SPARK PLUG SELECTION FOR CLASSIC ENGINES

A number of factors have to be considered when selecting suitability of a spark plug for classic and vintage engines, which can differ from the originally recommended item.

The following points need to be considered before looking at available spark plugs:
• Intended use (Competition / Hard use / General Road / Commuting / Low speed or Vintage road runs / Museum)
• Condition of engine
• Fuelling / Timing set up
• Modifications (including upgrades to ignition system)

All the above points can have a significant effect, and even result in engine damage if the incorrect spark plug is used.

LONG TERM STORAGE

Classic and vintage engines are, by their very nature, less likely to be used as everyday vehicles. If fuel is left un-used for a prolonged period, then the fuel can become 'stale' over time. When the engine is attempted to be started, the stale fuel can wet foul any spark plugs and fail to start. A sensible precaution to prevent this issue is to drain any fuel from the vehicle before storage. Modern fuels can be susceptible to degrading more quickly, becoming harder to ignite after perhaps just 3 months. There are proprietary fuel stabiliser additives on the market, designed to prevent this from occurring, but NGK cannot comment on their effectiveness as we have no direct experience in the use of these products.

RESISTOR SPARK PLUGS

Many older ignition systems are based on lower voltage magneto set-ups. NGK resistor plugs use a high quality ceramic material for the resistor construction, which provides a very stable resistance level, typically 5k Ohms. Even a magneto ignition system can produce tens of thousands of volts, which is more than capable of running a resistor plug. The actual level of resistance at the electrode gap under combustion chamber pressures is far greater than any resistor installed in a spark plug. Resistor plugs can and are used by many owners with this system without any issues, providing the ignition system is in good condition. Some owners successfully use the modern NGK Iridium 'IX' range of spark plugs in conjunction with magneto ignition systems. One advantage of the 'IX' range is the use of a very fine-wire centre electrode (0.6 mm diameter), which requires less voltage to create a spark, beneficial when using a low powered ignition system.

HEAT RANGE AND INTENDED USE

The heat range of a plug is a measure of it's ability to disperse the heat of combustion. Put simply, a spark plug does not produce any heat, but must manage the heat it is subjected to from the combustion process to maintain its optimum operating temperature (between 450-870°C). Please note this temperature refers to spark plug firing end (nose) temperature and is not related in any way to cooling system or oil temperature. If the firing end of a spark plug exceeds 870°C then the ceramic can ignite any fuel on contact, leading to pre-ignition and subsequent engine damage. If the firing end of a plug falls below 500°C (the minimum self-cleaning temperature) then carbon can accumulate on the insulator, eventually leading to a misfire as the current leaks away to ground. This is why selection of spark plug heat range is critical for the engine the plug is intended for. NGK spark plugs use a low number (e.g. 2,4...) for a 'hot' (soft) spark plug - designed to retain relatively low combustion chamber temperatures in the firing end of the plug to prevent fouling. A 'hot' plug is usually found in horticultural equipment. A 'cold' (hard) NGK spark plug will have a high number (e.g. 8,9,10...) - designed to disperse the high combustion chamber temperatures quickly to prevent the firing end from overheating. 'Colder' type plugs are usually found in high performance equipment (sports bikes/race cars).

The actual use the engine is put to can also have an affect on combustion chamber temperature. Many vintage or classic machines are subjected to occasional starting whilst in storage or they are left to warm up gradually by the owner before use. Whilst this is mechanically sympathetic for the engine components, it can be detrimental to the spark plug. This is because the idle mixture can be very rich, and/or the combustion chamber temperatures lower than when in normal road use. This can quickly lead to fouling of the plug firing end, again eventually resulting in a misfire.

Another cause of fouling of the plugs can result from how the engine is used. If we take, for example, a classic motorcycle which originally has a 'cold' NGK B8ES spark plug recommended for the machine when it was new. This 'cold' spark plug may have been perfectly acceptable when the bike was used every day, under 'spirited' use by the proud owner enjoying the full performance of their new machine. If this same machine, 30-40 years later but still in exemplary mechanical condition and set-up is only used on very low speed club runs, then the original plug heat range may be unsuitable as it cannot reach its operating temperature. In this instance, if the present owner decides they are not going to use the machine any harder, then a 'hotter' B7ES may be a more appropriate spark plug option, providing they understand the risks of pre-ignition in using a 'hotter' heat range.

The reverse of this example can also be relevant. If we take, for example, a road production vehicle which is only used by the current owner as a track or competition machine, then the original recommended road plug could overheat if the engine is in constant full-load/high speed use. In this case, if the standard recommended plug is a B8ES, then a colder 'B9ES' may be a more suitable spark plug, to cope with continued high speed use and associated higher combustion chamber temperatures.

One point to note is that 2-Stroke engines are far less forgiving on plug heat range compared to 4-Stroke engines. If the heat range of the plug selected for a 2-Stroke is too 'hot' (soft), then the dangers of pre-ignition can quickly lead to the 'dreaded' melted piston conclusion.

FOULING

Fouling of a spark plug to the point of misfire occurs when the surface of the ceramic insulator surrounding the centre electrode is coated in contaminants, which allows the spark current to leak away to ground. Any particles adhering to the insulator surface can provide a conductive path for electricity. It should be noted that these particles do not come from the spark plug, and as such fouling is always a result of particles within the combustion chamber, rather than a fault of the plug. There are many causes that can create fouling of a spark plug, incorrect fuel mixture, excess oil entering the combustion chamber, stale fuel or incorrect heat range selected, to name a few. In all cases, replacing the plugs can temporarily cure the misfire or starting problem, but if the root cause is not identified then the fouling problem will eventually re-occur.

A tactic sometimes employed to overcome oil fouling of spark plugs in an engine that suffers from excess oil in the combustion chamber is to attempt using a 'hotter' (softer) grade heat range. This is in effect treating the symptom rather than curing the cause, one of the only examples where a 'hotter' plug may be selected, as long as the risks of detonation are understood first.

MODIFICATIONS

Modifications carried out to an engine to increase its horsepower will increase the combustion chamber temperatures. Any published NGK catalogues are for un-modified production engines only. When an engine is designed by a vehicle manufacturer, hundreds of hours of testing and design are dedicated to ensure that each engine component will operate to satisfaction across a variety of engine and environmental conditions. Any engine modification in effect alters the engine characteristics and as such, it is the end users responsibility to ensure that every engine component that may be affected, is considered and re-specified if necessary. This is especially relevant to spark plug design and heat range. It is not possible for NGK to provide a recommendation for a modified engine. For NGK to make a recommendation, the spark plug needs to be tested and certified for that engine. Suggestions can be made regarding plug types to test, but the list for modifications and variations is endless and as such making a recommendation is not possible.

SUMMARY

In essence a spark plug is a simple device for creating a spark, although as can be seen above, it is a very complex subject that can involve many different designs, materials and heat ranges. The spark plug can be affected by many external factors, which can alter its performance.