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 values, 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 values, 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 values, 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

1. Widen Electrode Gap
2. Close Electrode Gap
Spark Plug Tightening Torque

Tightening for a Flat or Conical Seal

- **Flat seat**: 90°
- **Conical seat**: 15°
Spark Plug Heat Range

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

① Spark plug with high heat-range code number (“hot plug”). Large insulator nose area absorbs much heat, low heat dissipation.

② Spark plug with medium heat-range code number. Insulator nose area smaller than in “hot plug”. Lower heat absorption, better heat dissipation.

③ 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.
Numbering System

BOSCH SPARK PLUGS

REPLACEMENT SPARK PLUGS

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

Differences from basic design:
1. FDB design with 140 ground electrodes
2. Binary ground electrodes
3. Special length thread
4. Extended insulator nose
5. Special design

*) Double hexagon  *) Hexagon size 19.0 mm for low-power engine version W8