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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 19355.3-2016

**Zinc coatings -- Guidelines and recommendations for the
protection against corrosion of iron and steel in structures --
Part 3: Sherardizing
(English Translation)**

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1 Scope

This Part of GB/T 19355 provides guidelines and recommendations to the fundamental principle that is applicable to anti-corrosion sherardizing design of workpieces.

The sherardized coatings' protection of workpieces depends on the construction method of sherardized coatings, the design of workpieces and the specific environment where workpieces are exposed to. Sherardized workpieces can adopt additional coatings (beyond the range of this Part of GB/T 19355), for example, organic coatings (wet coatings or powder coatings), which can provide further protection. This combined coatings that are applied to sherardized workpieces are generally known as

"composite coating system".

Please refer to ISO 12944-5 and EN 13438 for the basic guideline of this question.

The anti-corrosion maintenance of sherardized steel workpieces is beyond the range of this Part of GB/T 19355.

Relevant requirements of specific products (for example, sherardized coatings of fastening pieces or steel pipes) shall be prior to the basic recommendations in this Part.

2 Normative References

The following documents are indispensable to the application of this Standard. In terms of references with a specified date, only versions with a specified date are applicable to this Standard. The latest version (including all the modifications) of references without a

specified date is also applicable to this Standard.

GB/T 10123 Corrosion of Metals and Alloys - Basic Terms and Definitions (GB/T

10123-2001, ISO 8044.1999, eqv)

ISO 12944-5 Paints and Varnishes - Corrosion Protection of Steel Structures by

Protective Paint Systems - Part 5. Protective Paint Systems

ISO 18265 Metallic Materials - Conversion of Hardness Values

EN 13811 Sherardizing - Zinc Diffusion Coatings on Ferrous Products -

Specification sherardized. Special measures shall be adopted, for example, filling up hollow workpieces with sherardized mixtures can guarantee perfect sherardizing inside the product.

Sherardizing is also applicable to spring and high-strength steel. In order to protect the comprehensiveness of this type of workpieces from any influence, sherardizing shall be conducted at an appropriate temperature in accordance with the quenching temperature and tempering temperature of these workpieces. Spring shall be sherardized at a few and unloaded state before being assembled. In accordance with the thermal treatment temperature of these components before sherardizing, sherardizing can be conducted within the range of a relatively low temperature of

320 °C ~ 380 °C. However, sherardizing at a relatively low temperature would prolong the treatment time.

Workpieces with soft soldering or resin bonding shall not be sherardizing, because this nature of welding will be influenced by the sherardizing process.

Welding shall be preferably conducted before sherardizing. All the welding shall leave no residues. After sherardizing, workpieces can receive spot welding, but since the sherardizing coating shall be relatively thin, the thickness of the sherardizing coat shall be < 15 µm under the ideal state.

In terms of surface and holes with matching requirements, extra gap shall be reserved, so that sherardizing coating with specific thickness (refer to EN 13811) can be accepted.

Please refer to 4.4 for recommendations on the gap of threaded components

4.4 Gap of Threaded Components

Although sherardizing can form well-proportioned sherardizing coating with no significant changes on the thread profile, sufficient gap must be retained between the external and internal thread. Please refer to Table 1 for the recommended gap.

If only the external thread is sherardized, and it is matched with the standard non-

sherardized internal thread (or vice versa), half of the gap listed in Table 1 shall be retained in threads that are sherardized.

Due to the alloy composition of zinc/ferroalloy coating, dark orange and brown rust might be generated while being exposed to the outside. This cannot be confused with the corrosion of matrix materials. It is a result of a change of the initial color of zinc/ferroalloy coating caused by oxidization while being exposed to the external moist condition.

This discoloration is harmless to the properties of sherardized coating and the application of sherardized workpieces. Under continuous exposure, the surface color would become dark, but the sherardized coating has a service life, which depends on the thickness of the sherardized coating.

5.2 Recommendations for Storage and Transportation

If possible, tubular and other hollow sherardized workpieces shall be vertically placed and naturally stored for later usage. They shall be prevented from accumulated water or any other corrosive fluid. Large-sized workpieces shall be stored under dry condition.

Pay more attention to the storage of (large) thread materials and protect threads from any damage.

The outdoor transportation of large-sized workpieces shall be handled under dry condition. If possible, please them in (sealed) containers or packaging bags.

6 The Influence of Workpieces' State on Sherardizing

Quality

6.1 Composition

Sherardizing is applicable to non-alloy carbon steel, low-alloy steel, sintering material, malleable gray cast iron and cast iron. Spring steel and high-strength steel can obtain relatively satisfying sherardized coating. In accordance with the quenching temperature and tempering temperature of these components, sherardizing shall be conducted at an appropriate temperature within the range of 320 °C ~ 380 °C.

The chemical composition of steel will not exert any practical influence on the composition or thickness of the sherardized coating.

6.2 Surface Condition

Clean the surface of the matrix material before sherardizing.

Surface dirt cannot be eliminated through sandblasting. It shall be eliminated before mechanical pre-treatment. The responsibility of eliminating the pollutants shall be negotiated by sherardizing experts and the demand side.

6.3 The Influence of Surface Roughness on the Thickness of Sherardizing

thermal cycle control capability, steel's mechanical properties might be reduced.

Therefore, consult experts' opinions regarding the thermal treatment process that eliminates stress.

In the welding area or the area affected by oxygen cutting, residual stress and hardening might be formed. Its numerical value depends on different factors, such as the length and thickness of welding, and the welding process.

Residual stress and hardening that exist in assembly parts might lead to damage and deformation of workpieces' coatings. Therefore, appropriate design and welding technique shall be adopted to minimize the residual stress and hardening. In terms of small important structural components, it is recommended that thermal treatment that eliminates stress shall be increased. Extra thermal treatment might be obtained to eliminate stress. Similar recommendation might also be applicable to drilling and stamping procedure.

6.4.3 Hydrogen Embrittlement

During acid pickling, structural steel generally will not generate brittleness; if hydrogen exists, it will not affect structural steel under general circumstances.

If steel hardness is > 34 HRC, 340 HV or 325 HB (refer to ISO 18265), minimize the absorption of hydrogen during the surface pickling with hydrochloric acid. Generally speaking, the hardness of welding and heat affected zone (HAZ) of structural steel will not exceed 340 HV. Therefore, hydrogen embrittlement will not be triggered on these areas during surface treatment.

During sherardizing, gradually heat up the workpieces to the processing temperature (generally, $320\text{ }^{\circ}\text{C} \sim 419\text{ }^{\circ}\text{C}$). Before the sherardized coating is formed, the absorbed hydrogen can be released.

6.5 Large-sized Workpieces and Thick Steel

The thickness and dimension of steel workpieces will not exert any influence on the formation of the sherardized coating, and the composition and nature of the sherardized coating.

7.1 Processing Environment

The sherardized coating is closely related with the contour of the sherardized workpiece. However, in terms of threaded components, gap deviation shall be reserved on matching thread, so that the thickness of sherardized coating can be acceptable. Please refer to the recommended gap in Table 1.