

## **Bosch Recommended Check/Replace Intervals**

Many vehicle manufacturers do not provide recommended check/replacement intervals for oxygen sensors, because it is hard to predict when an oxygen sensor will fail.

OEM oxygen sensor manufacturers, such as Bosch, work hard to ensure that oxygen sensors last as long as possible. The latest designs can last over 150,000 miles under laboratory bench-testing conditions! But out on the road, sensors are subject to very difficult conditions which can cause sensors to fail earlier than they do under laboratory conditions.

For example, oxygen sensors can fail when the sensor's ceramic element is exposed to certain types of silicone compounds or when an oil-burning engine leads to the sensor becoming oil-fouled. Also, a small amount of poorly refined gasoline can kill an oxygen sensor, as can the use of some over-the-counter fuel additives which are not "oxygen sensor safe."

These failures can occur either: 1) instantaneously at the time the contaminant contacts the oxygen sensor, causing a dead (totally nonfunctional) sensor, or 2) gradually over a period of time. Gradual deterioration results in a "slow" sensor which does not react as quickly as it should, thus causing the catalytic converter to perform less efficiently. This can lead to premature failure of the catalytic converter, which is an expensive item to replace. Under conditions of gradual deterioration, "slow" sensors eventually become "dead" sensors.

Unfortunately, the symptoms of a "slow" or even "dead" oxygen sensor are not always obvious to the vehicle owner, unless the vehicle fails an emissions test, a decline in fuel economy is noticed, or if driveability problems occur.

Furthermore, while a "dead" sensor can be detected by the do-it-yourselfer with a relatively inexpensive digital volt-ohmmeter, a "slow" sensor can only be diagnosed by a more expensive oscilloscope or scope meter. Thus, the do-it-yourselfer will probably not be able to spot an oxygen sensor problem until it is too late, and the catalytic converter is already well on its way to failure.

As part of a sensible preventive maintenance program, we recommend that either:

- 1) oxygen sensors be checked on a lab scope or scope meter by a professional automotive technician at intervals specified in this catalog, or
- 2) oxygen sensors be replaced by the do-it-yourselfer at the intervals specified in this catalog.

The "check/replace" intervals published in this catalog are not intervals specified by the vehicle manufacturer, but are instead recommendations based on our experience and knowledge of oxygen sensor technology.

One-wire and two-wire "unheated" type oxygen sensors should be checked or replaced every 30,000-50,000 miles. These sensors rely solely on hot exhaust gas to heat up to operating temperature, and therefore are designed to allow a large volume of exhaust gas to make contact with the active ceramic element. Therefore, these sensors are exposed to contamination, especially the "wide-slot" varieties found on Chrysler, Ford, and General Motors vehicles.

"Heated" type oxygen sensors have a built-in heater which heats the sensors up to operating temperature. Therefore, much less exhaust gas needs to contact the ceramic element, making these sensors less prone to contamination. "Heated" type sensors can also be located further downstream (closer to the catalytic converter), which increases their life expectancy by reducing thermal shock. In addition, the latest versions feature improved ceramic elements which are more resistant to silicone, oil, and lead contamination. "Heated" type oxygen sensors should be checked or replaced every 60,000-150,000 miles.

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# Oxygen Sensors

# Technical Information

**Can Use Possible Substitutions (Footnote # 71):**

Sensors in each column are identical except for the length of the wiring harness. The sensor with the longer wiring harness can be used to replace the sensor with the shorter wiring harness.

Part No.	Length		Can Use 1	Length		Can Use 2	Length		Can Use 3	Length	
	in.	mm		in	mm		in	mm		in	mm
12022	21.7	550	12023	25.4	645						
12043	38.5	978	12019	43.7	1110						
12052	17.7	450	12053	30.1	765						
12054	22.0	560	12203	39.8	1010						
12102	11.8	300	12114	13.4	340	12112	20.3	515			
12114	13.4	340	12112	20.3	515						
13008	19.7	500	13058	28.7	730						
13010	11.4	290	15701	15.0	381						
13012	25.2	640	13047	28.7	730						
13019	38.2	970	13957	47.6	1210						
13026	14.7	374	15637	32.7	830						
13029	21.6	549	15503	27.6	700						
13034	66.1	1680	13119	66.1	1680						
13045	20.5	520	13038	24.0	610						
13047	28.7	730	13011	36.3	922						
13053	8.7	220	13022	13.9	354						
13056	15.0	380	13489	27.6	700						
13058	28.7	730	13011	36.3	922						
13059	61.8	1570	13049	69.3	1760						
13060	8.9	225	13389	9.4	238						
13068	24.8	630	13109	37.0	940						
13095	17.9	455	13136	18.5	470						
13100	18.1	460	13399	22.1	562						
13109	37.0	940	13108	55.7	1415						
13111	50.4	1280	13450	67.3	1710	13483	55.0	1397			
13120	34.6	880	13301	44.9	1140						
13122	11.9	302	13100	18.1	460	13399	22.1	562			
13132	11.8	300	13695	15.4	390						
13134	11.8	299	13139	13.9	354						
13136	18.5	470	13354	20.9	530						
13153	21.9	555	13155	35.9	911						
13164	25.6	649	15208	29.9	760						
13165	22.8	580	13112	39.0	990						
13178	16.9	430	13694	21.7	552						
13184	22.9	582	13974	24.6	625						
13194	16.1	410	13032	19.3	490						
13198	14.6	370	13200	20.5	520						
13224	17.7	450	13091	22.4	570						
13226	35.8	910	13257	50.0	1270						
13231	21.3	540	13108	55.7	1415						
13242	31.1	790	13228	36.6	930						
13245	49.6	1260	13299	72.0	1829						
13249	18.5	470	13007	22.4	570						
13254	18.3	465	15479	23.4	595						
13255	7.1	180	13250	17.7	450						
13256	17.3	440	13637	19.7	500						
13258	22.8	579	13071	30.7	780						
13264	32.7	830	13226	35.8	910						
13271	11.8	300	13264	32.7	830						
13272	12.2	310	13280	18.0	457						
13287	13.0	330	13579	19.3	490						
13287	13.0	330	15266	18.1	460						
13311	14.4	365	13420	12.2	310						
13311	14.4	365	13224	17.7	450						
13315	34.8	885	13413	50.8	1290						
13316	10.8	275	13272	12.2	310						
13361	29.5	750	15044	36.4	925						
13372	7.9	200	15708	11.1	281						
13394	16.5	420	15076	21.7	550						
13444	16.5	420	13029	21.6	549						
13474	14.6	372	13055	29.3	745						

# Technical Information

# Oxygen Sensors

Part No.	Length		Can Use 1	Length		Can Use 2	Length		Can Use 3	Length	
	in.	mm		in.	mm		in.	mm		in.	mm
13482	8.7	220	13416	8.7	220						
13483	55.0	1397	13450	67.3	1710						
13500	15.0	380	13766	18.5	470						
13571	10.8	275	13844	12.4	315						
13574	22.4	568	13892	23.6	600						
13579	19.3	490	15327	19.7	500						
13581	31.6	803	13879	37.4	950						
13637	19.7	500	15391	21.1	535						
13659	7.7	195	13271	11.8	300						
13694	21.7	552	13682	43.3	1100						
13728	12.8	325	15487	12.8	325						
13766	18.5	470	13035	23.6	599						
13780	12.2	310	13694	21.7	552						
13787	13.0	330	13694	21.7	552						
13832	10.4	265	13460	12.6	320						
13833	33.3	845	13425	38.8	985						
13863	19.7	500	13563	26.4	670						
13870	9.4	240	13887	14.2	360						
13872	40.9	1040	15549	48.8	1240						
13886	14.2	360	15322	22.4	570						
13887	14.2	360	15265	16.9	430						
13892	23.6	600	13838	29.7	755						
13942	10.8	274	13950	15.4	390	13953	19.1	485			
13950	15.4	390	13953	19.1	485						
13959	21.5	545	13184	22.9	582						
13960	25.2	640	13838	29.7	755						
13970	9.8	250	13886	14.2	360						
13974	24.6	625	15477	25.2	640						
15028	17.3	440	13538	19.7	500						
15028	17.3	440	15032	19.7	500						
15040	13.8	350	13765	13.8	350						
15044	36.4	925	13872	40.9	1040						
15278	12.2	310	15327	19.7	500						
15280	13.2	335	13694	21.7	552						
15323	20.9	530	13574	22.4	568						
15327	19.7	500	15323	20.9	530						
15391	21.1	535	13184	22.9	582						
15459	23.0	585	15615	24.3	618						
15461	24.4	620	15583	26.0	660	13412	27.8	705			
15477	25.2	640	15484	31.1	790						
15503	27.6	700	13111	50.4	1280						
15519	10.6	270	15525	10.6	270						
15543	12.2	309	13361	29.5	750						
15544	42.1	1070	13111	50.4	1280						
15564	12.4	315	15284	14.8	375						
15566	12.8	325	15487	12.8	325						
15582	18.1	461	15462	26.0	660						
15583	24.4	621	13412	27.8	705						
15583	24.4	620	15594	26.3	675						
15591	15.7	400	13407	25.0	635						
15596	27.6	700	15600	27.6	700						
15604	24.4	620	15615	24.4	620						
15623	19.7	500	15486	20.1	510						
15634	9.8	250	13765	13.8	350						
15705	11.8	300	13122	11.8	300	13100	18.1	460	13399	22.0	560
15710	13.9	352	13377	14.6	370						
15716	10.6	270	15717	15.4	392	15718	18.9	481			
15717	15.4	392	15718	18.9	481						
15718	18.9	481	15719	21.8	553						

<b>Term</b>	<b>Definition</b>
<b>Air/Fuel Ratio</b>	In combustion, the amounts (in mass) of air and fuel involved in the combustion. For gasoline engines, the ideal Air/Fuel ratio is 14.7:1.
<b>Air/Fuel (A/F) Sensor</b>	See Wideband A/F Sensor. The term used by some sensor and vehicle manufacturers to differentiate wideband oxygen sensors from switching oxygen sensors.
<b>Closed Loop Operation</b>	Closed loop operation for an engine occurs when the ECM is receiving inputs from all sensors. In closed loop operation, the ECM is able to vary the cycle time for the injectors based on the inputs of throttle position, air mass, and the amount of free oxygen in the exhaust stream. Typically, oxygen sensors are the last sensors to become operational, since they must be heated to an operating temperature of at least 350° C. Until the oxygen sensors become operational, the ECM uses presets to determine the injector cycle times.
<b>Control Sensor</b>	Same as pre-catalyst sensor.
<b>Diagnostic Sensor</b>	Same as post-catalyst sensor.
<b>Downstream Sensor</b>	Same as post-catalyst sensor.
<b>ECM or ECU</b>	Engine Control Module or Electronic Control Unit; the computer that receives sensor input and controls injector timing.
<b>Emissions–California</b>	Vehicles certified for sale in California have an underhood emissions label stating that the vehicle conforms to U.S. EPA regulations and to California regulations applicable to the vehicle model year. Several states in the northeast, including Maine, Massachusetts, New York, and Vermont have adopted the California standards. Therefore, if there is a difference in oxygen sensor part numbers for California (Calif.) vehicles in this catalog, that difference may also apply to vehicles sold in these northeastern states.
<b>Emissions–Federal</b>	Vehicles with “49-State Emissions” certification have an underhood emissions label stating that the vehicle conforms to U.S. EPA regulations applicable to the vehicle model year. The label also states that the vehicle does not meet the emissions requirements for California or, “a state that has adopted California standards.”
<b>Heated Sensor</b>	A three or four wire sensor that includes a resistive element to bring the oxygen sensor to its operating temperature much more quickly than can be achieved using the hot exhaust gases alone.
<b>Lambda (-I)</b>	The ratio of the current (instantaneous) Air/Fuel ratio to the ideal (14.7:1) Air/Fuel ratio. If the engine is running rich, $\lambda < 1$ . If the engine is running lean, $\lambda > 1$ .
<b>Monitor Sensor</b>	Same as post-catalyst sensor.
<b>OE-Fit Sensor</b>	A sensor that is the original equipment sensor or one that has been engineered to fit multiple applications with minimal adjustment by the installer.
<b>Oxygen Sensor</b>	A device that generates a variable voltage or alters a reference voltage depending on the amount of free oxygen in the engine exhaust.
<b>Planar Sensor</b>	An oxygen sensor in which the ceramic sensing element with integrated heater is a thin, flat sandwich of zirconia ceramic and printed metallic and insulating layers. These layers are fused into a single piece at very high temperature in a kiln.

**Glossary of Terms**

<b>Term</b>	<b>Definition</b>
<b>Post-Catalyst Sensor</b>	An oxygen sensor mounted in the exhaust stream after the catalytic converter. The output from this sensor is used by the ECM primarily to ensure that the catalytic converter is performing within specifications.
<b>Pre-Catalyst Sensor</b>	An oxygen sensor mounted in the exhaust stream before the catalytic converter. The output of this sensor is used by the ECM to vary injector timing.
<b>Reference Air</b>	Air inside the oxygen sensor that provides a “normal” oxygen reference, in comparison to the amount of oxygen in the exhaust stream.
<b>Switching Sensor</b>	For zirconia types, the voltage output from the sensor changes very rapidly from 800mv to 300mv as the exhaust mixture changes from rich (no free oxygen) to lean (free oxygen). This rapid change occurs at the ideal Air/Fuel mixture of 14.7:1. The opposite occurs as the exhaust mixture changes from lean to rich. For titania types, the resistance across the sensing element changes very rapidly at the ideal Air/Fuel mixture. A voltage is applied by the ECM, and the voltage drop across the sensing element is measured.
<b>Thimble Sensor</b>	An oxygen sensor in which the ceramic sensing element is shaped like a thimble, with a hollow space inside for the reference air and heater. The ceramic can be either zirconia or titania. Nearly all oxygen sensors prior to 1998 were thimble designs.
<b>Titania Sensor</b>	The ceramic sensing element of the oxygen sensor is made of titania dioxide. Resistance across the sensing element changes with the amount of free oxygen in the exhaust gas.
<b>Unheated Sensor</b>	A one or two wire oxygen sensor that depends on the temperature of the exhaust gas to reach an operating temperature of 350° C.
<b>Universal Sensor</b>	An oxygen sensor that typically includes a connector(s) that allows the sensor to utilize the existing OE wire configuration. Universal sensors can often cover a wide range of applications.
<b>Upstream Sensor</b>	Same as pre-catalyst sensor.
<b>Wideband A/F Sensor</b>	An oxygen sensor that produces a precise output signal in proportion to the Air/Fuel ratio. This allows the sensor to accurately measure the oxygen content in the exhaust gas.
<b>Zirconia Sensor</b>	The ceramic sensing element of the oxygen sensor is made of zirconia dioxide. Voltage generated across the sensing element changes with the amount of free oxygen in the exhaust gas.

The illustrations below show several of the most common mounting configurations for oxygen sensors, depending on engine type and alignment. The terms used for each sensor location match the terms used in the Application Guide of our catalog. Check carefully to ensure that you are using the correct sensor for each location. Please note that the left side is the drivers side, the right is the passenger side.

