SPARK PLUG VISUAL ANALYSIS

2000

A Picture Is Worth ....

STITT®

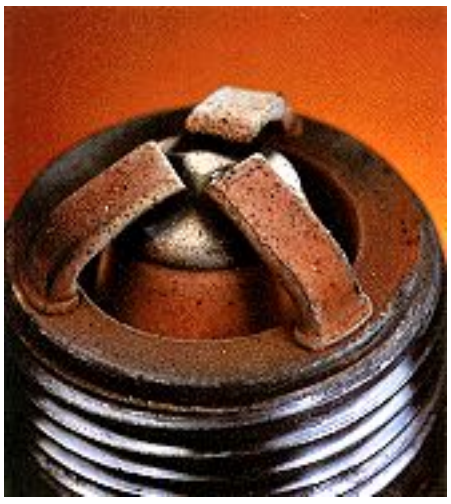
SPARK PLUG COMPANY

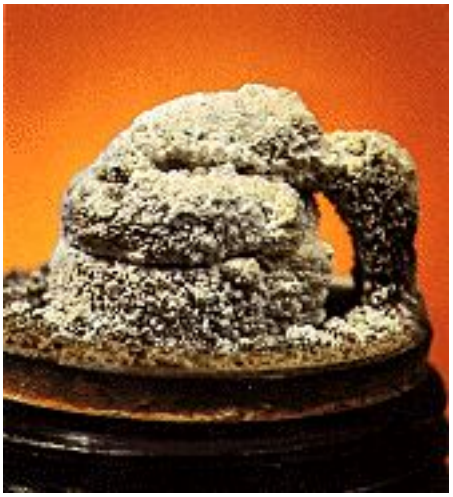
Many times an engine problem can be solved by carefully examining its spark plugs for visual clues to abnormal conditions that may exist in the engine's power cylinders.

The following photographs were taken of plugs returned to our laboratory for analysis. Each is a window to an engine and can assist in determining the source of a problem.

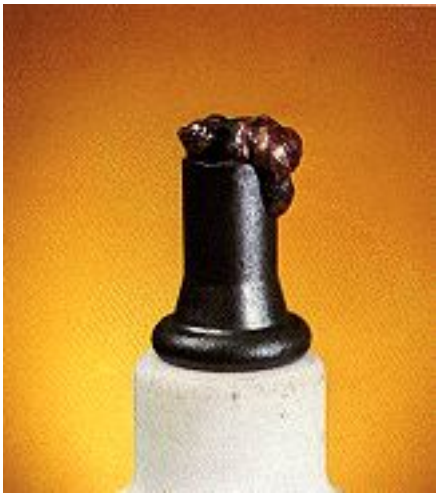
The VISUAL:	The PHOTOGRAPH:	The ANALYSIS:
Light casting of whitish ash uniformly deposited on firing-end.		**NORMAL FIRING-END.** Normal, light ash deposits are common indicators of healthy spark plugs from a healthy engine.
Shear fracture of steel spark plug shell at the thread relief.		**OVER-TORQUE.** Spark plug steel can only withstand so much torque. Over-torqueing can exceed the strength of the spark plug's thread relief. Federal Spark Plug Standards require that 14mm spark plugs only withstand 45 ft. lbs. without damage; 18mm only 65 ft. lbs.; and 7/8"-18 only 85 ft. lbs. Only by using an indicating torque wrench can this over-torque damage be eliminated.
Torched-out hole in spark plug's steel shell. Probably but not always a melted firing-end as well.		**TORCH-EFFECT DETONATION.** This is an extremely destructive engine event known to blow holes in pistons, cylinder liners, and cylinder heads. Check engine timing, mixture controls, and all engine functions.

The VISUAL:	The PHOTOGRAPH:	The ANALYSIS:
Spark plug's threads flattened, torn or missing.	 	**CROSS-THREADING.** Threads that have lost their sharpness usually indicate that the spark plug has been cross-threaded or installed in a port which has been tapped undersize. Crossthreading can occur when the plug installation is not started by hand. A good solution is to install all plugs hand tight before final mechanical torque is applied.
Orange-colored residue on threads or spark plug firing-end .		**COOLANT-ADDITIVE RESIDUE.** This orange colored material is the residue from an engine coolant-additive. When found on the spark plug threads, it indicates that cylinder head is probably cracked in the area of the spark plug port threads.

The VISUAL:	The PHOTOGRAPH:	The ANALYSIS:
Molten center electrode or melted ground electrodes and center electrode. Possibly fractured and melted ceramic. Occasionally, melted steel shell.	 	**PRE-IGNITIONDETONATION.** A melted nickel center electrode and/or melted ground electrodes always indicate that the spark plug has encountered higher than normal operating temperatures. Since the melting temperature of nickel is 2600°F, melting nickel indicates that the spark plug has probably been a victim of sustained pre-ignition or detonation. Check engine timing, mixture controls, and all engine functions.
Red, grainy deposits on insulator nose and firing-end.		**IRON OXIDE DEPOSITS.** Firingend deposits of iron-oxide may prevent the discharge of energy across the spark gap. These iron oxide deposits usually indicate that there may be corrosion in the fuel gas line or the main transmission pipeline. If the engine has cylinder injection air starters, corrosion may also be found there. Lastly, iron oxide deposits may indicate a cracked cylinder head.

The VISUAL:	The PHOTOGRAPH:	The ANALYSIS:
Crusty, white deposits accumulating on firing-end.		**BARIUM/CALCIUM FOULING.** The use of high-ash lubricating oils affect the performance of an engines spark plugs. If you suspect this operating problem, check the engine manufacturer's lube oil specifications. If ash content of lube oil used does not conform to manufacturer's specifications, change to a recommended lube oil. If engine provides power cylinder lubrication, check power cylinder lubrication rate to assure that lubrication rate is within specifications. If the lube oil is one recommended by engine manufacturer's specifications, check that cylinder liners are not scuffed or scored. Next, check engine lube oil consumption history and then check the piston rings. If lube oil ash deposits indicate an excessive accumulation in one quadrant of firing end, lube oil leakage down intake valve guides may be indicated.
Black, fluffy deposits on firing-end.		**CARBON DEPOSITS.** Fluffy black carbon deposits usually indicate too rich a fuel/oxygen mixture. If a change in the mixture to a leaner setting fails to remedy this carbon fouling, try using Stitt's next hotter heat range spark plug.

The VISUAL:	The PHOTOGRAPH:	The ANALYSIS:
Coked lubricating oil on spark plug insulator. Could also be paint or other conductive material.		**CONDUCTIVE CONTAMINANTS ON FLASHOVER PORTION OF INSULATOR.** Paint, coked lube oil, grease and other conductive materials can cause misfiring by promoting flashover. Make every effort to keep the flashover portion of the spark plug insulator clean and free of conductive contaminants.
Heavy residue of gray-colored or copper-colored compound in threads.	 	**EXCESSIVE APPLICATION THREAD LUBRICANT.** Too much thread lubricant can eventually cause problems. Though thread lubricants can have antigalling properties if used sparingly, too much can allow an excessive increase in the clamping force and this can make the spark plug impossible to remove. If heavy quantities of thread lubricant have been the practice of spark plug installation, we recommend that the carbonized residue be removed from the cylinder head's spark plug ports at each plug change by using a thread chaser/seat cleaning tool or a full bottom tap. If solid-state ignition systems are being operated, special care should be taken to remove carbonized thread lubricant in the port threads. This material can add resistance to the ground return circuit of the ignition system and can affect ignition performance.

The VISUAL:	The PHOTOGRAPH:	The ANALYSIS:
Copper deposits on center electrode, possibly bridging spark gap to ground electrode(s).		**COPPER RUN-OUT.** If spark plugs with copper in the center electrode operate at excessively high temperatures, copper run-out generally occurs when the center electrode temperature has exceeded 1900°F, a temperature much higher than the design-intended operating temperature of the electrode. This run-out of copper almost always shorts out the spark plug by bridging the spark gap. Check all engine functions that can prevent spark plugs from operating within their design-intended temperature range. Check to determine if too hot a heat range spark plug has been used in a high output engine. Or perhaps too much or too little installation torque has caused this problem. If so, make sure that spark plugs are being installed with an indicating torque wrench to the spark plug manufacturer's recommendations . Pre-ignition may also be indicated when copper runout is observed with ignition too far advanced or mixture too lean.To extend the spark plug's temperature range, consider the substitution of spark plugs with electrodes of solid nickel, which will extend temperature limit of center electrode to 2800°F before melting occurs.

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