



DESIGN SPECIFICATION SPARK PLUG SENSOR

To customize the spark plug sensor / adaptor to your specific application a detailed description of the original spark plug and bore is required.

A proper analysis of the original spark plug is needed in order to ensure the best performance and durability of the sensor solution and a comparable spark initiation in the cylinder. Based on these data AVL can design the sensor according to the customer needs. The data is stored for further orders. The input as well as forwarding the form can be carried out electronically. The order form is also available as download at www.avl.com/sensors.

Base information:

Customer name / contact	Affiliate name / contact	Date

Engine information:

Engine manufacturer / code		Spark plug manufacturer / part number	
Fuel type	<input type="checkbox"/> Gasoline / E0 – E10	<input type="checkbox"/> E85 / E100	<input type="checkbox"/> CNG / LPG

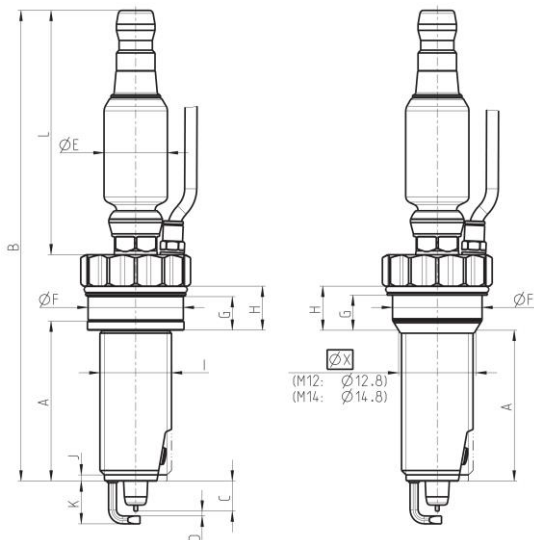
Spark plug sensor solutions (type selection via checkbox):

Sensor	Thread diameter [I]	Selection
ZI22	M10 x 1	<input type="checkbox"/>
ZI33	M12 x 1.25	<input type="checkbox"/>
ZI45	M14 x 1.25	<input type="checkbox"/>

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Specify shape and dimension of the original spark plug:

Dimension



Dimension

Reach [A] = _____ mm
 Total length [B] = _____ mm
 Spark protrusion [C] = _____ mm
 Electrode gap [D] = _____ mm
 Insulator diameter [E] = _____ mm
 Shaft diameter [F] = _____ mm
 Length [G] = _____ mm
 Length [H] = _____ mm
 Thread return [J] = _____ mm
 Maximum depth [K] = _____ mm
 Length of insulator [L] = _____ mm

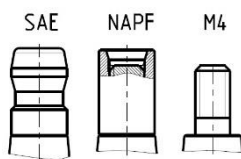
Connector (type selection via checkbox)

SAE ☐ NAPF ☐ M4 thread ☐

Sealing (type selection via checkbox)

Flat ☐ Conical ☐

Connector



Heat range

Scale type _____

Heat range _____

Ground electrodes specification

Indexed mounting ☐ Number of electrodes _____

Electrode type (type selection via checkbox)

Surface gap ☐ Side ☐ Top ☐
 Straight ☐ Bent ☐ Needle ☐

Mounting hexagon

Mounting hexagon = HEX _____

Installation socket information (necessary for conical sealing and HEX <16):

Dimension

Outer diameter mounting tool = _____ mm

Diameter spark plug bore = _____ mm

FREQUENTLY ASKED QUESTIONS SPARK PLUG SENSOR / -ADAPTER

AVL has made a list of frequently asked questions and tricks for spark plug sensors.

Question Why isn't it always possible to determine a suitable measurement spark plug with information like engine type, OEM part number or manufacturer code?

Answer AVL doesn't have an information about the recommended original spark plug for every engine type. A check with the information available in the internet results typically in the OEM part number, sometimes also in the manufacturer code. It is possible to define the measurement spark plug directly in cases where AVL already has a suitable measurement spark plug for the engine type. The OEM part number leads sometimes to the manufacturing code but some OEMs don't supply manufacturing codes anymore. The manufacturing code helps to get most of the information as many spark plug manufacturers have conversion tables in order to compare the naming. This is valid for thread length, sealing, etc. Some manufacturers don't distribute information about spark protrusion and customized adaptations. This information needs to be measured manually. The conversion of the heat range into the BOSCH scale is sometimes tricky. Conversion tables have a high uncertainty in heat ranges so that it is sometimes needed to get the original spark plug for analysis. If this is valid the spark plug is available after clarification.

Question Why is the usage of the correct heat range important?

Answer The heat value is information about the thermal load of the spark plug. Every spark plug has a temperature range in which the spark plug temperature should be independent from the engine map. Lower limit of this range is called soot border. The spark plug isn't hot enough to burn the soot particles from the spark plug if the temperature is below this limit. Misfire is the result if the spark plug is contaminated with too much soot. The upper border is called glow ignition border. The engine could have uncontrolled pre-ignitions if the temperature of the spark plug is above the limit. Reason is a pre-ignition on the surface of the spark plug body.

Question The measurement spark plugs from AVL are only available in dedicated heat ranges (07, 3, 5, 7 / type specific). Which heat value should be taken if the original one is not matching?

Answer Recommendation of AVL is to choose a colder heat range. The colder heat range could only lead to misfire events due to too much soot on the spark plug. But this behavior is only visible in a small range of part load and can be reduced by variation. A warmer heat range would lead to glow ignition which must be avoided.

Question Why is the choice of the electrode gap so important?

Answer The electrode gap defines the discharging function of the spark plug and with this also the volume in which the spark energy is applied to the fuel-air-mixture for inflammation. The inflammation is also depending on the mixture (fuel-air-ratio λ) and the gas density (ρ) during ignition time. A dedicated electrode gap (incl. tolerance) is recommended in order to bring enough ignition energy into the chamber. The engine will have misfire problems if the electrode gap is too small due to missing energy. The spark plug can get spark over events if the electrode gap is too high. Between the electrode gap and the ignition voltage is a correlation. The spark doesn't ignites from center electrode to the mass electrode if the ignition voltage goes above the electric strength. The electric energy will go the way with smallest resistance and will discharge to the spark plug housing via the insulator. This results into an irreversible damage and the insulators needs to be replaced.

FREQUENTLY ASKED QUESTIONS SPARK PLUG SENSOR / -ADAPTER

Question What is the difference in the design of an original spark plug and a measurement spark plug? Why do some measurement spark plugs have a limitation in electrical strength?

Answer The components of the measurement function (membrane, measurement elements, ...) need space in parallel to the ignition function. The space is realized in different ways for different sensor types by design features like concentric center electrode, different material size for insulators and positioning of components. The measurement spark plugs of the old generation (ZI21, ZI31, ZF43) have a maximum electric strength of 30 kV, the spark plugs of the new generation (ZI22, ZI33, ZI45) have 45 kV.

Question Could the electrode gap be adjusted with no limits?

Answer The maximum electrode gap should be 0.6 mm in case of older measurement spark plugs from generation ZI21, ZI31 and ZF43. 0.8 mm is possible for natural aspirated engines. Depending on the charging pressure it is also possible that the electrode gap is smaller than 0.6 mm. The electrode gap could be adjusted to the value of the original spark plug for measurement spark plugs from actual generation ZI22, ZI33 and ZI45 due to the electrical strength. The measurement spark plugs of this generation are delivered with 0.8mm gap.

Question Should the electrode gap be checked before every usage as well as during operation and how could this be done?

Answer AVL recommends to check the electrode gap before every usage and also during operation (every 50 to 100 h depending on fuel). The check could be done with the tool TA32 from AVL. If you need more information for the adjustment of the gap, please refer to the manual or your local AVL contact.

Question AVL has measurement spark plugs with pre-defined spark protrusion (1, 3, 5 mm, depending on type). How can this be adjusted?

Answer The absolute spark protrusion of an original spark plug can be rebuild with the measurement spark plug by the help of special sealing rings. These sealing rings are mounted on the thread and replaces the standard sealing ring. AVL measurement spark plugs can also be used without any sealing ring if a dedicated spark protrusion is needed.

Question Is it possible to use AVL spark plugs also without sealing ring?

Answer The sealing surface of the AVL spark plug is manufactured with a high accuracy and smaller roughness in comparison to the original spark plug. Based on this AVL measurement spark plugs could be used without of sealing ring if needed due to the specification (adjustments of the position of ignition). Mounting torque doesn't change due to this adjustment.

Question How can the lifetime of a measurement spark plug be optimized?

Answer The measurement spark plug should be used only while fulfilling the measurement task. Additional tests like endurance without use of an indicating measurement system should be done with the original spark plug.

Question How could an already existing spark plug be mounted in an oriented position?



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Answer AVL has sealing rings (used as indexing washers) with different thickness. With this the oriented position can be reached with a minimum impact to the spark protrusion.
