DENSO

IRIDIUM SPARK PLUG for GAS ENGINES

IRIDIUM SAVER

Take our long lasting plugs.

Saves on your maintenance costs.

DENSO

IRIDIUM

DENSO is one of the world's leading manufacturers of automotive components and systems and has pioneered many exciting new products. We were the first company to introduce long-life Iridium spark plugs to the market in 1997. Following the success of these ultra-durable Iridium plugs, DENSO developed the IRIDIUM SAVER range - a high-efficiency longer-life spark plug for gas engines that combines the performance benefits of Iridium technology with a number of environmental benefits. Now DENSO has launched the latest generation of hard-wearing spark plugs - the DENSO DOUBLE IRIDIUM (DDI) spark plug. DDI spark plug technology improves and extends the spark plug's lifespan and requires significantly less maintenance than competitor spark plugs. The DDI spark plug is particularly effective when used in bio-gas engines. Try DENSO DDI spark plugs today.

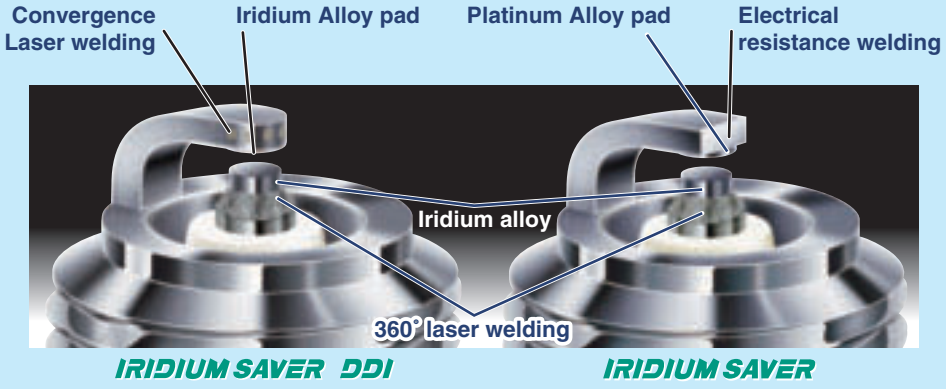
The DDI's key to long plug life.

unique"Iridium alloy"

A unique, high welding point "Iridium alloy" developed and patented by DENSO, dramatically improves wear resistance compared to other Iridium plug Patent:Japan(2877035), UK(2302367), USA(6094000)

Iridium design

Iridium pads both on center electrode and on ground electrode,to minimize spark gap expansion.



LASER WELDING

Convergence laser welding

Wedge by laser welding fixes Iridium alloy pad on ground electrode securely, which realizes high reliability in high temperature combustion engine.

LASER WELDING

360˚ laser welding

Secure welding of the Iridium tip by "360˚ laser welding" can withstand all extreme engine conditions.

Patent:Japan(2921524), USA(6078129)

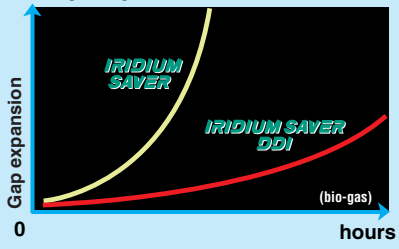
LONG LIFE

Proving longer life

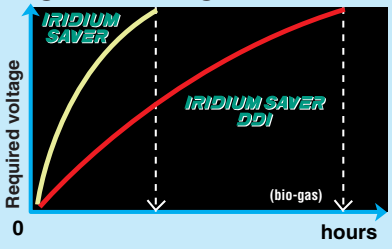
Gap expansion is suppressed by Double Iridium Pads on both sides.

This suppression of gap expansion results in a longer life than Iridium Saver.

Gap expansion



Ignition Voltage limit



The above is analysed by DENSO

SAVER DDI*

*DENSO Double Iridium

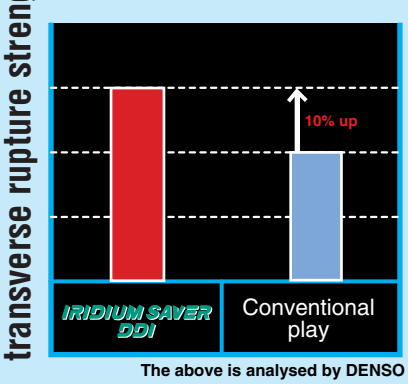
DDI plugs, it's a smart choice.

key to high reliability

Dielectric Ceramics

High Dielectric Ceramics

Newly developed ceramics with finer grain, molded-in higher pressure and higher density prevents electrical breakdown of insulator.



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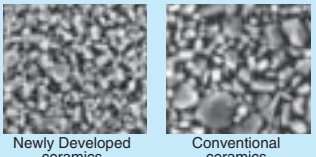
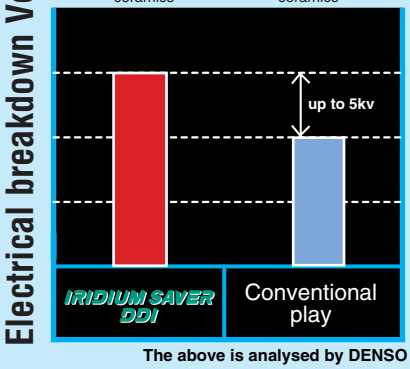


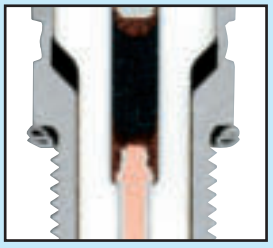


The above is analysed by DENSO

Resistor Noise Reduction

Highly reliable monolithic resistor

IRIDIUM SAVER guarantees high reliability for withstanding high combustion pressures by incorporating stress resistant monolithic resistor that adheres to the resistor glass in the high temperature furnace.
In addition, this eliminates interference to electronic equipment from high energy coil noise.



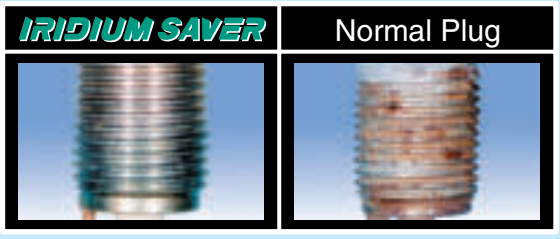
Nickel

Special Nickel plating with better corrosive resistance

Better corrosive resistance for condensed acid water

Exposure Test by acid steam atmosphere

Test length : 700hours
Temperature : 90deg.C
Acid water : pH = 2



The above is analysed by DENSO

Smooth replacement even in severe conditions.

- With the use of oil or lubricant, the tightening torque must be 30Nm for Cast Iron head and 22.5Nm for Aluminum head for M18 thread.
- With the use of oil or lubricant, the tightening torque must be 20Nm for Cast Iron head and 17.5Nm for Aluminum head for M14 thread.
- Install plugs when engine is cold.

DENSO

IRIDIUM SA

DENSO's OEM expertise and commitment to innovation enables them to remain at the forefront of cutting-edge gas engine spark plug development. The unique and specialist technology used in the IRIDIUM SAVER and IRIDIUM SAVER PERFORMER spark plugs range extends their lifespan, making them ideal for high-compression lean-burn engines. Iridium Saver and Iridium Performer spark plugs also help to maximise engine performance and deliver extra durability. Because they require minimal maintenance compared to standard plugs, Iridium Saver and Iridium Performer spark plugs increase service interval times. Try DENSO's IRIDIUM SAVER or IRIDIUM SAVER PERFORMER spark plugs today.

The SAVER's key to long plug life

unique"Iridium alloy"

A unique, high welding point "Iridium alloy" developed and patented by DENSO, dramatically improves wear resistance compared to other Iridium plug Patent:Japan(2877035), UK(2302367), USA(6094000)

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Secure welding of the Iridium tip by "360˚ laser welding" can withstand all extreme engine conditions.

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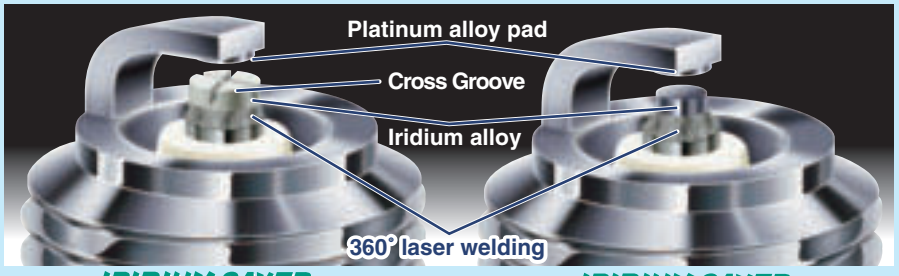
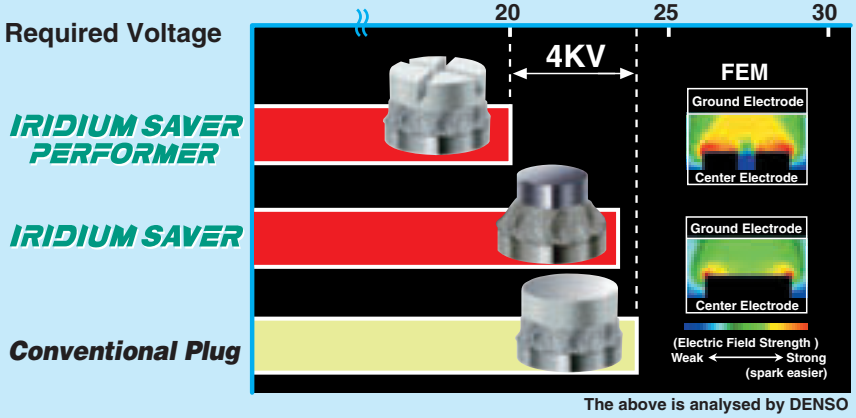


IRIDIUM SAVER PERFORMER　　IRIDIUM SAVER

Cross Groove design (M18mm Plug)

4 small electrodes created by Cross Groove improve sparking performance and suppress dispersion in voltage value, for an outstanding voltage decrease. Patent:USA(6215234)



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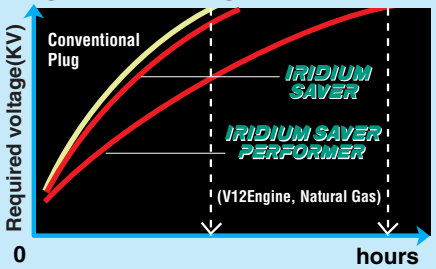
Proving longer life

Required voltage is suppressed by
1)unique "Iridium alloy"
2)Cross Groove electrode, resulting in a longer life than conventional plug.

Ignition Voltage limit



The above is analysed by DENSO

IVER PERFORMER

Identification

G **I** **3** - **1** **A**

- **G**: for Gas Engine
- **I**: Plug type and installation dimension
- **3**: Initial Gap
- **1**: Plug type and installation dimension
- **A**: Terminal design

Plug type and installation dimension			
Number	Thread	Hex size	Reach
E	M14 x 1.25	20.8mm	19mm
N			12.7mm
K		16mm	19mm
I	M18 x 1.5	22.2mm	20.6mm
L		20.8mm	

Initial Gap	
Number	Nominal value
3	0.3mm
4	0.4mm
5	0.5mm
6	0.6mm
7	0.7mm

Terminal design		
	Number	SPEC.
	none	solid
	A	With nut

Plug type and installation dimension

1. *IRIDIUM SAVER*
   Iridium pad without cross groove on center electrode and Platinum pad on ground electrode.
3. *IRIDIUM SAVER*
   For vehicle
5. *IRIDIUM SAVER DDI*
   Iridium pad without cross groove on center electrode and Iridium pad on ground electrode.*3

1. *IRIDIUM SAVER PERFORMER*
   Iridium pad with cross groove on center electrode and Platinum pad on ground electrode.
3. *IRIDIUM SAVER*
   Iridium pad without cross groove on center electrode and Platinum pad on ground electrode.
5. *IRIDIUM SAVER DDI*
   Iridium pad without cross groove on center electrode and Iridium pad on ground electrode.*3

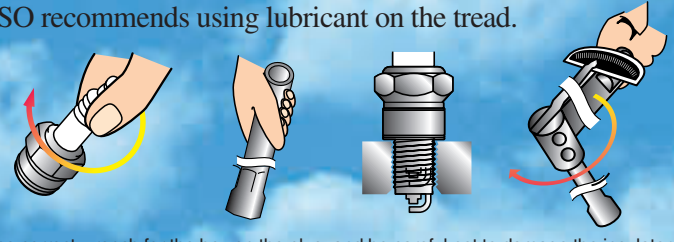
Cross Reference

CHAMPION	BERU	IRIDIUM SAVER DDI	IRIDIUM SAVER PERFORMER	IRIDIUM SAVER
RB77WPC / RB77WPCC KB77WPCC / RB77CC PB78WPC RB75N / RB75PP*2	18GZ 4-77 / 18GZ 6-77 18GZ 20		GI3-1A	GI3-3A
	18GZ 6-77-2	GI3-5A*3		
RB75WPCC	18GZ 5-77		GL3-1A	GL3-3A
	18GZ 5-77-2	GL3-5A*3		
RB76N *1 / RB76PP *1	18GZ 7 *1		GI3-1A	GI3-3A
RN79G (0.015)	14R-3 CPU / 14-3 CPU / 14R-5 DPU / 14R-4 CDP			GE3-1
	14R-4 CIU	GE3-5		
RN79G (0.02)				GE5-1
RC78PYP*4	14FR4 DPU0 / 14FR-4DIU			GK3-1A(GK3-3A)*3*5
	14FR-4DIU	GK3-5A		
RL85G	14R-5 BPU / 14R-4 ADP / 14R-5 BIU			GN3-1A

Insulator length of 18GZ series is shorter than GI3-3A and GI3-1A.
*1 Insulator length of RB76N and RB76PP,18GZ7 is shorter than GI3-3A and GI3-1A.
*2 Insulator length of RB75PP is longer than GI3-3A and GI3-1A.When DENSO spark plugs are used instead of above mentioned,check wether spark plug caps can be used on DENSO spark plugs.
*3 Available in the near future.
*4 Insulator length of RC78PYP is 5mm longer than GK3-5A,GK3-1A and GK3-3A.
*5 For CNG vehicle.

Recommended Tightening Torque

DENSO recommends using lubricant on the tread.



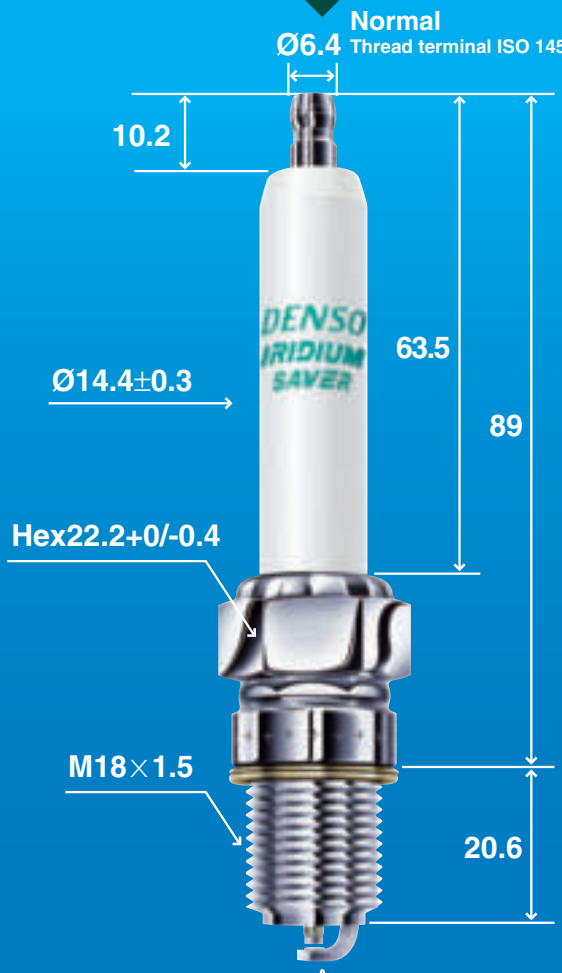
1 Use the correct wrench for the hex on the plug, and be careful not to damage the insulator.
2 When changing spark plugs, please make sure that oil, etc does not fall in the combustion chamber.
3 When installing the spark plugs, please make sure the cylinder is clean.
4 Make sure the plugs are vertical, then tighten them by hand until they cannot be tightened any further.
5 Use a spark plug wrench and tighten according to the recommended torque.

Thread size	lubricant (on housing thread)	Recommended tightening torque*
M14 x 1.25	With lubricant	20 Nm
	Without lubricant	30 Nm
M18x 1.5	With lubricant	30 Nm
	Without lubricant	45 Nm

*for cast iron head

DENSO IRIDIUM

GI3-1A GI3-3A GL3-1A GL3-3A



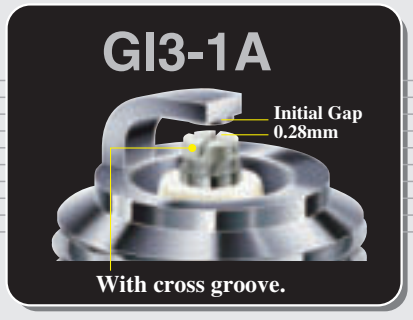
OPTION

Longer terminal nuts are available as option.

The Longer terminal nuts must be used (or installed) for MTU and SKL engines.

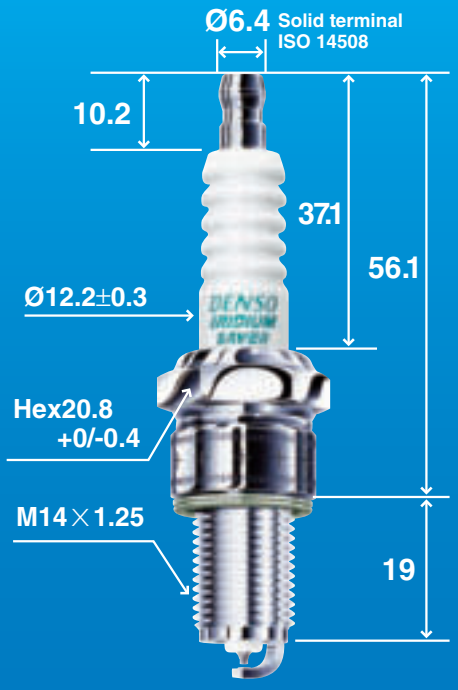
IRIDIUM SAVER

IRIDIUM SAVER PERFORMER



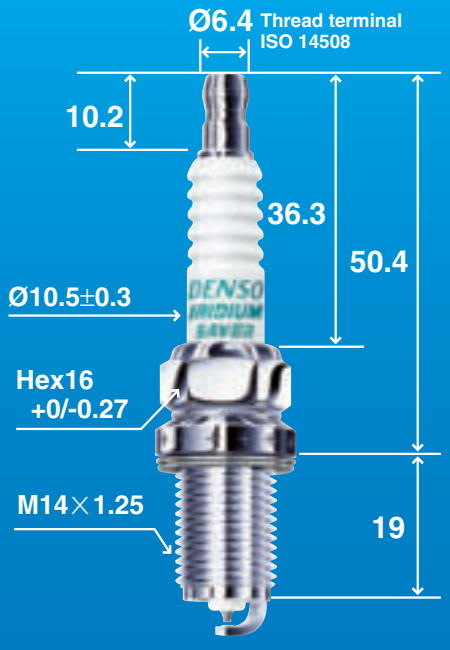
SAVER

GE3-1 GE5-1 GE3-5



GN3-1A

GK3-1A(GK3-3A*1) GK3-5



IRIDIUM SAVER

IRIDIUM SAVER DDI

*1 Available in the near future

DENSO IRIDIUM

APPLICATION IRIDIUM SAVER

Engine maker	Engine types	IRIDIUM SAVER DDI	IRIDIUM SAVER PERFORMER	IRIDIUM SAVER	Gap (inch)
CATERPILLAR	3306, G333 1/2" Reach			GN3-1	0.3mm (.012)
	3306, G333 3/4" Reach, G343, G3304,	GE3-5		GE3-1	0.3mm (.012)
	G3400 series	GE3-5		GE3-1	0.3mm (.012)
	G342, G353, G375, G379			GN3-1	0.3mm (.012)
	G3500 (non B, C and E series)		GI3-1A	GI3-3A	0.28mm (.011)
	G3600 series		GI3-1A	GI3-3A	0.28mm (.011)
	G397, G398, G399			GN3-1	0.3mm (.012)
CUMMINS	6B, 6C, L-10			GK3-3A*1	0.3mm (.012)
	QSV 81-V16, QSV 91-V18		GI3-1A	GI3-3A	0.28mm (.011)
DAE WOO	GV222TIC, GE08TIC,GE12TIC,GV180TIC,GV158TIC	GK3-5		GK3-1A	
DEUTZ MWM	G620 V-8, TBG616 V-8, TBG616 V-12		GL3-1A	GL3-3A	0.28mm (.011)
	TBG616K V-8K, TBG616K V-12, TBG616K V-16K		GL3-1A	GL3-3A	0.28mm (.011)
	TBG620 V-8, TBG620 V12, TBG620 V-16		GL3-1A	GL3-3A	0.28mm (.011)
	TBG620K V-12K TBG620K V-16K		GL3-1A	GL3-3A	0.28mm (.011)
DORMAN	6SEG, 8SEG, 12SEG	GE3-5		GE3-1	0.3mm (.012)
	6SETCWG MinNox	GE3-5		GE3-1	0.3mm (.012)
GUASCOR	FG180, FGLD180, FG240		GI3-1A		0.28mm (.011)
	FGLD240, FGLD360, FGLD480		GI3-1A		0.28mm (.011)
GE JENBACHER	J612, J616, J620 (1995/9 - BMEP = 16 bar or less)		GI3-1A	GI3-3A	0.28mm (.011)
JOHN DEERE	6076AFN30 (150, 200 H.P.)	GK3-5		GK3-1A	0.3mm (.012)
LIEBHERR	G 924 T	GE3-5		GE3-1	0.3mm (.012)
	G 924 TC	GE3-5		GE3-1	0.3mm (.012)
	G 926 T	GE3-5		GE3-1	0.3mm (.012)
	G 926 TC	GE3-5		GE3-1	0.3mm (.012)
	G 926 TC 40	GE3-5		GE3-1	0.3mm (.012)
	G 9408 TC	GK3-5		GK3-1	0.3mm (.012)
	G 9408 TC 40	GK3-5		GK3-1	0.3mm (.012)
MAN	E 0824 E 301, E 0824 E 302, E 0826 E301, E 0826 E302,	GE3-5		GE3-1	0.3mm (.012)
	E 2842, E 2842 LE, E 2843 LN, E 2876, E 2866 LUH01	GE3-5		GE3-1	0.3mm (.012)
	E 0834, E0836			GK3-3A*1	0.3mm (.012)
	E 2866 DUH03			GE5-1	0.5mm (.020)
PERKINS	G4-203, G4-236, 900 Series			GE5-1	0.5mm (.020)
	4000 Series		GI3-1A	GI3-3A	0.28mm (.011)

Engine maker	Engine types	IRIDIUM SAVER DDI	IRIDIUM SAVER PERFORMER	IRIDIUM SAVER	Gap (inch)
SUPERIOR	1706G2, 1712G1		GI3-1A	GI3-3A	0.28mm (.011)
VOLVO TRUCK	GH10C, MG9			GE3-1	0.3mm (.012)
WARTSILA	Model 175 (1994 -), W220SG	GK3-5		GK3-1A	0.3mm (.012)
	W25SG, W28SG, W34SG, W20V, 34SG		GI3-1A	GI3-3A	0.28mm (.011)
WAUKESHA	AT Series				
	8L-AT25GL / AT27GL (13/16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	12V-AT25GL / AT27GL (13/16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	VGF Series Inline 6				
	F18G, F18GL / GLD		GI3-1A	GI3-3A	0.28mm (.011)
	VGF Series Inline 8				
	H24G, H24GL / GLD		GI3-1A	GI3-3A	0.28mm (.011)
	VGF Series V-12				
	L36GL / GLD		GI3-1A	GI3-3A	0.28mm (.011)
	VGF Series V-16				
	P48GL GLD		GI3-1A	GI3-3A	0.28mm (.011)
	VHP Series Inline 6				
	2895GL (13 / 16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	3521GL (13 / 16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	VHP Series V-12				
	L5108GL (13 / 16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	L5790GL (13 / 16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	L7042GL (13 / 16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	VHP Series V-16				
	P5115GL		GI3-1A	GI3-3A	0.28mm (.011)
	P9390GL (13 / 16" Reach Heads)		GI3-1A	GI3-3A	0.28mm (.011)
	VSG Series				
	F11G, F11GSI / CSID, P2154G, P2154GSI	GE3-5		GE3-1	0.3mm (.012)
	H1077G, H1077GSI, L1616G, L1616GSI	GE3-5		GE3-1	0.3mm (.012)

This chart should be used for guidance only. Design and material differences between manufacturers may vary the heat range. See recommendation section for specific engine applications. Where manufacturers' names and/or numbers are stated these are given for reference purpose only and do not indicate source of manufacturer or any connection in the course of trade with the manufacturer named.

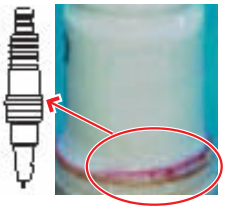
- **Read packaging instructions before use.**
- **Stop engine when exchanging plug. If not, it could result in fire and electric shock.**
- **Tighten plug by the fixed torque with plug wrench.**
- **Spark plug gap has been set to regulation value, do not adjust.**
- **Do not install IRIDIUM SAVER spark plugs into an engine which contains modified cylinder heads, valves, pistons etc. This will cause damage to plug and engine.**

***1Available in the near future**

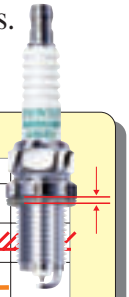
DENSO IRIDIUM

Handling Failure Mode & countermeasure

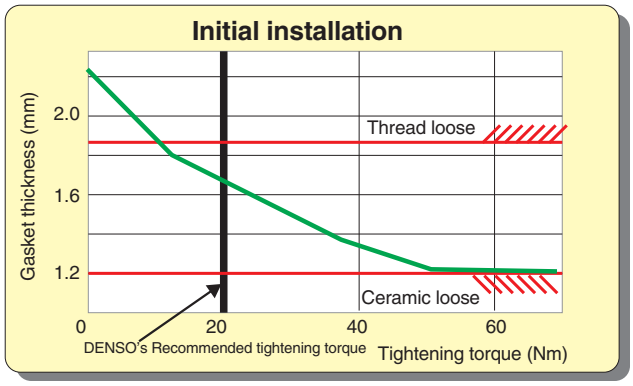
An effective way to diagnose the engines operating conditions is to check if the spark plugs look abnormal. If all cylinders are operating normally then the spark plug appearance is light grey, there are tanned deposits and there is a slight electrode erosion.

	Loose ceramic	Breaking of thread portion	Ceramic crack at upper housing portion	Flash over	High temperature oxidation	Sparking failure
Phenomena						
Cause	Excessive plug tightening.		Hit ceramic head with plug wrench when spark plug is tightened / removed.	Deterioration of plug boots.	High combustion temperature.	The spark plug did spark because of deposits on the sparking portion of the insulator.
Counter measure	Tighten with proper torque.		Use torque wrench correctly.	Replacement of plug boots.	Change with new plug due to end of longevity. Please investigate the cause that the combustion temperature rises.	Clean the sparking portion of the insulator.

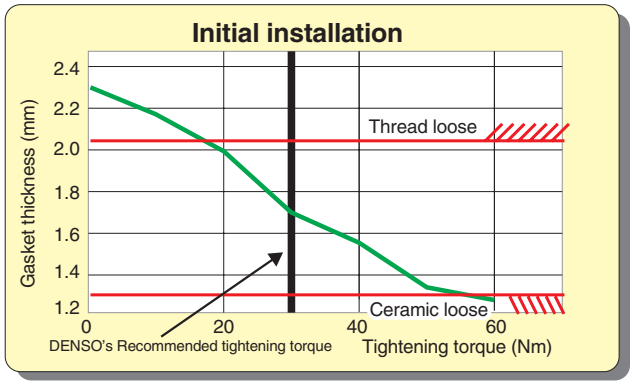
Regarding tightening you can estimate if the tightening torque was proper or not by gasket thickness.

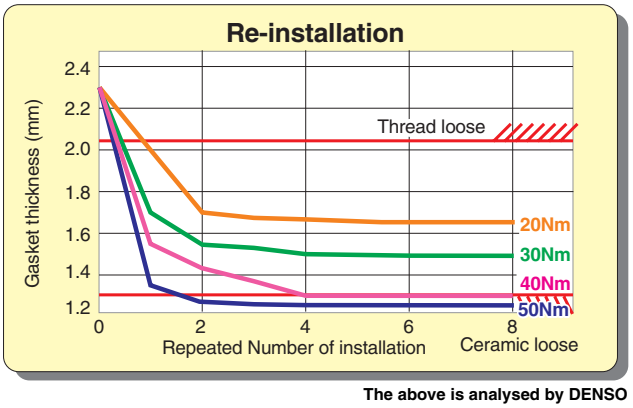


M14X1.25 With lubricant for cast iron head



M18X1.5 With lubricant for cast iron head





The above is analysed by DENSO

Superb DENSO plug quality. (M18 Iridium Saver plug.)

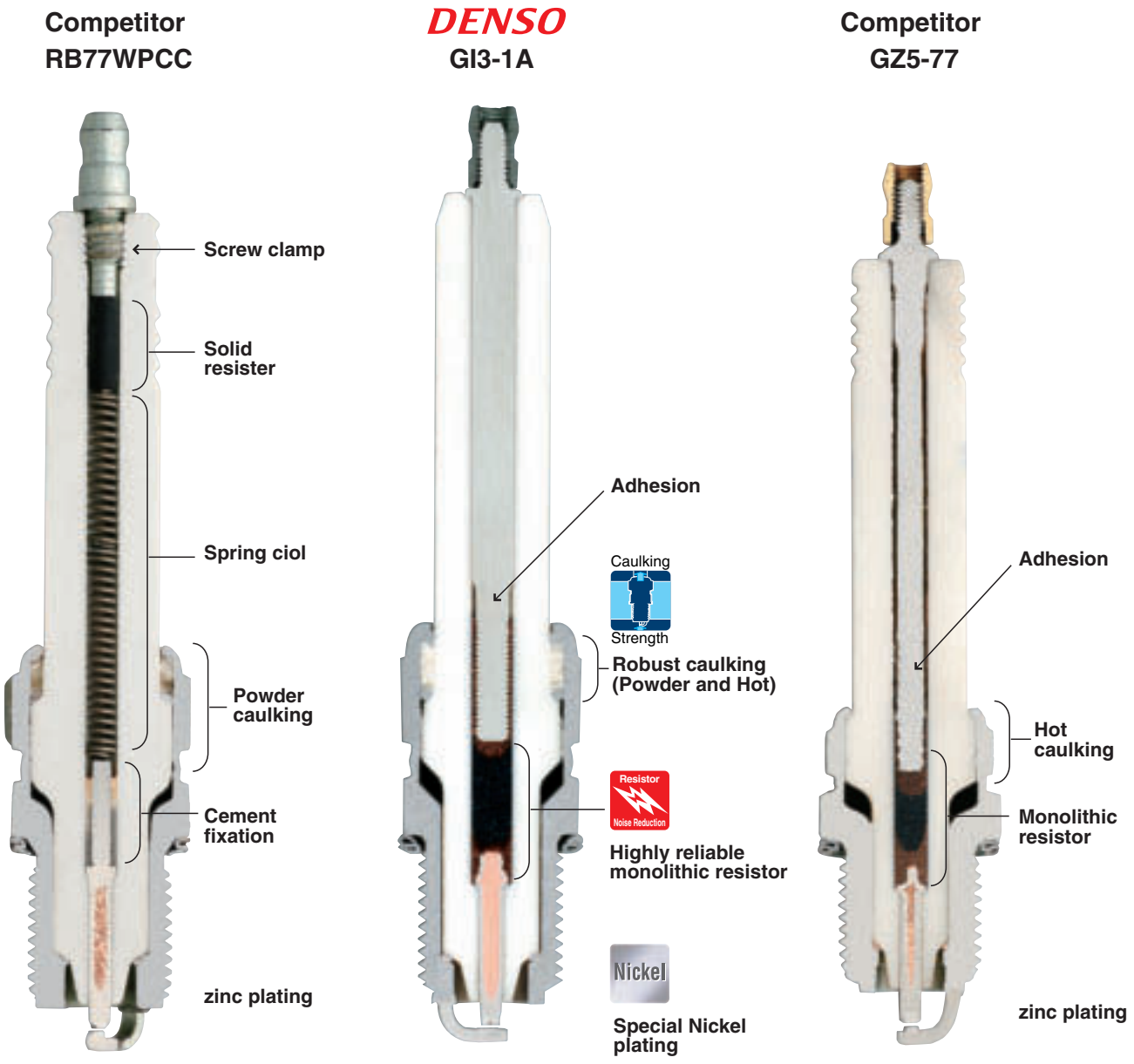
Try to prolong plug replacement time by using high reliable IRIDIUM SAVER spark plug.

Caulking
Strength

To secure stable reliability, IRIDIUM SAVER adopts a robust structure, such as a robust monolithic structure in the insulator. And the bottom portion of insulator is housed by the installation metal shell by a robust caulking.

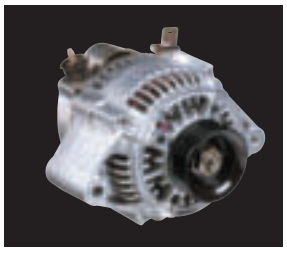
Resistor
Noise Reduction

IRIDIUM SAVER guarantees high reliability withstanding high combustion pressure by incorporating a stress resistant monolithic resistor that adheres in the high temperature furnace to the resistor glass.In addition, this eliminates interference to electronic equipment from high energy coil noise.



The above is investigated by DENSO

DENSO Company Profile



DENSO Corporation was founded in 1949 and is one of the world's leading manufacturers of automotive components.

With 76 production facilities in 23 countries, DENSO produces a wide range of quality products for the automotive industry and is one of the world's largest original equipment suppliers to many leading automotive brands.

The company has a wide range of products including:

- Air conditioners and heaters for cars, commercial vehicles and trains
- Electrical automotive and electronic control products (incl. Spark plugs)
- Fuel management systems
- Radiators
- Meters
- Filters
- Telecommunications
- Other non-automotive products

To maintain it's high product quality standards and its leadership position, DENSO invests more than 8,8% of its net sales in R&D programs, achieving worldwide sales of USD 19.9 billion with over 95.000 employees in 2004.

To meet the need of its customers and the international market more effectively, DENSO has established sales offices in over 26 countries as well as in Japan.

DENSO Europe BV, the subsidiary in The Netherlands and European Headquarters, was established in 1973. As well as being the European strategy planning center, DENSO Europe BV also handles the following aftermarket activities:

- European Aftermarket Sales
- European servicing
- European logistics

DENSO EUROPE B.V.
Hogeweyselaan 165, 1382 JL WEESP, The Netherlands
Mailing address:P.O.Box 89, 1380 AB WEESP, The Netherlands
Tel. (31) 0294-493493, Fax (31) 0294-493493
www.denso-europe.com E-mail:info.amsales@denso.nl

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