

# Bosch Industrial Spark Plugs: The Right Spark Plug for Every Engine

From the invention of the automotive oxygen sensor to the introduction of platinum spark plugs, to the development of the first scan tool, Bosch is uniquely positioned to offer almost every product that a modern workshop needs to stay competitive.

Innovations from Bosch continue in the combined solutions offered at nearly every touchpoint of today's vehicles. Whether it is the parts to replace, the equipment to diagnose, the shops to service the vehicle, or the technical training, Bosch is with you at every turn.

Everyday, Bosch replacement parts and diagnostic equipment are relied upon as the essential elements to keep service shops operating and vehicles on the road. These two features of the Bosch Automotive Aftermarket offering are combined with our extensive service network and our technical training to make Bosch a distinctive partner in the industry.

This is where you get original Bosch quality:

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## Bosch Industrial Spark Plugs: Engineered to Perform

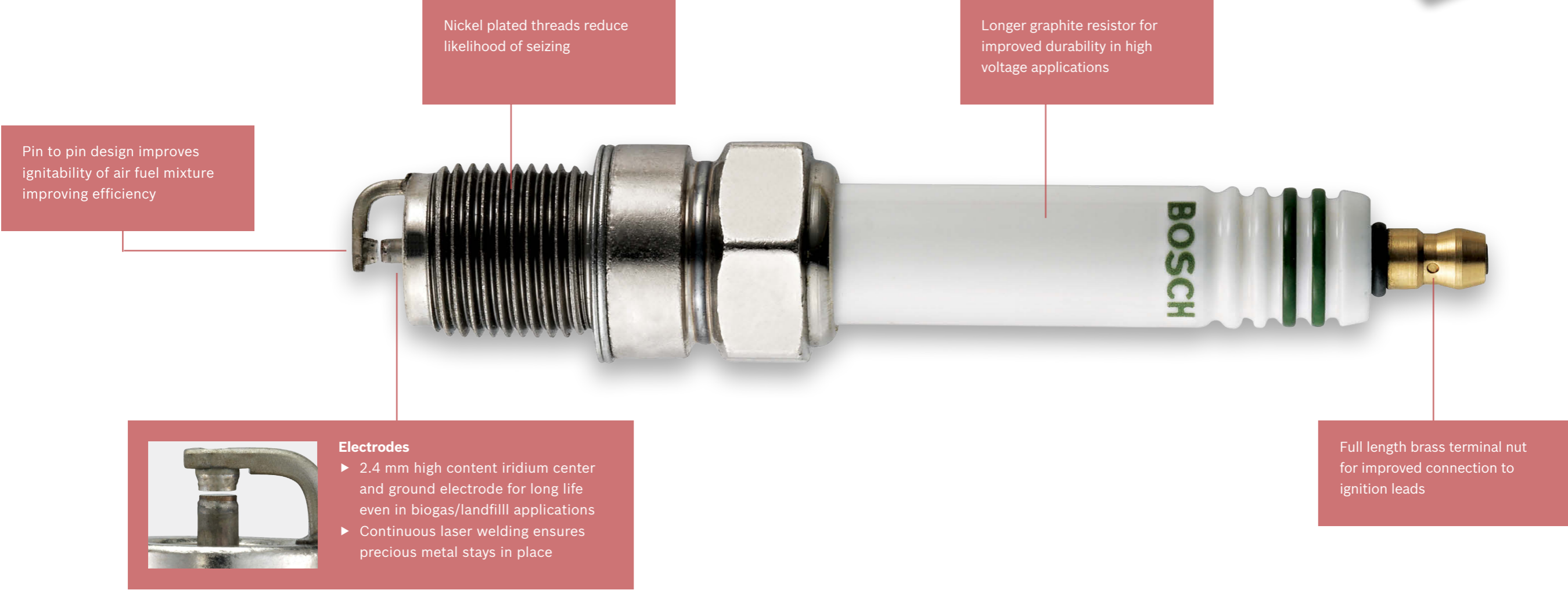


# Introducing the **new Double Ir Spark Plugs**

“Back in early 2010 we at VIRIDOR Heathfield Power Plant were looking for different gas engine spark plugs to run in our Cummins QSV 91’s (running on landfill gas) in a bid to extend spark plug life and reduce downtime. R&M Walsh offered a set of Bosch 7305 plugs to trial in our QSV91. Keeping to our desired maintenance routine of 750hrs and 1500hrs, the Bosch 7305 ran for approx 3500hrs, and apart from clean and re-gaps, have performed well above our expectations. We feel that the Bosch plug offers superb performance and life and appears to be well suited to the harsh running conditions of landfill gas.”

Kevin – VIRIDOR, UK

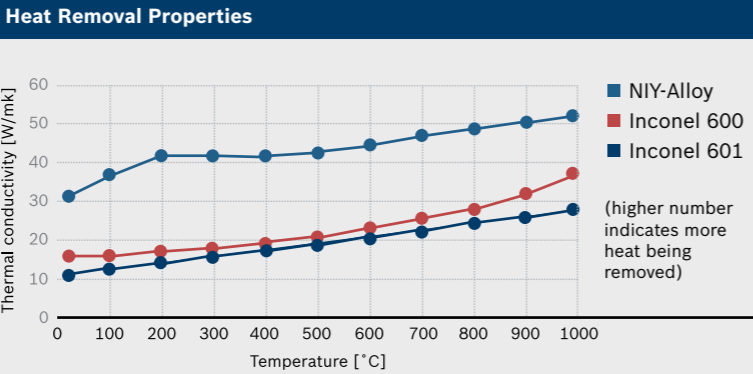
New packaging of all Bosch industrial spark plugs is significantly stronger than previous packaging ensuring plugs arrive to the engine well protected and ready for service. A security sticker over the opening of M18 plugs is now used to ensure the plugs you receive are authentic Bosch spark plugs.



**Electrodes**

- ▶ 2.4 mm high content iridium center and ground electrode for long life even in biogas/landfill applications
- ▶ Continuous laser welding ensures precious metal stays in place

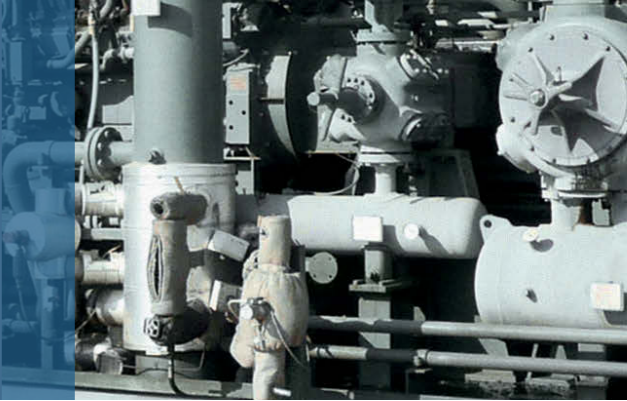
The Nickel Yttrium (NiY) alloy used on the ground electrode of the Bosch industrial series spark plugs dissipates heat much better than competitor materials. This results in lower temperatures of the ground electrode and longer run times.



**Applications**  
 Two M18 and two M14 designs to fit the most common applications

|      |      |
|------|------|
| M18  | M14  |
| 7305 | 7315 |
| 7308 | 7322 |

**Test Results**  
 Over 4500 hours in a Cat 3520C running ~52% CH4 landfill gas, 100% load, 1.6 MW generator. 50% longer than the current plug used.



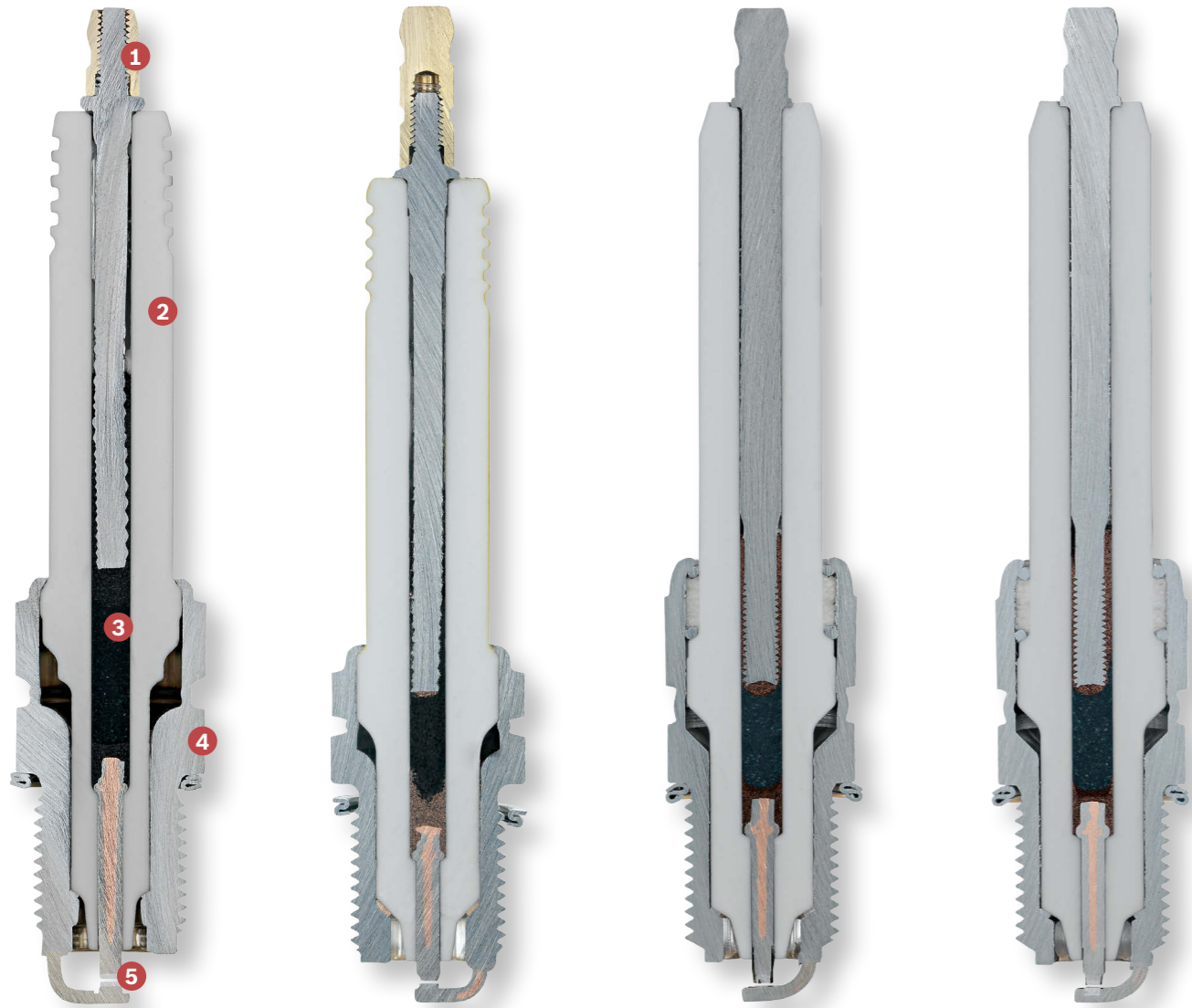
# Competitive Benchmark

Bosch 7305

Competitor A

Competitor B

Competitor C



- 1 Full length terminal stud with brass terminal nut: Terminal stud increases spark plug strength and the brass terminal nut reduces corrosion ensuring the spark plug has a clean connection to the ignition lead.
- 2 Ribbed pyranit insulator: 95% aluminum oxide reduces likelihood of dielectric punctures in high voltage applications. Ribbed profile reduces possibility of flashover.
- 3 Graphite metal glass resistor: Increased length improves reliability of the resistor in high voltage applications reducing resistor failures.
- 4 Nickel plated steel shell: Specially designed for high mechanical strength to prevent breakage during removal. The housing is also nickel coated to prevent seizing in the engine.
- 5 See electrode comparisons on the next page.

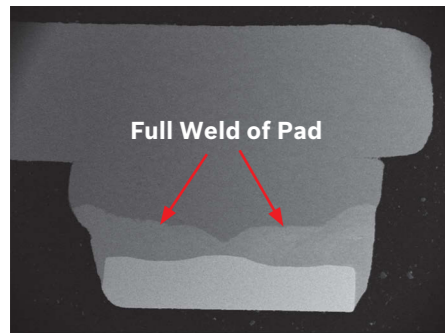
# Competitive Comparison

| Bosch 7305   | Competitor A  | Competitor B   | Competitor C  |
|--|---|--|---|
| <p>1 2.4 mm iridium center electrode continuous laser welded</p> <p>2 2.4 mm iridium pad projected from ground electrode continuous laser welded and resistance welded</p> <p>3 Ground electrode profile 2.8 mm x 1.7 mm</p> | <p>2.0 mm iridium center electrode continuous laser welded</p> <p>2.2 mm iridium pad projected from ground electrode, continuous laser welded</p> <p>Ground electrode profile 2.8 mm x 1.7 mm</p> | <p>2.4 mm iridium center electrode pulse laser welded with cross grooves</p> <p>2.4 mm iridium pad flush with ground electrode, pulse laser welded</p> <p>Ground electrode profile 4.2 mm x 1.6 mm</p> | <p>2.0 mm iridium center electrode pulse laser welded</p> <p>2.4 mm iridium pad flush with ground electrode, pulse laser welded</p> <p>Ground electrode profile 4.2 mm x 1.6 mm</p> |

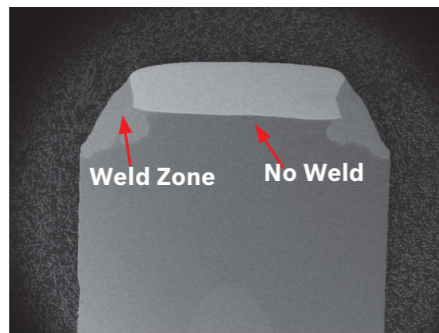
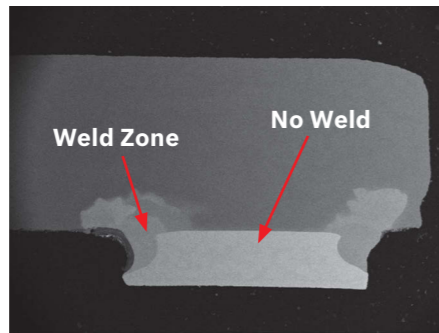
- 1 Bosch advantage: With a larger center electrode it yields a 44% larger wear area over 2.0 mm electrodes increasing longevity. Cross grooves remove ~10% of surface area from electrode increasing gap erosion, but reduce ignition voltage.
- 2 Bosch advantage: Projected precious metal improves access to air fuel mixture reducing quenching and improving ignitability, laser and resistance welding reduces likelihood of precious metal separation.
- 3 Bosch advantage: Smaller width of ground electrode reduces quenching and eases ability to gap.

# Electrode Comparison

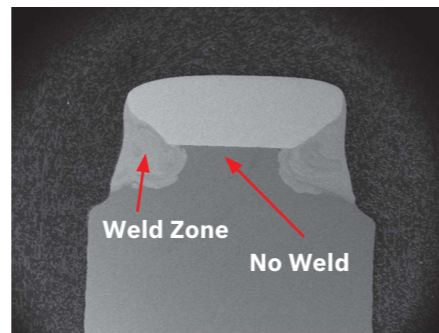
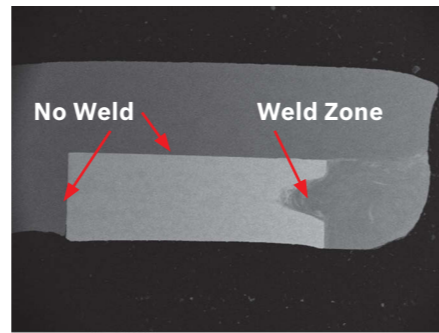
## Bosch 7305



## Competitor A



## Competitor C



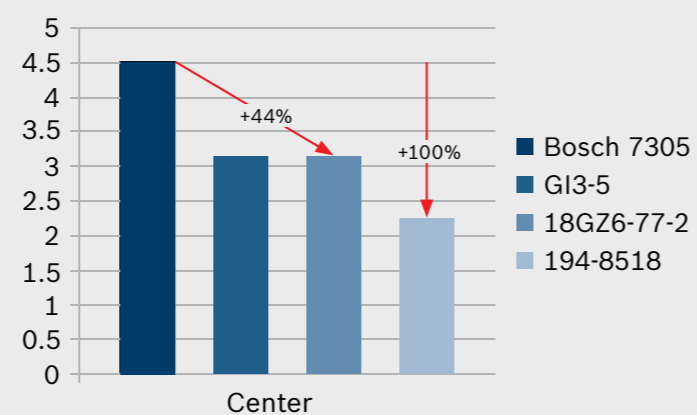
In these cross sections of the electrodes, note that the welding of the Bosch spark plug supports the entire iridium pad. In the other plugs, the welded zone is only on the edges of the precious metal pins. This complete

weld ensures the precious metal pin has the strongest connection possible to the base material and will not separate even in the most demanding applications.

The larger surface area of the center electrode helps increase longevity. The increased precious metal available reduces gap expansion resulting in longer run times.



### Center Electrode Surface Area



# At a Glance

## Product Cross Reference Guide

| Bosch Part# | Denso Part# | Champion Part#                         | Beru                  |
|-------------|-------------|--|-----------------------|
| 7302        | -           | RB75N / RB75PP*                        | 18GZ20                |
| 7303        | -           | RM77N / RM77PP                         | 18GZ22                |
| 7305        | GI3-1/GI3-5 | -                                      | 18GZ6-77-2            |
| 7306        | GI3-3       | RB77WPCC / KB77WPCC / RB77CC / RB77WPC | 18GZ6-77              |
| 7307        | GL3-3       | RB75WPCC                               | 18GZ5-77              |
| 7308        | GL3-1/GL3-5 | -                                      | 18GZ5-77-2            |
| 7311        | GE3-1       | RN79G                                  | 14R-4CDP / 14R-4DIU2  |
| 7313        |             | RN5C                                   |                       |
| 7315        | GE3-5       |  | 14R-4CIU2 / 14R-4DIU2 |
| 7321        | GK3-3       | RC78PYP / RC78PYP15 / RC78WYP          | 14FR-4DPU0            |
| 7322        | GK3-1/GK3-5 |  | 14FR-4DIU             |

\*Ceramic length different from RB75PP, adapter may be required

## Double Platinum vs. Double Iridium



### Bosch 7306

- ▶ 2.0 mm platinum iridium center electrode: surface area = 3.14 mm
- ▶ 0.6 mm x 2.8 mm platinum iridium pin: surface area = 1.68 mm
- ▶ Continuous laser welding on center and ground

### Bosch 7305

- ▶ 2.4 mm high content iridium center electrode: surface area = 4.52 mm – 44% larger than 7306
- ▶ 2.4 mm x 2.8 mm high content iridium ground electrode: surface area = 4.52 mm – 169% larger than 7306
- ▶ Continuous laser welding on center and ground with additional resistance weld on ground for added strength

# Industrial Spark Plugs: Specifications

|                         | 7302                    | 7303                    | 7305             | 7306                    | 7307             | 7308             | 7311                    | 7313                | 7315             | 7321            | 7322            |                  |
|-------------------------|-------------------------|-------------------------|------------------|-------------------------|------------------|------------------|-------------------------|---------------------|------------------|-----------------|-----------------|------------------|
| <b>10 Digit</b>         | 0 242 356 501           | 0 242 356 502           | 0 242 356 503    | 0 242 356 504           | 0 242 356 507    | 0 242 356 508    | 0 242 255 512           | 0 242 236 580       | 0 242 255 519    | 0 242 255 511   | 0 242 255 518   | 0 241 256 524    |
| <b>Availability</b>     | Available               | Available               | Available        | Available               | Available        | Available        | Available               | Available           | Available        | Available       | Available       | Available        |
| <b>Hex</b>              | 7/8" (22.2 mm)          | 7/8" (22.2 mm)          | 7/8" (22.2 mm)   | 7/8" (22.2 mm)          | 13/16" (20.8 mm) | 13/16" (20.8 mm) | 13/16" (20.8 mm)        | 13/16" (20.8 mm)    | 13/16" (20.8 mm) | 5/8" (16 mm)    | 5/8" (16 mm)    | 13/16" (20.8 mm) |
| <b>Thread</b>           | 18 mm                   | 18 mm                   | 18 mm            | 18 mm                   | 18 mm            | 18 mm            | 14 mm                   | 14 mm               | 14 mm            | 14 mm           | 14 mm           | 14 mm            |
| <b>Reach</b>            | 13/16" (20.6 mm)        | 1/2" (12.7mm)           | 13/16" (20.6 mm) | 13/16" (20.6 mm)        | 13/16" (20.6 mm) | 13/16" (20.6 mm) | 3/4" (19 mm)            | 3/4" (19 mm)        | 3/4" (19 mm)     | 3/4" (19 mm)    | 3/4" (19 mm)    | 3/4" (19 mm)     |
| <b>Heat Range</b>       | 3                       | 3                       | 3                | 3                       | 3                | 3                | 3                       | 7                   | 3                | 3               | 3               | 3                |
| <b>Center Electrode</b> | 0.8 mm Platinum/Iridium | 0.8 mm Platinum/Iridium | 2.4 mm Iridium   | 2.0 mm Platinum/Iridium | 2.0 mm Iridium   | 2.4 mm Iridium   | 2.0 mm Platinum/Iridium | Copper with Yttrium | 2.4 mm Iridium   | 1.25 mm Iridium | 2.4 mm Iridium  | 0.8 mm Platinum  |
| <b>Ground Electrode</b> | Platinum Inlay          | Platinum Inlay          | 2.4 mm Iridium   | Platinum Inlay          | Platinum Inlay   | 2.4 mm Iridium   | Platinum Inlay          | Nickel              | 2.4 mm Iridium   | Platinum Inlay  | 2.4 mm Iridium  | Platinum         |
| <b>Gap</b>              | 0.011" (0.3 mm)         | 0.011" (0.3 mm)         | 0.011" (0.3 mm)  | 0.011" (0.3 mm)         | 0.011" (0.3 mm)  | 0.011" (0.3 mm)  | 0.011" (0.3 mm)         | 0.020" (0.5 mm)     | 0.011" (0.3 mm)  | 0.011" (0.3 mm) | 0.011" (0.3 mm) | 0.011" (0.3 mm)  |
| <b>Resistance</b>       | 3 kOhm                  | 6 kOhm                  | 6 kOhm           | 3 kOhm                  | 3 kOhm           | 6 kOhm           | 6 kOhm                  | 6 kOhm              | 6 kOhm           | 6 kOhm          | 6 kOhm          | 1 kOhm           |



Double Ir



Double Ir



Double Ir



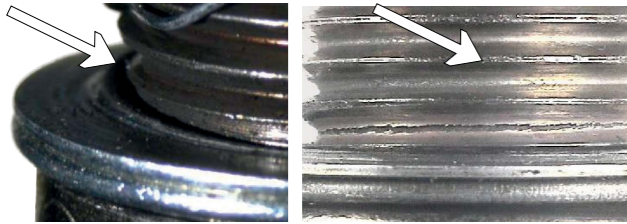
Double Ir



# Failure Modes

## Over Torquing

### Cracks in the threads



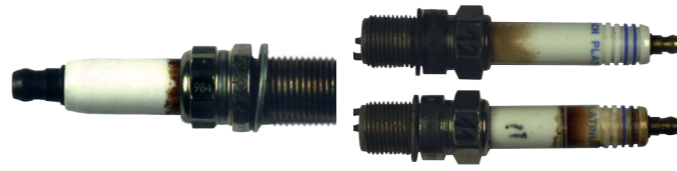
M18 plugs should be torqued to 35-45 Nm (26-33 Lb-ft)  
M14 plugs should be torqued to 28 Nm (21 Lb-ft)

Over torquing is the most common cause of problems with industrial spark plugs. Over torquing can cause the seal between the ceramic and housing to break and cause cracks in the housing allowing combustion gases to escape. If the ceramic is not loose, the discoloration on the ceramic is called corona discharge and is normal when high voltages are present.

#### Note:

If using anti seize lubricant, 1000°C “metal free” lubricant must be used. Hot metal lubricants can cause spark plugs to seize in the cylinder head.

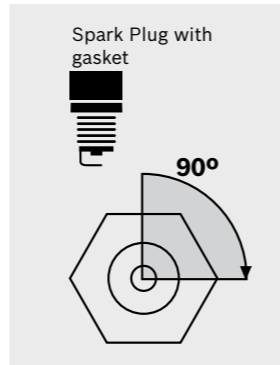
### Corona Discharge



Bosch recommends when installing spark plugs to use a torque wrench and the correct torque in ft.-lbs. As a general guideline, if a torque wrench is not available, hand tighten the plug until it is seated in the cylinder head. Spark plugs with gaskets should be tightened an additional 90°.

#### Note:

Avoid overtightening or undertightening as spark plug or engine damage may result. Always follow the manufacturer recommended torque specifications.



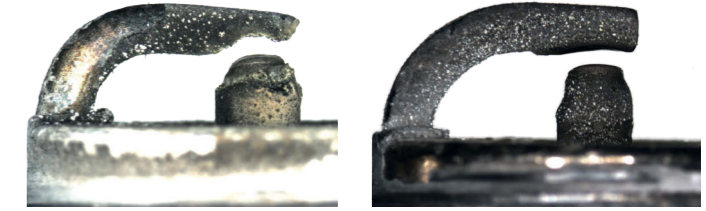
## Deposits

### Normal Operating Conditions



Plugs are covered with normal oil ash. Engine is operating as desired.

### High Electrode Wear



Engine is operating as desired, but plugs have reached the end of their life. Replace plugs.

### Excessive Engine Oil



Plugs are coated with oil indicating high oil consumption. This could lead to a spark plug failure such as cracked insulator or oil fouling resulting in difficulty starting.

### Iron Deposits



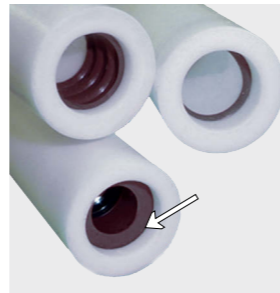
The red coating is iron. The conductive iron leads to misfires as the spark travels from the center electrode to the housing instead of jumping between the electrodes (note white lines on the ceramic). The engine is not operating as desired. Valves may not be seating correctly.

## Ignition Lead Maintenance

It is critical to avoid contamination in the ignition leads. The brownish green buildup is contamination and can cause flashover resulting in misfires. This contamination can be dirt, oil, or ozone. The dirt and oil can accumulate with time if the lead is placed over a dirty spark plug. The ozone forms when a poor connection between the lead and the spark plug terminal nut is present. The poor connection forms ozone which builds up on the walls of the lead. As this contamination builds, it increases the chances of flashover resulting in misfires.



Always check the o-rings at the bottom of the ignition lead. A proper fitting o-ring reduces the likelihood of flashover and misfires. If misfires are occurring, changing the o-rings may solve the problem and save money.

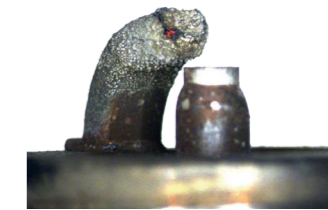


### Mishandling or Impact



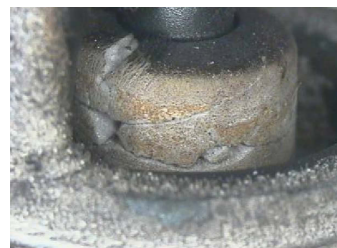
Plug was damaged during installation or impacted during use. Use caution when installing new plugs. Do not drop plugs into cylinder head during installation.

### Excessive Heat



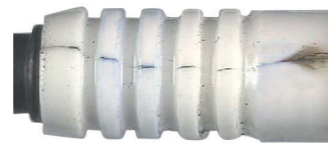
A melted ground electrode indicates pre-ignition. Ensure proper heat range of the plug is used and check ignition timing.

## Ceramic Failures



### Ceramic Puncture

Punctures in the ceramic caused by high ignition voltages.



### Flashover

Spark is traveling over ceramic from the terminal stud to the housing. Check insulator boots for proper fit and replace if necessary.

## High Transversal Forces

### Damage Caused by Socket



### Socket with Supports (not recommended)



Use a torque wrench with a wide bore. Wrenches with supports, as seen to the right, are more likely to damage the ceramic.

During installation and removal, if the socket is not fully seated on the plug or is applied at an angle, the side force can cause cracks in the ceramic between the housing and insulator.

# Industrial Spark Plugs: Application Guide

| Engine Make            | Model                                       | Double Ir | Long Life | Standard |
|------------------------|---|-----------|-----------|----------|
| <b>Caterpillar</b>     | G3306, G333 3/4" Reach                      | 7315      | 7311      |          |
|                        | G343  | 7315      | 7311      |          |
|                        | G3304                                       | 7315      | 7311      |          |
|                        | G3400 Series                                | 7315      | 7311      |          |
|                        | G3508                                       |           | 7306      | 7302     |
|                        | G3512                                       |           | 7306      | 7302     |
|                        | G3516                                       |           | 7306      | 7302     |
|                        | G3516B                                      |           | 7306      | 7302     |
|                        | G3520                                       | 7305      | 7306      |          |
|                        | G3520C (Biogas only)                        | 7305      | 7306      |          |
|                        | G3600 Series                                |           | 7306      |          |
| <b>Cooper Bessemer</b> | ENG, CNG                                    |           | 7303      |          |
|                        | GDJ, GMA, GMB, GMC, w/G402 reducing Bushing |           | 7303      |          |
|                        | GDT, GFB, GFE, GFK, w/G402 reducing Bushing |           | 7303      |          |
| <b>Cummins</b>         | L-10  | 7322      | 7321      |          |
|                        | QSV 81G                                     | 7305      | 7306      | 7302     |
|                        | QSV 91G                                     | 7305      | 7306      | 7302     |
|                        | QSK 19G                                     | 7305      | 7306      |          |
|                        | QSK 45G                                     | 7305      | 7306      |          |
|                        | QSK 60G                                     | 7305      | 7306      |          |
|                        | QSK 38G                                     | 7305      | 7306      |          |
| QSK 50G                | 7305  | 7306      |           |          |
| <b>Deutz</b>           | G620 V-8, TBG616 V-8, TBG616 V-12           | 7308      | 7307      |          |
|                        | TBG616K V-8K, TBG616K V-12, TBG616K V-16K   | 7308      | 7307      |          |
|                        | TBG620 V-8, TBG620 V12, TBG620 V-16         | 7308      | 7307      |          |
|                        | TBG620K V-12K, TBG620K V-16K                | 7308      | 7307      |          |
| <b>Dresser Clark</b>   | TLA6  | 7322      | 7321      |          |
| <b>Dorman</b>          | 3DAG, 4DAG, 6DAG                            | 7315      | 7311      |          |
|                        | 6QG   | 7315      | 7311      |          |
|                        | 6PG, 12PG                                   |           | 7303      |          |
|                        | 6SEG, 8SEG, 12SEG                           | 7315      | 7311      |          |
|                        | 6SETCWG Min Nox                             | 7315      | 7311      |          |
|                        | 12SG  |           | 7303      |          |
|                        | 12S, 12STCWG, 12STCAG                       |           | 7303      |          |
|                        | DATG-4                                      | 7315      | 7311      |          |
| <b>General Motors</b>  | 305, 351, 401, 478, 702 Gasoline and LPG    | 7315      | 7311      |          |
| <b>Guascor</b>         | FG180, FGLD180                              | 7305      | 7306      | 7302     |
|                        | FG240, FGLD240                              | 7305      | 7306      | 7302     |
|                        | FGLD360                                     | 7305      | 7306      | 7302     |
|                        | FGLD480, SFGLD480                           | 7305      | 7306      | 7302     |

| Engine Make                 | Model                            | Double Ir | Long Life | Standard |
|-----------------------------|----------------------------------|-----------|-----------|----------|
| <b>John Deere</b>           | 300 Series                       | 7315      | 7311      |          |
|                             | 400 Series (Nat. Gas and LPG)    |           | 7303      |          |
|                             | 500 Series (Nat. Gas and LPG)    |           | 7303      |          |
| <b>Liebherr</b>             | G 924T, G 924TC                  | 7315      | 7311      |          |
|                             | G 926T, G 926TC, G 926TC 40      | 7315      | 7311      |          |
|                             | G 9408 TC, G 9408 TC 40          | 7322      | 7321      |          |
| <b>MAN</b>                  | E 0824 E301, E0824 E302          | 7315      | 7311      |          |
|                             | E 0826 E301, E0826 E302          | 7315      | 7311      |          |
|                             | E 2842, E2842 LE                 | 7315      | 7311      |          |
|                             | E 2843 LN                        | 7315      | 7311      |          |
|                             | E 2876                           | 7315      | 7311      |          |
|                             | E 0834                           | 7322      | 7321      |          |
| <b>Perkins</b>              | E 0836                           | 7322      | 7321      |          |
|                             | G4-203                           | 7315      | 7311      |          |
|                             | G4-236                           | 7315      | 7311      |          |
|                             | 900 Series                       | 7315      | 7311      |          |
|                             | 4000 Series                      | 7305      | 7306      |          |
|                             | <b>Superior</b>                  | 1706G2    | 7305      | 7306     |
| 1712G1                      |                                  | 7305      | 7306      | 7302     |
| 2400 G Series               |                                  | 7305      | 7306      | 7302     |
| <b>Waukesha</b>             | ATGL Series                      |           |           |          |
|                             | AT27GL Series - 13/16" Rch Heads |           | 7306      | 7302     |
|                             | VGF Series                       |           |           |          |
|                             | P48                              | 7305      | 7306      | 7302     |
|                             | L36                              | 7305      | 7306      | 7302     |
|                             | H24                              | 7305      | 7306      | 7302     |
|                             | F18                              | 7305      | 7306      | 7302     |
|                             | VHP Series                       |           |           |          |
|                             | P9390GSI                         |           | 7303      |          |
|                             | P9390GL - 1/2" Rch Heads         |           | 7303      |          |
| P9390GL - 13/16 Rch Heads   |                                  | 7306      | 7302      |          |
| L7044GSI - 13/16" Rch Heads | 7305                             | 7306      |           |          |
| L7042GSI                    |                                  | 7303      |           |          |
| L7042G                      |                                  | 7303      |           |          |
| 7042GL - 1/2" Rch Heads     |                                  | 7303      |           |          |

# Industrial Spark Plugs: Application Guide

| Engine Make                                  | Model                      | Double Ir | Long Life | Standard |  |
|--|----------------------------|-----------|-----------|----------|--|
| <b>Waukesha (cont.)</b>                      | 7042GL - 13/16" Rch Heads  |           | 7306      | 7302     |  |
|  | L5790G                     |           | 7303      |          |  |
|  | L5790GL - 1/2" Rch Heads   |           | 7303      |          |  |
|  | L5790GL - 13/16" Rch Heads |           | 7306      | 7302     |  |
|  | F3521G                     |           | 7303      |          |  |
|  | F3521GL - 1/2" Rch Heads   |           | 7303      |          |  |
|  | F3521GL - 13/16 Rch Heads  |           | 7306      | 7302     |  |
|  | <b>Other</b>               |           |           |          |  |
|  | L5108G, L5108GSI           |           | 7303      |          |  |
|  | L5108GL - 1/2" Rch Heads   |           | 7303      |          |  |
|  | L5108GL - 13/16" Rch Heads |           | 7306      | 7302     |  |
|  | L5115GL                    |           | 7306      |          |  |
|  | F1905GR                    |           | 7303      |          |  |
|  | F11G, F11GSI/GSID          | 7315      | 7311      |          |  |
|  | F1197GRSI                  |           | 7303      |          |  |
|  | F1905GRSI                  |           | 7303      |          |  |
|  | F2894G, F2894GRSI          |           | 7303      |          |  |
| F2895G, F2895GSI                             |                            | 7303      |           |          |  |
| F2895GL - 1/2" Rch Heads                     |                            | 7303      |           |          |  |
| F2895GL - 13/16 Rch Heads                    |                            | 7306      | 7302      |          |  |
| F3520G                                       |                            | 7303      |           |          |  |
| L5100GR, L5100GRSI                           |                            | 7303      |           |          |  |
| L5788GR, L5788GRSI                           |                            | 7303      |           |          |  |
| L7040G                                       |                            | 7303      |           |          |  |
| 6BZ, 6LRZ, 6LRZB, 6MZA, 6MZR                 |                            | 7303      |           |          |  |
| 6NK, 6WAK, 6WAKB                             |                            | 7303      |           |          |  |
| 140GK, 145GK                                 |                            | 7303      |           |          |  |
| 180G, 180GB, 180GKB, 185GLB                  |                            | 7303      |           |          |  |
| 190, 190GLB, 195G, 195GK                     |                            | 7303      |           |          |  |
| <b>Other Natural and LP Gas (14mm Heads)</b> |                            |           |           |          |  |
| P2154G, P2154GSI                             | 7315                       | 7311      |           |          |  |
| H1077G, H1077GSI                             | 7315                       | 7311      |           |          |  |
| L1616G, L1616GSI                             | 7315                       | 7311      |           |          |  |
| VRG220, VRG330                               | 7315                       | 7311      |           |          |  |
| VRN265, VRN283, VRN310                       | 7315                       | 7311      |           |          |  |

# Other Industrial Products



7330 – Combustion Sensor

## Combustion Monitoring

Also included in the Industrial Series is the 7330 Combustion Sensor for Caterpillar G3600 series engines. This sensor immediately alerts the engine management at the first sign of abnormal combustion. The same robust construction and innovative design found in the 7306 spark plug can be found in the Bosch Industrial Series Combustion Sensor.



15703 – Oxygen Sensor

## Industrial Oxygen Sensors

Bosch has both Rich Burn, traditional switching-type sensors and Lean Burn, the LSU broadband Lambda sensors. The Rich Burn is a standard narrow band type oxygen sensor and is only capable of accurately measuring a stoichiometric air/fuel ratio (e.g. 14.7:1). The Lean Burn is a planar ZrO<sub>2</sub> two-cell limit current sensor with an integral heater suitable for measuring the oxygen content and the λ value of exhaust gases in vehicle engines.

Common switching sensors used in stationary gas engines are 12028, 15718, 13190 and the 15703. Lean burn sensors are used when the air fuel ratio has more air than in a stoichiometric mixture.



Knock Sensors

## Knock Sensors

Vibration sensors of this type are suitable for detecting structure-born vibration occurring for example in motor-vehicle engines due to irregular combustion and in machines. Thanks to their robust design, these vibration sensors can withstand even the most severe operating conditions.