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Technical opinion on corrosion protection of fasteners

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Technical opinion on corrosion protection of fasteners

I. FORMAL BASIS OF THE OPINION

The opinion prepared on behalf of the company Gbo Fastening System Sp. z o.o. and on the basis of confirmation of the order registered in the Building Research Institute under No. 02248/16/ Z00NZM.

II. SUBJECT AND SCOPE OF THE OPINION

3 types of fasteners were subjected to this opinion:

Fasteners dedicated for fixing profiled steel sheets, steel elements and aluminium elements

1. Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 μm applied electrolytically, for use in accordance with PN-EN ISO 2081: 2011 tab. 1.
2. Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 μm and protected with paint coating - polyester with a thickness of not less than 50 μm, designed for use in environments with corrosivity categories C1, C2 and C3 according to PN-EN ISO 12944-2: 2001,
3. Fasteners made of common carbon steel, protected with a multi-layer protective coating gRey.coat or protected with multi-layer protective coating gRey.coat and paint coating - polyester with a thickness of not less than 50 μm, designed for use in environments with corrosivity category C1, C2, C3 and C4 according to PN-EN ISO 12944-2: 2001,
4. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1 ÷ 4, designed for use in environments with corrosivity category C1, C2, C3 and C4 according to PN-EN ISO 12944- 2: 2001,
5. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1 ÷ 4, protected by a multi-layer protective coating gRey.coat (BIMETAL) or protected by a paint coating - thick polyester of the minimum thickness of

50 µm, designed for use in environments of atmosphere corrosivity category C1, C2, C3, C4, C5-I and C5-M according to PN-EN ISO 12944- 2: 2001

Fasteners dedicated for sandwich panels fixing

1. Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 µm applied electrolytically, for use in accordance with PN-EN ISO 2081: 2011 tab. 1.
2. Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 µm and protected with paint coating - polyester with a thickness of not less than 50 µm, designed for use in environments with corrosivity categories C1, C2 and C3 according to PN-EN ISO 12944-2: 2001,
3. Fasteners made of standard carbon steel, protected with multi-layer protective coating gRey.coat or protected with multi-layer protective coating gRey.coat and paint coating - polyester with a thickness of not less than 50 µm, designed for use in environments with corrosivity category C1, C2, C3 and C4 according to PN-EN ISO 12944-2: 2001,
4. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1÷4, protected with a multi-layer protective coating gRey.coat (BIMETAL) or protected with a paint coating - polyester of minimum thickness of 50 µm, designed for use in environments with corrosivity category C1, C2, C3, C4, C5-I and C5-M PN-EN ISO 12944- 2: 2001

Fasteners dedicated for fixing insulation and waterproofing on flat roofs

1. Fasteners made of standard carbon steel, coated with zinc of minimum thickness of 12 or 20 µm applied electrolytically, for use in accordance with PN-EN ISO 2081: 2011 tab. 1,
2. Fasteners made of standard carbon steel, protected by a multi-layer protective coating gRey.coat designed for use in environments with corrosivity category C1, C2, C3 and C4 according to PN-EN ISO 12944- 2: 2001,

3. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1÷4, designed for use in environments with corrosivity category C1, C2, C3 and C4 according to PN-EN ISO 12944- 2: 2001,
4. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1÷4, protected with multi-layer protective coating gRey.coat (BIMETAL), intended for use in environments with corrosivity category C1, C2, C3, C4, C5-I and CS-M according to PN-EN ISO 12944- 2: 2001

Scope of review included:

- analysis of the technical documentation of these fasteners,
- analysis of the standards related to the classification of corrosive environments and corrosion protection,
- analysis of test results of corrosion resistance presented and performed by the internal laboratory of the Orderer,
- assessment of the application range with regard to corrosive properties of the environment.

III. PURPOSE OF THIS OPINION:

The purpose of this review was to assess the scope of these fasteners for the category of corrosiveness of the environment in accordance with PN-EN ISO 12944-2: 2001, in which the fasteners can be used as intended.

IV. TECHNICAL BASIS FOR THIS OPINION

Technical basis for this opinion were:

- Technical documentation of the products with regard to the applied corrosion protection
- Research report No. 0413/16 of 07.06.2016 r. related to resistance to neutral salt spray executed by Gbo Fastening System Sp. z o.o.
- Examination report of resistance to neutral salt spray dated 16.03.2016 r. executed by Gbo Fastening System Sp. z o.o.

Tests report of resistance to humid atmosphere containing SO_2 dated 30.03.2016 executed by Gbo Fastening System Sp. z o.o.

- PN-EN ISO 12944-2:2001 "Paints and varnishes. Corrosion protection of steel structures by means of protective paint systems. Part 2: Classification of environments "
- PN-EN ISO 2081: 2011 "Metallic coatings and other inorganic coatings. Electrolytic zinc coatings with the treatment on iron or steel "
- PN-EN ISO 3506: 2009 "Mechanical properties of corrosion-resistant stainless steel fasteners",
- PN-EN 10088-1: 2014 "Corrosion resistant steel types. Part 1: List of steel types resistant to corrosion"

V. EVALUATION OF CORROSION RESISTANCE OF FASTENERS

According to the information received from the Orderer, fasteners listed in point II of the opinion, there are 5 different types of corrosion protection:

1. Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 μm, applied electrolytically according to PN-EN ISO 2081: 2011.
2. Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 μm, protected with paint coating - polyester with thickness of not less than 50 μm,
3. Fasteners made of common carbon steel, protected with multi-layer protective coating gRey.coat or protected with multi-layer protective coating gRey.coat and polyester paint coating - with a minimum thickness of 50 μm,
4. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1-4,
5. Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1÷4, protected by a multi-layer protective coating gRey.coat (BIMETAL) or protected by paint coating - polyester with a minimum thickness of 50 μm.

Ref. 1. Fasteners of common carbon steel of min. zinc coating of 12 or 20 um

According to PN-EN ISO 2081: 2011 tab. 1 for outdoor use in moderate environments, the recommended thickness of zinc coating 12 or 25 µm (according to PN-EN ISO 2081:2011 tab. 1). According to the above, the zinc coating with a minimum thickness of 12 or 20 µm according to the declaration of the Orderer can be used in moderate outdoor environments according to PN-EN ISO 2081: 2011 tab. 1.

Ref. 2. Fasteners of common carbon steel with zinc coating of min. thickness of 12 or 20 µm protected with polyester paint coating with a minimum thickness of 50 µm.

Corrosion resistance of the fasteners with organic coating is increasing compared to screws protected only with zinc coating. These fasteners protected with coating system (zinc thickness of min. 12 or 20 µm + polyester coating min. 50 µm) were subjected to testing for resistance to neutral salt spray at the time of 1136 hours. (PN-EN ISO 9227: 2007). The results of the research included in the test report No. 0413/16 of 07.06.2016 issued by Gbo Fastening System Sp. z o.o., showed no corrosion damage in the form of red corrosion of steel or white corrosion of the zinc coating.

Ref. 3. Fasteners of common carbon steel, secured with multi-layer protective coating qRey.coat or protected with multi-layer protective coating and polyester paint coating gRev.coat - of thickness not lower than 50 µm

The Orderer declares in the description of gRey.coat provided that this coating consists of 3 layers. The first layer is a zinc coating with a minimum thickness of 4µm. The next layer is the intermediate bonding with a thickness of 1 µm, ensuring the proper adhesion of the topcoat. The surface layer is ceramic coating of a thickness of about 5 µm. The Orderer has provided research reports of corrosion resistance of steel fasteners, secured with multi-layered protective coating gRey.coat to neutral salt spray according to PN-EN ISO 9227: 2007 (exposure time - 1000 hrs.) and resistance to humid atmosphere containing 2,0 l SO_2 per 300l of volume of the chamber in accordance with PN-EN ISO 3231: 2000 (exposure time - 15 cycles). According to the test results presented by Gbo Fastening System Sp. z o.o. there was no corrosion damage.

Ad. 4. Fasteners made of austenitic steel - corrosion resistance category A2.

The corrosion resistance of fasteners made of corrosion-resistant steels depends on the chemical composition of the steel affecting the durability and quality of the passive layer providing protection against corrosion and on the surface condition resulting from the final treatment.

According to the information received from the Orderer fasteners are made of corrosion-resistant steel, belonging to the group of austenitic stainless steel, chrome-nickel type, grade A2 according to PN- EN ISO 3506: 2009 (1.4301 according to PN-EN 10088-1:2014). According to PN-EN 1993-1-4: 2007 Eurocode 3, grade steel 1.4301 is recommended for use on elements operated in rural and urban environments of low and average corrosion aggressiveness of the environment and marine environments with low aggressiveness.

Ref. 5. Fasteners made of austenitic steel - corrosion resistance grade A2, secured with multi-layer protective coating gRey.coat (BIMETAL) or protected with polyester paint coat of thickness not lower than 50 um.

According to the information received from the Orderer, the fasteners are made of corrosion-resistant steel, belonging to the group of austenitic steel, chrome-nickel type, grade A2 according to PN-EN ISO 3506: 2009. Additional corrosion protection is a multi-layer protective coating gRey.coat (BIMETAL) or a paint coating - polyester with a thickness not lower than 50 µm. gRey.coat and polyester paint coating of a minimum thickness of 50 µm increases the corrosion resistance of the fasteners, as determined on the basis of the research reports presented by Gbo Fastening System Sp. z o.o.

VI. CONCLUSIONS

Due to the materials used for production of fasteners, corrosion protection and declared corrosion resistance (confirmed by positive results of tests confirming resistance to neutral salt spray and humid atmosphere containing SO_2) it has been confirmed that:

1) Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 µm applied electrolytically, can be used in accordance with PN-EN ISO 2081: 2011 tab. 1.

2) Fasteners made of common carbon steel, coated with zinc of minimum thickness of 12 or 20 µm and protected with a polyester paint coating of a thickness of at least 50 µm, are suitable for use in environments with corrosivity categories C1, C2 and C3 (long-term duration) according to PN-EN ISO 12944-2: 2001,

3) Fasteners made of common carbon steel, protected with a multi-layer protective coating gRey.coat or protected with multi-layer protective coating gRey.coat and polyester paint coating - with a thickness of at least 50 µm, are suitable for use in environments with corrosivity category C1, C2, C3 and C4 (long-term duration) according to PN-EN ISO 12944-2: 2001.

4) Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1 ÷ 4, are suitable for use in environments with corrosivity category C1, C2, C3 and C4 (long-term duration) according to PN-EN ISO 12944-2: 2001, with the exception of environments with increased chloride content e.g. marine and coastal areas, pool halls.

5) Fasteners made of austenitic steel - corrosion resistant grade A2 according to PN-EN ISO 3509: 2009 part. 1÷4 protected with a multi-layer protective coating gRey.coat (BIMETAL) or protected with paint coating - polyester with a minimum thickness of 50 µm, are suitable for use in environments with corrosivity category C1, C2, C3 C4, CS-I and C5-M according to PN-EN ISO 12944-2: 2001,

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