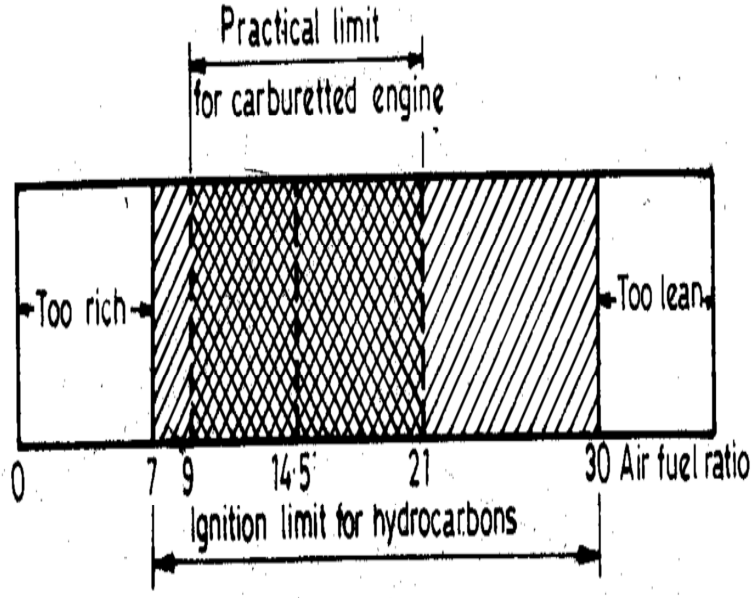
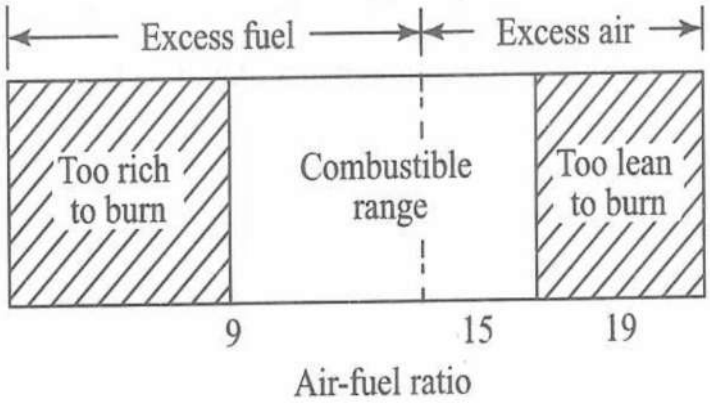
Air-Fuel Mixtures

Ignition of charge is only possible within certain limits of fuel-air ratio. Ignition limits correspond approximately to those mixture ratios, at lean and rich ends of scale, where heat released by spark is no longer sufficient to initiate combustion in neighbouring unburnt mixture.

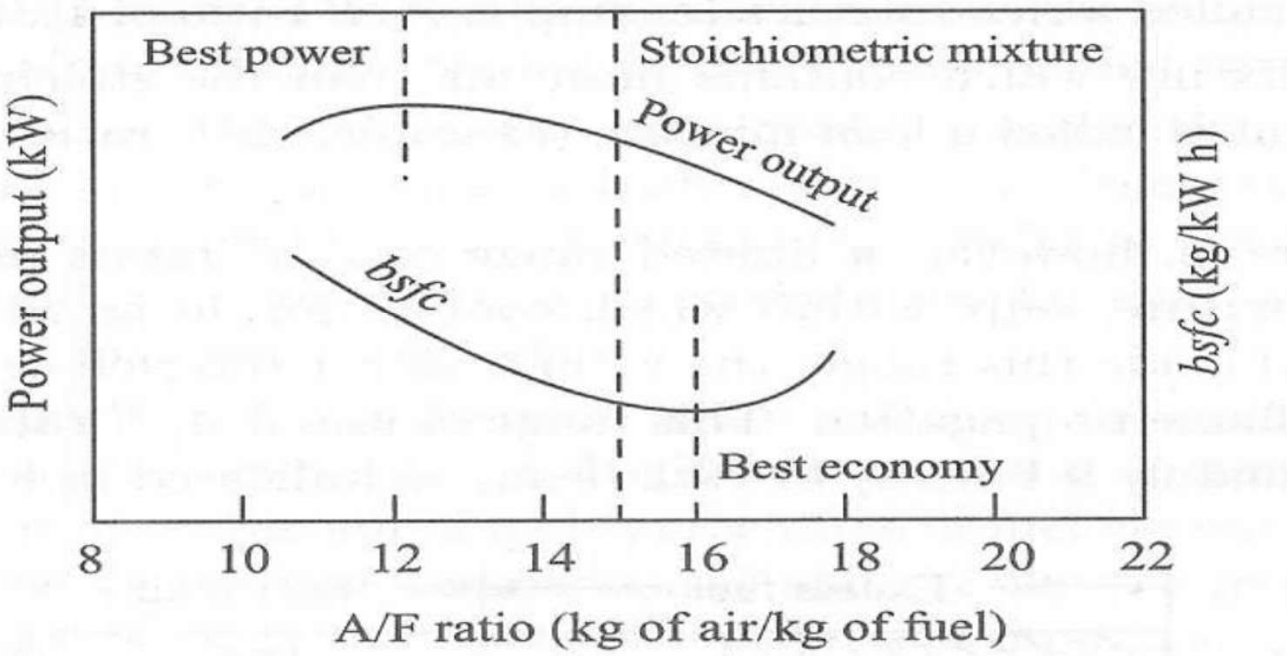
For hydrocarbons fuel the stoichiometric fuel air ratio is 1:15 and hence the fuel air ratio must be about 1:30 and 1:7



- Chemically Correct (15:1)
- Rich Mixture (10:1)
- Lean Mixture (17:1)



Variation of power output and sfc with A-F ratio in SI engine (Full throttle and constant speed)



- Maximum Output = 12:1 (Best power mixture)
- Minimum Fuel Consumption = 16:1 (Best economy mixture)

Various Loads

Idling/Starting: Engine runs without load. Produces power only to overcome friction between the parts. Rich mixture is required to sustain combustion.

Normal Power/Cruising/Medium Load: Engine runs for most of the period. Therefore, fuel economy is maintained. Low fuel consumption for maximum economy. Requires a lean mixture.

Maximum power/Acceleration: Overtaking a vehicle (short period) or climbing up a hill (extra load). Requires a rich mixture.

Starting a Cold Engine

When an engine is cold, a very small % fuel will vaporize in the intake and compression process. The fuel is also cold, and much more viscous, creating a lower flow rate. The engine metal parts are cold and inhibit vaporization.

Further, during the compression stroke, cold cylinder walls will absorb heat and reduce vaporization. Engine lubrication is cold and more viscous, making the engine turn more slowly in the starting process.

Starting and Warm-up Requirements

When a cold engine is started, the heavy end of gasoline is not evaporated. Although the fuel/air ratio at the carburettor may be well within the flammability limits of gasoline-air mixtures, but the ratio of evaporated fuel-to-air in the cylinder may be far too lean to ignite. It is, therefore, necessary to supply 5 to 10 times richer fuel at the carburettor to obtain enough evaporated light ends to ignite, until the manifold and cylinder parts become warm.

As the engine warms up, the fuel/air ratio requirement at the carburettor must be reduced to refrain the evaporated fuel/air ratio from becoming too rich.