



## Spatter Matters

Weld spatter occurs during spot welding when small liquid particles are expelled from the surface of the materials being welded together, due to all the pressure and heat. The flying molten metal (spatter) can cause a wide variety of problems that add unnecessary costs and risks.

### **Spatter welding:**

- High cost to repair or replace Personal Protective Equipment (PPE)
- Higher electrical power usage and related costs
- Uneven, jagged or dimpled spots caused by spatter
- Higher maintenance costs for cleaning and equipment
- Costs to repair or replace welding equipment
- Health and safety implications for employees
- Increased production down-time

### **Spatter-free welding:**

- Cost savings on PPE
- Reduced power consumption and related costs
- Better weld quality and less rework
- Reduced maintenance costs
- Lower consumable equipment costs
- Safer and cleaner environment
- Increased production up-time
- Reduced component testing and related costs



### **About Luvata**

Luvata is a world leader in metal solutions manufacturing and related engineering services. Luvata's solutions are used in industries such as renewable energy, power generation, automotive, medicine, air-conditioning, industrial refrigeration, and consumer products. The company's continued success is attributed to its longevity, technological excellence and strategy of building partnerships beyond metals. Employing over 6,500 staff in 17 countries, Luvata works in partnership with customers such as Siemens, Toyota, CERN, and DWD International.

### Nissan's journey towards spatter-free welding

Nissan's Sunderland Plant (NMUK) has been the UK's largest car producer for 15 years running as well as biggest exporter for 13 consecutive years.

Representing over £3.5 billion of investment the plant directly employs around 6,000 staff and produces 2,000 cars every day.

Record levels of productivity have enabled Nissan Sunderland to continue to secure contracts for new models, currently producing the Note, Qashqai, Qashqai+2 and Juke plus the recently introduced 100% electric Nissan Leaf.

The plant is currently gearing up to welcome the next generation Qashqai, the new Nissan Note and a yet to be named Infiniti model, Nissan's luxury brand.

Within NMUK, the Body Shop is a highly-automated section of the factory with over 800 robots; pressed-panels are welded together to create the complete body shell of the car, which is then transferred to the Paint Shop.

### Spatter comes with a cost

NMUK has spent significant resources on problems directly caused by spatter. This includes damage to sensors, cables, jigs, clamps and mechanical drives. Spatter has to be manually removed, which also comes with a cost.

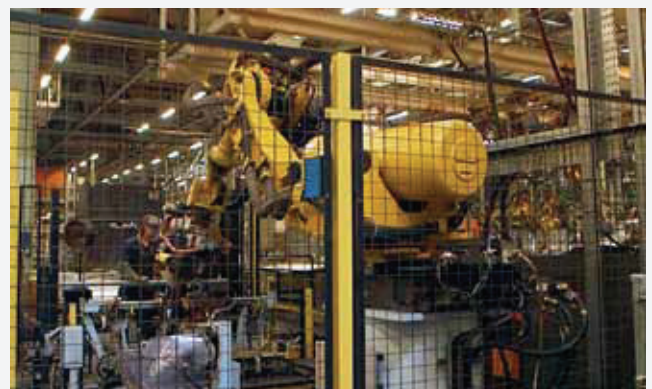
"We switched to using Luvata electrodes, but mainly focused on the actual cost benefits, not the long-term costs of the spatter," indicates the Weld Team Supervisor from NMUK. "The welding expert from Luvata was persistent in explaining we needed to consider those costs as well. With Luvata's expertise, we worked together to select the correct material weld cap and fine tuned the welding parameters to enable the reduction of weld spatter."

With numerous materials – different alloys and grades of steel – and an average of 4,000 spot welds per vehicle, not every weld is exactly the same. As the world's leading manufacturer of resistance-welding electrodes, Luvata offers a wide range of electrodes that give customers a choice concerning spatter.

"Based on our production requirements and in working closely with Luvata, we were able to pick the right electrode for us. For NMUK, it resulted in a spatter-reduced weld."



NMUK Standard Parameter



NMUK Spatter Reduction Parameter





## Z-Trode®

The ideal cap electrode for resistance welding of light-to-medium gauge coated and uncoated steels and aluminum alloys

The Luvata Z-Trode® cap electrode is cold-formed from CDA Alloy 15000 zirconium copper. The combination of advanced copper metallurgy and our cold-forming technology gives you an electrode that outperforms conventional electrodes.

### Spatter matters

Z-Trode is the electrode of choice for the Luvata Spatter Reduction Project. The reduction or even elimination of weld expulsions reduces maintenance, protective clothing and rework costs and improves productivity. A better weld quality and reduction in energy costs of up to 10% are just some of the project benefits.

### Prevents sticking

Electrode sticking is inevitable when welding galvanized steel with conventional electrodes. Chrome in a conventional electrode does not prevent the zinc from alloying into the copper electrode creating a brass intermetallic surface on the electrode weld face, which diminishes the weld nugget size and degrades the weld quality. But Z-Trode is an alloy of pure zirconium and oxygen-free copper. The zirconium discourages the alloying effect on the electrode weld face and prevents sticking. This increases productivity without special dressings or increased power requirements to weld coated materials.

### Resists mushrooming

When compared to CuCrZr and CuCr alloys, the zirconium-copper alloy resists mushrooming and wear due to its superior conductivity. Z-Trode's conductivity allows it to be used with lower current settings and less heat, greatly improving the alloy's resistance to mushrooming.



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### Requires less energy

In comparison to CuCrZr and CuCr alloys, Z-Trode requires lower current due to its higher electrical conductivity, when used on both sides of the weldment. This results in longer electrode life, more consistent welds and energy savings. Welder current settings can be reduced up to 20% from the conventional CuCrZr and CuCr settings, with no loss in weld integrity.

### Reduces downtime

Overall maintenance of Z-Trode caps is much less than with conventional electrodes, increasing welding process and production efficiencies.

### Produces smooth start-ups

Z-Trode caps require no warm-up, conditioning time or initial preparation following electrode changes.

### Most cost-effective electrode

Z-Trode's increased life expectancy, maintenance savings, lower energy requirements and consistent quality welds assure you the most return on your investment.

### Z-Trode production

Z-Trode's freedom from oxygen allows us to alloy the copper with the optimum level of zirconium; that's what gives excellent conductivity, and that's what gives you the ability to reduce current settings.

### Z-Trode's physical properties

All Z-Trode electrodes are cold worked and most items are fully cold formed to ensure the maximum possible amount of cold work. Result; mechanical properties equivalent to conventional CuCrZr and CuCr electrodes, but with better electrical conductivity.

Hardness at ambient temperature:	Minimum 65 HRB
Conductivity:	Minimum 85% IACS

### Z-Trode's non-stick properties

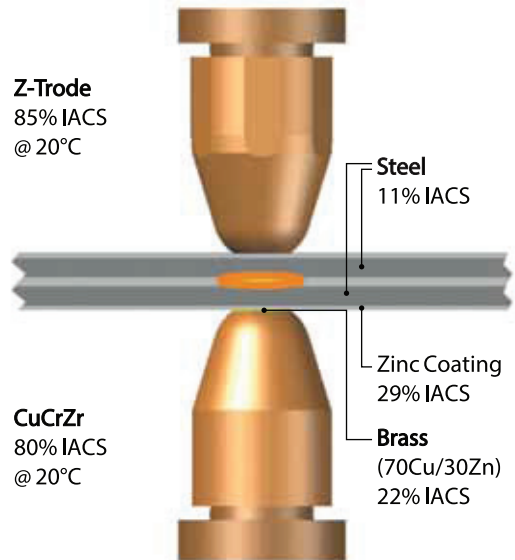
A resistance weld forms where the electrical resistance in an assembly is highest. Z-Trode's superior conductivity means that the maximum electrical resistance in an assembly is always clearly between the steel or aluminum sheet. This reduces heat generated between the sheet and electrode, which in turn reduces sticking.

### Traceability

All Luvata materials are fully traceable. Z-Trode electrodes can be recognized by their flats around the periphery of the electrode.

Luvata welding electrodes are available in all industry sizes, geometries and tapers.

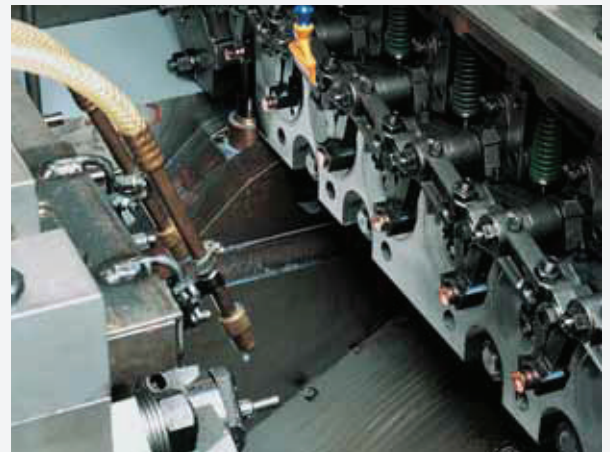
### Conductivities



### Melting Points

Zinc	~420°C
Brass (70Cu/30Zn)	~1027°C
CuCrZr	~1075°C
<b>Z-Trode</b>	<b>~1080°C</b>
Steel	~1427°C

Electrical and physical constants



Cold heading





## Nitrode®

No other cap electrode can match Nitrode® for its cost-effective, high quality performance in resistance-welding applications

Luvata's Nitrode cap is a cold-formed alloy of copper dispersion strengthened with Aluminium Oxide. It consistently outperforms copper chrome and copper chrome zirconium electrodes in resistance to annealing, consistent electrical conductivity, electrode life and maintenance costs.

### Longer weld life

Nitrode caps last longer than conventional electrodes by resisting annealing.

### Non-stick

Nitrode caps reduce sticking of electrodes on galvanized steel and other coated metals. The refractory qualities of  $Al_2O_3$  reduce the infusion of liquid and gaseous zinc into the copper matrix.

### Resists mushrooming

Nitrode's resistance to mushrooming minimizes its dressing frequency to one-fourth that of conventional electrodes, significantly reducing line downtime and re-welds.

### Reduces maintenance downtime

Nitrode caps require less overall maintenance than conventional CuCrZr and CuCr electrodes, increasing welding process and production efficiencies.

### Reduces energy requirements

Nitrode requires lower current when used on both sides of the weldment. Current settings on your welder can be reduced by up to 10% from conventional settings, with no loss of weld quality.

### Smoother start-ups

Nitrode caps require no warm-up, conditioning time or initial preparation following electrode changes. If you use automatic step-up controls, the incremental settings can be varied to minimize current adjustments with no loss of weld integrity. The results are fewer electrode changes, fewer interruptions for dressing and smoother start-ups.



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### Works on all steels

Nitrode has demonstrated superior welding performance for a variety of steels, including HSS, HSLA, micro-alloyed, nitrogenized, low-carbon, electrolytically zinc-coated, galvanized and many others.

### Nitrode cuts your company's costs

Improved up-time from reduced tip changes, maintenance savings, less tip-dressing, improved weld quality, and lower current settings will increase your company's productivity, and cut your costs compared to conventional electrodes.

### Nitrode metallurgy

Nitrode is a composite alloy of copper and  $Al_2O_3$  to become CDA alloy 15760. Conventional copper alloys anneal at temperatures over 500°C. Nitrode does not suffer significant loss of properties till nearly the melting point of 1083°C.

### Nitrode's physical properties

Hardness at ambient temperature:	Minimum 75 HRB
Conductivity:	Minimum 75% IACS

### Nitrode's longer weld life

The contact surface of a resistance welding electrode reaches temperatures of up to 900°C during the welding process. As the contact surface on a CuCrZr or CuCr electrode anneals, it softens and the contact surface grows, limiting the electrode life. Nitrode electrodes resist annealing and slow the mushrooming effect on the contact surface of the electrode, allowing more welds before tip dressing, heat stepping, or tip change.

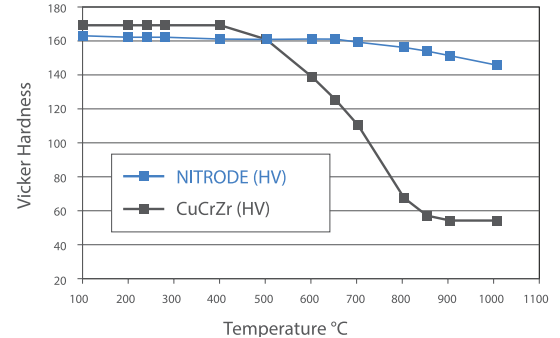
### Heat stepping

Nitrode electrodes allow more welds per heat step than conventional alloys. Adjusting heat-programs allows you to take advantage of the longer life of Nitrode electrodes.

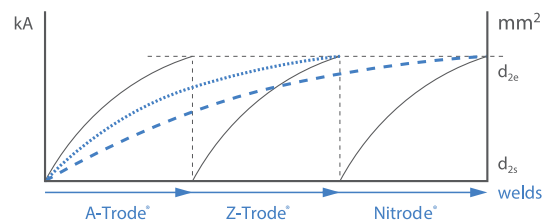
### Traceability

All Luvata materials are fully traceable. Nitrode electrodes can be recognized by their single knurls.

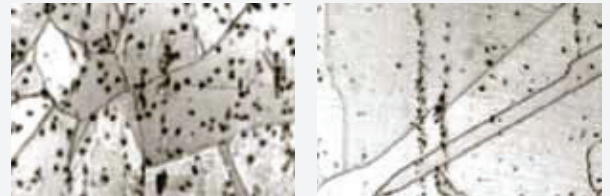
Luvata welding electrodes are available in all industry sizes, geometries and tapers.



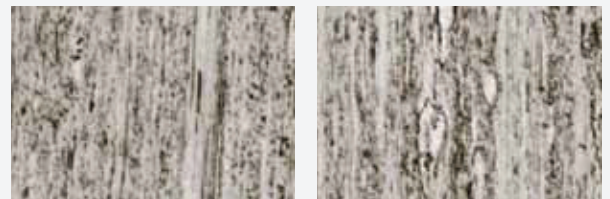
Hardness at high temperature



Heat stepping



CuCrZr before and after annealing at 900°



Nitrode before and after annealing at 900°



CuCrZr after 1200 welds

Nitrode after 1200 welds





## A-Trode<sup>®</sup>

The universal cap electrode for reliable resistance welding of light-to-medium gauge coated and uncoated steels

### A-Trode<sup>®</sup> production

Produced by Luvata's proprietary billet casting process, A-Trode's freedom from oxygen allows us to alloy the copper with the optimum levels of chrome and zirconium. Electrodes are cold headed or machined to suit the required shape.

Luvata has a long history of supplying high quality CuCrZr (A-Trode) electrodes.



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## Specification - Quality

Alloy	C18150 CuCrZr, EN ISO 5182 A2/2, DIN 17666 Wn 2.1293
Chemical composition	Cr 0.7% to 1.2%, Zr 0.06% to 0.15%. Others max. 0.2%, Cu remainder.
Physical material properties at 20°C	<div> <div>Mass</div> <div>8.9g/cm<sup>3</sup></div> </div> <div> <div>Specific heat</div> <div>0.376 J/kg.K</div> </div> <div> <div>Thermal conductivity</div> <div>320 W/m.K</div> </div> <div> <div>Expansion coefficient (20-300°C)</div> <div>17.0 x 10<sup>-6</sup> m/mK</div> </div> <div> <div>Electric conductivity (solution-annealed and hardened)</div> <div>min. 43 S/m</div> </div> <div> <div>Softening temperature</div> <div>min. 74% IACS</div> </div> <div> <div></div> <div>min. 500°C</div> </div>
Dimensions and tolerances	To ISO 5821 or other standards as required. Special electrodes to customer drawing.
Packaging	Most items in cartons of 500 pieces.
Documentation	Acceptance test certificate EN 10204 3.1 B possible if desired against a charge.
Area of application	Male and female resistance welding electrodes. Backing dies. Series welding backing dies. Indirect welding backing dies.

Errors and omissions excepted. Values given are industry standards.

## Specifications - Quality

Form of supply	Tensile strength [N/mm <sup>2</sup> ]	0.2% Offset yield strength [N/mm <sup>2</sup> ]	Elongation AS [%]	Hardness HV
Electrodes	≥ 490	≥ 430	≥ 15	≥ 172

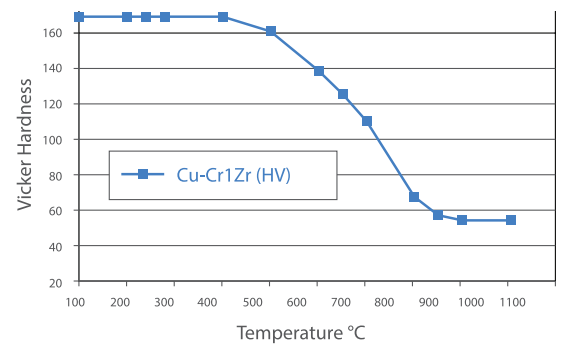
## Luvata's other resistance welding products

Nitrode® Dispersion Strengthened Copper

Z-Trode® Zirconium Copper

Backing dies, adaptors and other resistance welding accessories.

Luvata welding electrodes are available in all industry sizes, geometries and tapers.



A-Trode metallurgy



Conventional CuCrZr grain structure



Luvata CuCrZr fine grain structure