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## CORRESPONDENCE

## WARNINGS

The present document may be revised, when necessary, with the publication of new editions. It is therefore essential that those who use the same ensure they have the latest edition.

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	<b>CORROSION RESISTANCE COATINGS (CRC)</b>	<b>CARRARO STD N. 4-02-07/2 Page 3 of 10</b>
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## **1. SCOPE**

**1.1** This specification covers requirements for Corrosion Resistance Coatings [CRC] for any general part.

**1.2** Types and classes of CRC are described in Table 1.  
Coatings Types in some case are identified with trademark.  
The CRC which have not been included in the table 1 yet, has to be approved by the Carraro Drivotech engineering before employing it in the serial production.

## **2. CRC CLASSIFICATION AND APPLICATION**

**2.1** CRC are used primarily as a protective coating on ferrous based materials. The coatings are intended to extend the corrosion resistance of the substrate material. Applications of CRC include nuts, bolts, pins, hardware, and other parts.

**2.2** CRC Types are divided in reference on friction coefficient:

**A.** no friction range limitation

**B.** friction range restricted specially for fasteners application

**2.3** CRC Classes are divided from **1 to 7** and the higher is the class, the higher is the resistance in red corrosion.

CARRARO DRIVETECH Corrosion Resistance Coating (CRC)							
Type, Class, Material Description and Requirements							
SILVER OR GRAY COLOR IN APPEARANCE (Unless otherwise specified)							
Type	Class	Description	Potential Hydrogen Embrit(3)	CRC Coating Product	Coating Thickness (µm)	Friction Coefficient range	Red Corrosion Resistance ISO 9227 (Hours_min.)
A	1	Black oxide treatment	No	Black oxide -DIN 50938	0,2	-	60
	2	Passivated electroplated zinc base coat. (2)	Yes	Fe/Zn 5 (4)	5	-	120
	3			Fe/Zn 8 (4)	8		170
	4			Fe/Zn 12 (4)	12		240
	5	Inorganic zinc rich base coat. (1)	No	Delta-Protekt KL100 Geomet 321	6	-	500
	6			Delta-Protekt KL100 Geomet 321	8		700
B	1	Passivated electroplated zinc base coat with integral lubricant. (2) (5)	Yes	Fe/Zn 5 LUB (4)	5	0.10÷0.16	120
	2			Fe/Zn 8 LUB (4)	8		170
	3			Fe/Zn 12 LUB (4)	12		240
	4	Inorganic zinc rich base coat with integral lubricant.(1) (6)	No	Delta-Protekt KL100+Delta Seal GZ Geomet 321L	6	0.10÷0.16	500
	5			Delta-Protekt KL100+Delta Seal GZ Geomet 321L	8		700
	6	Inorganic zinc rich base coat with integral lubricant.(1) (7)	No	Delta-Protekt KL105 Geomet 500	6	0.12÷0.18	500
	7			Delta-Protekt KL105 Geomet 500	8		700

**Table 1**

(1) This coatings are classified according to their characteristics, for example:

Fe/Zn 12 LUB;

Fe: indicates the base metal (iron or steel)

Zn: indicates the electrolytic coating (zinc)

12: indicates the thickness of the coating expressed in µm

LUB: indicates the addition of lubricants, when friction coefficient for must be kept within the range 0.10 ÷ 0.16

(2) Fasteners indications: From M4 up to

(3) Fasteners indications: From M6 to M16

(4) Fasteners indications: From M6 up to

(5) Colors range limitations: GRAY, YELLOW, BLACK, GREEN

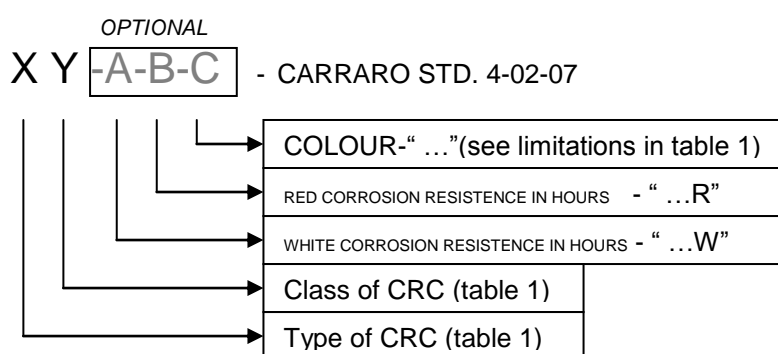
### **3. DRAWING SPECIFICATIONS**

The engineering drawing shall call out the CRC specification.

#### **3.1 CRC DESIGNATION**

The CRC designations have to be included in the surface treatment section of the format table.

The designation note is structured as follows:



Example 1.

A1 – CARRARO STD. 4-02-07

Example 2.

B5 - YELLOW – CARRARO STD. 4-02-07

This example shows a special color requirement, yellow, with the same characteristics of the B5 CRC in Table 1.

Example 3.

A5 – 200W - 400R – BLACK - CARRARO STD. 4-02-07
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This example show all the special requirements in a CRC Carraro standard 4-02-07:

- A5: indicates the CRC in according to Table 1;
- 200W: indicates the ISO 9227 salt spray white corrosion resistance in hours;
- 400R: indicates the ISO 9227 salt spray red corrosion resistance in hours (different from default);
- BLACK: the special color required and admitted (see table 1).

#### **4. HEXAVALENT CHROMIUM - PROVISIONS**

To comply with European Directive 2000/53/CE, unless otherwise agreed, as of 01/07/2007 it will no longer be possible to supply to the CARRARO Group any component treated with coatings containing hexavalent chromium.

Hence, starting from 01/07/2007, the codes for coatings containing hexavalent chromium, listed in Table 2 and shown on the technical reference documentation (drawings, tables, specifications, etc.), must be considered not conforming.

Therefore, in case the Suppliers had documents (e.g. engineering drawing) still prescribing coatings that contain hexavalent chromium, they must manufacture and supply the components with the corresponding hexavalent chromium free coatings as indicated in Table 3 or specifically agreed with Carraro Drivetech.

COATINGS WITH HEXAVALENT CHROMIUM PASSIVATION, NOT COMPLYING WITH European Directive 2000/53/CE and the subsequent revision of 27/06/02				
Designation	Nominal thickness of coating µm	Characteristics	Typical use	First appearance of oxidation white – red h (ISO 9227)
Fe/Zn 8 c1A UNI EN ISO 4042	8	Clear transparent passivation sometimes with a bluish hue	Components fitted before the paint oven	6-48
Fe/Zn 5 c2C UNI EN ISO 4042	5	Yellow iridescent passivation	Components fitted after the paint oven	48-72
Fe/Zn 8 c2C UNI EN ISO 4042	8	Yellow iridescent passivation	Components fitted after the paint oven	72-120
Fe/Zn 12 c2C UNI EN ISO 4042	12	Yellow iridescent passivation	Components fitted after the paint oven	72-144
Fe/Zn 12 c2N UNI EN ISO 4042	12	Black passivation	Components fitted after the paint oven	24-96
DACROMET 320A	5-8	Inorganic zinc rich base coat	-	500 (Red oxide)
DACROMET 320B	8-12	Inorganic zinc rich base coat	-	700 (Red oxide)


**Table 2**

(\*)Where it is necessary a specific friction coefficient;

SUPPRESSED	REPLACED WITH N. 4-02-07/1
Fe/Zn 8 c1A UNI ISO 2081 4520	A3 B2 (*)
Fe/Zn 5 c2C UNI EN ISO 4042	A2 - YELLOW B1 - YELLOW (*)
Fe/Zn 8 c2C UNI EN ISO 4042	A3 - YELLOW B2 - YELLOW (*)
Fe/Zn 12 c2C UNI EN ISO 4042	A4 - YELLOW B3 - YELLOW (*)
Fe/Zn 12 c2N UNI ISO 2081 4520 black	A3 - BLACK B2 - BLACK (*)
DACROMET 320A	A5 B4 (*)
DACROMET 320B	A6 B5(*)

**Table 3**



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## **5. DEHYDROGENATION**

Unless otherwise indicated or agreed with Carraro Drivetech S.P.A, the dehydrogenation treatment must be carried out if the material ultimate tensile strength UTS is  $\geq 1000$  MPa or the hardness is  $\geq 34$  HRC.

For example, the screws with black oxide treatment consequent to quenching and tempering to an ultimate tensile strength UTS  $\geq 1000$  MPa or an hardness  $\geq 34$  HRC (e.g. 10.9 screw material class), requires the dehydrogenation treatment.

## **6. CORROSION RESISTANCE**

### **6.1 RED CORROSION**

Parts coated with CRC shall be capable of withstanding neutral salt spray testing as per ISO 9227 or ASTM B117.

### **6.2 WHITE CORROSION**

Parts coated with CRC shall be capable of withstanding neutral salt spray testing as per ISO 9227 or ASTM B117.

### **6.3 COEFFICIENT OF FRICTION**

Controlled and consistent frictional characteristics are important for the successful application of fasteners. Friction coefficients must be measured in accordance with ISO 16047.

All CRC coatings which are applied to fasteners must be treated with a friction modifier in order to guarantee the friction coefficient specified in table 1.

### **6.4 DIMENSIONS AND TOLLERANCES**


#### **6.4.1 General dimensions**

In general, whenever a CRC coating is required, dimensions and tolerances shall be referred to the conditions after coating. As exception to the above, the dimensions and tolerances of the fasteners are referred to the conditions (e.g after or before coating) specified by the corresponding thread standard.

#### **6.4.2 Thickness of the protective coatings**

Unless otherwise specified, the upper and lower thickness value of the coating for ISO metric treads must comply with ISO 4042 for galvanic treatments and ISO 10683 for inorganic zinc rich base coat.

When applied to fasteners, excessive buildup of coating material can interfere with thread engagement and affect torque-tension characteristics. CRC coated fasteners must meet all of the dimensional requirements. In case a coating is applied, any interference with thread engagement shall not be permitted.

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## **7. SPECIAL REQUIREMENTS**

Special surface colours or corrosion resistance may be applied as special requirements. These special requirements shall be designated according to CARRARO STD. 04-02-07, and properly called out in the CARRARO drawing.

## **8. TESTS FOR CRC QUALIFICATION**

### **8.1 COATING THICKNESS**

Coating thickness shall be measured on significant and representative surfaces using X-ray fluorescence spectroscopy in accordance with ISO 3497 or microscopically method according to ISO 1463.

### **8.2 CORROSION RESISTANCE**

The neutral salt spray test shall be performed according to ISO 9227 or ASTM B117.

### **8.3 ADHESION TEST**

This test must be considered passed if there are no detachment phenomena after heating the component at 210°C and tempering in cold water.

## **9. INSPECTION AND REJECTION**

The coating shall be dense, uniform, free of porosity, pinholes, blisters, flaking, cracks, and stains, as well as be free of other discontinuities that affect appearance, part reliability or corrosion resistance. All coated parts shall be dry to the touch when received by the procuring facility. A coated part shall withstand normal handling and installation without a resulting loss of coating. Any loss of coating from normal handling and installation will cause the part to be considered unacceptable. Any fastener component must be in according with UNI 3740-10. All the requirements and specifications on this standard must be met to declare acceptable a CRC (\*).

(\*)In case the supplier wanted to employ a coating different from those one specified by CARRARO, the supplier has to ask for approval by submitting the change proposal to CARRARO Engineering, prior to deliver any part.