal before idle mixtures are checked. The propeller control has to be kept towards the ‘increase rpm setting’ in the warming up process, and the adjustments are only to be made when normal operating temperatures are reached.

After the idle mixture is adjusted, the ide stop has to be reset to bring it to the idle rpm as specified in the aircraft’s manual. The idle speed is usually adjusted by means of a set screw, which is turned to achieve the ideal rpm. For this purpose, the engine is again warmed up and run at nearly half of normal speed to clear the engine. Once, it reaches normal operating temperatures, the set screw can be adjusted near the fuel injector throttle body that is usually opposite the idle mixture’s star wheel. The idle rpm is usually between 650-700. The mixture control is brought towards the idle cut-off position. Some carburetors use an eccentric screw for adjusting the idle rpm, whereas some use a spring-loaded screw that helps limit the closing of the throttle valve. In both cases, the screw is adjusted to decrease or increase the rpm while the throttle is prevented from stopping. The throttle is first opened to clear the engine and then closed allowing the rpm to stabilize (Aeronautics Guide, 2018). The operation is repeated until the desired idle rpm is achieved.

The idle rpm speed is also affected by changes in the idle mixture; thus, if the mixture is too rich, for instance having a 150rpm rise on shutdown, then this can be corrected by moving the idle mixture control to create a 50-rpm rise. The engine will then idle at about 100 rpm faster. If these settings are changed, the idle speed has to be adjusted again to bring it back to the normal range of 650-750 rpm.

# References

Aeronautics Guide. (2018). *Aircraft Reciprocating Engine Carburetor Maintenance*. Retrieved April 13, 2019, from Aircraft Systems Tech: https://www.aircraftsystemstech.com/p/carburetor-maintenance.html

FAA. (2006). Aircraft Systems. In *Pilot's Handbook of Aeronautical Knowledge.* Federal Aviation Administration.

Mcbride, P. (2007, June 22). *How can I fine-tune idle mixture?* Retrieved April 13, 2019, from General Aviation: https://generalaviationnews.com/2007/06/22/how-can-i-fine-tune-idle-mixture/