

38999 Series III Black Zinc Nickel



The RoHS Alternative to Cadmium

SOURIAU Black Zinc Nickel: the best in terms of price and performance for aerospace and defense equipment.



SOURIAU Zn Ni ■ A unique alternative plating process to cadmium.

RoHS compliant ■ A unique SOURIAU plating process compliant with RoHS regulations.

The first QPL qualified ■ SOURIAU Zn Ni is the first product which has been qualified by US Defense standards organization (DLA Land and Maritime).

High corrosion resistance ■ 500 hours salt spray.

Available in mass production ■ Available for many SOURIAU ranges.



Presentation

**SOURIAU RoHS Black Zinc Nickel:
The first QPL qualified cadmium free plating**

Various Environmental Directives impose requirements on the electrical and electronic equipment manufacturers: the RoHS (Restriction of use of certain Hazardous Substances) directive, part of the WEEE (Waste Electrical and Electronic Equipment) directive.

SOURIAU has more than 15 years of experience in producing Zn Ni with continuous improvements to comply with MilAero harsh environment conditions. As a result, **SOURIAU** Zn Ni provides customers with the most cost-effective solution for a cadmium alternative finish.

SOURIAU Zinc Nickel is the first QPL qualified to the most recent release of the MIL 38999 standard (rev. L).



SOURIAU main platings comparison

SOURIAU Plating	Robustness	Weight	Conductivity	RoHS	Designed for Unpressurized Area	Salt Spray Withstanding
Composite Nickel	++	 	++++		Yes	2000H
Aluminum Black Zinc Nickel	+++		+++		Yes	500H
Aluminum Olive Green Cadmium	+++		+++		Yes	500H
Stainless Steel Passivated	+++++		+++		Yes	500H
Aluminum Nickel	+++++		+++		Yes	48H

SOURIAU plating compatibilities with Black Zinc Nickel

Aluminum Black zinc nickel (Z)				Composite Cadmium (J)
Aluminum Black zinc nickel (Z)				Aluminum Cadmium (W)
Aluminum Black zinc nickel (Z)				Stainless steel Passivated (K)
Aluminum Black zinc nickel (Z)				Composite Nickel (M)
Aluminum Black zinc nickel (Z)				Aluminum Zinc cobalt (ZC)
Aluminum Black zinc nickel (Z)				Aluminum Nickel (F)

Notes: Same salt spray withstanding with reverse configuration (plug black zinc nickel + receptacle with other SOURIAU platings).
Aluminum black zinc nickel + alodine plate = 500 hours salt spray.

SOURIAU plating capabilities

- ▶ Plating process masters in house:
 - Plating production lines dedicated to 38999 Series
 - Full automatic line process
 - Mass production capability
- ▶ For many years, SOURIAU has been developing and improving environmentally friendly processes in order to anticipate and then exceed environmental regulations.
- ▶ Production site is ISO 14001 since 2001 with Zero Cadmium emission!



Comparison of plating codes available on the market

Requirement	Aluminum Electroless Nickel	Aluminum Cadmium	Composite Nickel	Aluminum Black Zinc Nickel	Others		
					Nickel PTFE		Pure Electro Deposited Aluminum
					Thick	Thin	
Finish code class per MIL spec.	F	W	M	Z	T		P
RoHs Compliant	Yes	No	Yes	Yes ⁽¹⁾	Yes	_ (8)	_ (9)
Galvanic compatibility with cadmium	Poor	Very good	No	Good ⁽²⁾	Poor ⁽³⁾	Poor ⁽³⁾	Good
Easy to produce in mass production and with multi sourcing	Yes	Yes	Yes	Yes	No ⁽⁴⁾ (10)	No ⁽⁴⁾ (10)	No ⁽⁵⁾
Finish according to standard	ASTM B733	ASTM B766		ASTM B841	No standard ⁽⁶⁾ (proprietary process)	No standard ⁽⁶⁾ (proprietary process)	No standard ⁽⁶⁾ (proprietary process)
Shell-to-Shell Continuity < 2.5 mΩ	Yes <1 mΩ	Yes	Yes	Yes	Yes	Yes	Yes
Durability (500 mating cycles)	Yes	Yes	Yes	Yes	Yes	Yes	_ (7)
Salt spray resistance	48 hours	500 hours	2000 hours	500 hours	500 hours	500 hours ⁽⁸⁾	500 hours ⁽⁷⁾
Temperature rating	according to standard 175°C	Yes	Yes	Yes	Yes	Yes	Yes
	200°C	Yes	No	Yes	Yes	Yes	
Not Reflective	No	Yes	No	Yes	Yes	Yes	Yes
Non-Magnetic	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cr6+ < 0.01 % (RoHS limit = 0.1 % max)	Yes	No	Yes	Yes	Yes	_ (8)	_ (9)
Easy to check homogeneity / Thickness of layer	Yes	Yes	Yes	Yes	No ⁽¹⁰⁾	No ⁽¹⁰⁾	Yes
Environment friendly	Poor	Poor	Poor	Good	Poor ⁽¹¹⁾	Poor ⁽¹¹⁾	-
Human health and safety		Poor		Yes	Poor ⁽¹²⁾	Poor ⁽¹²⁾	Poor ⁽¹³⁾
Compatibility with new de-icing fluid (with potassium acetate)	Yes	Yes	Yes	Yes ⁽¹⁴⁾	_ (14)	_ (14)	_ (14)

See next page for notes explanation.

1 SOURIAU Zinc Nickel (Z code) and RoHS

A unique SOURIAU plating process compliant with RoHS regulation for Cadmium and Cr6+ restriction.

2 Electrical compatibility of Zinc Nickel (Z code with Cadmium (W code)

Electrical potential of Zinc Nickel and Cadmium are very similar which removes the risk of galvanic corrosion and defects after 500 hours salt spray.

3 Electrical compatibility of Nickel PTFE (T code) with cadmium (W code)

PTFE is an inert polymer, therefore the galvanic potential of Nickel + PTFE will be the potential of the Nickel alone. It means that the electrical compatibility is not guaranteed between Nickel PTFE and Cadmium for long salt exposure, which is not the case for Zinc Nickel (electrical potential close to Cadmium).

4 Nickel PTFE (T code) production processes complex and expensive

Nickel PTFE requires specially manufactured high tolerance machined parts (special requirement on surface roughness) as the thicker plating is not compatible with standard machined parts.

- These special machined parts lead to a higher cost and quality risk (mixing very similar parts and special care in case of outsourcing).
- Therefore, the high thickness of nickel PTFE means a long deposit time and also a more expensive process.
- The lifetime of the chemical mixture is half than an electrolytic nickel or nickel alloy (Zinc Nickel) mixture.

5 Pure Electrodeposited Aluminum (P code) very complex and unique deposition process

Very complex and expensive process which requires a building with special containment facility and not available in standard plating shops. Main limitation are the following:

- Flammable and explosive solvent which requires inert atmosphere.
- Highly skilled worker (expertise and training)
- Specific care for handling and storage of mixture in a separate building.

6 ASTM standards

These standards are defined to allow a reliable quality level of plating process with multisourcing option. Nickel PTFE (T code) and Pure Electrodeposited Aluminum (P code) are not defined by ASTM industrial standards.

7 Cycles of durability, limitation for Pure Electrodeposited Aluminum (P code)

Performance limitation has been raised in 38999 salt spray by tests against Pure Electrodeposited Aluminum:

- Galling: abrasive wear of Ni-plated EMI band leads to generate conductive particles with a potential risk of short circuiting the contacts.
- Requires use of lubricants - limited effectiveness, risk of lower electrical continuity.

8 Thin Nickel PTFE (T code) salt spray resistance

Thin Nickel PTFE (T code) could require Cr VI to meet corrosion performance and consequently not comply with ROHS limit. This is one way to heal pores at defect sites of the primary parts and to decrease the production cost of the thick Nickel PTFE plating (see note 4).

9 Pure Electrodeposited Aluminum (P code) and Chromium VI

Chromium VI is required to meet high corrosion performances.

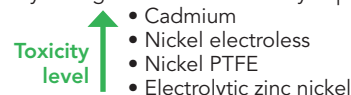
10 Thickness control of Nickel PTFE layer (Thin and Thick Layer)

There is no standard in line equipment to control the homogeneity of PTFE concentration within the plating material and the only way to control the PTFE concentration is achieved with complex lab equipment such as Scanning Electron Microscope (PTFE is a non conductive material).

There is consequently a strong limitation for in line process control and ability to outsource. It means that the lack of control associated with the risk of non homogeneity of the PTFE concentration could lead to an uncontrolled dormant failure and a rapid corrosion.

11 Environment friendly, limitation for Nickel PTFE (T code)

The average bath lifetime of the chemical nickel PTFE is half that of electroless nickel and 10 times less than nickel alloy (zinc nickel) bath. This leads to a higher waste volume of nickel pollution. Furthermore, the waste toxicity of electroless nickel or nickel alloys is higher than the electrolytic process:

- 
- Cadmium
 - Nickel electroless
 - Nickel PTFE
 - Electrolytic zinc nickel

In addition, the PTFE material is toxic and indestructible. Some PTFE suppliers might stop their PTFE production after 2013 (ie. Dupont)

12 Nickel PTFE (T code) is potentially hazardous to human health

The Nickel PTFE material is recognized as toxic and indestructible. Most of the experts are considering PFOA (used in PTFE) a «likely human carcinogen». This was also proposed by the Environmental Protection Agency (EPA).

13 Pure Electrodeposited Aluminum (P code) process is very hazardous to safety

For Pure Electrodeposited Aluminum, production is a very high risk for human safety due to:

- Flammable and explosive solvent which requires inert atmosphere.
- High skilled of workers necessary (expertise and training).
- Specific care for handling and storage of mixture in a separate building.
- Pure Electrodeposited Aluminum is considered a dangerous explosive process for people involved in the plating process.

14 De-icing fluid (contains potassium acetate)

SOURIAU Zinc Nickel is compatible with de-icing fluids containing potassium acetate. No datas found regarding Nickel PTFE or Pure Electrodeposited Aluminum.



Description

- For pressurized & unpressurized application
- Indoor/outdoor
- High contact density #22:
 - The only connector series with #22 qualified contact
 - Up to 128 #22 contacts
- Contact protection: 100% Scoop proof
- Robustness:
 - Robust coupling system (scoop proof)
 - 500 mating/unmating operation
 - Up to 500 hours salt spray withstanding
 - Vibration: 44g @ 175°C

Technical features

Materials

- **Shell:** Aluminum
- **Shell plating:** Black zinc nickel (Z)
- **Insulator:** Thermoplastic
- **Grommet and interfacial seal:** Silicone elastomer
- **Contacts:** Copper alloy
- **Contacts plating:** Gold over nickel plated
- **Endurance:**
 - . 500 mating cycles all materials
 - . 1500 mating cycles for composite connectors with specifics contacts
- **Shock:** 300g, 3 ms according EN 2591-D2 method A
- **Vibration:**
 - . Sinus:
 - . 10 à 2000 Hz, 3x12 hrs (60g, 140 - 2000 Hz) with T° cycling
 - . Random:
 - . 50 to 2000 Hz, 2x8 Hrs (1g2/ Hz, 100 - 2000Hz) at T° max.
 - . 25 to 2000 Hz, 2x8 Hrs (5g2/ Hz, 100 - 300Hz) at ambient T°

• Contact retention:

Contacts size	24	22	20	16	12	8	4
Min force in N	30	44	67	111	111	111	200

Electrical

• Test voltage rating (Vrms):

Service	sea level	at 21000 m
R	400	N/A
M	1 300	800
N	1 000	600
I	1 800	1 000
II	2 300	1 000

• Contact resistance:

Contacts size	26	22	20	16	12	8	4
Resistance mΩ	16	14.6	7.3	3.8	3.5	3	2

• Insulation resistance:

≥ 5 000 MΩ (under 500 Vdc)

• Contact rating:

Contacts size	26	22	20	16	12	8	4
Rating (A)	3	5	7.5	13	23	45	80

• Shell continuity: 2.5 mΩ (Z)

• Shielding:

- . 85 db at 1 GHz (Z)
- . 50 db at 10 GHz (Z)

Environmental

- **Temperature range:** -65°C +200°C (Z)
- **Sealing:** Mated connectors meet altitude immersion requirements of MIL-DTL-38999.
- **Salt spray:** 500 Hrs (Z)

Resistance to fluids

- **According to MIL-DTL-38999 standard**
 - . Gasoline: JP5 (OTAN F44)
 - . Mineral hydraulic fluid: MIL-H-5606 (OTAN H515)
 - . Synthetic hydraulic fluid: Skydrol 500 B4
- **LD4 (SAE AS 1241)**
 - . Mineral lubricating: MIL-L-7870A (OTAN 0142)
 - . Synthetic lubricating: MIL-L-23699 (OTAN 0156), MIL-L-7808
 - . Cleaning fluid: MIL-DTL-25769 diluted
 - . De-icing fluid: MIL-A-8243
 - . Extinguishing fluid: Bromochloromethane
 - . Cooling fluid: Coolanol

Dimensions, layouts, contacts, accessories, tooling & derived series

Please consult «8D Series - MIL-DTL-38999 Series III» catalog on www.souriau.com

MIL-DTL-38999 Series III - Part numbers

Basic Series	D38999/	20	Z	B	35	P	N	L
Shell style								
20: Square flange receptacle								
24: Jam nut receptacle								
26: Plug with RFI shielding.								
Plating								
Z: Black zinc nickel								
Shell size: A, B, C, D, E, F, G, H, J								
Contact layout: See SOURIAU «8D Series - 38999 Series III» catalog								
Contact type								
P: Male A: Connector supplied less pin contact or with specific contacts (marking : A + orientation)								
S: Female B: Connector supplied less socket contact or with specific contacts (marking : B + orientation)								
Orientation: N, A, B, C, D, E								
L: For P or S contact type only, connector delivered without contacts, connector marking P or S (without L)								

SOURIAU 8D Series - Part numbers

Basic Series	8D	0	-	11	Z	35	P	N	L
Shell style									
0: Square flange receptacle									
1: In line receptacle									
7: Jam nut receptacle									
5: Plug with RFI shielding									
Square flange receptacle with clinch nuts available (please consult us)									
Jam nut receptacle with double flange available (please consult us)									
Type									
- : Connectors with standard crimp contacts.									
L: Receptacle with long PC tail (male and female size #22D, #20).									
C: Receptacle with short PC tail (male and female #22D, #20, #16).									
S: Receptacle with specific PC tail (male et female #22D)									
W: Receptacle with male contacts #22D for wire wrap (3 wraps)									
T: Receptacle with male contacts #20 for wire wrap (2 wraps)									
P: Receptacle with solder cup contacts - please consult us									
PC tail contacts without shoulder available (please consult us)									
Shell size: 09, 11, 13, 15, 17, 19, 21, 23, 25									
Plating									
Z: Black zinc nickel									
Contact layout: See SOURIAU «8D Series - 38999 Series III» catalog									
Contact type									
P: Male A: Connector supplied less pin contact or with specific contacts (marking : A + orientation)									
S: Female B: Connector supplied less socket contact or with specific contacts (marking : B + orientation)									
Orientation: N, A, B, C, D, E									
Specification									
046: Tinned straight PC tail									
251: Connector provided with power contacts (layouts with contact #8)									
022: Fuel tank									
Special custom									
None: Standard plastic cap									
M: Antistatic plastic cap									
L: For P or S contact type only, connectors delivered without contacts, connectors marking P or S plus orientation									

For further information contact us at technical.emear@souriau.com (Europe - Asia - Africa)
technical.americas@souriau.com (North America)
or visit our web site www.souriau.com