NTK

THE SENSOR SPECIALIST™

PREMIUM QUALITY AND PERFORMANCE. DOMESTIC AND IMPORT OE LEGACY.

The only premium full-line of over **7,500 sensors** in the aftermarket.

Fluid Level, Oxygen, Position, Pressure, Speed, Speciality and Temperature

OXYGEN SENSORS
over 1,350 part numbers
over 99% coverage*

TECHNICAL SENSORS
over 80 part types
over 6,500 part numbers

*Part coverage percentages are subject to change based on evolving vehicles in operation.

Technical Support: 877-473-6767
ngksparkplugs.com

THE SENSOR SPECIALIST™

TECHNICAL SENSORS

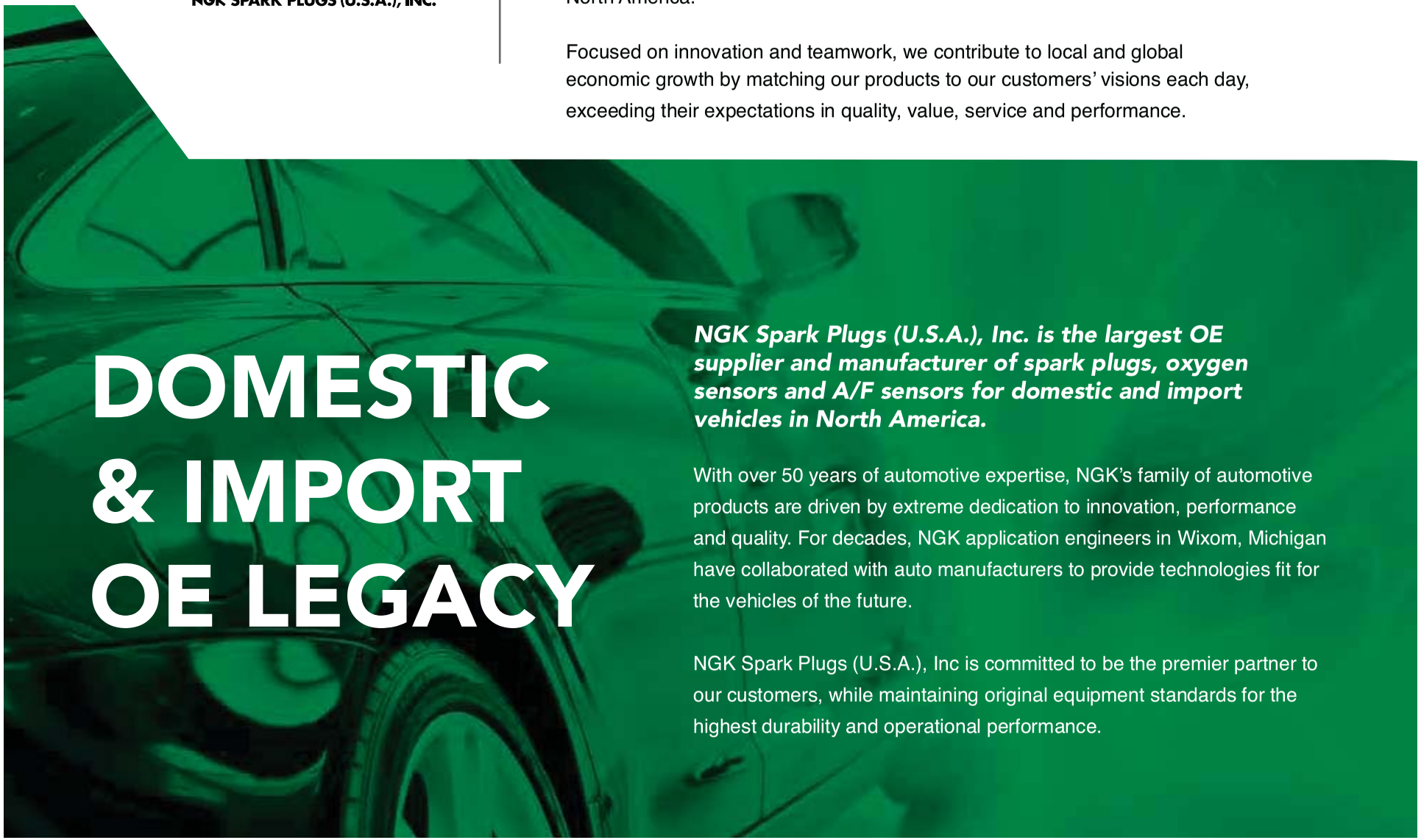
NGK SPARK PLUGS | NTK TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.

MISSION STATEMENT

We improve life through the environmentally responsible manufacture and precise application of advanced ceramic and material technologies for all of North America.

Focused on innovation and teamwork, we contribute to local and global economic growth by matching our products to our customers' visions each day, exceeding their expectations in quality, value, service and performance.



DOMESTIC & IMPORT OE LEGACY

NGK Spark Plugs (U.S.A.), Inc. is the largest OE supplier and manufacturer of spark plugs, oxygen sensors and A/F sensors for domestic and import vehicles in North America.

With over 50 years of automotive expertise, NGK's family of automotive products are driven by extreme dedication to innovation, performance and quality. For decades, NGK application engineers in Wixom, Michigan have collaborated with auto manufacturers to provide technologies fit for the vehicles of the future.

NGK Spark Plugs (U.S.A.), Inc is committed to be the premier partner to our customers, while maintaining original equipment standards for the highest durability and operational performance.

NTK® THE SENSOR SPECIALIST™

Building upon a foundation of premium full-line programs established under NGK ignition and NTK oxygen sensor products, NTK's expansion to technical sensors is part of our ongoing commitment to streamline product types and increase coverage under one premium brand: NTK, The Sensor Specialist™.

The only OE manufacturer with a full-line of technical sensors in the aftermarket, NTK technical sensors offer 85 technical sensor types with over 6,500 SKUs. On average, shops perform nearly 30 technical sensor replacements every month. With sensor replacements increasing as new vehicles incorporate connected and automated technologies, trust The Sensor Specialist™ for full-line market support and OE application technology.

POSITION SENSORS

ADJUSTABLE PEDAL

AUTO DOOR LOCK

BRAKE MASTER CYLINDER DIAPHRAGM

BRAKE PEDAL

EGR VALVE

MEMORY SEAT

STEERING WHEEL

TRANSFER CASE RANGE

TDC

TURBOCHARGER VANE

ACCELERATOR PEDAL

ENGINE CAMSHAFT

ENGINE CRANKSHAFT

THROTTLE

ACCELERATOR PEDAL POSITION (APPS)

NTK accelerator pedal position sensors provide the ECM with two DC voltage signals that change as the position of the accelerator pedal changes.

Accelerator pedal position sensor failure may cause a vehicle to dangerously drop speed while operating on the road. NTK APPS are the exact original equipment design, incorporating the circuitry specified by OEMs within the sensor element to ensure consistency in signal output.

THROTTLE POSITION (TPS)

Throttle position sensors produce a DC voltage signal telling the vehicle computer the location of the throttle plate within the throttle body.

CAMSHAFT POSITION (CMP)

Camshaft position sensors are located along or at the front or rear of the camshaft, monitoring the rotations that camshafts make to open the intake and exhaust valves. Camshaft rotation timing is critical for the ECU, making the accuracy of the electrical signal outputs from camshaft position sensors vital to the communication between the ignition system and the vehicle computer.

CRANKSHAFT POSITION (CKP)

The crankshaft position sensor provides an electrical signal to the ECM indicating the exact location of the crankshaft rotational position.

EXHAUST GAS DIFFERENTIAL

FUEL TANK

POWER STEERING

BAROMETRIC

BRAKE FLUID

MANIFOLD ABSOLUTE

PRESSURE SENSORS

EGR PRESSURE

EGR pressure sensors measure the delta pressure in the EGR system which is used by the ECM to verify EGR valve operation. Delta pressure is a compared measurement of pressure between ambient air pressure and the positive pressure that should be in a functioning EGR system.

POWER BRAKE BOOSTER VACUUM

SUPERCHARGER

EXHAUST BACKPRESSURE

MANIFOLD DIFFERENTIAL

AUTOMATIC TRANSMISSION OIL

FUEL INJECTION

FUEL TANK PRESSURE (FTP)

Fuel tank pressure sensors are located on top of the fuel tank or EVAP line, there it converts fuel tank pressure into an electrical input to the ECM. The vehicle computer uses the fuel tank pressure sensor to verify EVAP system operation. This sensor is crucial to monitoring vehicle emissions output.

MANIFOLD ABSOLUTE PRESSURE (MAP)

MAP sensors can be mounted directly onto the intake manifold or mounted remotely with a vacuum hose going to the intake manifold. This sensor is a major contributor to fuel injector pulse width and ignition and valve timing, reporting engine load to the engine computer.

SPEED SENSORS

MANUAL TRANSMISSION

AUTOMATIC TRANSMISSION

STEERING WHEEL MOTION

POWER STEERING

ENGINE RPM

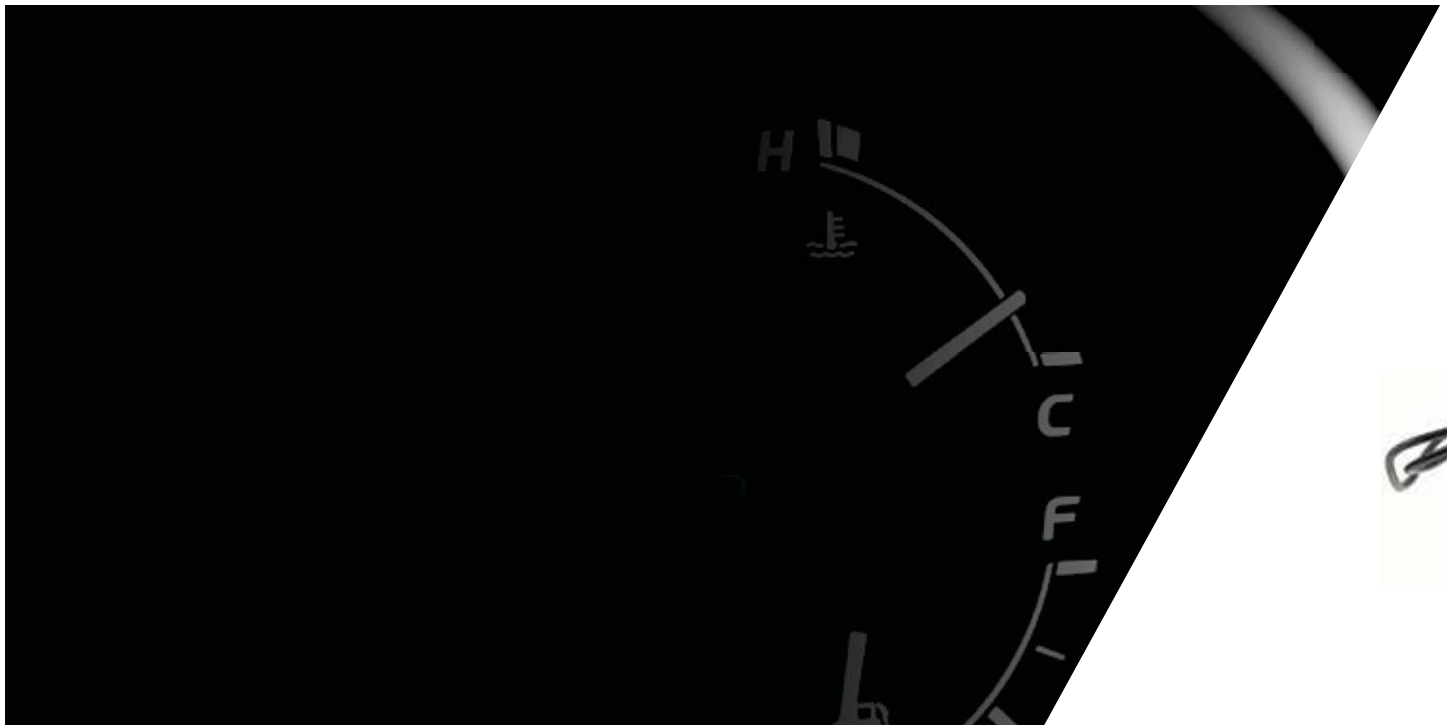
ANTI-LOCK BRAKE (ABS)

ABS sensors are located at each wheel through the backing plate, mounted through the wheel hub towards the spindle, located on the transmission tail shaft, or on top of the differential assembly. ABS sensors send a signal from the wheels to the ECU, which controls the anti-lock brake system operation.

VEHICLE SPEED

Vehicle Speed sensors help the ECU or the Anti-Lock Brake Control Module (ABCM) calculate vehicle speed by producing a signal in accordance with the wheel or axle speed.

TEMPERATURE SENSORS



ENGINE INTAKE

BATTERY

AIR CHARGE

ENGINE COOLANT

AIR CHARGE TEMPERATURE

Often confused with ambient temperature sensors, air charge sensors report the temperature of the air coming into the engine.

ENGINE COOLANT TEMPERATURE

The ECM determines the engine coolant temperature by monitoring the signal output from the coolant temperature sensors.

AMBIENT AIR

EGR VALVE

EXHAUST GAS (EGT)

FUEL

ENGINE CYLINDER HEAD

HVAC HEATER CORE

SPECIALTY SENSORS

ENGINE INTAKE MANIFOLD RUNNER

ABS DECELERATION

IGNITION MISFIRE

ACCELERATION

BATTERY CURRENT

HEADLIGHT LEVEL

TAIL LIGHT OUTAGE

IGNITION KNOCK

PARKING AID

SUSPENSION RIDE HEIGHT

AUTO HEADLIGHT

IGNITION KNOCK

Knock sensors are located at the engine block, either threaded into the side of the block or under the intake manifold, producing an input voltage that the ECM uses to measure engine dynamic vibration. Ignition knock sensors allow the vehicle computer to monitor the combustion chamber, advancing or delaying ignition and valve timing or injector pulse width for optimal engine performance.

PARKING AID

Located along the front and/or rear bumper, parking aid sensors emit frequencies off objects near them. This allows the vehicle's parking assist system to alert the driver of objects in the vehicle's path. Parking aid sensors are commonly replaced during collision repairs. These sensors communicate to each another; if one fails or the sensors fail to communicate, a trouble code will be set.

AUTO HEADLIGHT

Auto headlight sensors are typically located in the center of the front dash panel, providing signal outputs that indicate ambient light levels.

SUSPENSION RIDE HEIGHT

Mounted onto a control arm or strut assembly, the suspension ride height sensor sends signals to the ECU to adjust suspension settings. Road debris or unpaved roads cause wear on ride height sensors. Failure can cause the rear suspension to sag, handling concerns or vehicle stability faults.

FLUID LEVEL SENSORS

WASHER FLUID

BRAKE FLUID

ENGINE OIL

ENGINE COOLANT

FUEL

POWER STEERING FLUID

Fluid level sensors are intended to provide a warning of a low fluid situation to the vehicle's operator and sometimes the vehicles control module(s). A sensor failure could cause an indicator to illuminate on the dash, same as if the fluid level were low. Should a leak or loss of fluid actually be present, the sensor would not be able to accurately report this, which could lead to a costly and time-consuming repair.

EMISSIONS SENSORS

SWITCHING O2

Switching oxygen sensors are 87% of current emissions sensor replacements.

Predominantly located downstream of the catalytic converter, switching oxygen sensors continue to make up the majority of emissions sensor replacement with approximately 6.3 million aftermarket units.

The use of 1-W, 2-W and 3-W switching sensors have decreased over the last few years, being replaced with 4-W switching sensors and modern WRAF type sensors.

WIDEBAND (A/F)

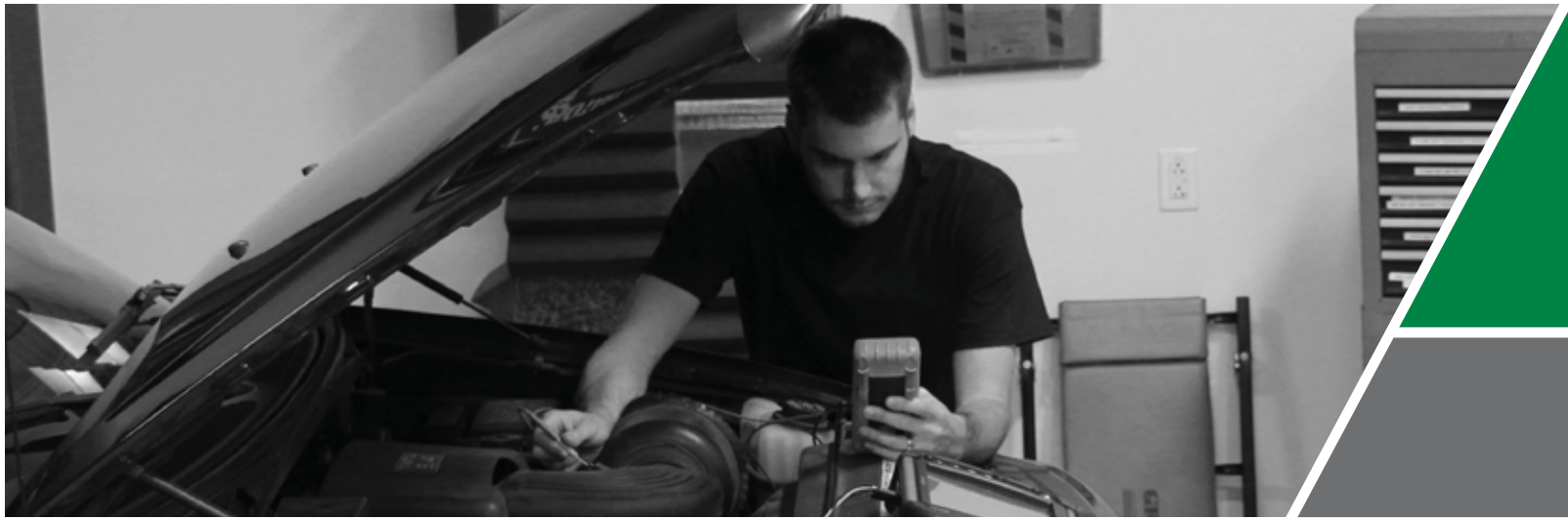
Wide band sensors monitor the air fuel ratio to a higher degree of accuracy to provide precise ratio control. NTK is a pioneer of wideband sensor manufacturing, having developed the technology in the 1980s for North American OEMs.

Wideband sensor technology is rapidly increasing, making up 40% of emissions sensors in current model year vehicles. In response to this, NTK is continually expanding its wideband sensor parts, averaging 5% growth for parts in operation (PIO) annually.

Due to the complexity of wideband technology, OE part replacement is strongly recommended and with almost 250 million wideband sensors on the road today, supplying the OE part is more important than ever before.

Increasing government regulations on emissions and fuel efficiency, along with growing connected car technologies, make quality and complex OE sensor evermore crucial. As The Sensor Specialist™, NTK is continually adding new part numbers and developing new technology to meet the increasing emissions sensor market demand. NTK supplies more oxygen sensors to OEMs than any other supplier. Over the past ten years, NTK has been the only company to show continual growth in emissions sensor market share for parts in operation.

TECHNICAL TRAINING & PRODUCT TESTING



NGK SPARK PLUGS TECHNICAL TRAINING SPECIALISTS

NGK'S TECHNICAL TRAINING MISSION

Geared toward the modern technician, NGK Spark Plugs (U.S.A.), Inc.'s Technical Training combines the instruction of hands-on industry techniques and OEM expertise in a contemporary, lecture-style atmosphere. Focused on further defining diagnostic skills relating to emissions components, our training enables technicians to adapt to transitional industry trends.

EDUCATION

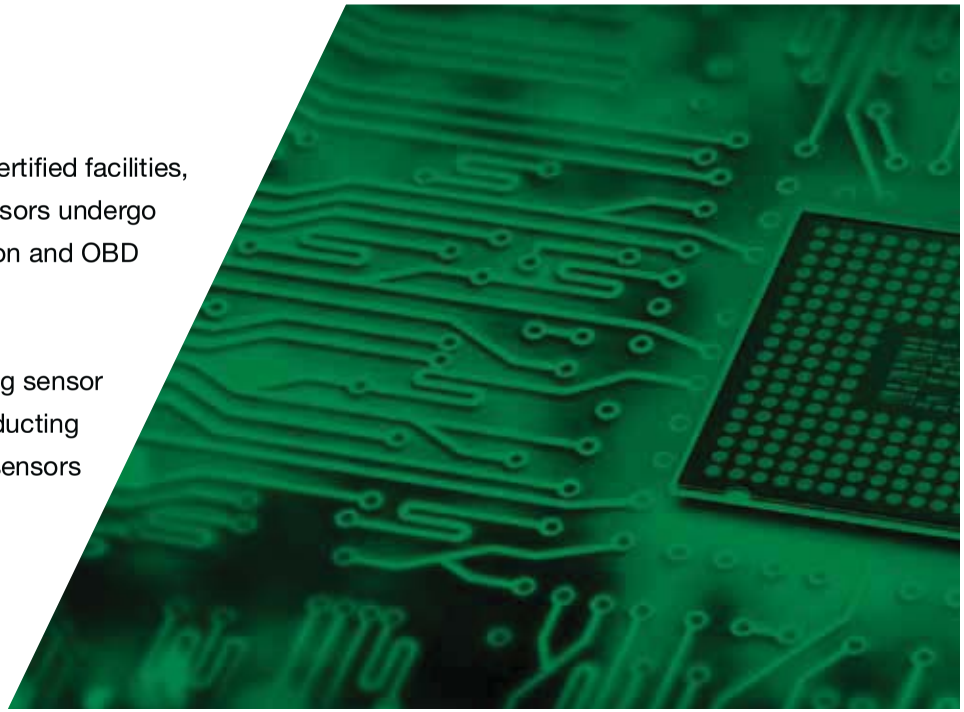
NGK's technical support team is staffed with ASE-certified technicians to provide training and assistance to installers, whether they are professionals or do-it-yourselfers. We are in a new age of automotive innovation. Connected and intelligent car systems are rapidly influencing the diagnostic procedures for automotive repairs. The challenge faced by most technicians is keeping their skills current with evolving engine systems.

Our Advanced Drivability and Advanced Ignition training programs are designed to teach technicians how to use modern and traditional diagnostic tools more effectively when identifying repairs. As an ASE-accredited CASE (Continuing Automotive Service Education) accredited training provider, NGK awards CEU (Continuing Education Unit) credit, conducts need analysis, develops education materials and evaluates knowledge acquired by participants. The Advanced Drivability Training is an extension of NGK's commitment to educating for the future.

RIGOROUS TESTING STANDARDS

NTK manufactures sensors in ISO 14001, TS 16949 and TS 17025-certified facilities, ensuring a quality that meets or exceeds OE specifications. NTK sensors undergo extreme test conditions that include vibration, thermal shock, vibration and OBD verification on vehicle testing.

In-house technical sensor specialists work to provide industry-leading sensor solutions by thoroughly investigating sensor-related repairs and conducting case studies. NTK engineers are continuously developing technical sensors to prevent common repair problems found in other sensor parts.



THE SENSOR SPECIALIST™

NGK Spark Plugs (U.S.A.), Inc.
46929 Magellan Drive
Wixom, MI 48393

QUESTIONS?
877-473-6767

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THE SENSOR SPECIALIST™

ANTI-LOCK BRAKE SYSTEM

SPEED SENSOR

PURPOSE
The anti-lock brake system (ABS) sensor monitors wheel speed

FUNCTION
- Sends an analog or digital signal to the ECM to help prevent the brakes from locking during a stop
- Uses this signal to determine the amount of wheel lock-up and/or wheel slippage for the anti-lock brake, traction control and stability control systems

POSITION
- At each wheel, the differential or transmission tail shaft housing

CAUSE FOR REPLACEMENT
- ABS/brake lamp illumination
- No/erratic ABS operation
- No/erratic traction control operation
- No/erratic stability control operation

The NTK Difference

- **Glass reinforced plastic for superior resistance to contamination**
- **Includes all necessary brackets and hardware**
- **Application specific harness length**

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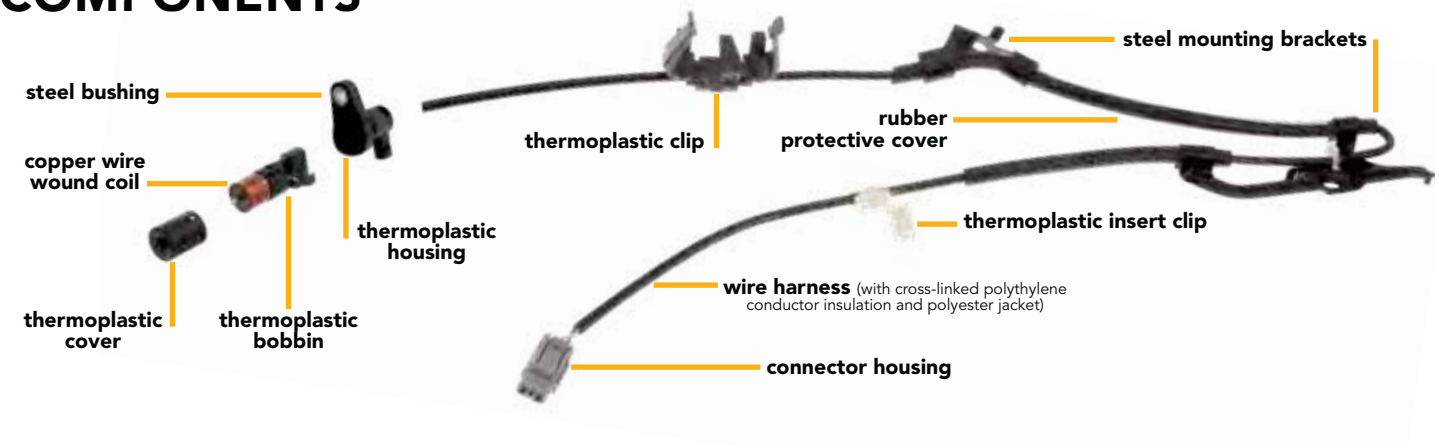
ANTI-LOCK BRAKE SYSTEM SPEED SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	AB2017	17,881,756	2013 - 1999	Cadillac, Chevrolet, GMC, Hummer
2	AB1376	7,752,946	2014 - 1990	Ford, Lincoln, Mazda, Mercury
3	AB1994	7,438,262	2014 - 2007	Cadillac, Chevrolet, GMC
4	AB1381	3,890,470	2005 - 1998	Dodge, Ram
5	AB2048	3,250,368	2015 - 2007	Dodge, Jeep
6	AB1985	3,195,453	2014 - 2007	Cadillac, Chevrolet, GMC
7	AB2003	2,984,905	2015 - 2004	Ford, Lincoln
8	AB0624	2,526,227	2014 - 2007	Nissan
9	AB1987	2,107,753	2009 - 2000	Buick, Chevrolet, GMC, Isuzu, Oldsmobile, Saab
10	AB1729	1,828,978	2007 - 2001	Chrysler, Dodge

THE SENSOR SPECIALIST™

AUTOMATIC TRANSMISSION

SPEED SENSOR

PURPOSE
The automatic transmission speed (ATS) sensor measures the rotational speed of the transmission shafts

FUNCTION
- Input and output transmission speeds are monitored and relayed to the ECM/TCM by either an analog or digital signal for proper shift points, speedometer operation and transmission diagnostics

POSITION
- Mounted internally or externally on the transmission

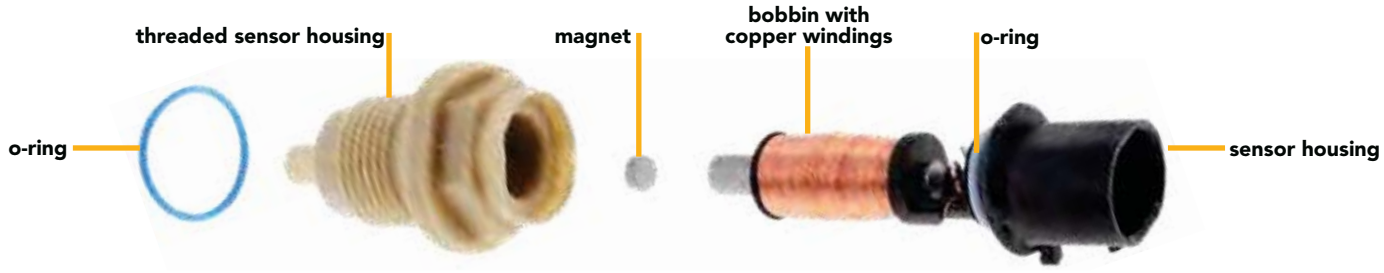
CAUSE FOR REPLACEMENT
- Check engine lamp illumination
- Poor/erratic shifting
- No/erratic speedometer operation
- Transmission limp/fail-safe mode

The NTK Difference

- **High strength thermoplastic is resistant to temperature, moisture and chemicals**
- **Pre-installed o-ring precisely matches OE material and diameter for ease of installation and superior sealing**
- **Sensor output signal matches OE specifications**

AUTOMATIC TRANSMISSION SPEED SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	AU0117	12,708,412	2015 - 1992	Lexus, Scion, Toyota, Pontiac
2	AU0109	10,931,934	2017 - 1999	Chrysler, Dodge, Jeep, Plymouth
3	AU0125	8,118,673	2017- 1989	Chrysler, Dodge, Jeep, Plymouth
4	AU0137	6,497,758	2012 - 1988	Chevrolet, GMC
5	AU0139	5,773,714	2017 - 1998	Chrysler, Dodge, Plymouth
6	AU0200	4,863,898	2017 - 2007	Chrysler, Dodge, Ram
7	AU0136	4,411,753	2011 - 1995	Chevrolet, Oldsmobile, Pontiac, Saturn
8	AU0001	4,166,122	2002 - 1992	Ford, Lincoln, Mercury
9	AU0142	3,022,973	2005 - 1998	Ford, Lincoln, Mercury
10	AU0110	2,860,686	2005 - 1996	Acura, Honda

THE SENSOR SPECIALIST™

EXHAUST GAS RECIRCULATION

PRESSURE SENSOR

PURPOSE

The exhaust gas recirculation (EGR) sensor determines the exact pressure within the exhaust gas recirculation (EGR) system

FUNCTION

- Measures the pressure changes during EGR operation
- The signal is sent to the ECM to ensure proper exhaust gas flow and system function

POSITION

- Located near the EGR valve in the engine compartment

CAUSE FOR REPLACEMENT

- Check engine lamp illumination
- Rough idle
- Engine hesitation
- Poor fuel economy
- Loss of engine power
- Failed emissions test

The NTK Difference

- **First-to-market to utilize improved solid state dual sensor technology**
- **High strength thermoplastic is resistant to temperature, moisture and chemicals**

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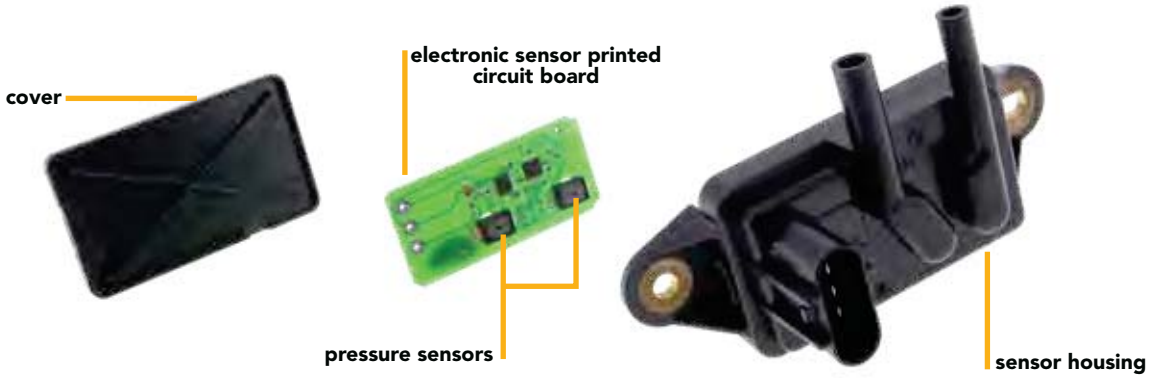
Tech Support: (877) 473-6767 ext. 2

THE SENSOR SPECIALIST™

EXHAUST GAS RECIRCULATION PRESSURE SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	EA0009	11,808,618	2011 - 1994	Ford, Lincoln, Mazda, Mercury
2	EA0008	2,959,948	2005 - 2000	Ford, Lincoln, Mazda, Mercury
3	EA0011	1,421,121	2004 - 1994	Ford
4	EA0007	500,145	1996 - 1990	Ford, Lincoln, Mazda, Mercury
5	EA0013	448,050	2010 - 2004	Ford
6	EA0001	254,323	2011- 2008	Ford
7	EA0004	229,193	1995 - 1990	Ford, Mercury
8	EA0014	127,924	2010 - 2008	Ford
9	EA0002	126,375	2012	Ford
10	EA0003	108,859	1992 - 1986	Ford, Mercury

THE SENSOR SPECIALIST™

ENGINE CAMSHAFT

POSITION SENSOR

PURPOSE
The engine camshaft sensor determines the exact position and speed of the camshaft(s)

FUNCTION
- Sends an analog or digital signal to the ECM to ensure proper timing of fuel injection and ignition as well as VVT operation

POSITION
- Located in the cylinder head, valve cover or timing cover

CAUSE FOR REPLACEMENT
- Check engine lamp illumination
- No start
- Hard start/extended cranking time
- Failed emissions test
- Engine misfire

The NTK Difference

- **More robust circuit board design to increase durability**
- **Precision-wound, coated-copper windings to increase longevity**
- **Magnet size and strength optimized for precise signal output**
- **100% thermo-shock and vibration tested to ensure the best performance in extreme conditions**

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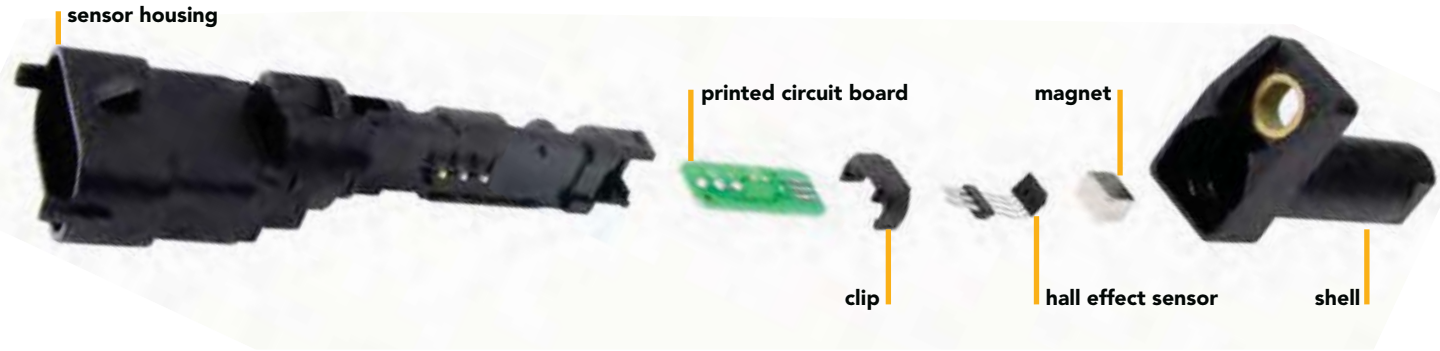
THE SENSOR SPECIALIST™

ENGINE CAMSHAFT POSITION SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	EC0117	9,632,538	2017 - 1991	Ford, Lincoln, Mazda, Mercury
2	EC0099	8,247,434	2007 - 1999	Buick, Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saab, Isuzu
3	EC0321	6,545,004	2016 - 2004	Buick, Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saab
4	EC0001	4,966,320	2007 - 1995	Cadillac, Chevrolet, GMC, Isuzu, Oldsmobile
5	EC0323	4,463,157	2016 - 1994	Buick, Chevrolet, GMC, Isuzu, Oldsmoble
6	EC0114	4,292,758	2007 - 1999	Chrylser, Dodge, Jeep, Ram, Mitsubishi
7	EC0339	3,526,455	2015 - 2004	Chrylser, Dodge, Jeep, Ram
8	EC0054	3,290,356	2017 - 2007	Buick, Chevrolet, Olsmobile, Pontiac, Acura, Honda
9	EC0034	3,163,667	2009 - 1994	Chrylser, Dodge, Jeep, Ram, Mitsubishi
10	EC0066	3,094,850	2018 - 2010	Buick, Cadillac, Chevrolet, GMC, Saab, Saturn

THE SENSOR SPECIALIST™

ENGINE COOLANT

TEMPERATURE SENSOR

PURPOSE

The engine coolant sensor determines the exact temperature of the engine coolant

FUNCTION

- Sends an analog signal to the ECM to ensure proper air/fuel ratio along with proper operation of the cooling fan(s) and temperature gauge

POSITION

- Located on the cylinder head, engine block, thermostat housing or intake manifold

CAUSE FOR REPLACEMENT

- Check engine lamp illumination
- No/erratic gauge operation
- No/erratic cooling fan operation
- Engine overheating
- Rough idle
- Engine hesitation
- Poor fuel economy
- Failed emissions test

The NTK Difference

- **Thread sealant/o-ring installed (where applicable)**
- **Thermistor placement within the housing matches original design to ensure proper output**
- **Proper thermal conductive grease to provide accurate temperature transfer to the thermistor**

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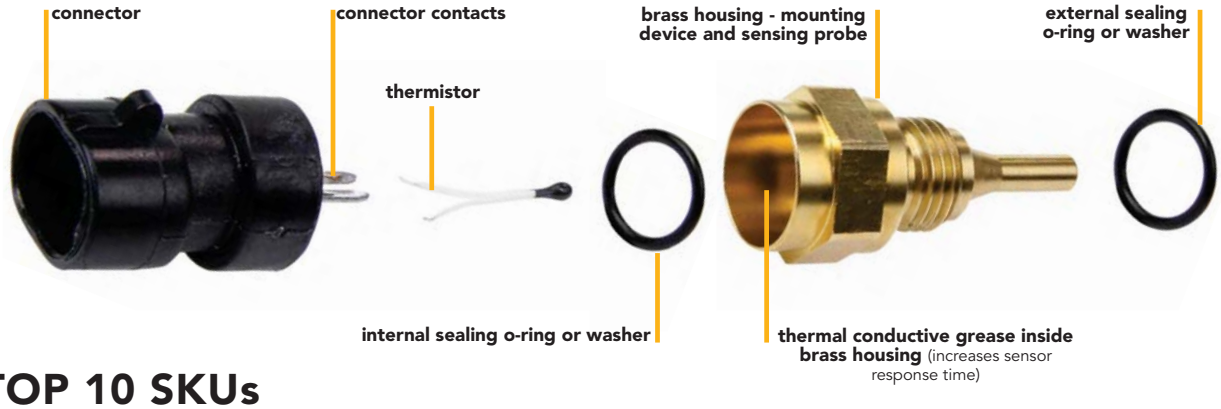
THE SENSOR SPECIALIST™

ENGINE COOLANT TEMPERATURE SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	EF0075	24,639,256	2016 - 1998	Buick, Cadillac, GMC, Isuzu, Pontiac, Saturn
2	EF0074	20,002,810	2013 - 1979	Buick, Cadillac, GMC, Isuzu, Pontiac
3	EF0008	19,825,956	2014 - 1979	Buick, Chevrolet, Pontiac
4	EF0105	12,376,348	2017 - 1985	Chevrolet, Pontiac, Suzuki
5	EF0103	12,058,648	2016 - 1991	Ford
6	EF0112	7,360,841	2017 - 2000	Hyundai
7	EF0034	7,223,617	2016 - 2008	Chrysler, Dodge, Jeep, Ram, VW
8	EF0110	6,550,299	2011 - 2001	Acura, Honda
9	EF0095	6,349,104	2009 - 1996	Chrysler, Dodge, Jeep, Ram
10	EF0106	5,774,829	2016 - 2000	Ford, Lincoln, Mazda, Mercury

THE SENSOR SPECIALIST™

ENGINE CRANKSHAFT

POSITION SENSOR

PURPOSE
The crankshaft sensor determines the exact position and speed of the crankshaft

FUNCTION
- Sends an analog or digital signal to the ECM to ensure proper timing of fuel injection and ignition, as well as misfire monitoring

POSITION
- Located in the engine block, in or on the timing cover, near the harmonic balancer or flywheel

CAUSE FOR REPLACEMENT
- Check engine lamp illumination
- No start
- Hard start/extended cranking time
- Failed emissions test
- Engine misfire
- Engine stalling

The NTK Difference

- **More robust circuit board design to increase durability**
- **Precision-wound, coated-copper windings to increase longevity**
- **Magnet size and strength optimized for precise signal output**
- **100% thermo-shock and vibration tested to ensure the best performance in extreme conditions**

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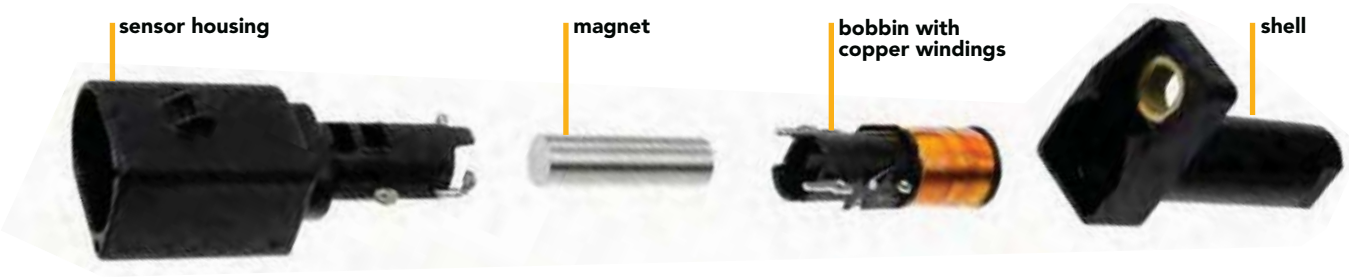
ENGINE CRANKSHAFT POSITION SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	EH0201	11,418,799	2005 - 1986	Ford, Lincoln, Mercury, Panoz
2	EH0157	8,425,782	2011 - 1997	Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saab, Isuzu
3	EH0403	6,322,041	2011 - 2007	Buick, Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saab
4	EH0160	5,264,482	2009 - 1993	Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saab, Isuzu
5	EH0139	3,493,280	2005 - 1995	Buick, Chevrolet, GMC, Oldsmobile, Pontiac, Saab, Saturn
6	EH0147	3,404,631	2007 - 1992	Buick, Chevrolet, Pontiac
7	EH0103	3,132,473	2011 - 1997	Chrysler, Dodge, Jeep, Plymouth
8	EH0206	3,073,715	2013 - 1995	Ford, Mazda, Mercury
9	EH0196	2,686,906	2010 - 2003	Ford
10	EH0392	2,280,636	2011 - 2006	Chrysler, Dodge, Jeep

THE SENSOR SPECIALIST™

FUEL TANK

PRESSURE SENSOR

PURPOSE
The fuel tank sensor determines the fuel vapor pressure or vacuum within the EVAP system

FUNCTION
- Sends signal to the ECM which varies with pressure or vacuum change, verifying the EVAP system integrity and operation

POSITION
- Located on the fuel tank or in a vapor hose

CAUSE FOR REPLACEMENT
- Check engine lamp illumination

The NTK Difference

- **High strength thermoplastic is resistant to temperature, moisture and chemicals**
- **Properly sized grommet/o-ring is pre-installed (where applicable)**

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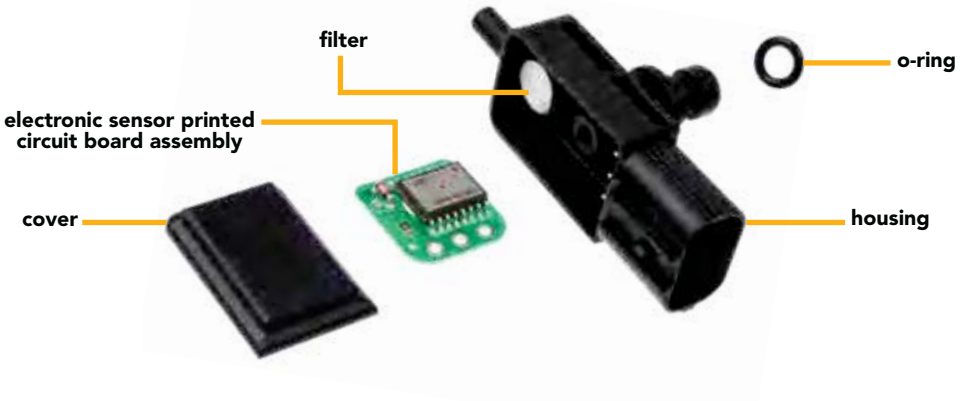
THE SENSOR SPECIALIST™

FUEL TANK PRESSURE SENSOR

COMPONENTS



TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	FG0012	30,794,556	2015 - 1996	Buick, Cadillac, Chevrolet, GMC, Hummer, Oldmobile, Pontiac, Saturn, Acura, Hyundai
2	FG0004	18,344,618	2017 - 2007	Buick, Cadillac, Chevrolet, GMC, Hummer, Oldmobile, Pontiac, Saab, Saturn,
3	FG0032	14,908,345	2017- 2003	Acura, Honda
4	FG0057	12,179,391	2016- 1996	Infiniti, Nissan
5	FG0066	10,193,909	2010 - 1996	Ford, Lincoln, Mercury
6	FG0034	3,629,346	2007 - 1999	Lexus, Scion, Toyota
7	FG0021	2,411,223	2005 - 1998	Acura, Honda
8	FG0002	2,303,680	2015 - 1998	Mercedes - Benz
9	FG0018	1,914,503	2005- 1997	Acura, Honda
10	FG0023	1,621,771	2011- 2001	Hyundai, Kia

THE SENSOR SPECIALIST™

IGNITION KNOCK

SPECIALTY SENSOR

PURPOSE
The ignition knock sensor determines if engine knock is present (caused by detonation)

FUNCTION
- A piezoelectric crystal, which generates a varying voltage based upon engine vibration intensity, sends a signal to the ECM
- Signal is used to retard ignition timing which prevents engine damage caused by pre-ignition

POSITION
- Located on the engine block

CAUSE FOR REPLACEMENT
- Check engine lamp illumination
- Engine hesitation
- Poor fuel economy
- Failed emissions test

The NTK Difference

- **Internally sealed to prevent moisture intrusion**
- **Advanced piezo ceramic technology for increased durability**
- **Shielded harness prevents electrical interference**
- **Harness length and wire gauge matches OE**

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THE SENSOR SPECIALIST™

IGNITION KNOCK SPECIALTY SENSOR

COMPONENTS

TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	ID0215	26,767,949	2017 - 2002	Lexus, Toyota
2	ID0232	9,648,597	2017 - 1996	Chrysler, Dodge, Jeep, Ram, VW
3	ID0300	9,301,180	2014 - 2004	Buick, Cadillac, Chevrolet, GMC, Isuzu, Pontiac, Saab, Saturn
4	ID0116	8,016,089	2007 - 1998	Buick, Cadillac, Chevrolet, GMC, Isuzu, Pontiac
5	ID0141	4,751,972	2017 - 1998	Ford, Lincoln, Mercury
6	ID0085	3,341,126	2010 - 1999	Acura, Honda, Saturn
7	ID0107	3,272,194	2002 - 1985	Buick, Cadillac, Chevrolet, GMC, Isuzu, Oldsmobile, Pontiac
8	ID0106	3,268,039	2005 - 1996	Buick, Chevrolet, GMC, Oldsmobile, Pontiac
9	ID0166	3,187,005	2005 - 1991	Toyota, Chevrolet
10	ID0301	3,179,264	2014 - 2004	Ford, Lincoln, Mazda, Mercury

THE SENSOR SPECIALIST™

MANIFOLD ABSOLUTE

PRESSURE SENSOR

PURPOSE

The manifold absolute pressure (MAP) sensor determines the intake manifold pressure or vacuum

FUNCTION

- Sends voltage signal to the ECM which changes with the varying pressure/vacuum within the intake manifold
- ECM uses signal to determine engine load and ensure proper air/fuel ratio

POSITION

- Intake manifold, throttle body or remote mounted under hood

CAUSE FOR REPLACEMENT

- Check engine lamp illumination
- Engine hesitation
- Poor fuel economy
- Failed emissions test
- Engine stalling
- Extended crank time

The NTK Difference

- **High strength thermoplastic is resistant to temperature, moisture and chemicals**
- **Properly sized grommet/o-ring is pre-installed (where applicable)**

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Tech Support: (877) 473-6767 ext. 2

THE SENSOR SPECIALIST™

MANIFOLD ABSOLUTE PRESSURE SENSOR

COMPONENTS

TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	MA0097	19,261,427	2011 - 1995	Buick, Cadillac, Chevrolet, GMC, Hummer, Oldsmobile, Pontiac, Saab, Saturn, Isuzu
2	MA0205	9,916,587	2016 - 2007	Chevrolet
3	MA0089	8,596,349	2008 - 1981	Buick, Cadillac, Chevrolet, GMC, Hummer, Oldsmobile, Pontiac, Saab, Saturn, Isuzu, Jeep, Volvo
4	MA0090	7,541,270	2009 - 1997	Buick, Cadillac, Chevrolet, GMC, Hummer, Oldsmobile, Pontiac, Saab, Saturn, Isuzu
5	MA0177	5,345,527	2013 - 2002	Chrysler, Dodge, Jeep, Mitsubishi, Ram
6	MA0182	4,977,030	2017 - 2003	Chrysler, Dodge, Jeep, Ram, Hyundai
7	MA0032	4,683,430	2017 - 2008	Hyundai, Kai
8	MA0094	3,590,846	2007 - 2001	Acura, Honda
9	MA0114	3,193,401	2003 - 1997	Dodge, Jeep, Ram
10	MA0088	3,1341,71	2005 - 1992	Acura, Honda

THE SENSOR SPECIALIST™

THROTTLE

POSITION SENSOR

PURPOSE
The throttle position sensor (TPS) determines the throttle plate position

FUNCTION
- Sends voltage signal(s) to the ECM to monitor the rotation of the throttle plate and ensure proper air/fuel ratio
- Signal is also used to verify proper throttle plate actuator function (on drive-by-wire systems)

POSITION
- Throttle body or remote mounted on the throttle linkage

CAUSE FOR REPLACEMENT
- Check engine lamp illumination
- Limp/reduced power mode
- Engine hesitation
- Failed emissions test

The NTK Difference

- **Contactless sensor technology on selected applications**
- **Internal spring contact to lead frame connection ensures greater reliability over soldered connections**
- **High strength thermoplastic is resistant to temperature, moisture and chemicals**

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THE SENSOR SPECIALIST™

THROTTLE POSITION SENSOR

COMPONENTS

TOP 10 SKUs

VIO Rank	NTK Part No	VIO	Year	Coverage
1	TH0045	12,450,336	2007 - 1993	Buick, Cadillac, Chevrolet, GMC, Oldmobile, Pontiac, Saturn
2	TH0098	9,089,183	2006 - 1994	Ford, Lincoln, Mazda, Mercury
3	TH0006	5,228,570	2014 - 2005	Buick, Cadillac, Chevrolet, GMC, Hummer, Pontiac, Saturn
4	TH0093	4,400,369	2011 - 1996	Ford, Mazda, Mercury
5	TH0009	4,199,935	2009 - 2003	Buick, Cadillac, Chevrolet, GMC
6	TH0086	3,772,168	2007 - 1997	Dodge, Ram, Jeep, Mitsubishi
7	TH0262	3738630	2010 - 2003	Ford, Lincoln, Mercury
8	TH0048	2,321,435	2005 - 1995	Buick, Chevrolet, Pontiac
9	TH0087	2,149,878	2007 - 1998	Chrysler, Dodge, Plymouth
10	TH0167	1,767,001	2007 - 2002	Dodge, Jeep, Mitsubishi

PREMIUM QUALITY AND PERFORMANCE

NTK position sensors are engineered to provide:
- **accurate and consistent signal**
- **longer component life**
- **proper alignment, positioning and spacing for easier installation.**

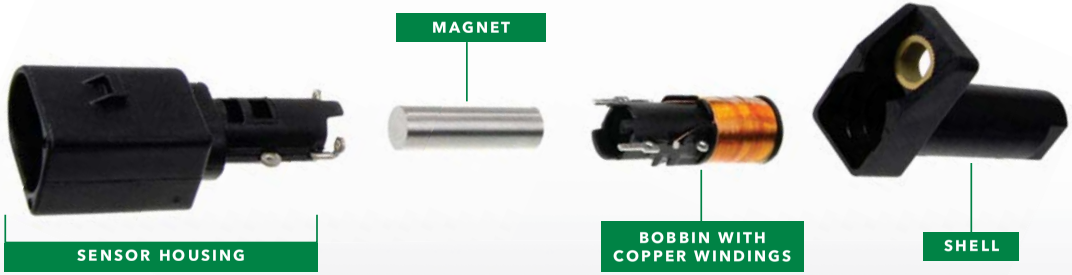
NTK engine camshaft and crankshaft sensors are available in either analog or digital technologies.

ENGINE CRANKSHAFT

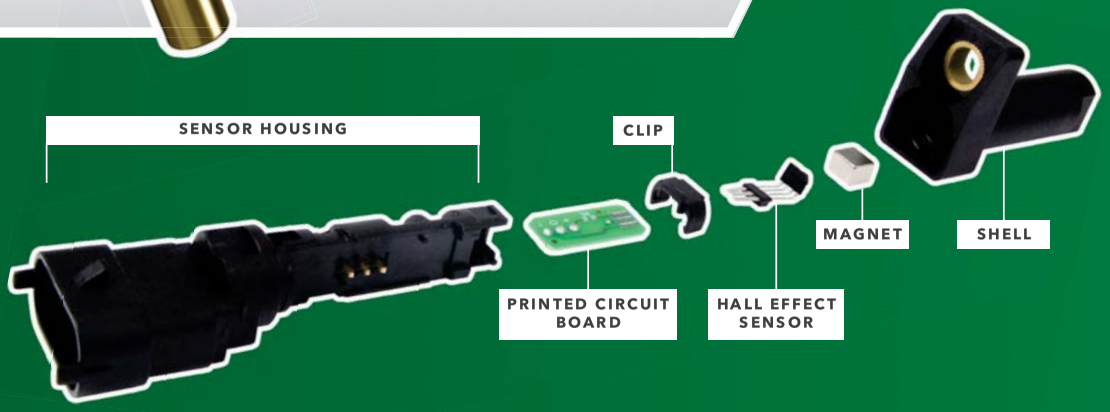
The NTK Difference

Analog Sensor Technology (shown)

- Precision-wound, copper-coated windings to increase longevity & proven premium performance
- Magnet size and strength optimized for precise signal output



ENGINE CAMSHAFT



The NTK Difference

Digital Sensor Technology (shown)

- More robust circuit board traces increase durability & performance
- Robotically soldered circuit board connections to increase reliability

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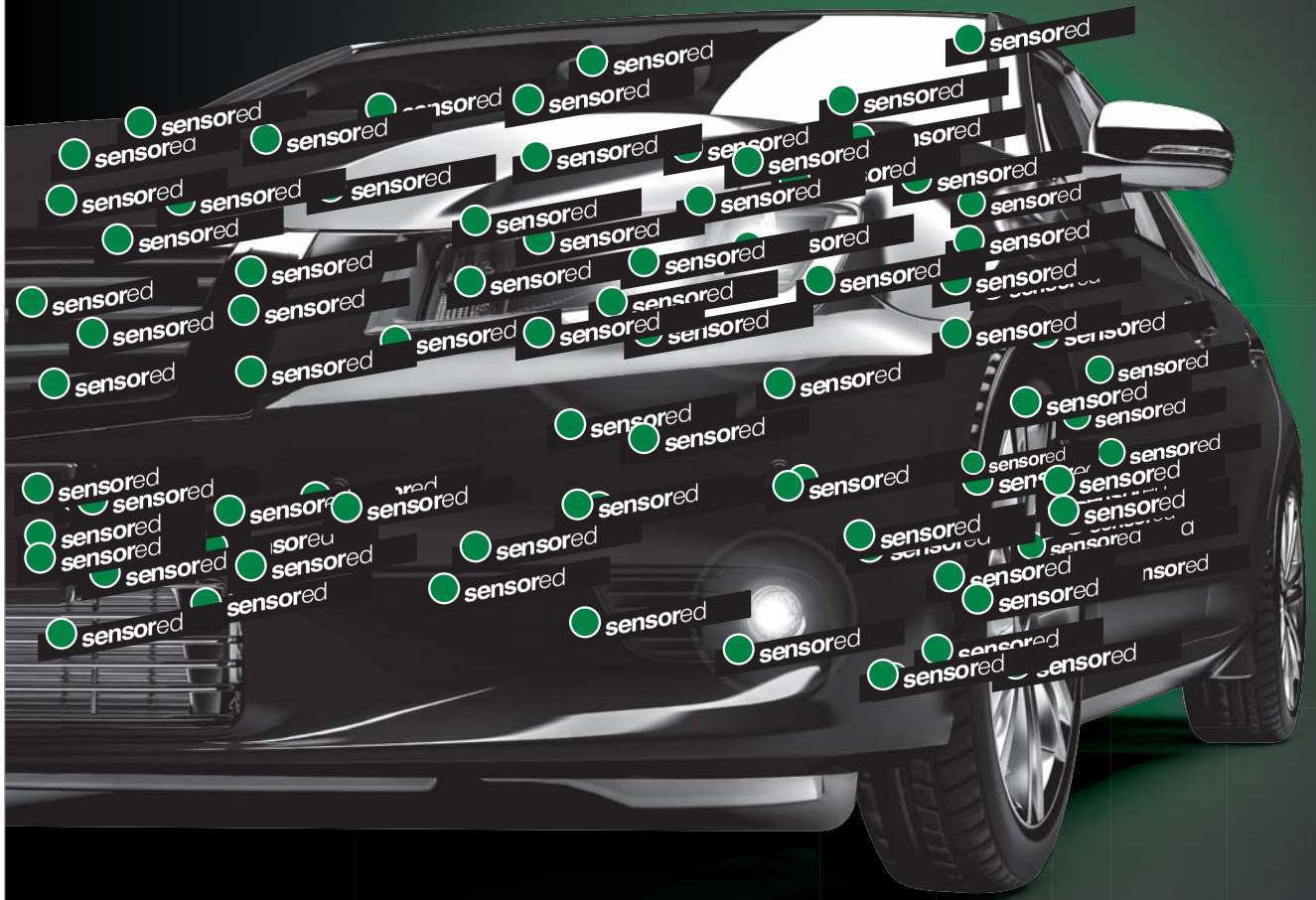
THE SENSOR SPECIALIST

A sensored load of new sensors.

A car load of over 6,500 sensors, in fact.



Engineered for optimum performance, our new sensors meet exacting OE requirements and are designed for reliability.

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NTK

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NEW NUMBER ANNOUNCEMENT

December 2018 | Sensors

SPEED SENSORS
64 new parts, **12.1 mil** VIO

FLUID LEVEL SENSORS
17 new parts, **6.1 mil** VIO

POSITION SENSORS
39 new parts, **13.4 mil** VIO

PRESSURE SENSORS
9 new parts, **956K** VIO

SPECIALTY SENSORS
35 new parts
15.7 mil VIO

TEMPERATURE SENSOR
1 new part
250K VIO

165 TOTAL SKUs

66 FIRST TO MARKET SKUs

48.7 mil VIO COVERAGE

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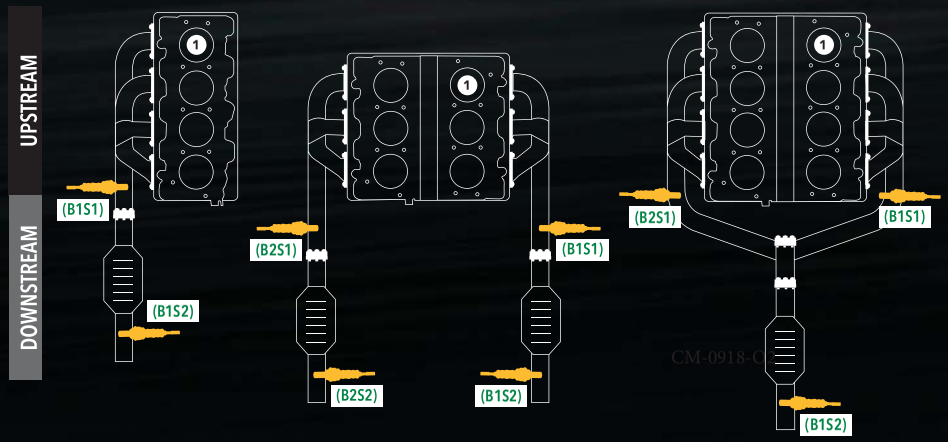
THE SENSOR SPECIALIST™

LEADING DOMESTIC & IMPORT
OXYGEN SENSORS

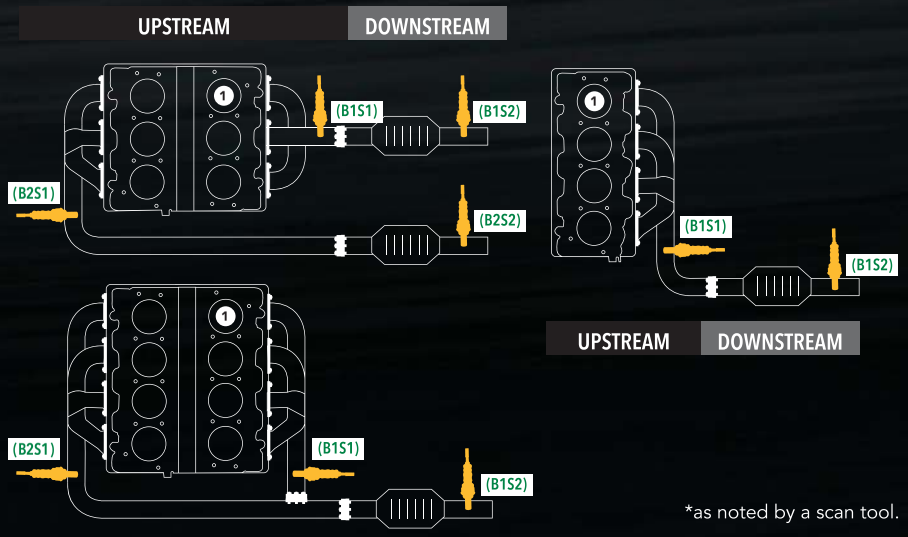
SENSOR POSITIONS*

Bank 1 is determined by locating the ❶ cylinder in the firing order.

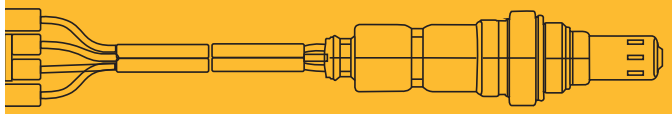
4-WHEEL DRIVE / REAR-WHEEL DRIVE / ALL-WHEEL DRIVE



FRONT-WHEEL DRIVE / ALL-WHEEL DRIVE



*as noted by a scan tool.



THE SENSOR SPECIALIST™

99.5% VIO COVERAGE

CM-0918-O2

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THE SENSOR SPECIALIST™

OXYGEN SENSORS

NTK Oxygen Sensors manufactures and supplies over half of original equipment (OE) oxygen sensors.

Each NTK sensor is designed specifically for an OEM application, down to the wire length, protective sleeve material, grommets, clips, and protection tube design. NTK is continuously developing sensor technologies to work with new advanced vehicle computer components.

The NTK Difference

Dual-coated Platinum element
Increases longevity and ensures quickest response time

Water resistant connector
Protects against water contamination related failures

3-stage element overcoat
Provides superior protection against element contamination

Fast light-off times
Reduced time spent in open-loop mode: decreases emissions, increases fuel economy

Variety of protective sheathings
Resists high temperatures with variety of OEM-specified materials (e.g. fiberglass, EPDM, etc.)

Pure alumina ceramic
Protects the sensor element by effectively filtering exhaust gas

99.5% VIO COVERAGE

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THE SENSOR SPECIALIST™

TECHNOLOGY

TITANIA

- Does not require outside reference air
- Features a smaller element to shorten light-off time
- Available in 12mm and 18mm thread size

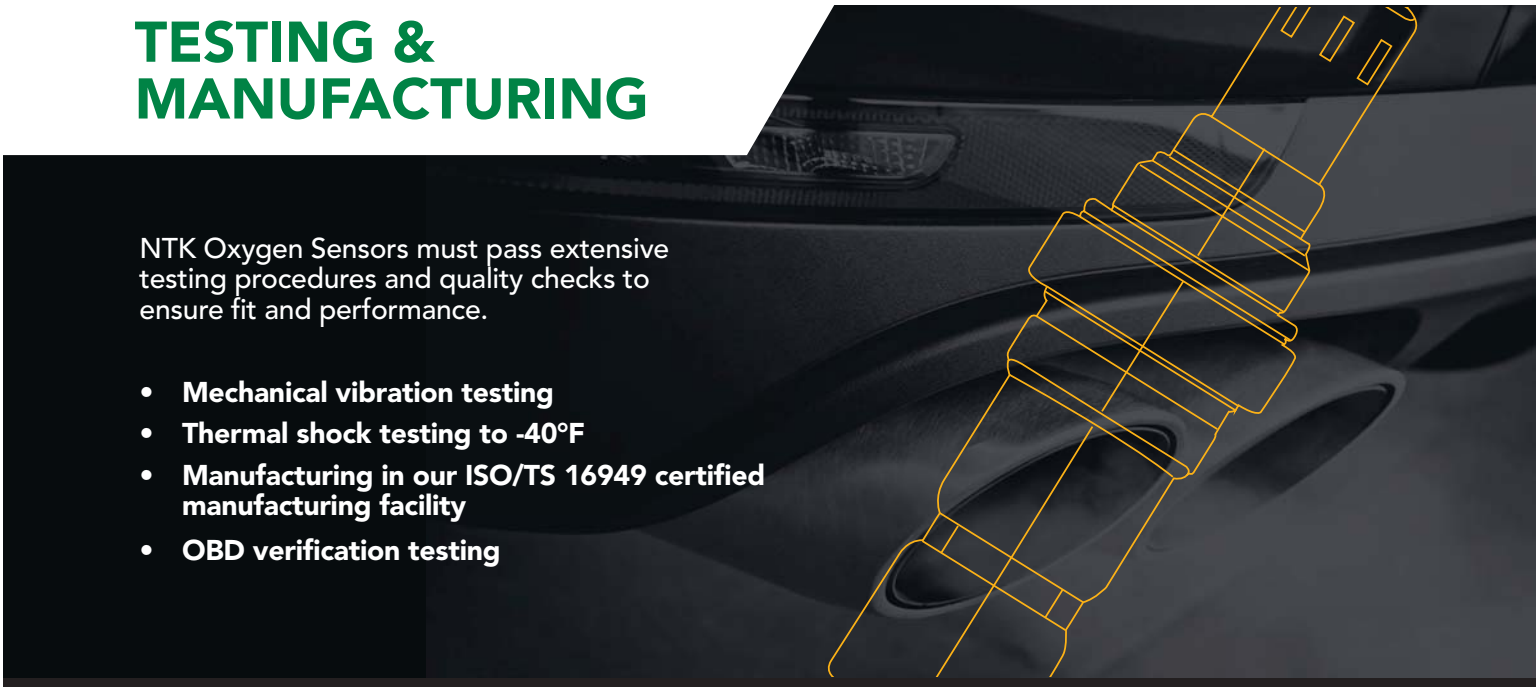
WIDE BAND (5-WIRE)

- NTK is one of the pioneers of wide band sensor technology
- Wide band sensors monitor the air fuel ratio to a higher degree of accuracy to provide precise ratio control

ZIRCONIA

- The most common sensor and is usually found downstream of the catalyst in newer vehicles
- Available in 18mm thread size

TESTING & MANUFACTURING



NTK Oxygen Sensors must pass extensive testing procedures and quality checks to ensure fit and performance.

- **Mechanical vibration testing**
- **Thermal shock testing to -40°F**
- **Manufacturing in our ISO/TS 16949 certified manufacturing facility**
- **OBD verification testing**

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THE SENSOR SPECIALIST™

NTK

SS-0817-OS2

NTK OXYGEN SENSORS

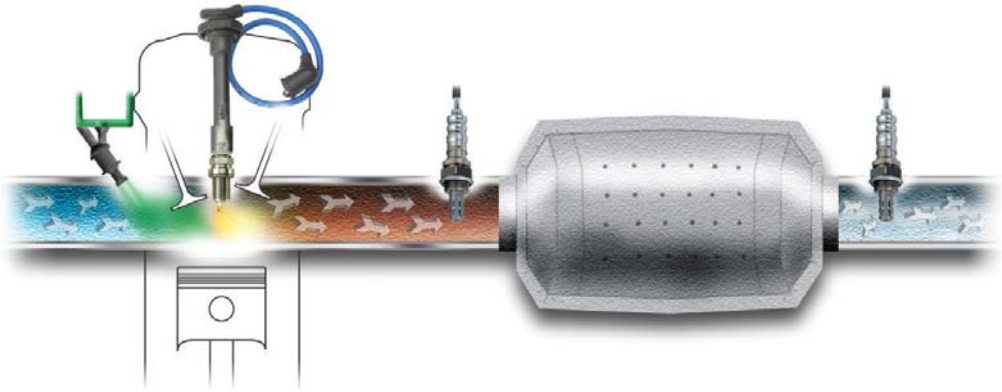
OXYGEN SENSOR Q&A

Questions and Answers on Oxygen Sensors

Q1

Q: What is an Oxygen Sensor?

A: An emission control component that senses the presence of oxygen in the exhaust stream.



Q2

Q: Why is an Oxygen Sensor needed?

A: Vehicles are one of the leading causes of air pollution in the world. As a result, government legislation has enacted regulation in many parts of the world to reduce vehicle emissions and increase fuel efficiency. By more closely controlling a vehicle's air fuel ratio, fuel efficiency can be increased, while tailpipe emissions are reduced.

The oxygen sensor functions as the eyes and ears for the ECU. Its role is to communicate with the ECU whether a vehicle is running rich or lean. The goal is to have the engine run close to 14.7 parts of air to 1 part of fuel. 14.7:1 is known as the Stoichiometric Point. At this point, optimum combustion under normal conditions occurs and the least amount of harmful gases are produced.

Smog filled skyline due to air pollution

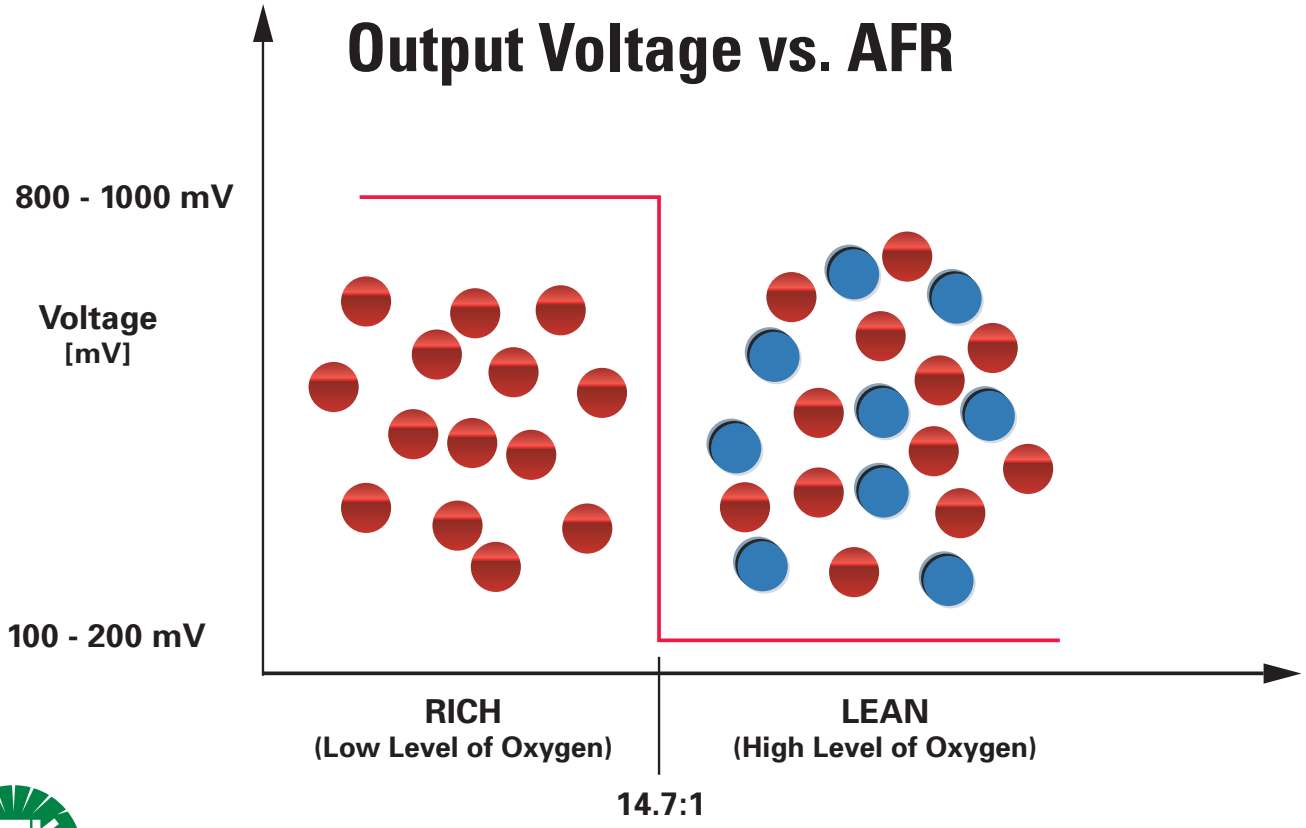
Q3

Q: How does an Oxygen Sensor work?

A: The sensor becomes operational at approximately 350˚C (650˚F).

At this point a chemical reaction occurs producing a high or low voltage based upon high or low levels of oxygen in the exhaust stream.

The oxygen sensor generates 800-1000 mV when the exhaust gas air/fuel ratio is rich. It will generate 100-200 mV when the exhaust gas air/fuel ratio is lean.



Q4

Q: Does my vehicle have an Oxygen Sensor?

A: Most vehicles produced for the North American market after 1981 have at least one oxygen sensor.

EPA laws required the introduction of oxygen sensors to decrease vehicle tailpipe emissions and improve fuel efficiency.

Early 1 Wire Sensor Design

Q5

Q: Where are Oxygen Sensors located?

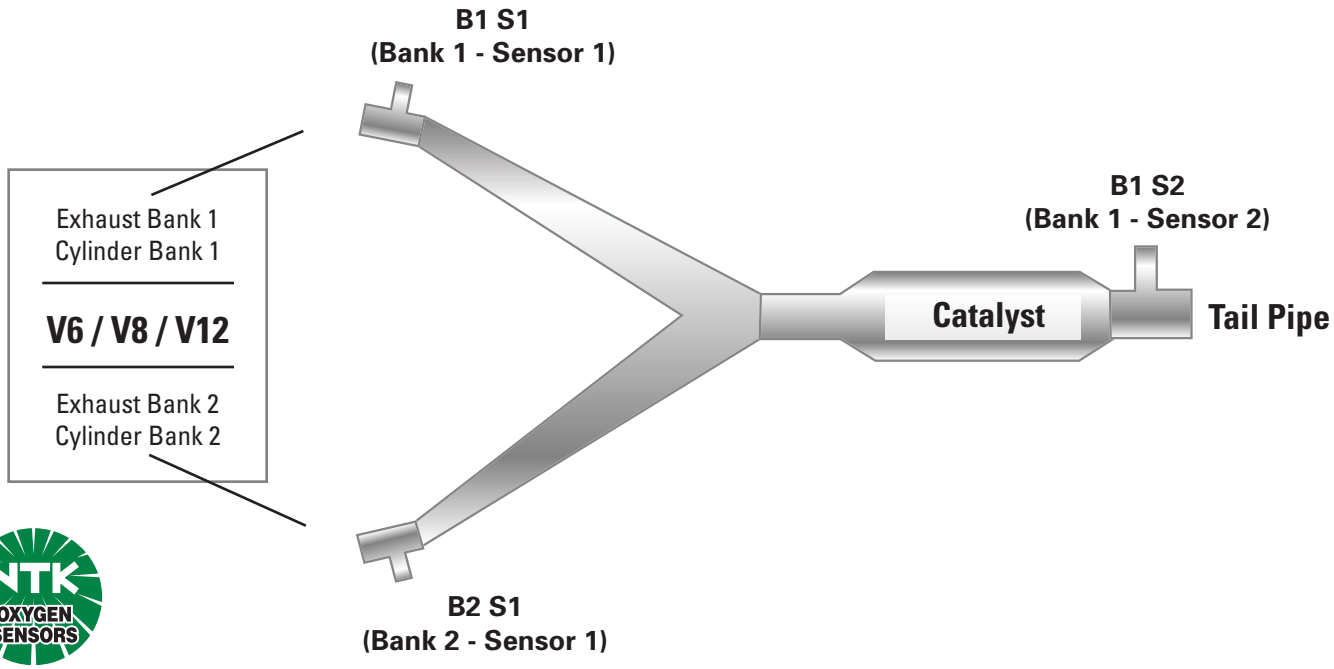
A: Vehicles produced before 1996 (OBDI) will have one or two sensors upstream of the three-way catalyst (catalytic converter). Vehicles produced after the 1995 model year (OBDII) will have oxygen sensors both upstream and downstream of the three-way catalyst.

To explain the sensor locations as found on a scan tool, you must first find the #1 cylinder location. Bank one (1) will always be the side of the engine with the #1 cylinder. Sensor one (1) will always be upstream of the three-way catalyst, while sensor two (2) will be downstream.

To determine left and right, as this is how the sensors are cataloged, you must first establish the front and rear of an engine.

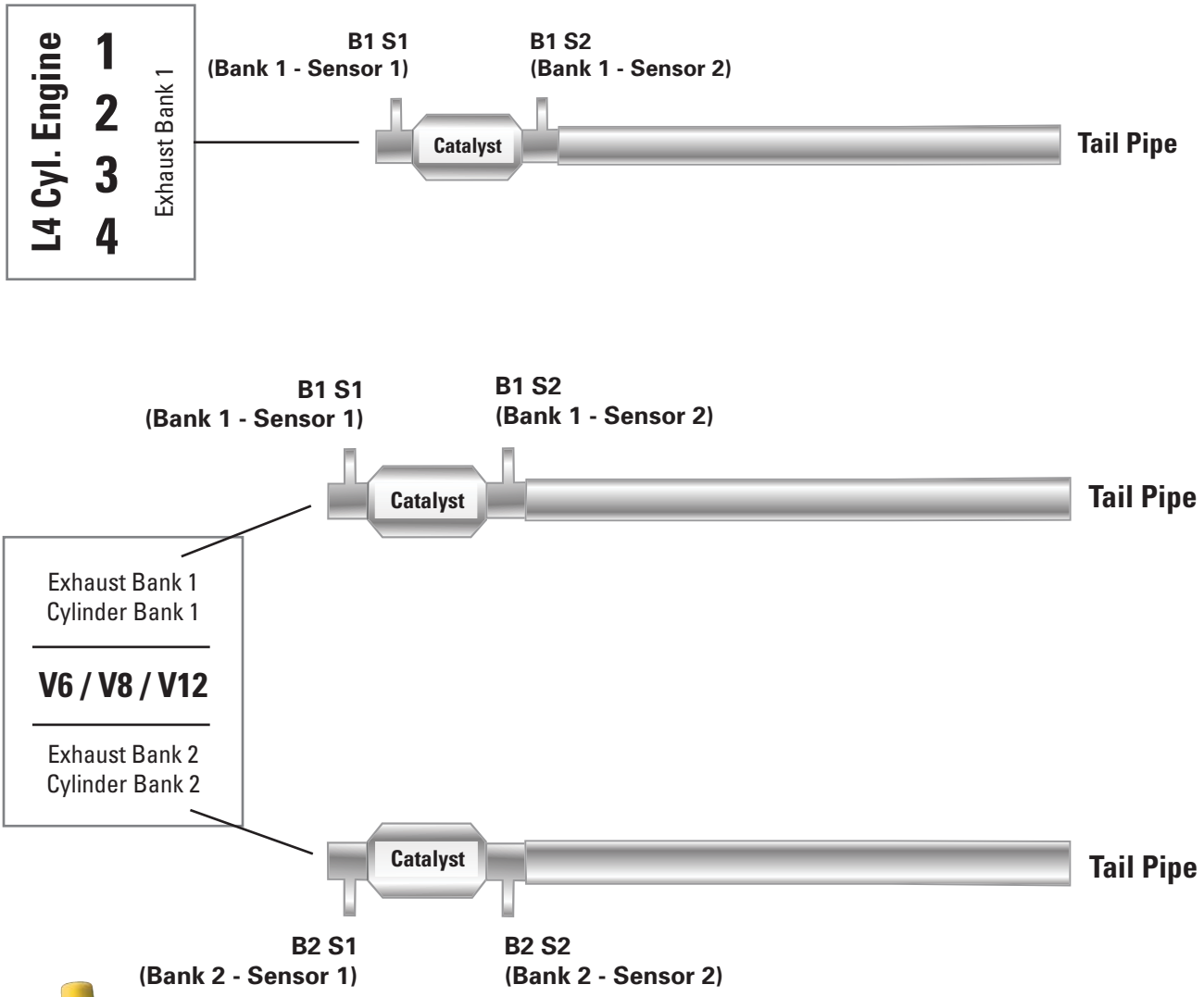
Front will be the side of the engine with the accessory drive belts for alternator, air conditioning, power steering, etc.

The left side of the engine will be the side to the left of the accessory drive belts when standing behind the engine. The right side of the engine will be the side to the right of the accessory drive belts when standing behind the engine.



Q: Where are Oxygen Sensors located?

Q5

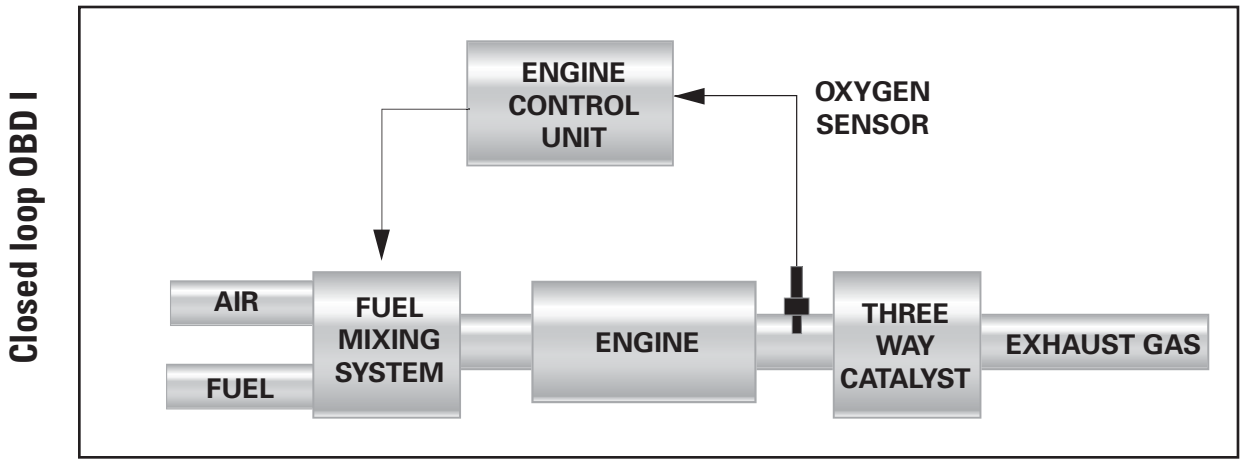


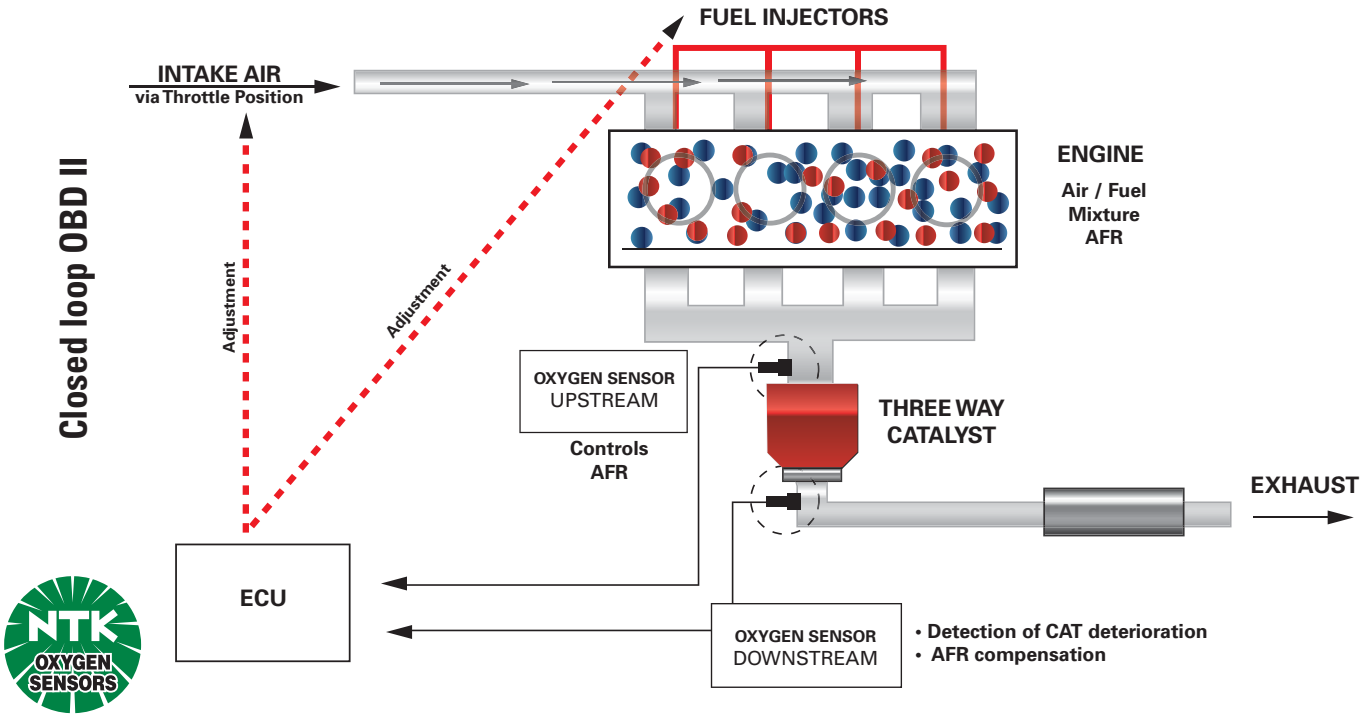
Q6

Q: What are “Open Loop” and “Closed Loop” modes?

A: Open loop mode is the period of time before the oxygen sensor becomes operational, usually at vehicle start up. It is also the default mode should a sensor problem occur.

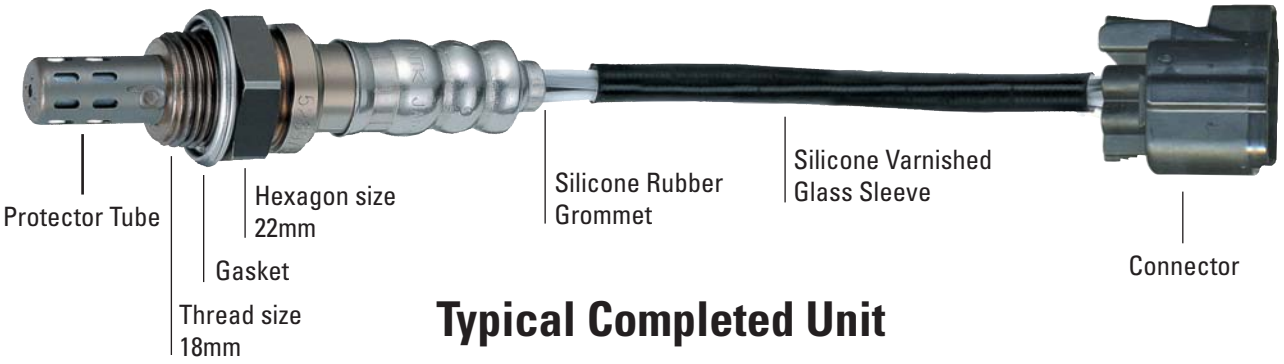
Closed loop mode is the desired mode where the oxygen sensor is operational. At this time AFR and exhaust emissions are being controlled.



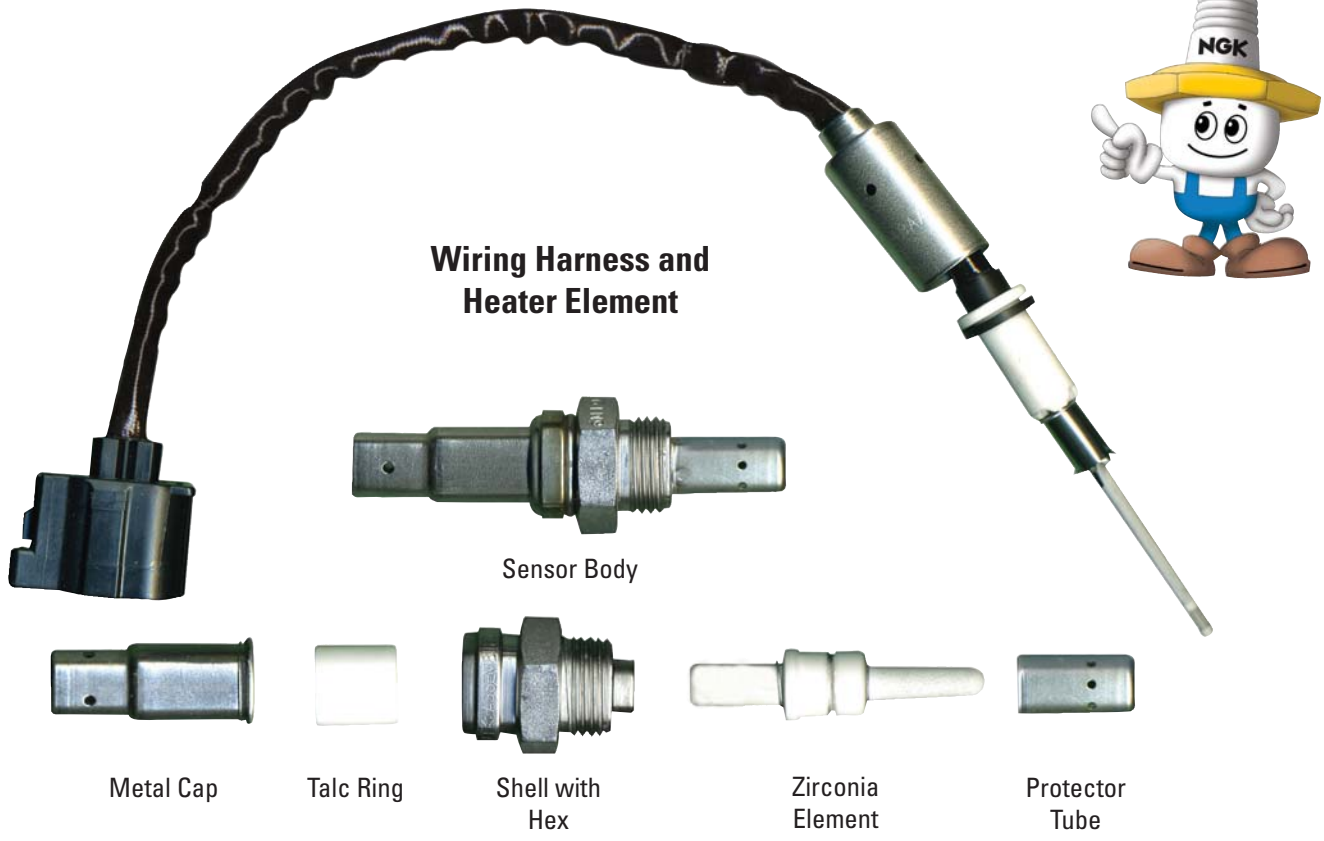


Q7

Q: What are the components of a Zirconia type Oxygen Sensor?



Typical Completed Unit

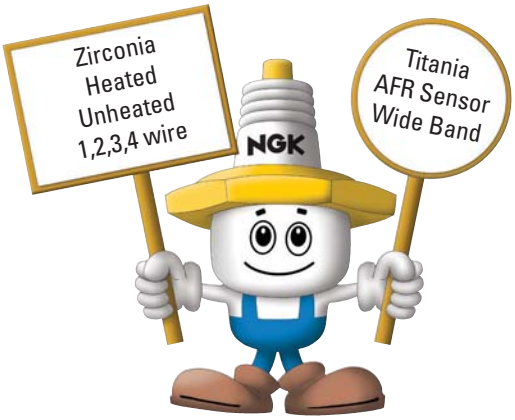


Typical Components

Note: The images above represent a typical oxygen sensor and its components. Each oxygen sensor part number is unique in its own way and the image's appearance and component vary based on the part numbers specification.

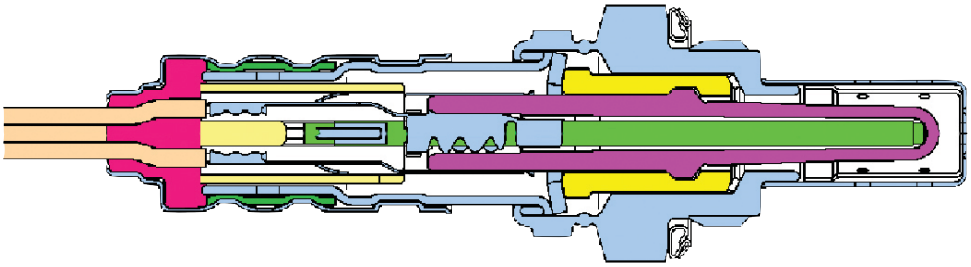
Q8

Q: What are the different types of Oxygen Sensors?



A: Zirconia

- Most popular (90% of the market)
- 1-4 wire configuration
- Heated or unheated
- Thimble or Planar type
- 18mm thread size
- Requires reference air



1 wire (unheated sensor)

- Signal wire
- Ground achieved through sensor body (earth ground)

2 wire (unheated sensor)

- Signal wire
- Ground wire (ground achieved through case or isolated ground)

3 wire (heated sensor)

- Signal wire
- Ground achieved through sensor body (earth ground)
- Two heater wires

4 wire (heated sensor)

- Signal wire
- Ground wire (ground achieved through case or isolated ground)
- Two heater wires

NTK OXYGEN SENSORS

Q: What are the different types of Oxygen Sensors?

Q8

Titania

- Always heated (3 or 4 wire)
- Requires no reference air
- Typically 12mm but some 18mm thread sizes

Q Are Zirconia and Titania sensors interchangeable?

A NO - Zirconia produces a voltage (less than 1v) while Titania require a voltage. Resistance is then measured and AFR is controlled accordingly.

AFR Sensor (4 wire)

- Similar structure to conventional (switching) type Zirconia oxygen sensors, but uses limiting current characteristics to measure AFR.
- ECU creates voltage variance across the sensor's electrodes-the potential difference is 300mv and current will be generated as needed to maintain a fixed voltage of 300mv. This limiting current is used for O2 sensing and is linearly proportionate to the amount of oxygen present.
- Thimble or Planar type
- Free of reference air
- Measures air/fuel ratios from 10:1 to 18:1

Wide Band Oxygen Sensor (5 Wire)

- Monitors AFR to a higher degree of accuracy- provides precise control of AFR.
- Wide Band sensors require a controller which is pre-programmed to control AFR at desired point (usually Stoichiometric point)
- Wide Band controller then sends signal to ECU for fuel trim adjustment
- Measures air/fuel ratios from 10:1 to 18:1

Q Are AFR sensors and Wide Band oxygen sensors interchangeable?

A NO

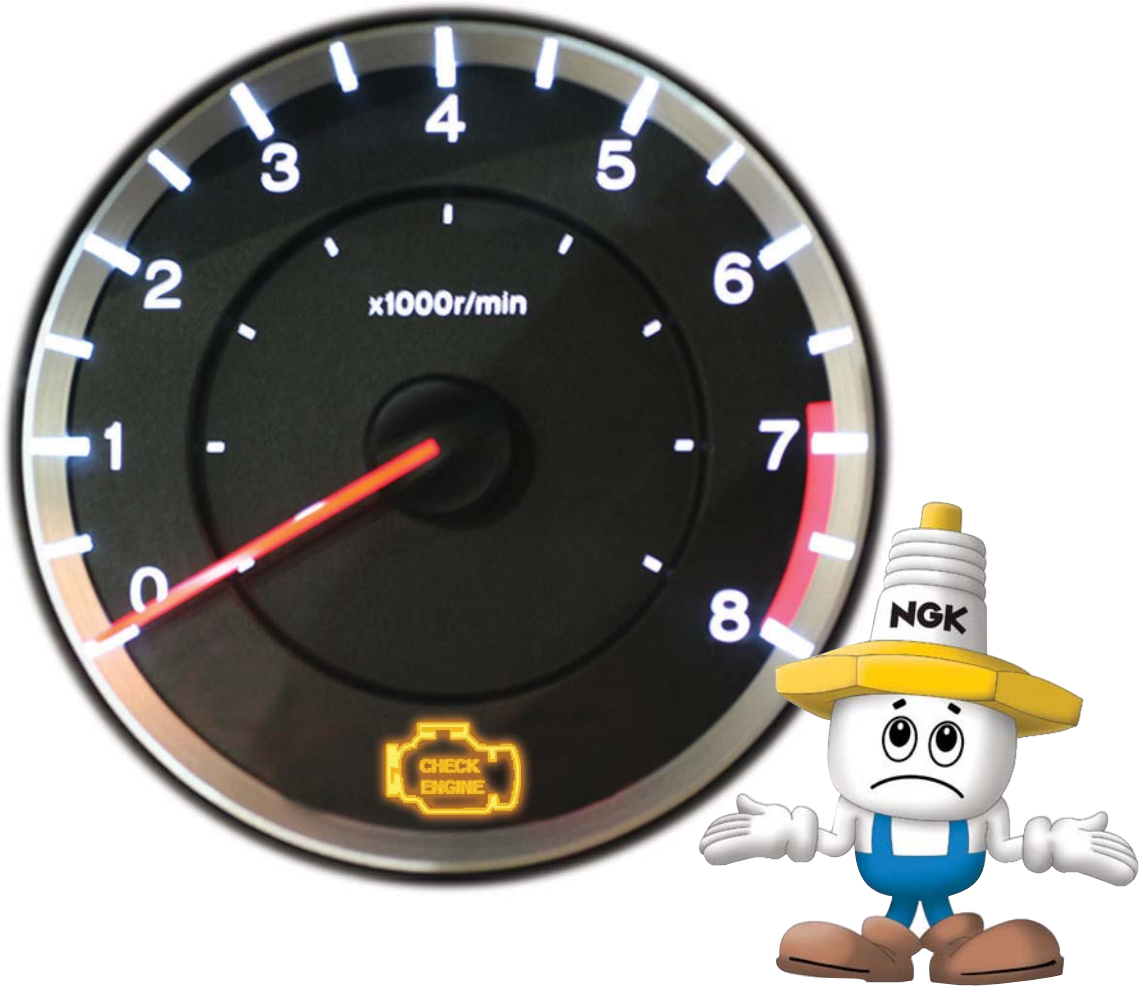
NTK OXYGEN SENSORS

Q9

Q: What are the obvious signs and impact of worn Oxygen Sensors?

A: The most obvious sign an oxygen sensor is failing or has failed is a check engine light. Vehicles are designed to inform the driver if there is a problem with the emissions system. A check engine light may point to a problem with the emissions system but does not necessarily mean the oxygen sensor is faulty.

Other signs of worn oxygen sensors are increased fuel consumption and an increase in vehicle emissions.



Q10

Q: How can I check my Oxygen Sensors to ensure they are working properly?

A: There are three (3) ways a sensor can be checked to see if it is functioning properly.

A professional repair shop will have scan tools to check sensor operation.

Advanced shops may have a tool called an oscilloscope. This tool will graphically display oxygen sensor output as it switches voltage from high to low.

Removed from the vehicle, a oxygen sensor can be checked using a common multi-meter to check for heater resistance. In the case of a faulty heater element, the resistance will read as an open circuit.

Scan Tool In Use

Q11

Q: What can shorten the life of an Oxygen Sensor?

A: Common causes for oxygen sensor failure are poisoning from substances such as engine coolant, silicone gasket materials or soot.

Often these problems can point to other mechanical issues with an engine.

Thermal shock from raw fuel or moisture in the exhaust can also cause a sensor heater element to crack.

The root cause of the problem should be addressed along with replacement of the oxygen sensor if needed.

PROBLEM -
Lead Poisoning

SYMPTOM - Shiny deposits are evidence of lead in the fuel. Lead attacks the precious metal of the sensor element & the catalytic converter.

SOLUTION - Sensor needs to be replaced and care taken to use only lead-free fuels.

PROBLEM -
Excessive Carbon / Soot Deposits

SYMPTOM - Thick soot deposits lead to blockage of the sensor protection tube and have a negative effect on reaction time. Causes can be a mixture that is too fuel-rich or the result of damage to the sensor heater.

SOLUTION - Sensor must be replaced in all cases with new sensor.

PROBLEM -
Silicone Contamination

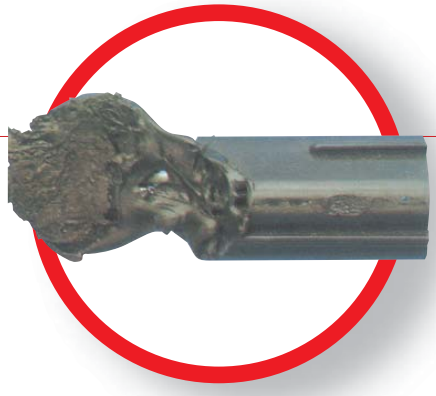
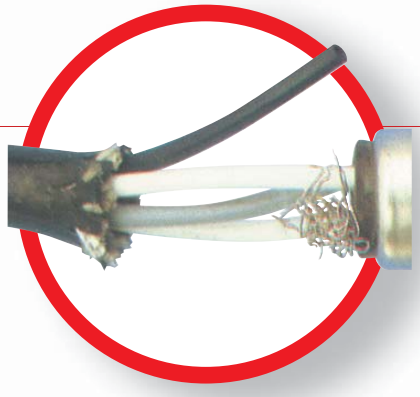
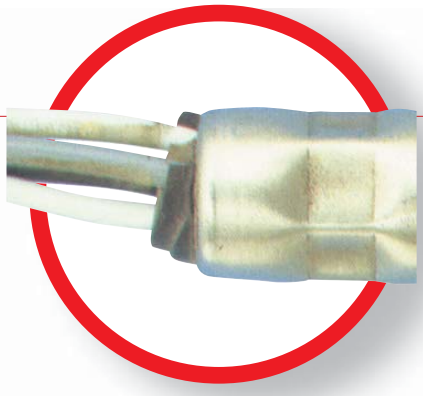
SYMPTOM - White deposits are evidence of silicone poisoning. Silicone based adhesives/products will contaminate the sensor element.

SOLUTION - Sensor must be removed and replaced with new sensor; care must be taken to use ONLY “oxygen sensor-friendly” products.

NTK OXYGEN SENSORS

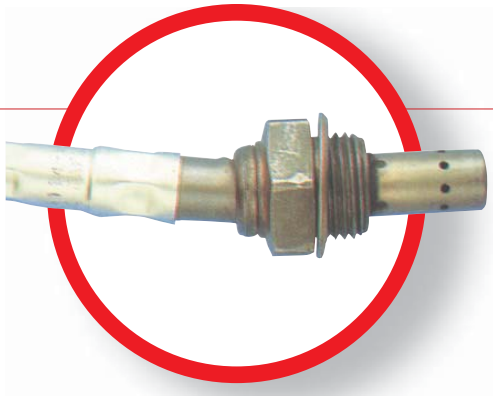
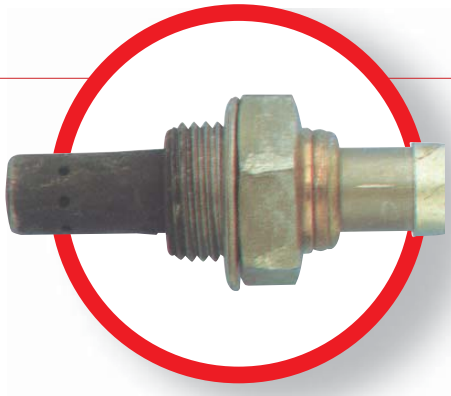
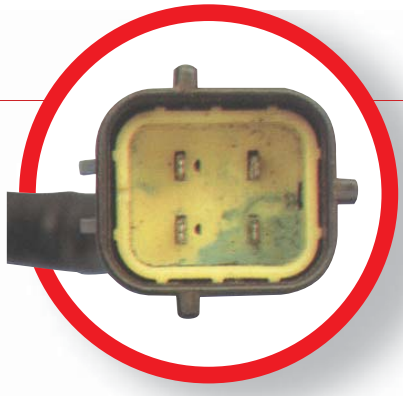
Q12

Q: What can I tell from visually inspecting an Oxygen Sensor?

Problem		Solution
Wires melted by contact with exhaust		Replace with new sensor and route without touching the exhaust
Frayed or broken wires		Replace with new sensor and make sure there is some slack in the wires
Wire Grommet is loosened water may enter the sensor		Replace with new sensor and make sure there is some slack in the wires

Q12

Q: What can I tell from visually inspecting an Oxygen Sensor?

Problem		Solution
Sensor is bent		Replace with new sensor
Soot deposits are blocking the openings of the protective sleeve, due to fuel-rich mixture or high oil consumption because of wear on engine or valves and leaks in the exhaust system		Diagnose and correct fault. Note: Excessive deposits of soot and oil on the protective sleeve are not caused by the sensor itself
Water in the connector		Replace with new sensor. Check electrical connections to connector seal and also the connection between the sensor and the engine control unit

NTK OXYGEN SENSORS

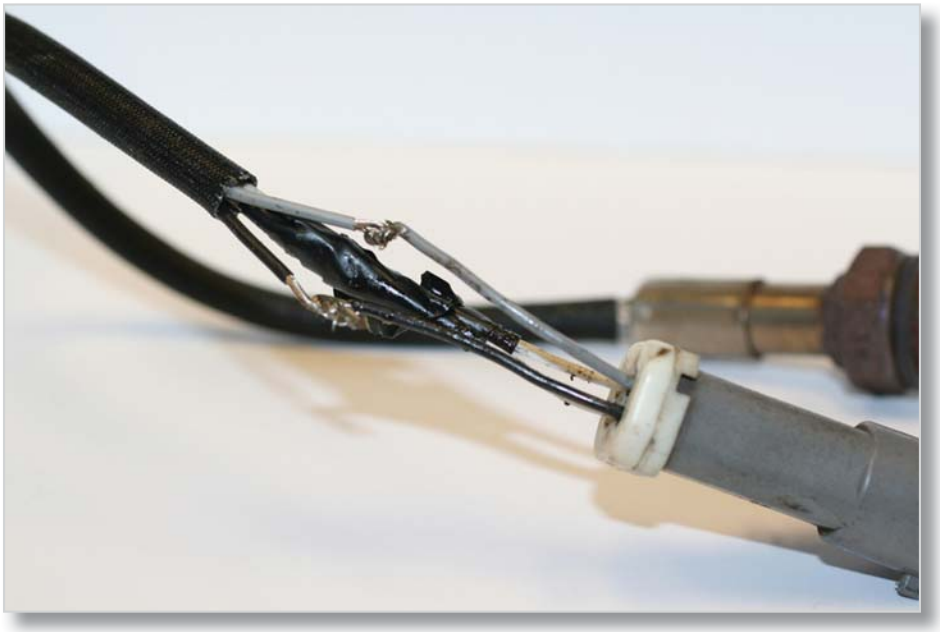
Q13

Q: What is a Universal Oxygen Sensor?

A: Universal oxygen sensors are designed to work on several applications, thereby reducing the number of stocking units needed.

Universal oxygen sensors do not have factory matched connectors and need to be spliced into place using the connector from the old sensor.

The use of universal oxygen sensors are not recommended as compatibility and installation issues often prevent the sensor from performing as well as an OEM matched unit.



Improper Universal Sensor Installation

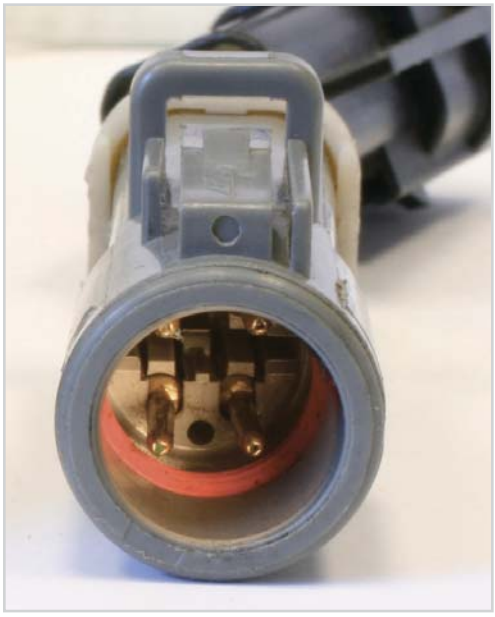
Q14

Q: What are the advantages of using a Direct Fit Oxygen Sensor over a Universal Oxygen Sensor?

A: A direct fit oxygen sensor has been engineered to ensure the operating parameters are the same as the OE sensors.

Direct fit sensors will have the correct connectors, hardware and wire length to ensure proper form, fit and function.

OE



Aftermarket

Aftermarket sensor programs may have small variances to the OE sensor to provide wider coverage. For example, the picture above illustrates the elimination of the mounting flanges and allows the aftermarket version to be utilized on both the left and right banks versus having two Aftermarket part numbers, as is the case with the OE part.

Q: How do I install an Oxygen Sensor?

Q15

A: Sensor installation will first require the proper tools. A specialty oxygen sensor socket is recommended for removal of the old sensor and installation of a new sensor.

1. Disconnect the battery.
2. Disconnect wiring harness from the old sensor.
3. Remove any hardware or clips if applicable.
4. Use the oxygen sensor socket (shown below) to remove the old sensor.
5. Apply anti-seize compound to the threads of the sensor (if not already pre-applied).
6. Use specialty socket to install the new sensor to the recommended torque.
7. Put in place any hardware or clips if applicable.
8. Connect the wiring of the new sensor to the existing vehicle wiring.
9. Reconnect the battery.

NTK OXYGEN SENSORS

Q16

Q: What is the expanded role an Oxygen Sensor plays in OBDII vs. OBDI ?

A: In OBDII equipped vehicles there is a sensor downstream of the three-way catalyst to monitor catalyst function and can also assist in controlling AFR by adjusting fuel trim.

If a catalyst has failed or there is a problem elsewhere in the system, the downstream sensor may trigger a MIL light or check engine light to warn of a possible problem.

In OBDII, the ECU is also monitoring the condition of the sensor signal response time, heater light-off time and heater resistance.

Downstream Oxygen Sensor

Q17

Q: What does the future hold for Oxygen Sensors?

A: As future emissions standards become tougher for all engines, even non-automotive applications, NTK is further developing sensor technologies to help provide cleaner, more efficient commercial and recreational engines. In the future, legislation will mandate emission controls on all engines. Today, many motorcycles, snowmobiles, marine and outdoor power equipment applications are using oxygen sensors to limit emissions.

Glossary

Term	Definition
AFR (Air Fuel Ratio)	The measurement or ratio mixture of air to fuel for internal combustion engines.
AFR Sensor	Air Fuel Ratio Sensor. A linear 4 wire oxygen sensor which actually measures air fuel ratio rather than producing a switching voltage. In this type of system, a constant voltage is applied to the sensor to get a desired AFR result.
Three-Way Catalyst (Catalytic Converter)	Emission control component designed to convert harmful poisonous gasses by heat & chemical reaction to non-poisonous environmentally friendly gases. • Converts - CO (Carbon Monoxide) to CO2 (Carbon Dioxide) • Converts - HC (Hydro Carbons) to H2O (Water) • Converts - NOx (Oxides of Nitrogen) to N (Nitrogen)
Closed Loop	Condition after oxygen sensors have reached operating temperature, AFR is controlled and emissions are reduced.
Direct Fit Sensors	Oxygen Sensors that include the wiring connector.
Downstream	Term referring to oxygen sensor position beyond the three-way catalyst located in the exhaust pipe to monitor catalytic converter output.
DTC (Diagnostic Trouble Code)	Code # downloaded from ECU by means of a scan tool identifying emissions related problems.
ECU (Electronic Control Unit)	A vehicle's on-board computer module responsible for controlling and adjusting multiple systems in real time such as fuel management, braking, ignition, etc.
EPA (Environmental Protection Agency)	US governmental agency responsible for federal emission laws & mandates.
HC (Hydrocarbons)	Emission pollutant resulting from incomplete fuel combustion & fuel evaporation.
Lean	Condition of AFR. Too much oxygen is present in the exhaust. AFR is greater than 14.7:1
MIL (Malfunction Indicator Lamp)	Also known as Check Engine Light, a warning lamp on a vehicle's instrument cluster that informs the driver of possible emissions related problem.
NOx (Nitrogen Oxides)	Formed when fuel is burned at high temperatures. Vehicles are the highest producer of NOx

Glossary

Term	Definition
OBDI	Federal emissions standard prior to 1996 model year vehicles. Usually vehicles have one or two oxygen sensors upstream of the catalyst.
OBDII	Federal emissions standard after 1995 model year mandating stricter emission control. Use of downstream oxygen sensors is required.
Open Loop	Condition at start up or wide open throttle where AFR is defaulted to rich, emissions are at its highest. AFR is not controlled by the sensors.
Oscilloscope	Instrument used to measure fluctuations in electrical current where amplitude is graphed as a temporary waveform on a fluorescent cathode screen.
Oxygen Sensor	Vehicle emission control component that senses the presence of oxygen in the exhaust stream.
Rich	Default condition of AFR in open loop mode & also the default condition of an emission related problem. Little oxygen is present in the exhaust. AFR is less than 14.7:1
Stoichiometric Point	Measurement of AFR - where optimum combustion occurs & the least amount of harmful poisonous gases are produced. AFR mixture at this point is 14.7:1
Titania Sensor	Narrow band oxygen sensor made of titanium dioxide that requires a voltage rather than producing one and changes its resistance in response to the oxygen content present in the exhaust stream.
Universal Oxygen Sensor	An oxygen sensor that lacks a wiring connector. Commonly used in the past to reduce SKU count and inventory costs.
Upstream	Term referring to oxygen sensor position in front of the three-way catalyst located in the exhaust manifold or Y pipe.
Wideband Sensor	A linear 5 wire oxygen sensor which measures air fuel ratio. This type of sensor produces a voltage from 0-5V to the ECU. The voltage produced corresponds with a definite air fuel ratio.
Zirconia Sensor	Narrow band O2 sensor made of zirconium dioxide based on an electrochemical fuel cell that produces an output voltage at its two electrodes comparing the amount of oxygen present in the exhaust stream to that of the atmosphere.

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AIR-FUEL RATIO MONITOR KIT
FOR ENGINE ENTHUSIASTS

NTK's Air-Fuel Ratio Monitor (AFRM) offers accurate and reliable wideband sensor technology. The kit monitors air-fuel ratio and provides lambda and stoichiometric read outs, while logging compatible data. This tool is recommended for tuning, racing, engine-building, modifications and dyno testing.

NTK has an OEM or OE-equivalent sensor for 99.5% of vehicles in operation and is continuously developing new technology for better fuel economy and tougher emissions regulations. The AFRM kit replaces the Powerdex AFX tool and features the new NTK ZFAS®-U2 sensor technology.

The NTK AFRM kit includes:

1. Compact display box (2.5 x 2.5 x 0.875 in)
2. 13 ft wiring harness
3. Exhaust boss & plug
4. NTK ZFAS®-U2 wideband sensor
5. Comprehensive air-fuel ratio tuning manual

The NTK Difference

LED display that shows AFR or lambda (λ)	Simplified free air calibration	Adjustable display speed
0-5V analog output signal	Selectable range of 9.0-20.0 : 1 AFR (0.62-1.37λ) or 9.0-16.0 : 1 AFR (0.62-1.1λ)	

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