1.0 SCOPE

This specification covers the galvanized coating applied to general steel articles, structural sections, angles, channels, beams, columns, fabricated steel assemblies, threaded fasteners and other steel components.

2.0 RELEVANT STANDARDS

BS EN ISO 1461:2022	Hot dip galvanized coatings on fabricated iron and steel articles
ISO 14713 – 1	Guidelines and recommendations for the protection against corrosion of iron and steel in structures – zinc coatings – part 1: general principles of design and corrosion resistance
ISO 14713 – 2	Guidelines and recommendations for the protection against corrosion of iron and steel in structures – zinc coatings – part 2: Hot dip galvanizing
ISO 2178	Non-magnetic coatings on magnetic substrates – measurement of coating thickness – magnetic method
ISO 9001:2015	Quality management system requirements

3.0 FABRICATION

Care shall be taken to avoid fabrication techniques which could cause distortion or embrittlement of the steel. All welding slag and burrs shall be removed prior to delivery to LTL Galvanizers.

Holes and/or lifting lugs to facilitate handling, venting and draining during the galvanizing process shall be provided at positions as agreed between the designer and the LTL Galvanizers. If holes/lugs not provided, designer shall give consent for the LTL Galvanizers to provide such vents & drains or lifting lugs.

Unsuitable marking paints shall be avoided and consultation by the fabricator with the LTL Galvanizers about removal of grease, oil, paint and other deleterious materials shall be undertaken prior to handing over the job for galvanizing.

All the above information shall also be found in the design guide provided for customers.

4.0 CHEMICAL COMPOSITION OF STEEL

Following table demonstrates the chemical composition of steel suitable for hot dip galvanizing.

	Elements % by mass		
	Si	**Si + 2.5 P**	**P**
1	≤ 0.03	≤ 0.09	-
2	≤ 0.35	-	-
3	$0.14 \leq Si \leq 0.25$	-	≤ 0.035

5.0 SURFACE PREPARATION

Surface contaminants and coatings, which cannot be removed by the normal acid cleaning process or by the degreasing process in the galvanizing operation, shall be removed by abrasive blast cleaning or some other suitable method.

Steelwork shall be treated with a degreasing chemical for the removal of oil & grease and followed by acid pickling for the removal of rust.

Acid used for the pickling shall be 35% ± 1.00 % Hydrochloric acid which is diluted with water to make most favorable concentrations.

6.0 GALVANIZING

Zinc used for galvanizing shall be Special High Grade (SHG) Zinc with the chemical compositions as identified in ISO 752, EN 1179 or EN 13283.

Galvanizing parameters such as galvanizing temperature, time of immersion, and withdrawal speed shall be employed to suit the requirements of the article.

7.0 COATING REQUIREMENTS

a. Coating thickness

Minimum coating requirements for the hot dip galvanized steel articles shall be in accordance with the table 3 and table 4 of BS EN ISO 1461:2022 standard.

Table 3 - Minimum coating thickness and mass on samples that are not centrifuged

Articles & its thickness	Local coating thickness (minimum) µm	Local coating mass (minimum) g/m^2	Mean coating thickness (minimum) µm	Mean coating mass (minimum) g/m^2
Steel > 6 mm	70	505	85	610
Steel >3 mm to ≤ 6 mm	55	395	70	505
Steel ≥ 1.5 mm to ≤ 3 mm	45	325	55	395
Steel < 1.5 mm	35	250	45	325
Castings ≥ 6 mm	70	505	80	575
Castings < 6 mm	60	430	70	505
NOTE this table is for general use; individual product standards may include different requirements including different categories of thickness. Local coating mass and mean coating mass requirements are set out in this table for reference in such cases of dispute.				

Table 4 - Minimum coating thickness and mass on samples that are centrifuged

Articles & its thickness	Local coating thickness (minimum) µm	Local coating mass (minimum) g/m^2	Mean coating thickness (minimum) µm	Mean coating mass (minimum) g/m^2
Articles with threads: > 6 mm diameter	40	285	50	360
≤ 6 mm diameter	20	145	25	180
Other articles (including castings) :				
≥ 3 mm	45	325	55	395
< 3 mm	35	250	45	325

Typical coating thickness of galvanized steel articles, galvanized by LTL Galvanizers (Pvt) Ltd are about 30 % higher than the standard requirement.

b. Surface finish

The galvanized coating shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect that is detrimental to the stated end use of the coated article. On silicon killed steels, the coating may be dull grey, which is acceptable provided the coating is sound and continuous.

If the chemical composition of the steel supplied by the customer is in accordance with the paragraph 4.0, most of the colour variations may be avoided.

8.0 INSPECTION/RENOVATION/REJECTION

Quality inspection shall be done by the LTL Galvanizers for coating thickness, excess Zn, uncoated areas, bare spots, etc…prior to delivery. Coating thickness shall be measured by using magnetic coating thickness meters which use magnetic induction method.

The total uncoated area for renovation shall not exceed 0.5 % of the total surface area of the component. Renovation shall be done by a suitable Zinc spray containing over 90 % pure Zn.

Cellular patterns, dark grey areas, surface unevenness, dross pimples and wet storage stain shall not be causes for rejection, providing the coating thicknesses remain above the specified minimum values. Welding seepages resulting from the use of intermittent welds around overlapping surfaces and rust bleeding due to unsealed joints in the fabrication also shall not be causes for rejection.

9.0 CERTIFICATE

When requested by the customer, a letter or a certificate shall be provided stating that the galvanizing complies with the requirements of BS EN ISO 1461:2022 standard.

10.0 SAFETY

a. Process safety

Safety requirements during the galvanizing process shall be maintained by the LTL Galvanizers (Pvt) Ltd according to the ISO 45001:2018. MSDS for all the chemicals used are also maintained properly.

b. Product safety

Zinc occurs naturally in the earth, air and foods you eat; it is the second most common trace metal, after iron, naturally found in the body. Zinc is essential to health, boosting the immune system, helping cells to grow, regulating appetite and healing wounds. Also Zn is 100 % recyclable. There are no known studies to suggest zinc corrosion products cause any harm to the environment.

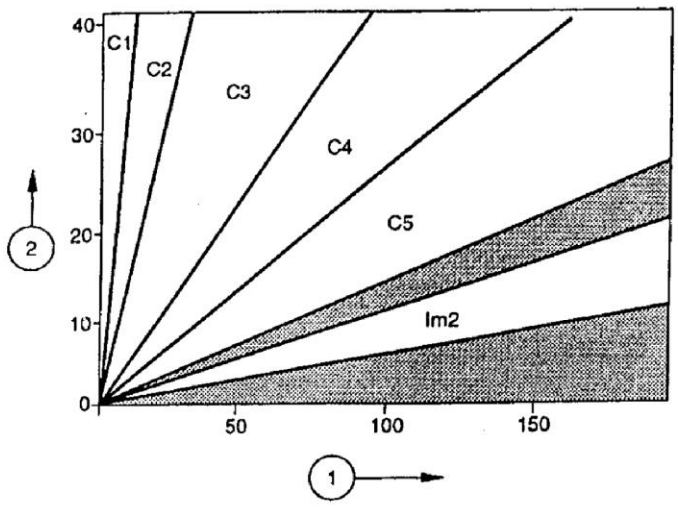
c. Welding of galvanized articles

Where galvanized steel is to be welded, adequate ventilation shall be provided. If adequate ventilation is not available, supplementary air circulation shall be provided. In confined spaces a respirator shall be used.

Grinding of edges prior to welding may be permitted to reduce zinc oxide fumes formed during welding and eliminate weld porosity which can sometimes occur.

11.0 Longevity

The corrosion rate of zinc and how long it will provide protection is a function of the coating thickness and the amount of corrosive elements in the atmosphere. The relationship between coating thickness and atmospheric conditions is contained in following graph.
Table 01 Environmental categories, corrosion risk and corrosion rate (ISO 14713)



1 coating thickness, in micrometres
2 coating life to first maintenance, in years

NOTE 1 Each environment is shown as a band; the lines show typical upper and lower coating lives for that environment.
NOTE 2 The specific effects of microenvironments are not included.

Figure 1 — Typical lives to first maintenance of zinc coatings in different categories of environment based on typical corrosion rates

Code	Corrosivity category	Corrosion risk	Corrosion rate Average thickness loss for Zinc µm/year
C1	Interior: dry	Very low	≤ 0.1
C2	Interior: occasional condensation Exterior: exposed rural inland	Low	0.1 to 0.7
C3	Interior: high humidity, some air pollution Exterior: urban inland or mild coastal	Medium	0.7 to 2
C4	Interior: swimming pools, chemical plants, etc Exterior: industrial inland or urban coastal	High	2 to 4
C5	Exterior: industrial with high humidity or high salinity coastal	Very high	4 to 8
Im2	Sea water in temperate regions	Very high	10 to 20

11.0 CUSTOMER ORIENTED SERVICE

Hot dip Galvanizing of steel articles shall be executed as per the requests made by customer complying with the following international standards in addition to the international standard **BS EN ISO 1461:2022**.

- ✓ **American standard - ASTM A 123/A 123M:** Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, Single pieces of steel or fabrications with different types of steel products
- ✓ **American Standard - ASTM A 153/A 153M:** Standard Specification for Zinc Coating (Hot-Dip) on Iron and Hardware Fasteners and small products that are centrifuged after galvanizing to remove excess zinc
- ✓ **Australian/New Zealand standard - AS/NZS 4680:** Hot dip galvanized (zinc) coatings on fabricated ferrous articles
- ✓ **Australian standard - AS 1214**: Hot dip galvanized coatings on threaded fasteners
- ✓ **Japanese Standard - JIS H8641:** Hot dip galvanized coatings
- ✓ **German Standard - DIN 50976:** Protection Against Corrosion; Hot Dip Galvanizing (general Galvanizing); Requirements And Tests