

CRISTAL™ E

A new generation of stainless steel MMA electrodes

Patent
pending

“The future of welding is clear”



2006-222

RL00537R

CRISTAL™: New generation of stainless steel coated electrodes



Our objective at Air Liquide Welding is to help our customers to optimise their performance by offering innovative products. To do so, the ALW dedicated R & D team is permanently working on the development of solutions to improve productivity and quality and to drive technological evolution.

The CRISTAL™ range of rutile coated stainless steel MMA electrodes for welding with direct current in the downhand position consists of 3 types:

CRISTAL™ E 308 L

Suitable for welding austenitic steels such as AISI 304 and 304 L.

CRISTAL™ E 316 L

Suitable for welding austenitic steels such as AISI 316 and 316 L.

CRISTAL™ E 309 L

Multi application electrode for welding stainless steels with 23 % Cr, 13 % Ni such as AISI 309 and suitable for joining dissimilar steels



Vacuum packaging is standard guaranteeing electrodes are ready for use and in exactly the right quantity.

Market segments

- Equipment for the food industry,
- Equipment for the chemical industry,
- Maintenance and repair.



Comparison of fume emission rates



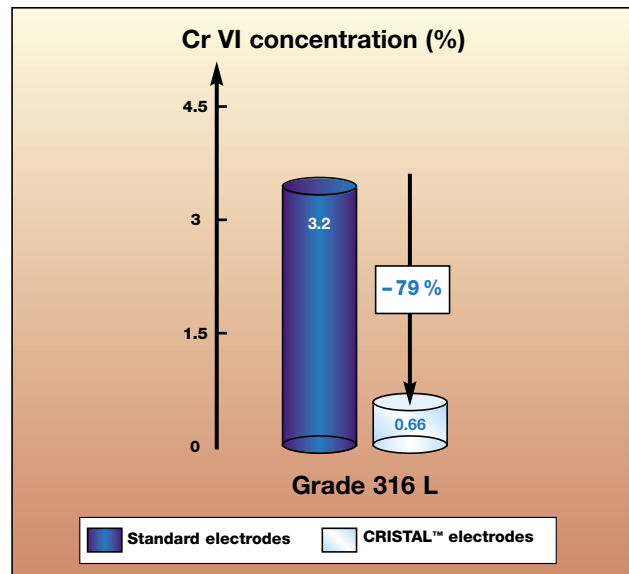
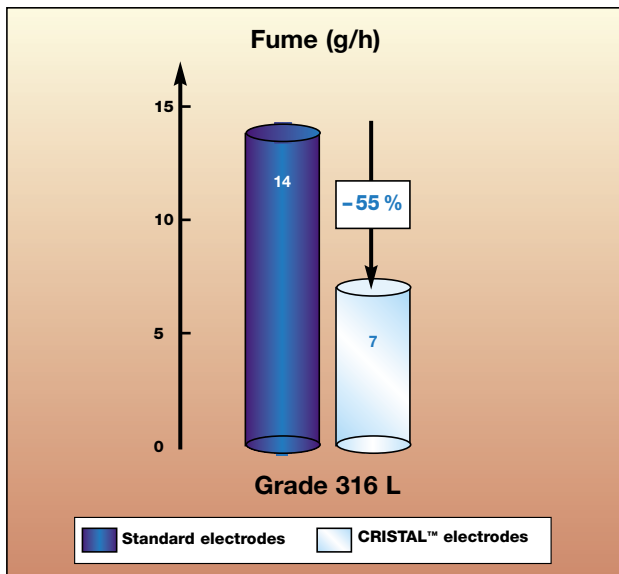
Comparative fume characteristics with standard electrodes for diameter 3.2 mm.

Electrode	Average emission rate in (g/h)	% CrVI	% Fe	%Ni	% Mn	%Mo
CRISTAL™ E 316L	7	0.66	9	0.86	5.6	0.11
Standard E 316L	14	3.20	5	0.29	2.4	0.16

Different conditions of use can lead to different results.

Results generated by TWI (The Welding Institute Ltd), Cambridge UK, August 2005

- Emission rate testing according to the methodology defined in pr EN 15011-4, EN ISO 15011-1:2002.
- Fume analysis according to BS ISO 15202-2&3 and BS ISO 16740:2005.
- Welding performed with an inverter on degreased mild steel base material, average current : 106 A – voltage: 25.7 V.
- Comparable reduction in fume emission and CrVI concentration have been obtained on 308L and 309L electrodes by Air Liquide Welding.



CRISTAL™ classification according to EN 15011-4

The new pr ISO EN 15011-4 norm is a European and International standard for health and safety in welding describing how to collect samples of welding fumes and gases for determination of the fume emission rate and chemical composition.

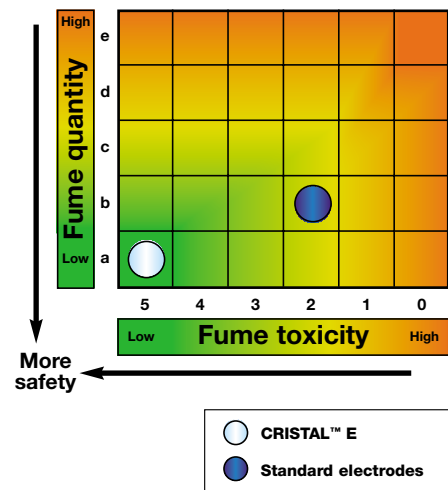
This norm allows the user to make an objective choice of the safest possible product for the application, optimising the working conditions, by attacking the problem at the source.

The CRISTAL™ MMA electrodes are all in class 5a

(welding fume limit value >4.5 mg/m³ and fume emission rate less than 3 mg/s).

Standard electrodes are in class 2B (welding fume limit value 1.5 to 2.5 mg/m³).

Class 5a is the lowest and thus the most hygienic class.



Mechanical, chemical characteristics and conformance



CRISTAL™ electrodes

■ Conformance

	AWS (A 5.4)	EN 1600
CRISTAL™ E 308 L	E 308L-17	E 19 9 L R 22
CRISTAL™ E 316 L	E 316L-17	E 19 12 3 L R 22
CRISTAL™ E 309 L	E 309L-17	E 23 12 L R 22



■ Chemical analysis and mechanical properties

	Typical EN1597-1 all weld mechanical characteristics				Chemical analysis, typical wt % all-weld-metal deposit (ISO 6847)								
	YS MPa	UTS MPa	E (l=5d) %	CVN+20 °C J	C	Si	Mn	S	P	Cr	Ni	Mo	Ferrite WRC 92
CRISTAL™ E 308 L	405	550	38	60	0.030	0.9	0.8	0.008	0.020	19	10.5	-	8
CRISTAL™ E 316 L	445	580	38	60	0.030	0.9	0.8	0.008	0.020	19.1	10.8	2.8	8
CRISTAL™ E 309 L	445	570	38	60	0.030	0.9	0.8	0.008	0.020	23	12.5	-	10

■ Approvals

TÜV - DB

■ Welding parameters

Diameter (mm)	Current (A)
2.5	70-80
3.2	110-120
4.0	125-135

Caution : for use only with direct current .

Very low moisture pick up after 5 days 80 % RH/27 °C: no porosity.
If necessary, re-drying: 250 °C / 2 h.

■ Product information

	Type	Diameter (mm)	Length (mm)	Quantity		Cat. no.
				Per pack	Per carton	
Electrode	CRISTAL™ E 308 L	2.5	300	28	448	W 000 234 624
		3.2	350	22	308	W 000 234 625
		4.0	350	18	216	W 000 234 626
	CRISTAL™ E 316 L	2.5	300	28	448	W 000 234 627
		3.2	350	22	308	W 000 234 628
		4.0	350	18	216	W 000 234 629
	CRISTAL™ E 309 L	2.5	300	28	448	W 000 234 630
		3.2	350	22	308	W 000 234 631
		4.0	350	18	216	W 000 234 632

CRISTAL™: a new generation of stainless steel electrodes

The welding industry is a modern industry, where efficiency, productivity, quality and innovation are key to competitive advantage. Welders are highly skilled professionals, whose performance can be optimized by the use of the innovative and unique range of CRISTAL™ welding consumables.

How do CRISTAL™ stainless steel MMA electrodes help to improve and optimize the welders' performance ?

Improved performance

- Better visibility of the weld pool
- Good weldability in DC mode and easy to use
- Good striking and restriking
- Good slag removal
- Low fume residues along the bead line and thus less cleaning

Quality

- Very regular, fine shaped, mitre, bead appearance

Working environment*

- Reduction of fume emission by 50%
- Cr VI is reduced by a factor of four compared to standard electrodes, making CRISTAL™ electrodes the safest available on the market.



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The advantages of DRY vacuum packaging

The vacuum packaging of CRISTAL™ MMA electrodes allows :

- easy storage without requiring special precautions,
- the electrodes are ready for use, reducing the risk of start porosity, even after long periods of storage,
- just enough electrodes for your application, in packs of 1 kg (2.5 kg for larger diameters), reducing wastage.



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* The use of CRISTAL™ does not replace the need for precautions to be taken when welding.

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