

Spark Plug Faces



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1. Normal Condition

Insulator nose grayish-white or grayish-yellow to brown. Engine is in order. Heat range of plug correct. Mixture setting and ignition timing are correct, no misfiring, cold-starting device functioning. No deposits from fuel additives containing lead or from alloying constituents in the engine oil. No overheating.



2. Sooted – Carbon-fouled

Insulator nose, electrodes and spark plug shell covered with velvet-like dull black soot deposits.

Cause: Incorrect mixture setting (carburetor fuel injection); mixture too rich, air filter very dirty, automatic choke not in order or manual choke pulled too long, mainly short-distance driving, spark plug too cold, heat-range code number too low.

Effects: Misfiring, difficult cold-starting.

Remedy: Adjust A/F mixture and choke device, check air filter.



3. Oil-fouled

Insulator nose, electrodes and spark-plug shell covered with shiny soot or carbon residues.

Cause: Too much oil in combustion chamber. Oil level too high, badly worn piston rings, cylinders and valve guides. In two-stroke engines, too much oil in mixture.

Effects: Misfiring, difficult starting.

Remedy: Overhaul engine, adjust oil/fuel ratio (2-stroke engines), fit new spark plugs.



4. Lead fouling

Insulator nose covered in places with brown/yellow glazing, which can have a greenish color.

Cause: Lead additives in fuel. Glazing results from high engine loading after extended part-load operation.

Effects: At high loads, the glazing becomes conductive and causes misfiring.

Remedy: Fit new spark plugs since cleaning the old one is pointless.



5. Pronounced lead fouling

Insulator nose covered in places with thick brown/yellow glazing, which can have a greenish color.

Cause: Lead additives in fuel. Glazing results from high engine loading after extended partload operation.

Effects: At high loads the glazing becomes conductive and causes misfiring.

Remedy: Fit new spark plugs since cleaning the old ones is pointless.



6. Formation of ash

Heavy ash deposits on the insulator nose resulting from oil and fuel additives, in the scavenging area and on the ground electrode. The structure of the ash is loose to cinder-like.

Cause: Alloying constituents, particularly from engine oil, can deposit this ash in the combustion chamber and on the spark-plug face.

Effects: Can lead to auto-ignition with loss of power and possible engine damage.

Remedy: Repair the engine. Fit new spark plugs. Possibly change engine-oil type.



7. Center electrode covered with melted deposits

Melted deposits on center electrode. Insulator tip blistered, spongy and soft.

Cause: Overheating caused by auto-ignition. For instance, due to ignition being too far advanced, combustion deposits in the combustion chamber, defective valves, defective ignition distributor, poor-quality fuel. Possibly, spark-plug heat-range value is too low.

Effects: Misfiring, loss of power (engine damage).

Remedy: Check the engine, ignition and mixture formation system. Fit new spark plugs with correct heat-range code number.



8. Partially melted center electrode

Center electrode has melted and ground electrode is severely damaged.

Cause: Overheating caused by auto-ignition. For instance, due to ignition being too far advanced, combustion deposits in the combustion chamber, defective valves, defective ignition distributor, poor-quality fuel.

Effects: Misfiring, loss of power (engine damage).

Insulator-nose fracture, possibly due to overheated center electrode.

Remedy: Check the engine, ignition and mixture-formation system. Fit new spark plugs.



9. Partially melted electrodes

Cauliflower-like appearance of the electrodes. Possible deposit of materials not originating from the spark plug.

Cause: Overheating caused by auto-ignition. For instance, due to ignition being too far advanced, combustion deposits in the combustion chamber, defective valves, defective ignition distributor, poor-quality fuel.

Effects: Power loss becomes noticeable before total failure occurs (engine damage).

Remedy: Check engine and mixture-formation system. Fit new spark plugs.



10. Heavy wear on center electrode

Cause: Spark plug exchange interval has been exceeded

Effects: Misfiring, particularly during acceleration (ignition voltage no longer sufficient for the large electrode gap). Poor starting.

Remedy: Fit new spark plugs.



11. Heavy wear on ground electrode

Cause: Aggressive fuel and oil additives. Unfavorable flow conditions in combustion chamber, possibly as a result of combustion deposits. Engine knock. Overheating has not taken place.

Effects: Misfiring, particularly during acceleration (ignition voltage no longer sufficient for the large electrode gap). Poor starting.

Remedy: Fit new spark plugs.



12. Insulator-nose fracture

Cause: Mechanical damage (spark plug has been dropped or bad handling has put pressure on the center electrode). In exceptional cases, deposits between the insulator nose and the center electrode, as well as center-electrode corrosion, can cause the insulator nose to fracture (this applies particularly for excessively long periods of use).

Effects: Misfiring, spark arcs-over at a point that is inaccessible for the fresh charge of A/F mixture.

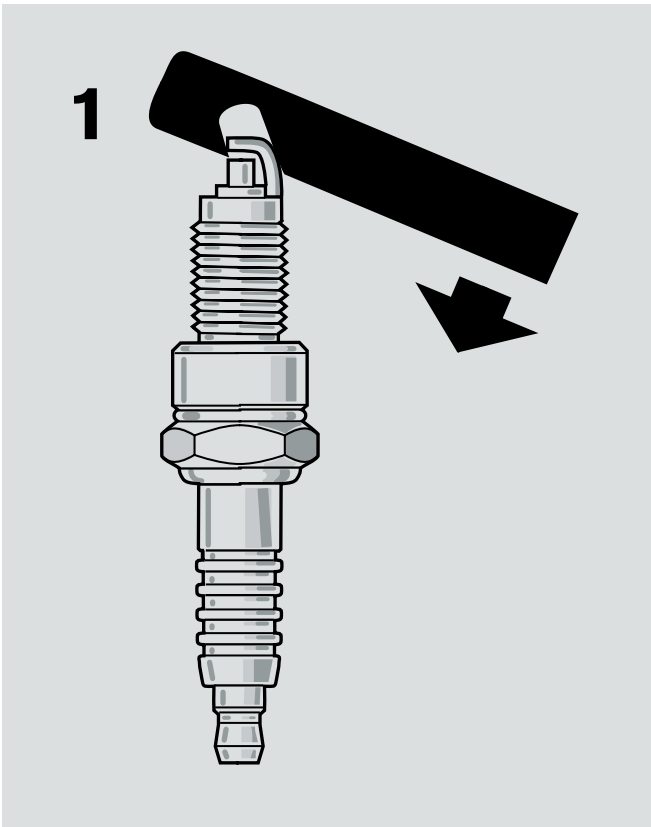
Remedy: Fit new spark plugs.



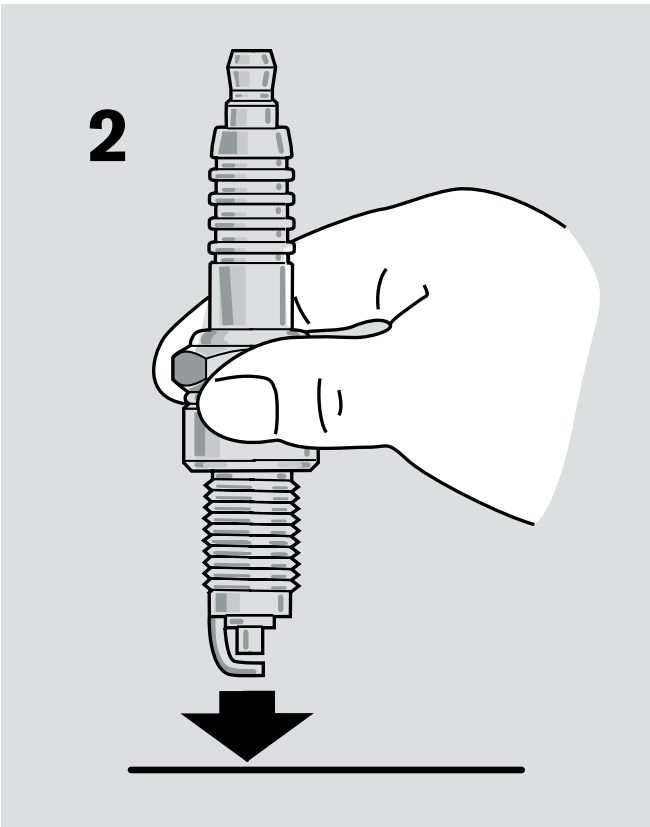
Spark Plug Gapping



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Widen Electrode Gap



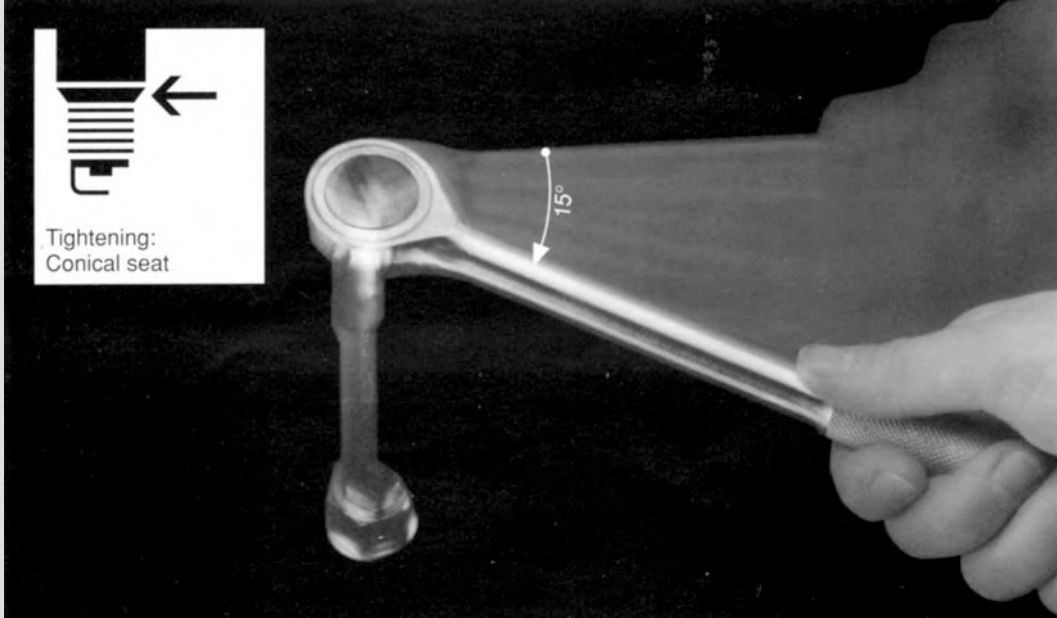
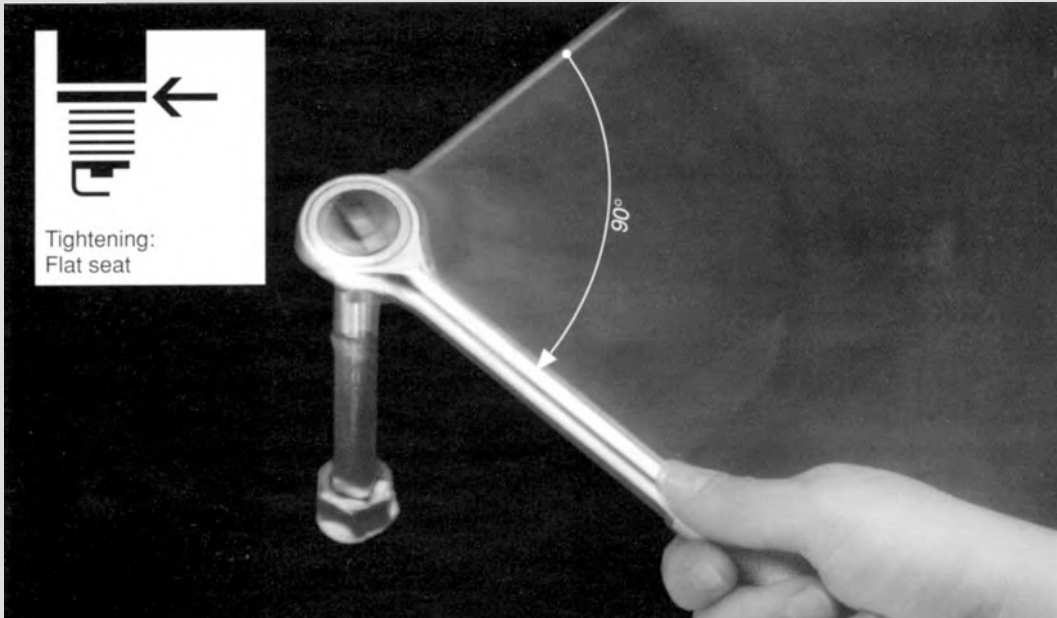
Close Electrode Gap

Spark Plug Tightening Torque

Tightening for a Flat or Conical Seal



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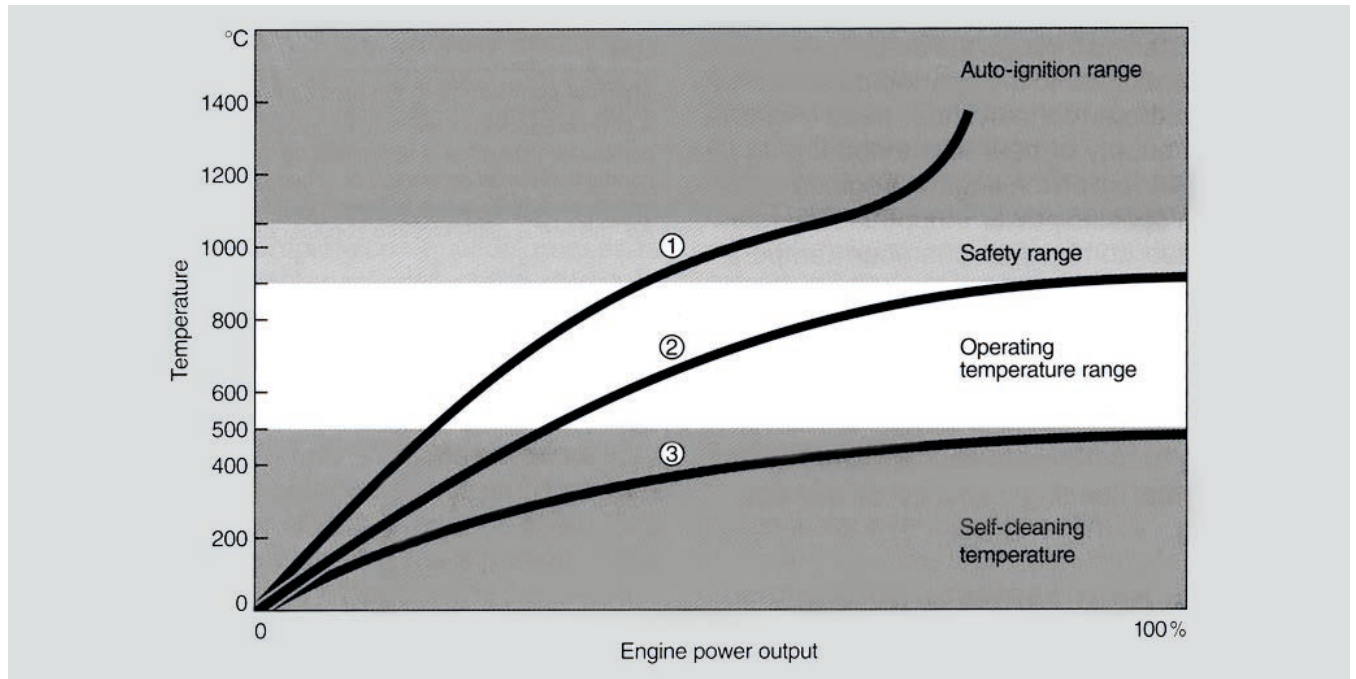


Spark Plug Heat Range

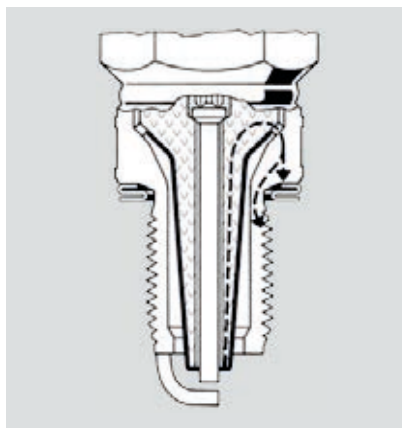
Temperature curves of spark plugs with different heat-range code numbers at full load in the same engine.



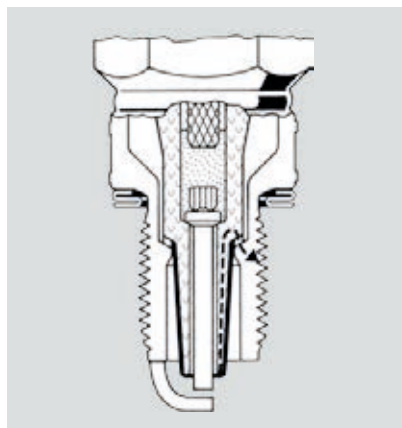
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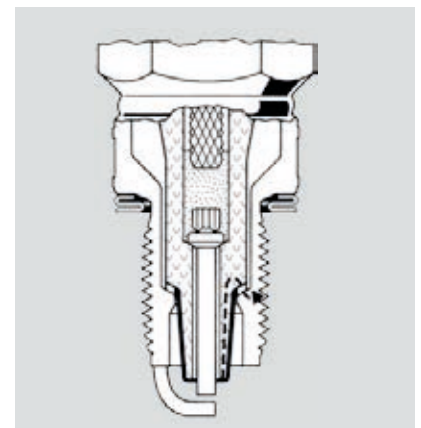
□ Spark plug with high heat-range code number (“hot plug”). Large insulator nose area absorbs much heat, low heat dissipation.



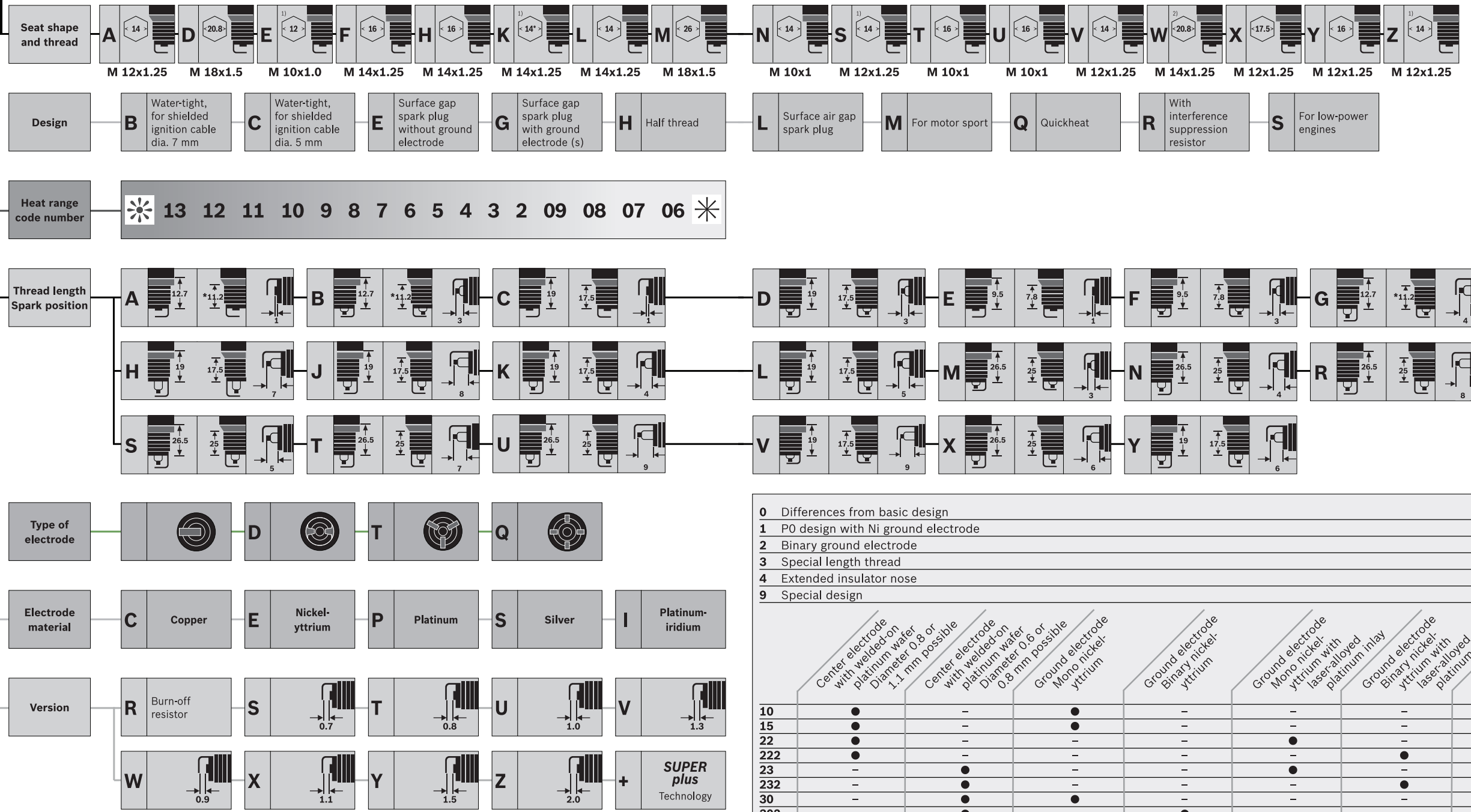
□ Spark plug with medium heat-range code number. Insulator nose area smaller than in “hot plug”. Lower heat absorption, better heat dissipation.



□ Spark plug with low heat-range code number (“cold plug”). Smaller insulator nose area absorbs little heat. Very good heat dissipation through short thermal conduction path.



— Heat-absorbing surface
 - - - - Thermal conduction path



	Center electrode with welded-on platinum wafer Diameter 0.8 or 1.1 mm possible	Center electrode with welded-on platinum wafer Diameter 0.6 or 0.8 mm possible	Ground electrode Mono nickel-yttrium	Ground electrode Binary nickel-yttrium	Ground electrode Mono nickel-yttrium with laser-alloyed platinum inlay	Ground electrode Binary nickel-yttrium with laser-alloyed platinum inlay
10	●	-	●	-	-	-
15	●	-	●	-	-	-
22	●	-	-	-	●	-
222	●	-	-	-	-	●
23	-	●	-	-	●	-
232	-	●	-	-	-	●
30	-	●	●	-	-	-
302	-	●	-	●	-	-
33	-	●	-	-	●	-
332	-	●	-	-	-	●

* The thread length for spark plugs with seat shape D and spark position A or B is 10.9 mm.

1) Double hexagon 2) Hexagon size 19.0 mm for low-power engine version WS