

SPECIFICATION P-82: 81
(UDC NO. 669, 586.5)

Z I N C C O A T I N G S



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Z I N C C O A T I N G S

0. **FOREWORD**

- 0.1 This specification has been prepared by the Design Department (T&G) of Power Wing, WAPDA and lays down specification for protective zinc coatings applied on iron and steel.
- 0.2 This standard is intended only for the purpose of procurement of materials and does not include the provisions of a contract.
- 0.3 This standard is subject to periodical revisions as and when required.
- 0.4 This specification is mainly based on ASTM A.90 and A.219, A.153.68, A-164.55, A.525.67, A.121.66, B.261-63, BS.443 : 1961.

1. **SCOPE**

- 1.1 The specification lays down test for the zinc coatings which has been deposited either by Hot Dip Method or by Electrodeposit Method on the articles as classified below. It also covers the weight of zinc coatings which shall be required per square meter of the surface area or its thickness.

Classification	Description of Articles
Class A-Fabricated products	Fabricated products from rolled, pressed and forged steel shapes, channels, angle iron, T shapes, plates, bars and strips c.g. structural poles, tubular poles, pipes channels and angle iron for platforms of pole mounting transformers, capacitors and voltage regulators, lattice steel cross bracket etc.
Class B-Castings	Castings; iron, malleable iron and steel.
Class C-Rolled pressed and forged articles	Rolled, pressed and forged articles such as insulator pins, anchor-shackle, eye-nuts, clamps, cotter pins, thimbles, covers, deadend clamps etc.
Class D-Nuts and Bolts etc.	Nuts, bolts, washers, nails, rivets, screws and similar articles.
Class E-Steel Wires	Steel structural strands, steel wire strands for overhead transmission lines, guys, messengers, spur wires, tie wires and barbed wires.
Class F-Steel Sheets	Steel sheets of all types and sizes.

2. MATERIAL

- 2.1 The zinc used in electro-depositing and not dip galvanizing shall be slab and shall conform to the following chemical composition:

Lead Max	1.6	%
Iron Max	0.05	%
Cadmium Max	0.50	%
Zinc Min	98.0	%

3. WEIGHT AND THICKNESS OF ZINC COATINGS

- 3.1 The weight of zinc coatings by hot dip method on various articles shall be as per Table-I below or otherwise specified in the relevant standards.

TABLE-1 WEIGHT OF ZINC COATINGS

Classification	Description of Articles	Wt. of Zinc Coatings	
		Individual Samples gm/sqm.	Average of 3 Samples gm/sqm.
Class A Fabricated Products	Fabricated products from rolled pressed and forged steel shapes, channels and angle iron, T-shapes, plates bars and strips e.g. structural poles, tubular poles, pipes, channel and angle iron for platform of pole mounting transformers, capacitors and voltage regulators, lattice steel cross arm bracket etc.		
	i) When the thickness of steel is 3mm to 6mm	550	610
	ii) 6mm and heavier material	610	700
	iii) Pipe for service-mast only	350	400
	iv) Distribution transformer station hardware & cross arm braces	450	500
Class B Castings	Castings, cast iron malleable iron and steel	550	610

Classification	Description of Articles	Wt. of Zinc Coatings	
		Individual Samples gm/sqm.	Average of 3 Samples gm/sqm.
Class C Rolled, pressed and forged articles	Rolled, pressed and forged articles such as anchor shackle eye- nuts, clamps cotter pings, thimbles, covers dead-end clamps etc.		
	i) 4.75mm and over in thickness and over 200mm in length	550	610
	ii) Under 4.75mm in thickness and over 200mm in length	380	460
	iii) 200mm and under in length and any thickness	330	400
	iv) Hardware of service- mast other than pipe, insulator pins & D- shackle assembly	450	500
Class D Nuts and Bolts etc			
	i) Bolts, nuts and drive screws (over 9.5mm in diameter) and similar articles, transmission tower bolts, washers 5mm and over in thickness	305	380
	ii) Screws and bolts (9.5mm and under in diameter) rivets, nails and similar articles, washers under 5mm in thickness	260	305

Class E

Steel Wires

The weight of zinc coating on steel structural strand, steel wire stand for overhead transmission lines, guys, messengers, spur wires and tie wires for similar purposes shall be as under:

<u>Stranded Wire dia mm</u>			<u>Weight of Zinc coating (gm/sqm)</u>
0.20	to	0.30	45
0.31	to	0.39	60
0.40	to	0.50	90
0.50	to	0.79	120
0.75	to	1.00	150
1.00	to	1.50	170
1.50	to	2.00	200
2.01	to	2.50	225
2.50	to	3.00	250
3.01	to	5.00	275
5.01	and larger		300

- i) The minimum weight of zinc coating in gm/sqm on barbed wires shall be as under

<u>dia mm</u>		
2.5	Including and above	250.00
2.0	to 2.4 mm	200.00
1.5	to 1.9 mm	1500.00

Class F

Steel Sheets

The minimum weight of zinc coating in gm/sqm on galvanized steel sheets shall be as under:

Coating Class	Average of Triple Sport Test	Min. Single Spot Test
2.75	716.00	610.00
2.5	640.00	550.00
2.25	564.0	490.00
2.00	503.00	427.00
1.75	427.00	366.00
1.50	350.00	305.00
1.25 commercial	274.00	244.00

3.2 Thickness of Zinc Coating by Electrodeposit Method

- 3.2.1 The minimum and average thickness of zinc coating, except threaded parts, by electrodepositing on steel articles shall be as under:

Coating Class	Local Thickness (mm)	Average Thickness (mm)	Application Conditions
Class G	.025	.038	Outdoor
Class H	.008	.013	Indoor

- 3.2.2 The minimum and average thickness of zinc coating on threaded parts of steel articles shall be as under:

Diameter (mm)			Average thickness minimum (mm)	Average thickness maximum (mm)
1.50	to	6.00	0.005	0.0065
6.01	to	12.00	0.0065	0.008
12.01	to	20.00	0.008	0.010

- 3.3 One gram of zinc per square meter of surface, based upon mathematical calculation, shall correspond to a coating thickness of 0.00014 mm.

4. TEST METHOD

4.1 Weight of Zinc Coating on Galvanized Sheets

4.1.1 Test Samples

Test specimens shall be (50 ± 0.25) mm square, except for material narrower than 50mm wide, in which case test specimens shall be of such a length that the area of the specimen is 2500 sq mm. When it is not possible to secure a specimen of 2500 sq mm in area, a smaller size may be used but it is recommended that a specimen of not less than 1300 sq mm be used.

- 4.1.1.2 The specimens shall be clean, they shall be washed with solvent naphtha or other suitable solvent, then with alcohol and dried thoroughly.

4.1.2 Test Method

4.1.2.1 Reagents

- i) Antimony chloride solution:

Dissolve 20 grams of Sb_2O_3 or 32 gm of $SbCl_3$ in 1000 ml of HCL (sp.g. 1.19)

- 4.1.2.2 Weigh the specimens obtained in accordance with 4.1.1 to the nearest 0.01 g. After weighing immerse each specimen singly in a solution made by adding 5 ml of antimony chloride to 100 ml of HCL (specific gravity 1.19) to cover the specimen and allow to remain therein until the violent evolution of Hydrogen has ceased and only a few bubbles are being evolved. This requires about 15 to 30 sec. The same solution may be used repeatedly until the time required for stripping becomes inconveniently long. The temperature of the stripping solution shall at no time exceed $38^\circ C$. After stripping, wash the specimen by scrubbing them under running water, dip in hot water and wipe or blow dry. Again weigh the specimen to the nearest 0.01 g.

4.1.2.3 Calculations

- i) The loss in weight represents the weight of zinc coating in grams on the samples, to find the weight of zinc coating per sq meter proceed as follows:

$$\text{Wt of coating in grams per meter of steel surface} = \frac{\text{Loss in Wt. in grams} \times 10^6}{\Lambda}$$

Where Λ – Area of stripped sample in sq mm.

4.2 Weight of Zinc Coating on Galvanized Wire

4.2.1 Test Sample

- 4.2.1.1 The specimens of galvanized wire may be of any length over 300 mm, but preferably about 600 mm. Where a continuous length is not available, shorter specimens totaling 300mm but preferably 600 mm shall be used.

- 4.2.1.2 The specimen shall be cleaned by washing with solvent naphtha or other suitable solvent, then rinsed with Alcohol and dried thoroughly.

4.2.2 Test Method

- 4.2.2.1 Test method shall be the same as described in clause 4.1.2.

4.2.3 Test Results

- 4.2.3.1 Calculate the weight of zinc coating as follow:

$$C = \frac{W1 - W2}{W2} \times d \times M$$

Where

C	=	Wt. of zinc coating in grams per sqm
W1	=	Original weight of specimen in grams
W2	=	Weight of stripped specimen in grams
M	=	a constant = 1958
d	=	diameter of stripped wire in mm

4.3 Weight of Zinc Coating on Articles Covered under Class A, B, C & D

4.3.1 Test Samples

- i) Samples for weight of coating determination, shall be selected in accordance with clause 6.4 or as specified in the relevant specification.
- ii) In the case of threaded articles, such as bolts and screws, the determination shall be made on a portion of the article that does not include any thread.
- iii) The specimens shall be cleaned by washing with solvent naphtha or other suitable solvent, then rinsed with Alcohol and dried.

4.3.2 Test Procedure

The procedure shall be the same as described in clause 4.1.2.

4.3.3 Test Results

- 4.3.3.1 Determine the total coated area of the specimen to the nearest 5 sq mm, alternatively for specimens of uniform thickness of base metal, such as piece of plate or pipe, determine the average thickness of the specimen to the nearest 0.25 mm.

4.3.3.2 Calculation

Calculate the weight of zinc coating by using the formula:

$$C = \frac{W1 + W2}{A} \times N$$

Where

C	=	Wt of zinc coating in gm/sqm of surface
W1	=	Original wt of specimen in grams
W2	=	Weight of stripped specimen in grams
A	=	Coated area of the specimen in sq mm.
N	=	A constant = (1000/400)

- (b) If the specimen has a uniform thickness of base metal, the weight of the zinc coating may be calculated using the following formula:

$$C = \frac{W1 - W2}{W2} \times G \times Z$$

Where

C	=	Wt of zinc coating in gm/sqm of the surface
W1	=	Original weight of the specimen in grams
W2	=	Weight of stripped specimen in grams
G	=	Thickness of stripped specimens in mm
Z	=	A constant = 3935

4.4 Test for Thickness of Electrodeposit Coating

4.4.1 Microscopic Test

The thickness of coating shall be determined on cross-sections taken perpendicular to the significant surfaces by the microscopic method described in the methods given below:

4.4.2 Test Specimens

4.4.2.1 To determine compliance with a specified minimum thickness of electrodeposited zinc, section the specimen at one or more significant surface where such a minimum may be expected.

4.4.3 Test Method

4.4.3.1 Hold the specimen rigidly and in such a position that the surface to be tested is perpendicular to the flat surface that is to be ground and polished (A deviation of 10 degrees from normal introduces an error of about 2% in thickness). The pieces may be plated first with a relatively thick coating of copper to protect the edges during grinding and polishing. On zinc deposit the first layer of copper from a cyanide solution after which, if desired, an acid copper solution may be used.

4.4.3.2 Grind and polish the section to be examined by regular metallographic methods, using successively finer abrasives the last being no coarser than 500 mesh. Polish zinc coating with minimum pressure in the direction from the hard basis metal to the soft coating, and alternatively at 45° and 135° angle to the plated surface.

4.4.3.3 Then treat the surface in such a manner as to obtain the maximum contrast between the coatings and the adjacent metals. Obtain such contrast by etching either the coating or the adjacent metal by an appropriate reagent. Suitable etching is desirable even when a contrast exists, since it will remove any soft metal that may have spread over a harder metal.

4.4.3.4 The following typical reagents are suitable for etching plated coatings:

Chromic Acid (H ₂ Cr O ₄)	200	g/Litre
Sodium Sulphate Na ₂ SO ₄	15	g/Litre

4.4.3.5 Measure the thickness of coating at any desired point on the exposed section by either of the methods described below:

- i) Measure the thickness with a filer micrometer ocular that has been calibrated in order to determine the value of the unit scale division against a scale graduated so accurately that the error will not exceed 2% for example; the scale may be graduated to 0.01 mm.

- ii) Project the image of the specimen especially of those specimens having very thin coating, at a known and properly calibrated magnification on the ground glass focusing plane of the camera of a metallographic microscope. Measure the width of the projected line of deposit with a graduated linear scale, the reading divided by the magnification shall give the thickness of the coating.

4.5 Adherence of the Coating Tests

4.5.1 Galvanized Sheets

4.5.1.1 Galvanized steel sheets shall withstand a bend through 180° in any direction without flaking of coating on the outside surface.

4.5.1.2 The sample under test shall be gripped in a hand operated vice with smooth jaws and shall be bent through 180° over a mandrel twice as thick as the sample if weight of zinc coating is equal or more than 525 grams/sq.m. The sample shall be folded over a mandrel equal to the thickness of sample if the weight of zinc coating is less than 525 grams/sq.m.

4.5.2 Galvanized Wire

4.5.2.1 Zinc coated wire shall be capable of being wrapped at a rate not exceeding 15 turns per minute in a close helices of at least two turns around a cylindrical mandrel equal to three times the nominal diameter of wire under test, without cracking or flaking the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers.

4.5.3 Articles Covered under Class A, Class B and C Heavy Materials

4.5.3.1 The pivoted hammer may be used to determine adherence of zinc coating on steel products 8 mm thick and heavier covered under class A, B & C. This test is applicable to flat surfaces only and shall not be used on round and curved surfaces. The hammer used shall conform to fig 4. The hammer blow shall be controlled by clamping or holding the pivoted base of the handle firmly on a horizontal surface of the galvanized member and allowing the hammer head to swing freely through an arc from vertical position to strike the horizontal surface. As illustrated in fig 2 the test shall consist of two or more standard blows forming parallel impressions with 6.5 mm spacing along a common axis so located that no part of an impression shall be closer than 13.0 mm to the edge of the member. Removal or lifting of the coating in the area between the impressions shall constitute failure. An extruded ridge less than 3 mm wide shall be disregarded. The specimen shall be tested in several places throughout its length.

4.5.4 Articles Covered under Class A, Class B & Class C Small and Light Materials

4.5.4.1 Small and light materials which are liable to deflect or deform under the hammer blow and curved or round articles which cannot be hammered properly should be tested by this method.

4.5.4.2 The adherence of zinc coating to the surface of the base metal shall be determined by cutting or prying with a stout knife, applied with considerable pressure in a manner tending to remove a portion of the coating. It shall only be possible to remove small particles of the coating by paring or whittling and it shall not be possible to peel any portion of the coating so as to expose the base metal.

4.6 Uniformity of Coating Test

4.6.1 Test Solution

4.6.1.1 The copper sulphate solution shall be made by dissolving approximately 36 parts by weight of commercial copper sulphate crystals in 100 parts by weight of distilled water. Heat may be used to complete the solution of copper sulphate crystals. If heated, the solution shall be allowed to cool. The solution shall then be agitated with an excess of powdered cupric hydroxide $\text{Cu}(\text{OH})_2$ about 0.81 gms/litre of solution. The presence of an excess of cupric hydroxide will be shown by the sediment of this reagent at the bottom of the vessel. The neutralized solution shall be allowed to stand for 24 hours and then filtered or decanted.

4.6.1.2 The test solution shall have a specific gravity of 1.186 at 18°C. To adjust a solution of improper specific gravity, add distilled water when the specific gravity is high, and add a copper sulphate solution of a higher specific gravity when the test solution is low in specific gravity.

4.6.1.3 Wire specimens shall be tested in a glass container at least 50mm in inside diameter for 2.5 mm dia wire and smaller, and at least 75.0mm in inside diameter for wire larger in diameter than 2.5 mm dia. The container shall be filled with fresh test solution to a depth of at least 100.0 mm. This quantity of solution shall be used for the simultaneous testing of one to seven test specimens. The solution shall be discarded after completion of the test and fresh solution used for any additional tests.

4.6.1.4 For testing articles other than wire, the quantity of copper sulphate solution required for each test will depend on the superficial area of the test specimen and the weight of coating. The quantity should not be less than 40 ml per gm of zinc coating on the specimen and shall be sufficient to cover the specimen so that the top surface of the solution is at least 13 mm above the top of the section of the specimen under test. The solution shall be discarded after completion of the test and fresh solution used for any additional tests.

4.6.2 Test Samples

4.6.2.1 The specimens selected for test shall be free from abrasion or cuts in the zinc coating, except those which may occur during manufacture or the preparation of the specimen for testing. Specimens of wire may be hand straightened.

4.6.2.2 The specimens shall be cleaned with a volatile organic solvent such as carbon tetrachloride, gasoline, or benzene, then rinsed with alcohol, and finally, thoroughly washed with clean water and wiped dry with clean cotton cloth. Test specimens shall be brought to a temperature of 15° to 21°C prior to beginning of the test.

4.6.2.3 Abnormal cases may arise when, by reason of unusual surface conditions, the copper sulphate solution will not act normally on the zinc coating. If there is any question of abnormality of performance of test specimens, the specimens shall be discarded and new ones selected. The new specimen shall be cleaned in alcohol, rinsed and wiped dry and then immersed for 3 minutes in a solution consisting of 1 part by volume of ammonium hydroxide (sp. Gravity 0.90) and nine parts of water. The specimens may be scrubbed with cotton cloth during this immersion. After cleaning the specimens shall be washed and wiped dry and then tested in accordance with the procedure laid down below.

4.6.3 Test Method

4.6.3.1 The test specimen shall be immersed in the copper sulphate solution, which shall be maintained at a temperature of 16 to 20 °C. The specimens shall remain in a fixed position in the solution for exact 1 minute. If a ½ minute dip is specified, it shall be given to the specimens after completion of all of the 1 min dip. There shall be no agitation of the solution during the immersion period and the specimen shall not be allowed to touch each other or the sides of the container. After each dip, the specimens shall be washed immediately in the rinsed water, and a fiber bristle brush shall be used to remove any copper deposit that may have formed on the zinc coating. Before returning the specimens to the test solution they shall be well drained of excess rinse water and wiped dry with a clean cloth.

4.6.3.2 Successive dips of 1 min. each shall be continued, with washing and wiping of the test specimens after each dip, until the specimens have withstood the required number of dips specified in Table-II or until the end, point has been reacted.

TABLE-II: WEIGHT OF COATING AND NUMBER OF DIPS

<u>Weight of Coating</u>			<u>No. of Dip</u>	
gm/sqm			1 minute	half minute
300	and	above	4	-
270	to	299	3	1
240	to	269	3	-
180	to	239	2	-
140	to	179	1	1
90	to	139	1	-
75	to	89	-	1

- 4.6.3.3 A recommended device for holding test specimens of wire in a fixed position is shown in fig 1. A similar device may be used for holding specimens of other small articles that are not required to be fully immersed in the test solution. Specimens that are completely immersed may be suspended by a string.

4.7 Visual Inspection

- 4.7.1 The galvanized surface shall be free from such imperfection as lumps, uneven coatings, blisters, gritty areas, uncoated spots, ash and flux inclusions, globules or heavy deposits of zinc which will interfere with the intended use of the material will not be permitted.

- 4.7.2 Following is the list of defects, their significance and possible remedies:

Condition	Causes	Recommended Actions	Ground for Rejection
Bare Spots	Paint, grease or oil residues	Check cleaning particles	Materials may be Accepted where bare spots are in accordance with clause 4.7.2
	Scale or rust residues	Check pickling particles	
	Residual welding slag	Blast-clean welds. Avoid coated rods.	
	Breakdown of preflux coating	Check preflux and drying conditions	
	Aluminum content of bath too high	Regulate aluminum additions	
	Rolling defects in basis steel	Check steel supply	
General Roughness	Articles in contact during galvanizing	Keep articles separated	Material may be accepted provided adhesion is good and degree of roughness is not too critical.
	Analysis or original surface condition of steel	Check steel supply	
	Over pickling	Reduce pickling use inhibitor	
	High galvanizing temperature and / or long immersion time	Adjust galvanizing conditions	

Pimples	Entrapped dross particles	Avoid agitation of dross layer check carry over of pickle salts	Material with finally disposed Pimples covering not more than 0.5% of the area may be accepted.
Lumpiness and Runs	Withdrawal speed too high	Remove work slowly	Materials of class ABC may be accepted whereas of class D, E, F rejected
	"Cold" galvanizing bath	Increase temperature	
	Delayed run-off from seams, joint bolt holes, etc.	Remove work slowly	
	Articles in contact during withdrawal	Keep articles separated	
Flux Inclusion	Steel flux burnt on during dipping	Refresh or renew flux blanket	Materials shall not be accepted
	Surface residues on steel	Check steel preparation	
	Flux picked up from top of bath	Skim before withdrawal	

4.7.3 Articles covered under class E & F shall be completely free from uncoated sports. However, small localized uncoated sports on fabricated pressed, forged and casted articles covered under class A, B & C may be ignored upto maximum of 0.25% of the total area. The area of such individual sports shall not exceed 0.5 square mm. Uncoated spots shall be patched with galvanizing repair paint.

4.8 Embrittlement Tests

4.8.1 Galvanized Angle Test (for Angle Irons only)

4.8.1.1 Test Requirements

- i) The elongation measured in accordance with clause 4.8.1.2 (i) shall not be less than 5 percent except as specified in para 4.8.1.2 (ii).
- ii) When the specimen does not show 5 percent elongation, the reduction in thickness shall be measured in accordance with clause 4.8.1.2 (ii). The sum of the percentage of elongation plus the average percentage reduction of thickness shall not be less than 10.

- i) For determining the elongation after fracture, a 51 mm gauge length (Fig 2) shall be prick punched in the middle of the edge of the vertical leg of the angle along a line parallel to its length and centered directly under the hole. After the test, the sum of the distance along this line from each punch mark to the corresponding edge of the fracture shall be measured to 0.25 mm with a flexible scale, and the percentage of elongation calculated. For specimens under 13.0 mm in thickness or those in which the distance from the edge of the hole to the edge of the angle is less than 10 mm, the elongation shall be measured over a 25 mm gauge length.
- ii) For determining the percentage reduction of thickness after fracture, the reduction shall be measured with a ball point micrometer at the 3 locations indicated in fig 3; namely (a) outer side of hole, (b) inner side of hole, (c) middle of leg. The percentage reduction of thickness shall be calculated on the basis of the original thickness of the angle and the average of the three values at a, b and c.
- iii) The length of the test specimen and the distance between the supports are shown in the following tables.

Length of angle L (mm)		Length between supports L ₁ (mm)	Minimum length L ₂ (mm)
Upto	100 mm incl.	356.0	457.0
Over	100 mm to 150mm incl.	508.0	610.0
Over	150 mm to 200mm incl.	762.0	915.0

- iv) The kind of hole, punched, sub punched and reamed, or drilled, shall be that employed in the fabricated material which the specimen represents. The dimensional values, diameter, and location of hole, shall be not less than those employed in the structural details. Care shall be taken not to place the hole near stamped or rolled _____ in identification marks.
- v) The test shall be made upon galvanized specimens having a temperature not below 60° and not over 90 °F when tested.
- vi) The test may be made in a universal testing machine, or by other means such as a press or bulldozer with the load applied slowly.

4.8.2 Embrittlement Tests for Materials Covered under Class B, C & D

4.8.2.1 The test is suitable for galvanized steel hardware of such shape and size that permit bending such as bolts, tower steps, insulator clevises, braces, rods etc. Clamp one end of the article in a vice and bend the other end through an angle of 90 degree of about a diameter equal to the dia or thickness of the article under test. A suitable length of pipe may be used as a lever to assist bending. The article after bending shall show no cracks on the outside surface of bend. If such a test is made on threaded articles, it shall be made on un-threaded portion. In case of completely threaded articles, the threads shall be removed and the 90 degrees bend shall be about a diameter equal to the reduced diameter of the article.

4.8.2.2 Castings and steel hardware of such or size that they do not permit bending, may be struck a sharp blow with a hammer of suitable weight. If the material is not embrittled, it should not crack under such a blow. However, if the article is tested to destruction, a white lustrous, coarse grain appearance of the resulting fracture is indicative of embrittlement and shall be cause for rejection.

5. TESTS

5.1 Tests on galvanizing shall be carried out as per table-III below or otherwise specified in the relevant standard. Tests were applicable are marked 'O'.

TABLE-III. TESTS ON GALVANIZING

Test	Class A	Class B	Class C	Class D	Class E	Class F	Articles galvanized by electrodeposit method
Visual Inspection	0	0	0	0	0	0	0
Wt. of zinc coating (on hot dip articles	0	0	0	0	0	0	X
Thickness of zinc coatings	X	X	X	X	X	X	0
Uniformity of coating test	0	0	0	0	0	0	X
Adherence Of coating Test	0	0	0	X	0	0	0
Embrittle- ment test	0	0	0	0	X	X	X

6. TEST SAMPLES – ACCEPTANCE AND REJECTION

- 6.1 The manufacturer shall provide all necessary facilities including testing equipment for carrying out tests free of cost to WAPDA. The cost of test samples destroyed during tests shall be borne by the manufacturer.
- 6.2 The WAPDA representatives shall have access at all times while work on WAPDA's contract is being performed. The manufacturer shall afford the WAPDA representative all reasonable facilities to satisfy him that the galvanizing is being furnished in accordance with the specification.
- 6.3 For visual inspection, articles shall be grouped into lots and test specimens shall be selected from a lot at random in accordance with table-IV. If the number of defective units does not exceed one, the lot shall be accepted. If the number of defective units exceeds two, the entire lot shall be rejected. In case the defective being two, another sample of double the quantity given in table-IV shall be selected at random and the test repeated. In case of any failure from the second selection, the entire lot shall be rejected.
- 6.4 Test specimens from each sample for determination of compliance to the tests specified in clause 8.2, 8.3, 8.4 & 8.5 shall be taken from each lot. The lot shall consist of a quantity as specified in table-IV, below or as otherwise specified in the relevant specification. If any sample fails to comply with the requirements laid down in this standard, another set of samples as per table-IV shall be taken from the remaining lot and test repeated. In case of any failure in the second set of samples, the whole lot shall be rejected.
- 6.5 Test samples from sheets or coils (Class E,F) for determination of weight of zinc coating shall be obtained as follows:
- i) When cut from coil, one sample from the centre and two samples from both ends of coil shall be taken.
 - ii) When cut from sheet, one sample from the centre and two samples from diagonally opposite corners shall be taken.
- 6.6 Test specimens from each sample sheets and coils for determination of adherence and uniformity of coating shall be obtained as follows:
- i) When cut from coil, sample shall be selected from one end of the coil.
 - ii) When cut from sheet, sample shall be taken from one corner of the sheet.

7. PASSIVATION TREATMENT

- 7.1 Zinc coatings applied by electrodeposit method shall be given full passivation treatment for maximum protection from corrosion by the following process.

- 7.2 The zinc plated components shall be well rinsed, then immersed for 5 to 10 seconds in a passivation solution of following composition:

Sodium dichromate	182	g/litre
Free sulfuric acid	6	ml/litre

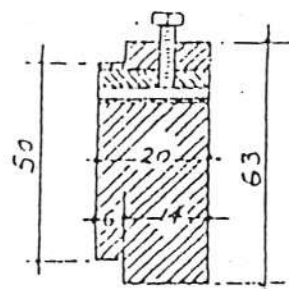
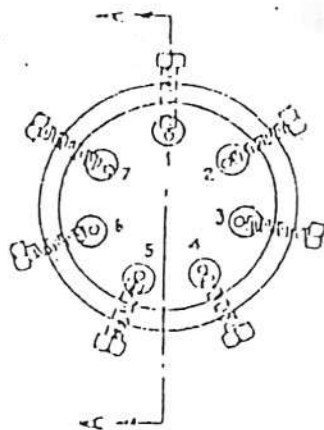
After pasivation the components shall be well rinsed in running water and then dired in warm air.

- 7.3 Passivation process other than one specified above, may be used subject to prior approval by WAPDA.

Encls: Figures 1.2.3.4 & table-IV.

TABLE - IV

Material Description	Lot	No. OF SAMPLES			
		Visual Inspection	Wt. of galvanizing Test or thickness of Zinc coatings	Uniformity and adherence of coating test	Embrittlement
1. Class A,B,C&D					
i) Fabricated, rolled, pressed, forged and cast articles covered under class A,B,C&D not more than 300 mm in length	1000 unit	100 units	3 units	3 units	3 units
ii) Fabricated, rolled, pressed, forged and cast articles covered under class A.B. C&D more than 300 mm in length	500 unit	100 units	3 units	3 units	3 units
2. Class E					
Galvanized steel wires, barbed wires binding wires etc.	100 coils or 10 km in length of wire of same size in form of coils whichever is less	10 coils	3 sample coils shall be selected from each lot and test specimens shall be cut from each coil as per clause 6.5 of this specification	3 sample coils shall be selected from each lot and test specimen shall be cut from each coil as per 6.6. of this specification.	
3. Class F					
Galvanized steel sheets	500 sheets of same size or 1000 kg in wt. whichever is less	25 sheets	3 sample sheets shall be selected from each lot and test specimens shall be cut from each coil as per clause 6.5 of this specification	3 sample coils shall be selected from each lot and test specimen shall be cut from each coil as per clause 6.6. of this specification	
4 Class G & H					
Galvanized articles by electrodeposit method	The procedure for sampling shall be the same as described above for hot dip galvanized articles				



SECTION A-A

Fig. 1

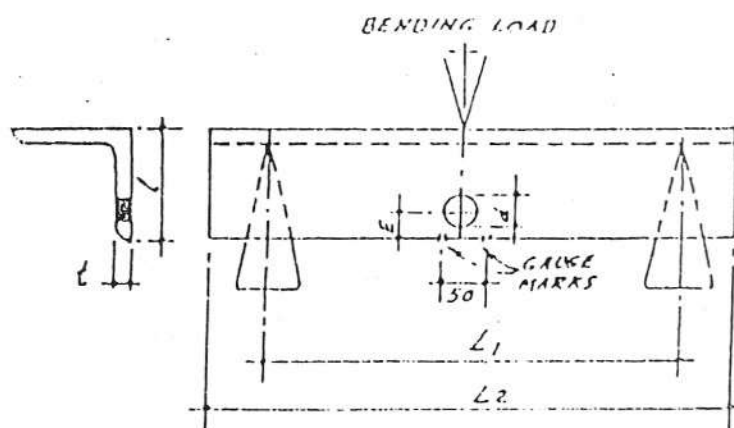


Fig. 2

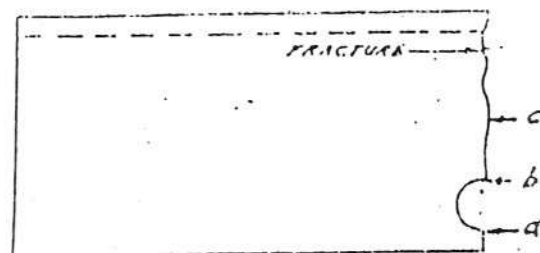


Fig. 3

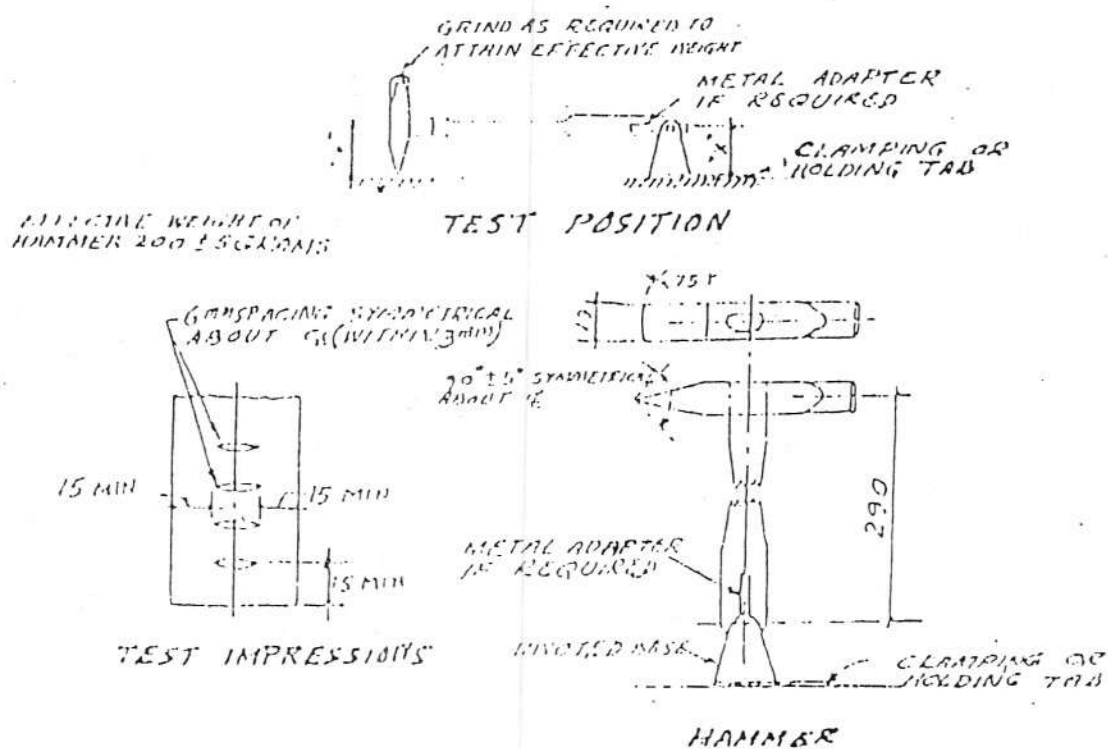


Fig. 4